

(February 6)

# The Fuel Supply of Central Canada.

BY DR. EUGENE HAANEL.\*

ADDRESSING the Canadian Club on the subject, "The Fuel Supply of the Central Provinces of Canada, and its Economic Use," Dr. Eugene Haanel, Director of Mines, said:

*Mr. President and Gentlemen,*—On a former occasion I had the honor of addressing the members of this Club on the subject of electric smelting. I am happy to be able to state that the production of pig iron by the electric process has been solved both technically and commercially. When the projects now under way in Sweden are realized, it will mean the annual production of 250,000 tons of electrically produced pig iron—nearly one half of the whole output of Sweden at the present day.

I regard it as a special privilege to be permitted to again address you on a subject of importance to the business interests and the domestic happiness of the inhabitants of Canada.

In a country such as ours, where, in addition to the increasing amount of fuel required for industrial purposes, we are, during the long winters, dependent upon artificial heat in our homes, the item of cheap fuel and its economic use becomes one of the most important factors in the comfort and prosperity of the nation. I have, therefore, chosen as the subject of my address: "The Fuel Supply of the Central Provinces and its Economic Use."

I confine my remarks to the central Provinces, because these Provinces are almost wholly dependent upon outside sources for their fuel. The other Provinces are sufficiently near the immense coal deposits of the extreme east and west to render them available as sources of fuel, without increasing the price unduly by the cost of long haulage.

The fuel resources of the central Provinces are represented by:

1. The wood still standing.

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\*Dr. Eugene Haanel, Director of Mines, Ottawa, is one of Canada's leading mineralogists. His address to the Canadian Club bore directly on the subject of Conservation of Natural Resources, to which he has given special attention of late years. He has been an advocate for years of the development of the Canadian peat deposits for fuel purposes.

2. Our oil deposits.
3. The oil contained in the oil shales of New Brunswick.
4. The lignite of Manitoba.
5. Water powers—the *houille blanche*—or white coal of the French.
6. And, lastly, the peat deposits of these Provinces.

With the exception of the lignite of Manitoba and the peat deposits and, to a continually decreasing extent, the wood of our forests, the other classes of fuel named, play an insignificant part as sources of fuel for domestic use and, with the exception of the utilization of our water-falls for the production of power, imported coal is the staple fuel for these Provinces.

For the year 1909 we imported coal to the amount of nearly 10,000,000 tons, valued at \$26,831,859.

The current prices of coal and wood, as per "Labor Gazette," September, 1910, are:

	COAL		WOOD	
	Anthracite	Bituminous	Hard	Soft
	per ton	per ton	per cord	per cord
Toronto.....	\$6.75	\$5.00	\$7.50-\$8.00	\$5.00
Montreal ....	6.00	5.00	\$8.00	6.00
Ottawa.....	7.50	5.50	6.50	3.50
Winnipeg....	10.50	9.00	6.00	5.00
Vancouver...	....	7.50	4.00	....

The increase in the cost of living and the price of our manufactures, consequent upon the high prices for this absolutely necessary material might be counterbalanced by increased energy, activity and business ability as long as we are assured of a constant supply. Conditions, however, as they exist to-day may not continue, but change, and change suddenly, and we may find ourselves deprived of fuel from the United States, without warning. For such an event we have made no provision, we have accumulated no extra store to meet such an emergency, but import only what is needed annually. A few years ago the strike in the coal mines of the United States demonstrated that such an event must be reckoned among the possibilities. I need not point out that other causes than strikes might deprive us for long periods of this outside source of fuel. It is, therefore, wise and statesman-like to make provision for any emergency and seek within our own territory the means of supplying this all-important necessity.

Fortunately, nature has provided a substitute for coal and wood in the peat bogs scattered in abundance throughout the central Provinces. It has been estimated that the known peat bogs of Manitoba, Ontario, Quebec and New Brunswick cover in the more settled portions of these provinces an area of 12,000 square miles, with an average depth of 6 feet. This is probably but a small fraction of the actual amount of this valuable fuel asset in existence in these provinces.

One square mile of peat bog with an average depth of 6 feet will produce 774,400 tons of peat fuel, containing 25 per cent. of moisture. The 12,000 square miles will, therefore, contain 9,292,800,000 tons of peat, having a fuel value equivalent to 5,306,074,000 tons of good coal. Such an amount of peat would supply fuel to 5,306,076 families for 100 years, assuming each family to consume an amount of fuel per annum equivalent in heating value to 10 tons of the best anthracite.

To ascertain more accurately our peat resources, the Mines Branch began three years ago an investigation of the more important peat deposits favorably situated as regards transportation. Since the quality of the peat contained differs greatly for different bogs, some being suitable for the manufacture of moss litter, while others contain peat sufficiently humified for the manufacture of peat fuel, instructions were given to ascertain not only the extent and depth of the peat bogs, but also the quantity and quality of the peat contained. So far, some 14 bogs have been investigated and mapped, and it is hoped that the information contained in our reports will prevent the exploitation of bogs for purposes for which the peat contained is unsuitable.

Many attempts have been made in Canada to utilize those peat resources for the manufacture of fuel, but up to within recent times unfortunately with little success, and with the waste of large capital. The reason for these failures is largely due to lack of knowledge of the nature of peat and the processes employed for the commercial manufacture of peat in the peat-using countries of Europe.

To furnish this necessary information to prospective manufacturers of peat fuel, the Department sent a member of the staff of the Mines Branch to Europe to investigate and report upon the manufacture of peat for fuel and other purposes in the peat producing countries of Europe. A few months after the appearance of this report, the Iron and Steel Institute of Sweden offered its writer the position of peat expert of the Institute, which he accepted.

To further encourage the peat industry of Canada, it was deemed essential to furnish actual demonstration of a successful commercial process of the manufacture of fuel from peat as practised in Europe, by the erection and operation of a plant in Canada. To carry out this idea the Department purchased 300 acres of peat bog with an average depth of 8 feet, near Alfred, Ontario, and erected a peat fuel plant, such as is used in Sweden and Russia for the manufacture of air-dried machine peat. There are 1,300 such plants in operation in Russia, which in 1902 produced 4,000,000 tons of peat fuel, with a yearly increase since then of nearly 200,000 tons. Many private plants exist in Russia in connection with cotton mills, producing annually 200,000 tons of peat fuel.

The process is an exceedingly simple one. The peat is dug by hand and transferred by an elevator into a pulping mill. The pulp resulting is conveyed by cable cars to the drying field, rolled out into a sheet of some 4 inches in thickness by a field press, which also divides the sheet into longitudinal strips, which are further divided transversely by means of 3-bladed roller knives, operated by a laborer. The pulp is thus divided into blocks, which are left to dry on the field. Turning and stacking for more complete drying is done by boys. The pulp mill, cable cars and field press are operated by a steam engine. The capacity of the plant is from 25 to 30 tons per 10-hour day. During last season, operating for 50 days, 1,600 tons of peat fuel were manufactured. The weather conditions of the season were very unfavorable, the men employed new to their work, and changes required in a new plant involved a number of stoppages. Under this severe test, the amount of fuel produced must be regarded as thoroughly satisfactory. The plant was visited by the members of the American Peat Society during their recent meeting in Ottawa in July last. Many other parties interested in peat have taken the opportunity to examine the plant and witness its operation.

In my address before the American Peat Society, which met at Ottawa last summer, I stated, that: allowing 140 days for a season's operation, the cost per ton of fuel, including interest on capital invested, amortization, oil and repairs, is as follows:

Cost of fuel on the field .....	\$1.40 per ton.
Cost of fuel stored in shed .....	1.65 per ton.

I have since then, however, come to the conclusion, that probably 110 working days will, considering our climatical

conditions, be a fairer estimate of the period during which peat can be manufactured. This shorter period of production will increase the cost of manufacture to about \$1.50 per ton on the field with our plant.

Some 600 tons of this peat fuel were sold in Ottawa and the vicinity of Alfred and it has given great satisfaction. Constant application is made to the Department for additional supplies, and telegrams received from outlying towns asking for carloads of it. These demands could, unfortunately, not be met, as the remaining amount of peat fuel is required for our fuel testing plant at Ottawa.

The fuel manufactured is specially adapted for grates, cooking stoves and wood stoves. In fact, for the grate this fuel is far superior to cannel coal. Its advantages over cannel coal are:

1. It burns with a clear, luminous flame, without poking.
2. It does not eject into the room burning particles, and does not, therefore, require a wire netting to protect the floor.
3. It leaves no unburnt material. The ash left is a soft flocculent powder.
4. It does not soil the hands.
5. It does not, as cannel coal, cover the back of the grate with a thick layer of soot.

Its disadvantage is its greater bulk.

The Government peat plant at Alfred serves the purpose of demonstrating the manufacture of air-dried machine peat and is suitable to be operated on bogs near villages or by groups of farmers who own peat lands and who are desirous of making their own fuel, as a cheap and excellent substitute for the high priced coal which they are now obliged to purchase. This is successfully done in Europe. The cost of the plant amounts to \$7,600, including duty and freight on engine, peat machine, cars and rails.

For the manufacture of peat fuel on a large scale, say 20,000 to 30,000 tons annually, mechanical excavators, spreaders and cutters should replace the manual labor employed at our plant. On account of roots and stumps which are found in most bogs, the mechanical excavators brought on the market have not hitherto proven successful. It is only within the last two years that the problem of the construction of a successful excavator has been solved by Lieutenant Ekelund of Sweden. By the employment of his machinery the cost per ton on an annual output of 30,000 tons is reduced to 92 cents in the shed.\* This figure includes interest and amortization of

\* The cost of common labour in Sweden is from \$1.08 to \$1.22 per day of 10 hours.

the bog and machinery, transportation to shed, interest and amortization of the sheds, management, taxes, etc. Both Mr. Nyström, the peat expert of the Iron and Steel Institute of Sweden, and Mr. Wallgren, the peat expert of the Swedish Government, who each investigated the Ekelund plant for three weeks, have verified this astonishingly low figure of the cost of production of the peat fuel at 92 cents per ton. By the adoption of the Ekelund machinery the problem of economically producing air-dried machine peat may be regarded as solved and the successful inauguration of a peat fuel industry looked forward to with confidence.

Ekelund, however, starting from air-dried machine peat with 40 to 50 per cent. of moisture, carries his process further to obtain a product in the form of powder with 10 per cent. of moisture, the heating effect of which is stated to be equivalent, pound for pound, to the best English bituminous coal. This peat powder is admirably adapted for industrial purposes. Blown under a boiler, it burns with a long, hot, smokeless flame, leaving no unburnt particles. The flame is readily regulated, extinguished and relighted at pleasure. The firing is automatic. The powder is a magnificent fuel for steam raising. As it gasifies instantly and completely, it deposits no soot on the tubes or other surfaces and avoids the smoke nuisance consequent upon firing with soft coal. There are no clinkers; the ash is a soft, friable powder, which is conveniently removed by a suction fan. Professor Odelstierna reports that the powder is not liable to spontaneous combustion, is admirably adapted to metallurgical operations, the flame being easily changed from an oxidizing to a reducing flame and vice versa. The combustion of the powder produces the highest temperatures which the structural material of our furnaces can stand. Furnaces using peat powder are more cheaply constructed than furnaces using soft coal or generator gas. This fuel is specially adapted to the cement, glass and clay industry.

The Ekelund process has, moreover, the advantage of being independent of weather conditions, since the partially air-dried peat harvested during the summer months may be worked up into peat powder during the winter months.

The cost of manufacture of one ton of peat powder made from air-dried peat, including power, wages, interest, amortization, taxes, insurance, wear of bags, etc., is in Sweden \$2.30 per ton. Cost of plant, including the necessary machinery, furnaces, buildings, all complete for the manufacture of 20,000 tons annually, is \$86,000.

The interesting statement has come to hand, that as a result of instructions received by the Railroad Commission of Sweden from the King, to investigate the feasibility of using peat fuel in locomotives, the Commission recently recommended the construction of freight engines using peat fuel. Designs for two engines have been submitted by the Commission; one larger, requiring two firemen, to have the same traction power as the regular type E of the Government railways, the other smaller, requiring but one fireman.

Whatever fuel, however, we use, be it imported coal or peat fuel, it is in the interests both of economy and the conservation of our fuel resources, that for manufacturing purposes we employ methods which will convert the largest number of heat units stored in the fuel into useful work, or, to state this in another way, convert the heat energy of the fuel into useful work with the least possible loss.

The general practice pursued in our manufactories of converting the energy stored up in the fuel into useful work, by burning it under a boiler and utilizing the expansive power of the resulting steam in a steam engine is a wasteful and inefficient method. Using a coal of 12,500 B. T. U. per pound, at \$4.00 per ton, an ordinary 250 H. P. steam plant requires a minimum of 5 pounds per B. H. P. H. This amounts to 15 tons, costing \$60.00 per H. P. year of 6,000 hours. Contrast this with a H. P. year developed in a modern gas producer power plant, which consumes only  $1\frac{1}{2}$  pounds of coal per B. H. P. H., that is,  $4\frac{1}{2}$  tons for a H. P. year of 6,000 hours, costing \$18.00. For peat containing 25 per cent. of moisture and 6,750 B. T. U. per pound burnt in a producer  $2\frac{1}{2}$  pounds are required for a B. H. P. H., assuming the power station to be erected on the bog and cost of manufacturing peat \$1.00 by the Ekelund process, (Ekelund's figure is 92 cents) the figures are as follows: for a H. P. year of 6,000 hours,  $7\frac{1}{2}$  tons are required, costing \$7.50.

Compare these figures:

Cost of coal for steam plant for one H. P. year of 6,000 hours .....	\$ 60 00
Cost of coal for gas producer power plants.....	18 00
Cost of peat, 25 per cent. moisture, for peat gas- producer power plant .....	7 50

These figures relate to plants of small capacity.

For larger plants, both steam and producer gas plants, the relative consumption of fuel will be proportionally less.

The great economy effected by a gas power plant over that

of a steam plant will be manifest when it is stated that the most perfect and skilfully operated steam plant probably in existence to-day, namely, the power plant of the Interborough Rapid Transit Company of New York City, requires 2 pounds of coal per B. H. P. H., while an ordinary producer plant requires only  $1\frac{1}{2}$  pounds. The saving effected by a producer plant in cost of fuel, over that of the most perfect steam plant, calculating coal at \$4.00 per ton, is \$6.00 per H. P. year of 6,000 hours.

Suppose that 5,000,000 tons of the coal imported into Canada are employed for the production of power by ordinary steam plants, it is evident from our figures that for the production of the same power in a gas producer power plant only 1,500,000 tons need to be imported. This not alone cuts down our coal bill for power to less than one-third of what we are now spending and sending in cash out of the country, but we are saving also to some extent labor charges in handling at the plants two-thirds of the coal now used in steam power plants.

The economical results to be achieved by the introduction of peat gas power plants are so promising that the Mines Branch installed last year at our fuel testing station at Ottawa, for purposes of investigation and demonstration, a Körting peat gas-power plant, consisting of a producer, gas engine and dynamo, each of 60 H. P. capacity. Several tests have already been made, and the plant is now regularly used for running the machinery of our concentrating laboratory, requiring about 40 H. P. The amount of peat fuel consumption is about  $2\frac{1}{2}$  pounds of peat with 30 per cent. of moisture for one B. H. P. H.

At present we are installing a 100 H. P. producer for lignite and soft coal, which we confidently expect can be operated successfully with peat. When this peat gas producer investigation is complete and we are assured that the operation of these producers is uniform and will present no difficulty in practice, we will be prepared to recommend their installation at suitable peat bogs for the production of power, either for industrial purposes at the bog, or for conversion of the power into electricity to be transmitted to neighboring towns and villages for power and lighting purposes, exactly as in the case of water power.

If this is to be achieved, the present method of working peat bogs for only 10-hour days of the short season of 11 working days must be abandoned in favor of 20-hour days. With peat gas power plants erected on suitable bogs, suitable

as regards extent and depth of the bog and quality of the peat contained, the electricity generated at the power station may then be employed for operating the machinery and the transport of the manufactured peat to sheds, while electric lights will illuminate the field for the night shifts.

When this plan, which has been realized in Sweden, has also been put into practical operation in Canada, we will then have rendered ourselves independent to a large extent of outside sources for our fuel; we will have gained another cheap source of electrical energy, where water-power is not available but peat is in abundance, and we will then be prepared, at least to some extent, for any emergency that may threaten a fuel famine.