

a cessation of activity by the Admiralty, and not until the early months of the war was airship construction entered upon with vigour. Having neither knowledge nor experience of our own, Britain was reduced to copying, as faithfully as possible, such German designs as we were able to capture. That lack of knowledge, and not a concession to essential utility, accounts for the present calamity may be inferred from the fact that the weight of the girders and gas fabric was much less than one-half of the gross weight of the ship, and that a modification of the proportions of total weight could have been made for the purpose of strengthening the girders had the necessity been foreseen.

The Air Ministry has assumed a great responsibility by its failure, during the last two years, to provide adequate facilities for fundamental research on airships. Now, for the second time, airship development is to be abandoned, and no further research is to be undertaken. This can be justified only if airships are always to be useless, a decision which may reasonably be questioned. Whatever may be the future of the airship, it appears to be true that the British authorities have never allowed it an opportunity of justifying itself, and the loss of R38 is not improbably due to lack of a fair field for the designer rather than to insuperable defects of the system of construction.

### Fuel Problems and Prospects.

By PROF. JOHN W. COBB

THE "James Forrest" lecture which was delivered before the Institution of Gas Engineers by Sir George Beilby on June 28 was given the title "Fuel Problems of the Future," and is one of the most comprehensive and interesting surveys of that subject which the present writer has had the pleasure of reading. Commencing with the proposition that "civilisation on its physical side is based on fuel," the lecturer proceeded to show what he meant by some picturesque and relevant illustrations, beginning with "the kindling of the first fire of dried leaves and branches by our prehistoric ancestors," which established "a new dividing line between man and the lower animals by mitigating the horrors and dangers of the darkness of night, and arousing social instincts."

The more prosaic subject of the price of coal, however, soon found its inevitable place in the lecture, and it was indicated how every one of us is being penalised not only by the dearness of the coal supplied, but also by its inferior quality, arising from the unwarrantable and unnecessary introduction of useless stones and shale. This brought on a reference to the new Gas Act, with its new principle of paying for "therms," but not for inert material, and an extension of the principle involved to coal itself was suggested.

If the gas undertaking is in future to be paid only for the therms delivered to the consumer, it is entitled to throw at least a portion of the responsibility on the coalowners and miners by paying only for the potential therms received in the coal, and not for the inert and inferior materials, which are not only valueless and detrimental to economical working in the retort-house, but lower the value of the coke produced.

Coal is, of course, the dominating fuel in these islands, and Sir George Beilby's survey does not leave that in doubt; but the fuel position of the world as it is disclosed by the most recent figures of production for all kinds of fuel is subjected to comprehensive review. If an authoritative pronouncement were made that a new fuel was

available in these islands which could compete effectively with coal, or was likely to be able to do so in the near future, it would arouse a natural enthusiasm, but, so far as this country is concerned, no comfort of that kind can be derived from dispassionate consideration of the facts of the case. The very interesting point is brought out, however, that Germany is facing, and indeed has already faced, the fuel problem of the immediate future, so far as she herself is concerned, by an extensive development of the lignite industry.

The glowing accounts of this development which have appeared in the technical Press during the past two years may have struck us as exaggerated, but the solid fact remains that the output of lignite in Germany last year was 111,000,000 tons.

This brown coal, though it contains from 40 to 50 per cent. of water, is to-day by far the cheapest source of thermal units. The deposits are often of great thickness, which can be worked open-cast and excavated by machinery with relatively little manual labour and light capital charges. Victoria (Australia) is also developing extensive deposits of brown coal, which are known to exist in Central Gippsland, and Canada is experimenting on the briquetting and carbonisation of the brown coals of Manitoba and Saskatchewan.

The other great source of fuel is oil, of which "the world's output for 1920 is estimated at about 97 million tons, of which

	Per cent.
The United States produced ... ..	64.8
Mexico produced ... ..	23.3
Russia produced ... ..	3.5
Dutch East Indies produced ... ..	2.5
India produced ... ..	1.2
Rumania produced ... ..	1.1
Persia produced ... ..	1.0
Countries producing less than 0.5 per cent. produced ... ..	2.6
Total ... ..	100.0

The amount seems large, but is only some 7 per cent. of the fuel output of the world reckoned

in tons, or 10 per cent. in potential therms. Sir George Beilby discussed the possible exhaustion of these resources in view of the rapid development in the use of motor spirit for motor transport and of fuel oil for transport by sea. He pointed out that it is only the rapid development of production in Mexico and the extensive interests of the United States in this production which have prevented the actual danger of shortage in America from becoming acute, and gave a long extract from a statement by Mr. J. O. Lewis, chief petroleum technologist to the United States Bureau of Mines, defining the position in that country. The conclusion of this authority is that America is quite rightly concerned over the domestic supplies of petroleum from oil wells, but, on the other hand, there are known deposits of oil shales which, in three States alone, promise to yield many times more oil than will ever be recovered from the oil wells of the United States, and that there is no concern as to the ultimate supply. He also believes it probable that eventually alcohol could meet the American needs should gasoline fail.

This brought Sir George Beilby to the consideration of alcohol, and to the inquiries of Mr. Walter Long's Committee, and of the Fuel Research Board with Sir Frederick Nathan as Power Alcohol Investigation Officer. With alcohol one difficulty is that the most suitable raw materials for its manufacture are as a rule also important foodstuffs, but experiments in Burma appear to indicate that the joint production of alcohol and paper from waste rice straw should be commercially possible, and research work for developing the use of cellulosic materials in alcohol production is reported as in hand. Sir George Beilby appears to think that the commercial production of alcohol on these or similar lines for local consumption will soon be established in various parts of the Empire, but that there is no immediate prospect of alcohol counting for very much as an imported fuel for use in this country.

An interesting account was given of what has been done in the winning and utilisation of peat, but a fundamental difficulty was stated in the following sentence:—

When it is realised that the peat deposit in a good bog 20 ft. deep is only the equivalent of a 12- or 14-in. seam of coal, it will be evident that even an output of 1000 tons a day of air-dried peat involves the laying-out and development of an enormous surface.

Prof. Pierce Purcell has been acting as Peat Investigation Officer of the Fuel Research Board, and 100 tons of air-dried Irish peat have been tried for boiler-firing and carbonisation, with quite encouraging results. But it will be understood that although the lecturer passed in review various fuels which had interest and value, he did not allow it to be forgotten that "coal is likely to remain the chief source of fuel, not only for Great Britain, but for the world at large, and that the problems of its winning, preparation, and use

still occupy the foreground in all serious consideration of the subject." He declared that "the greatest of the fuel problems of the future was to decide what proportion of the total coal consumed it will pay to subject to a preliminary operation of carbonisation or gasification, with the object of sorting out the potential thermal units of the coal into groups of higher availability or greater convenience as fuels, *e.g.* gas, motor spirit, fuel-oils, and coke." He pointed out once more that "though the operations of carbonisation and gasification involve the expenditure of some heat, the loss may be more than compensated for by the increased value of the new fuels."

Sir George Beilby has been interested for many years in low-temperature carbonisation and its possibilities—in the production of a solid, smokeless fuel for domestic purposes by the carbonisation of selected coals at 550° to 600° C. The matter is being taken in hand by the Fuel Research Board at its experimental station, and data have been acquired as to the yields and quality of the gas, oils, and coke produced under definite conditions; but, as the lecturer clearly indicated, the problem has two distinct sides, the technical and the economic, and it is very difficult to determine with any certainty the resultant of the commercial forces at work, which change their value in such a disconcerting way. Hence this cautiously worded summary of the position:—"My own belief is that low-temperature carbonisation can only be established on a sound commercial basis with low operating costs and a very moderate margin of profit." It is, however, to be hoped that the technical results obtained by the Fuel Research Board in its experiments, which should have a permanent value, and can be connected up with other factors in considering the commercial position of any such process, will be published as soon as they are available. Information on this subject from an unbiased and competent authority is wanted, and may serve to correct the extremes of laudation and condemnation to which we have become accustomed.

Considering now large are the quantities of coal used for steam-raising, Sir George Beilby rightly directed attention to the possibility of a large saving in fuel without any considerable capital expenditure which might be effected if steam plants were kept in order and their working properly supervised. Such supervision should begin, of course, with the coal itself, so soon as it becomes possible to exercise any reasonable degree of choice in that matter. The work of Mr. Brownlie, who has undertaken quite an extensive survey of steam-raising plants in some of our principal industries, has been very useful in this connection. As the lecturer pointed out, even if a moderate increase in efficiency of 10 per cent. were effected in the steam-raising plants of the country, it would result in a minimum saving of 7½ million tons per annum. Mr. Brownlie's

own experience leads him to take a much higher saving as a possibility.

The last part of the lecture was given up to a description of the new position of the gas industry since the passing of the Gas Regulation Act of 1920, which instituted the charging for gas by the therm and removed many useless restrictions. The new Act, which was based upon recommendations by the Fuel Research Board, will, in effect, not only make it possible to obtain and distribute as gas a portion of the volatile matter of the coal, but also permit much more extensive gasification of the fixed carbon. This should open out quite a new field of efficiency and economy. The lecturer referred in particular to one modern development in the gas industry on these lines which has been investigated with considerable thoroughness during the last three years. The process of increasing the yield of gas by passing a current of steam through continuous vertical gas retorts while carbonisation is being effected was investigated by a joint committee of the Institution of Gas Engineers and the University of Leeds, and the results were presented to the Institution

of Gas Engineers at its annual meeting in 1920. These results, including chemical and thermal balances obtained with different quantities of steam, were obtained from one Scottish coal, but similar work extended to English coals and carried out later at the experimental station of the Fuel Research Board has added to our knowledge. "We can now say with confidence that there is not only a very substantial gain in therms in the form of gas, but also in the yields of tar and ammonia," when the steaming process is employed.

Sir George Beilby concluded his lecture by a brief summary and a reference to the present spirit of unrest, which complicates fuel and all other problems into which the human element enters:—

This spirit, as it is manifesting itself to-day, is fatal to the progress of reconstruction and development on any extensive scale, and we, whose chief interest in life lies in the control and use of the power and resources of Nature for the service of man, can only continue to do the work next our hand, while we cherish the hope that the better side of human nature, which we know is only temporarily overshadowed, will gradually reassert itself.

### The "Proletarianisation of Science" in Russia.

By DR. BORIS SOKOLOFF (formerly Lecturer, Petrograd University).

"Science? What is science? It is only a tool in the hands of clever politicians."—From report of a public discussion on science held in the Petrograd Palace of Labour, September, 1920.

SCIENCE in Russia is now passing through difficult times. The experiments being carried out by the Bolsheviks in Russia are opposed to it—how could it be otherwise? Everything—art, education, poetry—have been "proletarianised"; why not science? During the whole of the year 1920 a campaign was being carried on against "bourgeois science." In the Press and at special meetings complaints were made of the reactionary tendencies of professors, of their strange indifference to politics, of the necessity of turning scientific men into advocates of the Soviet system. By the phrase the "proletarianisation of science" the Bolsheviks seem to understand a reorganisation of the methods of scientific investigation, the broadening of its basis, and its practical application. But the real idea at the back of their minds is to make science serve the ends of Bolshevism. This view was expressed as follows by Communist speakers at the Petrograd Students' Conference:—

Comrade Lounatcharsky is quite right in saying that science is now in the hands of mandarins of bourgeois origin. We must appropriate science; we must make it proletarian. In the place of professors and scientific men imbued with political indifference and *bourgeois* ideals we must put real proletarians, learned men who will be able to create a science which will be obedient to us.

Such is the theory. The "proletarianisation of science" in this sense is a matter of the independent reconstruction of scientific methods. But, in practice, the "proletarianisation of science" is quite a different thing.

Science is the crown of the human intellect; it is the sun which man has created from his own flesh and blood. It is necessary to realise that the work of a man of science is the property of humanity as a whole. Science inhabits the domain of the highest altruism. Scientific workers must be considered as the most valuable of men, the most productive element of society. The premature death of a man of science means a great loss to the country; this must be fully understood by the workers' Government.

Look at the death-roll of scientific men within the last few months, and you will see how great is the loss of scientific energy in our country. If this process of extinction of learned men continues at the same rate, Russia will be deprived of her brains. Free science is indifferent to politics. (Petrograd journal, *Science and its Workers*, No. 1: article on "What is Science?")

So writes Maxim Gorky, a supporter and faithful adherent of the Soviet Government. He writes, he tries to convince—whom? Not, of course, the Russian *intelligentsia*, who know the state of affairs better than Gorky himself. Gorky's appeal is evidently addressed to Bolsheviks, to the Soviet Government. However, they can neither understand nor appreciate the appeal. Being men of simplified views—doctrinaires and politicians—they cannot accept the fact that science must be independent of everybody and