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A STORY OF OIL

THIS is a story of oil. . . . It starts very early in Canada's history. The first producing oil well on the American continent was opened in Lambton County, Ontario in 1858. This was the year before the first well was drilled in the United States.

It has had many ups and downs, but oil is so firmly established in our way of life that it will hold the centre of the natural resource stage for many a year to come. Hardly any other substance illustrates so well how science and technology may be combined to contribute to human efficiency and comfort.

In many enterprises there is no substitute for oil. It is a primary source of power for industrial nations, and, says an article in the *New York Times,* regardless of any developments that now seem likely with respect to atomic energy, oil will continue to hold its importance.

The civilization in which we live is predominantly industrial. Canada's economy is coming more and more to rely upon a pattern of industrial activity which requires an adequate flow of power. Blessed above other nations in the amount of water power at hand to produce electricity, we have hitherto been stunted by shortage of domestic oil.

Up until a hundred years ago, no one bothered much about recovering oil from deep in the earth. Then James Oakes, probing for coal in Derbyshire, England, came upon a deposit of petroleum the consistency of treacle. He mentioned it to his brother-in-law, a scientist who later became Lord Playfair, who brought about the development of the oil industry.

At the same time James H. Young, a chemist from Renfrewshire, Scotland, distilled illuminating oil from coal, hence the common name "coal oil." Abraham Gesner, a Canadian, working independently, also made oil from coal, and his process was put into commercial use at Newtown Creek, now a part of New York City, in 1854. At 14 cents a pint, Gesner's invention did not tempt the frugal people of the 1850's to stay up burning midnight oil.

In the United States

Hard as it may be to believe, United States people drilling salt wells in the early eighteen-hundreds looked upon it as a nuisance when they struck oil. It was not until the summer of 1859 that a well was deliberately drilled for oil in Pennsylvania.

With a few months the valley was crowded with derricks; by 1862, oil had been discovered in four other states, and in these three years production jumped from 2,000 barrels to 3,057,000 barrels.

Reports of today's reserves in the United States differ widely. A professor of geology at Harvard told an audience two years ago that it is probable domestic production will fail to meet needs within 5 or 10 years. The Geological Survey reported last year that large areas of potentially rich oil and gas lands have never been adequately explored. An oil review two years ago declared the United States must eventually face the alternative of depending on foreign sources or relying on higher-cost substitutes for natural petroleum. Another review says that reputable geologists estimate that perhaps 50 billion barrels still remain in undiscovered reservoirs.

In Canada

Sir Alexander Mackenzie, the first white man to span the North American Continent from the Atlantic to the Pacific, mentioned the presence of petroleum in the banks of Elk River, at the eastern end of Lake Athabasca. That was in 1789.

In the year after Confederation, the *Year Book and Almanac of Canada* says: "Petroleum may be considered at present the most important mineral product of the Dominion." The figures given in this old *Year Book* do not match those in a booklet issued by the Dominion Bureau of Statistics in 1945 under the title *Chronological Record of Canadian Mining Events from 1604 to 1943.* The latter, in fact, does not give any oil production data up to 1881, while the older book says the Lambton oil "springs" yielded 4,138,520 gallons in a period of less than a year in 1862 — 1863, one

well giving 2,000 barrels in 24 hours. In August 1868 the amount of crude petroleum in stock, 250,000 barrels, was more than two years' supply for Canada's home consumption.

When we jump to more modern times we find drilling in progress at Fort Norman, 60 miles from the Arctic circle on the Mackenzie River. This is too far from population centres to be developed economically in peace time. The test well, completed in 1920, showed a reserve of about 30 million barrels, and up to the end of the Canol project in 1945 production totalled 1,977,646 barrels.

Today, the Prairie provinces produce more oil than they can consume, while Canada as a whole is dependent upon imported oil. We use well over 250,000 barrels a day, and it is forecast that by 1955 we shall need 350,000 barrels a day. That would require a reserve of 3 to 5 billion barrels. We have, in discoveries of recent years, dipped our drills into reserves totalling about one billion barrels, but those in the know declare that there is still a vast territory to be prospected.

Besides liquid petroleum, Canada has other sources for oil. Our natural gas can be converted into high-test liquid fuel; oil shales exist in the mountain region; bituminous coal will yield liquid fuel, and then there are the tar sands.

In these bituminous sands, Alberta has the greatest known oil reserve on the face of the earth. Estimates vary between that of Canadian geologists at one hundred billion tons and that of the United States Bureau of Mines at 250 billion tons. The yield, according to *Canada Year Book,* is about a barrel of oil per ton of sand. Some geologists hold the theory that because the oil content is not decreasing by evaporation, the sands are being fed from underground sources.

World Resources

Our knowledge of what lies under our feet is so slim that any attempt to estimate the amount or value of this or that mineral is of dubious value. One thing is certain: in the past fifty years we have consumed a vastly greater quantity of mineral products than was consumed in all the preceding period of man's existence on earth.

And the trend is upward. Mr. H. L. Keenleyside, Deputy Minister of Mines and Resources, painted an interesting picture in his address to the United Nation Scientific Conference on the Conservation and Utilization of Resources in August. He linked the increase in population (20 million persons every year) with the world-general desire for higher standards of living, and posed the question: what would happen if the rate of consumption of mineral resources were to rise throughout the world to even one-half of the present rate in the United States? It would mean, ignoring population increase for the moment, a demand for 18 billion barrels a year.

As Mr. Keenleyside points out, population will not stay where it is, and people of other nations may not be satisfied indefinitely with a rate of consumption only one half that of the United States: "Yet if demand in these proportions should develop, it would, so far as we now can estimate, be greatly beyond the capacity of any known or probable supply."

Two of the world's greatest industrial nations, the United States and the Soviet Union, are the largest producers of oil and natural gas, but with these two exceptions nature has placed oil in out-of-the-way places where nearby people have little interest in production and use. With more than 30 per cent of the proved petroleum reserves of the world within its boundaries, the Middle East is supplying only 10 per cent of the world's demand.

It is one thing to dig a well in Alberta or Texas, and lay a pipe-line across the prairies through civilized country to a market or tanker port; it is a very different thing to get a barrel of oil out of a Middle East field to refineries on the Mediterranean. The oil shipment paralysis that struck that area in August is evidence.

About Finding Oil

It is only of recent years that technical skill has been used in seeking oil and other minerals. Oil men were content to drill near seepages or other surface indications, or just to drill at random. Had that state of affairs continued, our known resources and our production would be far behind our needs.

Even the early "science" of prospecting for oil was merely a compound of luck and superstition. The old time prospector roamed around the country without equipment save a hammer and shovel. Wildcatters (men who drill for oil "on spec") decided where to drill on the flip of a coin, or by sailing their hats into the air and drilling where they landed. One whose adventure turned out successfully was on his way to a selected site when his wagon broke down. He decided in a burst of petulance to dig right where he was stranded — and struck oil.

The unvarnished truth is: it is impossible to detect oil beneath the ground by any scientific device known today. Even with a full array of the most reliable, modern instruments, the geologist can only hope to locate rock structures of a type in which oil deposits often occur. This is given us on the authority of the President of Shell Oil Company, in an address to the Newcomen Society of St. Louis.

There were, this summer, nearly 80 geophysical parties trying to locate oil "traps" on the western plains, 70 of them in Alberta. (Geophysics is the Science concerned with the physical characteristics and properties of the earth.)

The cost of this exploration is high. A United States economist has estimated that about a billion dollars would be needed to finance discovery, transportation facilities and refining capacity of sufficient oil to balance Canadian requirements.

Regardless of the exploration methods used, the only way to be sure of the presence of oil is to drill a well. It may cost $200,000 to examine a 200,000 acre reservation before a single drilling rig is erected, but when the President of Shell Oil Company sets the possible cost of drilling a well at half a million dollars, the advantage of thorough search is seen. The scientists give a picture of the underground layers, and at least tell you where the best chances lie for finding petroleum.

Hints for the Beginner

If you are thinking of going into the business, here is how to do it. In choosing your site, you must consider whether there is evidence that in some remote geologic age, hundreds of millions of years ago, the necessary organic matter was deposited at the bottom of oceans and lakes which were later elevated into a continent just where you wish to drill; whether nature provided a suitable storage reservoir, in the form of sedimentary rock or coral reefs which hold oil somewhat as a sponge holds water; whether the oil is covered by solid rock which prevents it from seeping to the surface or spreading over too large an area underground; and if there is the proper earth structure to have forced the oil into pools.

Then, being sure of the right place to bore, consider the cost. This depends on what you have to bore through, and how far down you have to go. Practically all Foothills drilling is around 10,000 feet, while it is an exception to have to go to 6,000 feet on the Prairies. Mr. N. M. Fowler, Statistician of James Richardson and Sons, estimates that a Leduc field well of about 5,300 feet could be completed and equipped for around $85,000; Redwater fields of about 3,100 feet might run $60,000; deeper drilling in Turner Valley could cost as high as $200,000 per well, while the shallow wells at Lloydminster can be completed for under $25,000.

If the site is well chosen, and you have the money to develop it, you must think of what the return will be. It is necessary at this point to look carefully into the government's rights, because the mineral lands of Canada are administered by either the Federal or the Provincial Governments. There are royalties to be considered: the Alberta government levies 12½ per cent on petroleum produced on Crown land, or as an alternative you may choose to pay on a sliding scale from 5 per cent to 15 per cent based on the square root of the average daily production.

Expense and risk combine to make oil prospecting and production an outstanding field for enterprise, but it is one to be tackled only by venturesome men. This word of caution is necessary, because oil money seems to many "easy" money.

Refining and Transportation

Plans for refinery expansion in the West are expected to provide for self-sufficiency by the end of the year, so that the familiar movement of crude petroleum eastward to refining points will be eliminated.

Refining is made necessary by the unfortunate fact that the hydrocarbons naturally present in crude petroleum are not the kind we find best for use in internal combustion engines. We have to change the structure in various ways.

Modern refining had its beginning in the Burton process in 1918, which yielded 25 per cent of gasoline from crude. In that year there were fewer than 200 technical men engaged in research in the petroleum industry: today there are upwards of 10,000. Their work had increased the yield of gasoline to over 45 per cent, around 1941, and they have found a multitude of other uses for derivatives of petroleum.

Refining no longer consists only of separation of a few petroleum fractions with general properties, such as gasoline, kerosene, lubricating oil and wax. It has become a process of chemical synthesis in which many different hydrocarbons having specialized properties can be manufactured at choice. This is done by "cracking", which means splitting up the larger, heavier, molecules into smaller lighter ones by high temperature and high pressure.

Getting oil from one place to another has never been one of the easier tasks of the industry. A memory of the past lingers on in the fact that we still express oil production in terms of barrels, although oil today seldom sees a barrel. It is handled through pipes, tank cars, tank ships, and other bulk carriers.

Alberta, unfortunately, does not have direct access to tidewater, and is at a disadvantage in that regard compared with the United States Gulf Coast, Venezuela, and other oil fields. A 20-inch pipe-line is to be built from the central Alberta oil fields to Regina, and slightly smaller pipes will carry the petroleum to the Lakehead. Pipe-line construction already in mind will cost $100 million.

The Canadian Prospect

Now let us look at the Canadian petroleum scene as it has developed in recent years.

The first Alberta oil boom started half a century ago when Kootenai Brown and Lafayette French saw Indians skimming the brown sticky liquid off a slough near Pincher Creek. They traded a pack-horse for the slough, raised capital in Calgary (starting that city as the oil capital of Canada) and in 1901 there was a forest of tents and a crowd of drillers. No oil was found. It was many years before Gulf Oil was successful in the same district, after drilling 12,000 feet.

In May 1914 the first well came in at Turner Valley. Up to this spring the Valley had yielded nearly 100 million barrels of oil and about 1,500 billion cubic feet of natural gas. It is estimated that it still has in reserve 25 million barrels of oil and 400 billion cubic feet of gas, tapped by 278 producing wells.

Fields outside Turner Valley have grown in importance. The Conrad and Taber fields were among major

producers in 1946. Lloydminster became the centre of interest late that year. This field, lying astride the Saskatchewan — Alberta border, has reserves variously estimated from 50 to 300 million barrels. The oil, thick as molasses in its natural state, makes good railway or ship fuel. There is thought to be potential oil and gas territory in Saskatchewan stretching from the United States border for 365 miles north.

In 1946 surveyors, working by seismograph, got encouraging reflections at Leduc. In November, a speculative well was started, and on February 13, 1947, Imperial Oil Company brought in Leduc *Discovery* with a flush flow of 1,000 barrels a day. By June, with four wells in production, Leduc was accepted as an oilfield. Within eighteen months, Canada became the largest oil producer in the British Empire, ousting Trinidad from leading position. At mid-1949 there were nearly 250 producing wells in the field, and 30 more were being drilled.

This discovery opened up a whole new area for intensive search. It revealed the existence of the coral reef type of formation which is typical of the rich West Texas area. Redwater, the second major field, was uncovered by Imperial in September 1948. Thickness of the storage limestone in this area is 144 feet as compared with 35 feet in the Leduc area. Woodbend field yields oil from two layers, and just west of Woodbend is the *Golden Spike,* with more than 500 feet of porous limestone. South of all these there has now been brought to attention a new broad stretch of territory, heralded by the Canadian Gulf Oil Company strike at Stettler. The potential is indicated as 3,000 barrels daily of light crude oil from about 100 feet of pay zone.

By the beginning of this year these efforts had established light crude oil reserves in Alberta conservatively estimated at 600 million barrels. The production capacity indicated now is 100,000 barrels a day, which is about 40,000 barrels a day more than the demand in the Prairie Provinces.

How Canada Benefits

It is not possible at this time to estimate how much Canada benefits in dollars and cents through the new oil discoveries, nor even in how many ways she benefits. It is safe to say, however, that these discoveries rank with the most significant developments that have ever taken place in this country.

Raw materials have always been vital in Canada, and every new source raises our prospects of continued prosperity. Upon these raw materials we have built a superstructure giving employment in the fields of production, technology, manufacturing, transportation and marketing.

There is one definite way in which immediate benefit is seen. Canada has always had to import the bulk of the petroleum products she used. The cost two years ago, when sixty per cent of our petroleum came from the United States, was $258 million, all of which came out of our very small fund of United States exchange. The Alberta discoveries may save $50 million a year of United States money hitherto spent on oil. If it should be possible to triple Alberta's production, we should be independent of United States supplies. It would be necessary, from a price viewpoint, to swap our western oil for United States oil brought into the east. Wider understanding across the border of our exchange difficulties should make this easy.

Saving United States exchange would be the great national benefit. Alberta, of course, is realizing a large new income as the result of these discoveries. The government revenues have been increased by the sale of crown lands and by royalties on production. There has been increased employment, and business has prospered because of big expenditures for exploration and development. Steel mills and fabrication firms will be busy on the steel plate and pipe needed for a thousand miles of line.

As to capital for development of the new fields, let us refer to Joseph E. Pogue, Vice-President of the Chase National Bank of New York, who spoke on the subject last year. Assuming that Canadian oil developments over the next ten years will require a billion dollars of capital funds, and that 50 per cent will be generated from operations, an amount of $500 million will remain to be raised from the capital markets. "Should these funds be sought in equal parts in Canada and the United States, then the Canadian capital markets will be called upon to furnish $250 million," he pointed out.

Oil industry planning is of the long-range kind, and is not a month-to-month operation. Looking ahead, analysts see an increasing demand for petroleum. They say that both as fuel and as raw material for chemical industries petroleum will remain among the leading minerals for many years. Splitting the petroleum molecule into almost every possible combination of its constituent parts has opened up entirely new vistas for scientific exploration, with what expansion of industry we cannot even guess.

And Dr. Theo. A. Link told the Canadian Institute of Mining and Metallurgical Engineers in Toronto early this year: "I believe that during the next decade the exploration for and discovery of new oil and gas pools in Western Canada will be such that the wildest of day-dreamers will seem amateurs."

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