

PROBLEMS OF THE INDIAN COAL INDUSTRY*

ONE of the many striking paradoxes for which India is famous is her coal position. India produces over 30 million tons of coal per year and is the second largest producer of coal in the British Commonwealth. Yet, our industrial development has not progressed beyond one-twentieth of our capacity. We have extensive deposits of coal, but we have hardly touched even the outermost fringes of the numerous industries that are based on coal and its products, and that are essential for our national welfare and progress. We have only to look at the latest advances made in the field of coal industry in other countries to convince ourselves of the utter neglect we have meted out to this important mineral, which in its importance may be compared to food. Coal is as much a food for the maintenance of industrial life as food is the fuel for the sustenance of human life.

For efficient utilisation and conservation of coal, all progressive countries have adequate provision both for research and development. In England, the coal situation is so serious that the whole industry has been under critical examination. Particular attention has been directed to explore the possibilities of mechanisation of the mining methods. This is expected to give not only longer lease of life to the mines but it will surely lead to the quickening of the pace of production and to the amelioration of the social conditions of coal miners. The U.S.A. has now the lead in this direction, although it is admitted that the first mechanical devices were employed in Great Britain. They were abandoned because research work in England in the subject of Engineering did not keep pace with the rapid utilisation of coal for industrial purposes. The arguments that the British coal seams were not amenable to treatment by mechanical methods of an automatic character seem to be based on prejudice and recent American attempts to provide automatic mining methods in England seem to have been on the whole a success. It is not hard to imagine how much of the arduous and unpleasant labour could be saved in this country if only efforts are made to introduce mechanisation in the mining of coal in India. As labour is still available in India comparatively cheaper, it may not be considered as vitally important as yet, but we must look ahead and provide for mechanisation.

Perhaps a few words on the achievements of coal research may not be out of place on this occasion. Research investigations on the preparation, transportation and storage have yielded results of great importance to the coal industry. It has involved scientific work on sizing and grading, briquetting, coal breakage, wet washing, dry cleaning and gravity washing under dense media and such subjects as control of fires, dewatering and drying, dust-proofing, coal storage and physical structure of coals.

* Extracts from the Opening Address delivered by Prof. Sir Shanti Swarup Bhatnagar, Director, Scientific and Industrial Research, on the occasion of the Foundation-Stone Laying Ceremony of the Fuel Research Institute, Digwadih—Dhanbad, on 17th November 1946.

The Regional Coke Research Committee in Great Britain have mainly addressed themselves to research investigations leading to increasing the flexibility of the coking process with a view to using inferior coals for the purpose of conserving the high grade coal resources and to controlling the products according to demand. This has led to several new processes such as the carbonisation of various single and blended coals and to the modification of the carbonisation plant itself. Mention must be made here specially of the plant known as the Narrow Brick Retort. Considerable investigations have been carried out in the U.K. on the chemical conversion of coal, tar and coal products. Of these, gasification, the hydrogenation and cracking of tars and oils and the Fischer-Tropsch Process for the production of synthetic petroleum are of special importance. The wide range of investigations covered by the various Fuel Research Laboratories include geological, physical and chemical survey of coal seams, coal cleaning and preparation of coal for the market; low and high temperature carbonisation; complete gasification of coal; production of hydrogen from coal and coke; and fundamental research comprising of solvent extraction, coalification, petrographical classification, study of porosity and surface, particle size determinations, X-ray diffraction, radiography, reflectivity, assays, thermal distillations, chromatographic separation, spectroscopic examination, etc.

The Coal Division of the Bureau of Mines in U.S.A. has been responsible for comprehensive investigations on coal in all its aspects from production to utilisation. Perhaps, the most notable achievements of America in this field are the oxidation products of coal. Numerous organic acids have been obtained by the oxidation of coal which are finding increasing importance in plastics, dyes and drugs industries. Mention must be made also of researches which have enabled producer-gas manufacture from inferior coals, development of smokeless burners for residential buildings, new coal-fired steam locomotives to compete with diesel locomotives, pulverised and colloidal fuels, complete gasification of coal, etc. In the coking industry perhaps the most outstanding work is that of Messrs. Koppers Company of New Jersey. They have introduced such features in their plant for producing coke which makes the once old hot and uncomfortable process, now a thing of joy. All the operations are automatically carried out in an air-conditioned basement; and with the aid of just a few men, large quantities of coke are produced from coal and the bye-products also are automatically collected. Intensely original and fascinating are the Russian investigations on underground gasification of coal. From the point of view of saving initial costs and the economic production of gas these investigations have attracted world-wide attention and the very idea underlying underground gasification, which makes use of the earth itself as a huge retort, which is heated by the fire that is produced gratis inside its bowels, is indeed revolutionary. It is not necessary for me to stress the significance of this development to this country where underground destruction of coal

by spontaneous fires has already resulted in colossal losses.

It has been estimated that the life of the reserves of Indian coals are as follows: All good quality coals—120 years; coking coal of good quality—about 62 years; non-coking coal of good quality—about 100 years. It will be seen that the position of the coking coal reserves in India is poor, especially in view of the fact that very large reserves of 'iron ore' of high grade are available in the country. Within 150 miles of the coalfields alone the iron ore reserves exceed 3,000 million tons. It is obvious that our reserves of coal are short of our needs. At the present rate of output and consumption and at the present rate of mining, the reserves in India can hardly last more than fifty years unless more efficient utilisation and conservation of the coking coals are practised.

Next in importance are all grades of coal of high volatile content and of the non-metallurgical type. These coals, apart from steam generation, have very special uses, such as carbonisation, by-products recovery, hydrogenation or synthetic production of oils, gas manufacture, chemical industry and so on. The coal-tar distillation industry, sadly neglected in the past, is an absolute necessity to-day. The great varieties of oils, high explosives, dyes, drugs and pharmaceuticals, plastics, insecticides, germicides, rubber, etc., which can be derived from coal-tar, are all essential for national progress and well-being. Great losses are also resulting from the primitive methods of soft coke or domestic coke manufacture and research must help in solving this problem.

Another source of loss of coal is during the mining operations. During mining a part of the coal is small or "slack" coal and as such it has no market in India. Utilisation of this coal with the help of modern scientific and technical methods of combustion and briquetting would avert this great waste. Many of the so-called inferior grades of coal of high ash content, of which India possesses a large and 'fairly unlimited' reserves are also not workable at present. These coals can be upgraded and efficiently utilised through research and development of appliances.

An important feature of our coal industry is the lack of any standards for specifications. It is not generally recognised that this lack of standards results in wasteful mining methods and in consequent loss of large reserves of coal. The present methods of certifying coals on the basis of the specifications of the Indian Coal Grading Board has often led to selective mining of seams resulting in serious loss of coal. Stowing and utilisation of the inferior qualities of coal are the only measures to check these wasteful methods of mining resulting in the loss of our irreparable national asset.

The 'by-products' industry, which is still in a primitive state in India, must also be developed for the future prosperity of the fuel industry and the nation. All these can only be achieved through co-ordinated and intensive scientific research. The first notable step taken in this direction was the constitution of a Fuel Research Committee in 1940 under the auspices of the Board of Scientific and Industrial Research with the late Dr. H. K. Sen as Chairman. Sir Cyril Fox and Mr. Farquhar succeeded

Dr. Sen as Chairman. During these six years the Fuel Research Committee has been responsible for initiating several research schemes bearing on Indian coal industry, the most important of which are the washability of Indian coals under the guidance of Dr. Charles Forrester of the Indian School of Mines; the coking and blending of coals under the joint auspices of Mr. Farquhar of the Tata Iron and Steel Co. and the Council; and the carbonisation and desulfurisation of Indian coals under the guidance of Dr. B. C. Guha and Dr. J. K. Chowdhury respectively. The most important activity of this Committee has, however, been its concerted effort to bring about a central Fuel Research Station for India which will carry out comprehensive research on all aspects of fuels. The Council of Scientific and Industrial Research accepted the recommendations of the Fuel Research Committee in respect of the urgent need for a National Fuel Research Institute and appointed a local planning committee to draw up detailed plans for the proposed Institute. Of this committee, the leading lights are all present here. Our special thanks are due to Mr. Kirby, Chairman of the Local Planning Committee, Dewan Bahadur Thacker, acting Chairman of the Fuel Research Committee, and Dr. Charles Forrester, Principal, Indian School of Mines. We miss Mr. Farquhar and Mr. Wilson-Haigh, who are on leave, and who contributed much towards the success of our earlier efforts. The Fuel Research Committee also appointed a Site Selection Committee, who after much careful thought and deliberation, chose the present site. Here the superior rights of about 100 acres of land were very generously donated to the Council by the Raja Shiva Prasad Singh Bahadur of Jharia for the construction of the Fuel Research Institute.

The Fuel Research Institute of India when completed will cover all aspects of research both fundamental and applied, on solid, liquid and gaseous fuels, although for the present the activities of the Institute must necessarily be confined to a large extent to solid fuels and coal in particular. The work has been divided into a short-term programme and a long-term programme, and this arrangement is only in accordance with the urgent and future needs of the country in respect of fuels.

The short-term programme includes:

- (1) *Rip Survey*.—A quick physical and chemical survey of Indian coals with a definite time limit, say two to three years, involving the determination of proximate analysis, coking properties, total sulfur, calorific value, carbon and hydrogen contents and washability of the major producing coal seams.
- (2) *Washability Tests*.—These tests will be carried out on full-scale samples from seams with a view to improving ash contents of coals of coking quality and for separating coking from non-coking coal in the same seams.
- (3) *The Coking and Blending of Coals*.—Laboratory, medium and full-scale tests (in co-operation with the industry) on some selected coal seams with a view to immediate exploitation and examination of the reactivity of coke.
- (4) *Low Temperature Carbonisation*.—Laboratory investigation for survey and

full-scale tests on some selected seams, again with a view of immediate exploitation and selection of some plants which have already proved successful on an industrial scale.

- (5) *Gasification*.—Investigation of alternative supply of fuel for the immediate manufacture of hydrogen for ammonia synthesis and for complete gasification of inferior grade non-coking coals for the manufacture of industrial gases. This is a subject of great interest and has been rather neglected in India.
- (6) *Investigations on Road Tar*.—In view of the post-war road building programme in India, this research will be undertaken early.

The long-term programme will include:—

- (1) Detailed survey of Indian coals for the determination of all the physical and chemical properties of coals, including agglutinating value, swelling properties, washability, calorific value; and development of specification tests.
- (2) Investigations on carbonisation and coking properties.
- (3) Deterioration of coal on storage and weathering.
- (4) Researches on de-ashing and preparation of coal for the market.
- (5) Researches on the nature of by-products of low and high temperature carbonisation with a view of their utilisation for the plastics, dyestuffs, drugs and pharmaceuticals, liquid fuels, lubricants and grease industries.
- (6) Briquetting.
- (8) Hydrogenation.
- (9) Oxidation of coal for the production of dyes, plastics and allied substances.
- (10) Liquid, gaseous and wood fuels.
- (11) Establishment of a Central Fuel Research Library.
- (12) Fundamental Research in Fuels.

All these proposed investigations stress the importance of coal as fuel and as a valuable source of chemicals for industry. I must, however, assure you all that the National Fuel Research Institute will not confine its activities to research on coal only. In fact, investigations on other fuels, such as for instance, mineral oils, gaseous fuels, colloidal fuels, etc., will form an important part of the functions of the Institute. In this connection, I would like to mention the importance of molasses-alcohol, which is a basic industry of India and which

has great potentialities as an industrial fuel. The present estimated production of alcohol in India is in the neighbourhood of 22 million gallons, and during the war, when petrol was in acute short-supply, molasses alcohol retrieved the position and it was successfully used as fuel in internal combustion engines in admixture with petrol. Investigations bearing on these aspects of all fuels besides coal, will certainly engage the attention of the Fuel Research Institute.

Research alone will not solve all our problems. State measures to control and conserve production and utilisation of coal on lines likely to promote the interests of the industry are equally important. The necessity of such measures was realised sufficiently long ago, and the Government set up Inquiry Committees twice in the last decade. These committees had formulated many far-reaching recommendations but the indifference of the authorities cold-stored the recommendations. Many of our problems would, by now, have been minimised if only the people who held authority then had the foresight to see the immensity of the problems and had acted on the recommendations. During the war, the problems assumed alarming proportions, and Sir Ardeshir Dalal on taking over the Planning and Development portfolio appointed the now well-known Indian Coalfields Committee under the chairmanship of Mr. K. C. Mahindra to review in detail the Indian coal position and to suggest ways and means of improving the coal industry. The Mahindra Committee have now submitted a useful report. They have brought out the importance of nationalisation of the coal industry in India and of setting up a separate Department of Fuel and Power and also of a National Fuel Board vested with powers to control production, distribution and utilisation of coal in India. The Committee have also stressed the importance of technical research on coal and have recommended the setting up of three Research Sub-Stations in the Raniganj, Bokaro and C.P. coalfields, in addition to the Central Research Institute. Another important recommendation of this Committee is that the cost of fuel research should be shared by Government and Industry and a cess of one pice per ton of coal despatched should be levied for this purpose. Similar recommendations were made earlier by the Council of Scientific and Industrial Research and the Sir Shanmukham Chetty Committee.

SOLAR SPECTRUM LINE INTENSITIES

DR. M. MINNAERT, of Utrecht, Holland, temporarily at Yerkes Observatory, described work now going on to compile a catalogue of the intensities of the Fraunhofer lines in the solar spectrum. Just before the war, the Utrecht Observatory published the *Photometric Atlas of the Solar Spectrum*, giving a graphic

record of the intensity distribution in all the Fraunhofer lines. The new catalogue, compiled from the atlas, is already complete for the red and infra-red regions.

—(Courtesy of "Sky and Telescope," No. 61, November 1946, p. 7.)