

lease expires. The methods which have been used and are now being employed in many parts of these coal fields are eminently unsatisfactory in this respect and steps should be taken now in the early days of the development of the coal fields to render impossible a repetition of the mistakes which are made in the older coal fields of Eastern Canada. To this end, an officer of undoubted capacity and integrity and with wide experience in the mining of coal should be appointed as Chief Inspector of Mines by the Dominion Government, to whom, among other things, all plans for the development of the coal mines working under lease from the Dominion Government should be submitted in advance and whose approval of the same should be necessary before the actual work of mining is begun, as is the case in all mines now worked under lease from the Provincial Government of Nova Scotia, or from the owners of coal lands in Great Britain. The mines should also, as in these cases, be inspected regularly by the Chief Inspector or his assistants in order to see that the plans which have been approved are being properly carried out.

From the coal which is mined and burned under boilers in the usual manner, only about 12% of the total efficiency is developed. And if, as is usually the case, only 50% of the coal is taken from the mine, there is secured only about 6% of the total efficiency of the coal contained in the area worked. If the coal is burned in gas producers and the gas so obtained used in internal combustion engines, a higher efficiency amounting to about 30% of the energy in the coal actually mined, or about 15% of the energy locked up in the coal of the whole area, is obtained. This is a distinct advance in efficiency but still represents an enormous waste. It is a waste, however, which at the present time we are unable to avoid.

On the other hand, the coal may be mined for the production of coke for metallurgical purposes. This was formerly made in the so-called Bee-hive furnaces, from which a relatively smaller yield of coke is obtained and all the other products yielded by the coal—gas, tar, ammonia, benzol, etc.—go to waste. In the best modern practice, however, the coal is coked in what are known as by-product ovens from which a larger percentage of equally good coke is obtained and all these other products are saved. About three-quarters of all the coke produced for metallurgical purposes in North America is still made in the old Bee-hive ovens. They flame for miles in Pennsylvania and excite no comment, while the burning of a \$1,000 house would draw a mob, and yet the waste is enormously greater. It has been estimated by Messrs. Campbell and Parker, of the United States Geological Survey, that at the prices which prevailed in 1907 the value of the by-products wasted in the Bee-hive ovens in that country was a little over \$55,000,000, and that on the other hand the value of the by-products from the retort ovens in the same year was a little more than one-third the value of the coke produced in them.

In Canada, by-product ovens are used by the Dominion Coal Company at Sydney and by the Algoma Steel Company at Sault Ste. Marie, but these are the only ovens of this type in the Dominion.

The coke which is used for metallurgical operations in Western Canada is all made in Bee-hive or Belgian ovens. While in these latter the gas given off by the coal is drawn off and may be used for heating purposes, the by-products, as in the case of the Bee-hive furnaces, go to waste. There are at present in Canada 2,024 ovens which do not save the by-products as against 730 which do save these valuable constituents of the coal. In Western

Canada there are 1,935 ovens of the former class and none of the latter.

Mr. F. E. Lucas, manager of the coke ovens of the Dominion Coal Company, estimates the saving effected by the use of the by-product oven to be \$1.93 per ton of coke made. This figure will, of course, vary to a certain extent with the locality in which the coke is produced, but it indicates the great additional yield which is secured when coal is coked by modern methods, more especially when the enormous tonnage of coke consumed in modern smelting is borne in mind. In the year 1912, 405,457 tons of coke were made in Bee-hive ovens in Alberta and British Columbia, representing a waste of approximately 12,569,167 pounds of ammonium sulphate and 43,383,899 gallons of tar; not to mention the benzol, creosote and other minor products and the immense amount of gas which would be available for heating and lighting purposes.

The principal objection which is urged to the introduction of the by-product oven is the expense of installation. But it is hoped that this objection will be overcome wherever possible since, as shown above, the by-products have high economic and market values and there will be a growing demand for them.

The tar is already being used extensively in the Dominion for a variety of purposes, among which may be especially mentioned that of the manufacture of briquettes from slack coal, thus effecting an additional economy in the utilization of this waste product. Ammonia, on the other hand, is a fertilizer of the greatest value, for which there is a great demand abroad and for which an ever-increasing demand will arise in Canada as the necessity of employing improved methods of agriculture is brought home to farmers. The by-product coke ovens of the United States produced in 1912 ammonia and ammonium sulphate to the value of \$9,519,268.

For some years past, in England and Germany attention has been paid to the problem of securing the largest possible yield of ammonia from coal during the process of coking. With the methods of coking ordinarily adopted at the gas works in these countries only about one-sixth of the nitrogen in the coal is obtained in saleable form as an ammonium compound. It has been found, however, that by employing certain improved methods the yield of ammonia may be increased by as much as 200 per cent.

The immense volumes of gas given off from the coal in the by-product ovens might be readily utilized in connection with associated industries, as, for instance, the burning of cement.

One of the most important problems which presents itself at the present time is the provision of an adequate supply of cheap fuel for the population of the prairie provinces of Canada. Very large areas of these provinces are underlain by beds of sub-bituminous coal and lignite which are estimated to contain 100,000,000,000 tons of these fuels. As yet, however, practically all the fuel in that portion of the plain east of Brandon is imported from the United States, while that used in the country west of Brandon is brought chiefly from the coal fields of the Rocky Mountains. This entails a long and expensive haul which results in a high priced fuel, and any temporary interruption of the supply results in a coal famine.

The reason why the mineral fuels of the plains have not been utilized is that they are expensive to mine owing to the absence of supplies of mine timber on the treeless prairies and they are also of a lower grade than the fuel