

International Aspects of the Petroleum Industry

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IN SUBSTANCE, the international aspects of the petroleum industry, as these relate to the United States, are as follows: The domestic production is not keeping pace with the domestic demands; our best engineering talent warns us of the imminence of a decreased production by our oil wells, although more oil is needed; and the only practical source whence this increasing demand can be supplied for some time to come will be the foreign fields. Other nations have given thought to the future and, in recent years, have shown a tendency to adopt strong nationalistic policies regarding their petroleum resources, policies that hinder or prevent the exploitation of these resources by other nationals. In consequence, we find that, facing a probable shortage of the domestic supply, our nationals are excluded from foreign fields; and this in spite of the fact that foreign nationals have been permitted to enter into and exploit our own oil resources on an equality with American citizens and without hindrance or restrictions. This country has supplied the larger part of the petroleum consumed by the world and yet, with a failing supply imminent, it finds that those countries that have been drawing upon our resources to supply their needs are showing a tendency to exclude us from their resources. In this way we shall be transferred from a position of dominance to one of dependence; and only by sufferance of those countries that are now seeking financial or political control of petroleum supplies, shall we be able to obtain the oil we will need.

IMPORTANCE OF PETROLEUM

Petroleum has become, during recent years, one of the essentials of our social and industrial life. All civilized countries recognize that the world is dependent on petroleum as on nothing else except textiles, foodstuffs, coal, and iron. Today, the tendency is toward an ever-increasing consumption of petroleum and its products as new and more efficient uses are found for them. The utilization of petroleum is extending more and more into the structure of our civilization. Consequently,

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it becomes a matter of the gravest concern whether we can go on building up an industrial and social structure dependent on petroleum unless we make provision for obtaining the necessary supplies. Unlike food-stuffs and textiles, the world's supply of petroleum is definitely limited; moreover, it is, like coal and iron resources, a wasting asset. But petroleum is a liquid, is by nature migratory, can be quickly extracted, and an oil field is readily exhausted; whereas coal and iron are extracted more slowly and, by prospecting, reserves can be blocked out for the years ahead. Oil fields once discovered are developed almost immediately; within a short time the peak of production is passed and decline sets in. We are constantly relying upon the discovery of new fields, at the moment unknown, to make up for the decline and depletion of those that are proved. Thus, we are living a hand-to-mouth existence and although during the past decades we have been very fortunate in making opportune discoveries—first Cushing, then Kansas, and then northern Texas—each of which has made up for a threatened deficit, the time must inevitably come when fortune will forsake us and the needed new production will not materialize. Then we may find ourselves suddenly thrown upon the mercy of the nations that control foreign sources of supply.

Few of us realize in how many ways petroleum products serve our daily needs. Petroleum in one form or another is used in every household; gasoline for the motor car, lubricating oils for bearings, kerosene lamps or paraffin candles for illumination. Not one of us can sit back and say that an adequate supply of petroleum is not a personal concern. Perhaps a recent statement appearing from enemy sources may convey most convincingly the importance of petroleum in modern life. Ludendorff, in his book on the late war, in speaking of the Rumanian campaign, says, "As I now see clearly, we should not have been able to exist, much less carry on the war, without Rumania's corn and oil, even though we had saved the Galician oil fields from the Russians."

IMPORTANCE OF INDUSTRY

During the world war, the Navy demonstrated the value of petroleum as marine fuel. Having a higher heating value than coal, a given tonnage assures a ship a much wider cruising range before refueling. In the mercantile marine the smaller bulk of fuel provides larger cargo space in the hull. Cleanliness and less labor for loading and burning are two other important features. In consequence, new ships are being built to burn oil and old vessels are being changed from coal to oil burners. Our greatest maritime rivals, the British, are rapidly equipping their merchant marine to burn oil, so that it has become obligatory upon the United States Shipping Board to do likewise in order that our vessels may be able to compete on an equal basis, as regards fuel, with foreign-owned bottoms.

The production, refining, and distribution of petroleum and petroleum products is one of our greatest industries; it provides a livelihood for many thousands of families. Although it has offered a big field for the engineer and chemist, in my opinion it has been comparatively unexploited by the mining engineer and is capable of absorbing hundreds, if not thousands, of properly trained and experienced engineers.

The oil industry also provides a wonderful field for our chemical engineers. Petroleum can be considered as a crude chemical, like coal tar, and the fuel value of all its products and the most efficient methods of utilizing them have not been discovered by any means.

Not only has petroleum furnished useful and essential products, but industries based upon these products rank among the major activities of the nation. Of such dependent industries, the greatest is the automotive industry. The automobile, the truck, the tractor and the airplane enter into our daily life. Today more than 6,000,000 automobiles are in use in the United States alone.

The three most important utilizations of petroleum are as fuel, as an illuminant, and as a lubricant. Petroleum fuels may be classified as light and heavy. The light fuels are gasoline, naphtha, and kerosene, which can be vaporized and used in the internal-combustion engine of the automobile or tractor. Heavy fuels are those that are burned directly for steam raising or for heating purposes, or can be used in internal-combustion engines of the Diesel type. About 57 per cent. of our output of crude petroleum is oil fuel of the heavy type, only a small proportion of which is used in internal-combustion engines; the other uses are relatively inefficient and for such uses petroleum is replaceable by coal. A larger use of this heavy fuel in the internal-combustion engine is hopefully expected, but with this development, the dependence of the world on petroleum will be increased still further.

This country is not as dependent upon petroleum illuminants as it was, although kerosene still is used in large quantities in districts not served by gas or electricity, and is an article of great importance in our trade with foreign countries.

Petroleum lubricants, although less in amount than the other products, are more generally used and are really more essential. They lubricate practically all bearings or moving parts. Quantitatively, there are no satisfactory substitutes and when one starts to replace, on a large scale, mineral lubricants by animal or vegetable oils of satisfactory quality, the dependence of our industrial life on petroleum lubricants becomes evident.

When we realize what petroleum, directly and indirectly, has done for our country and when we try to see what improvements in our ways of living the future holds for us, the significance of the international aspects of the petroleum industry becomes clearly evident. When we consider

the number of automobiles turned out yearly, the airplanes that will play an important part in commerce, the trucks that will supplement present transportation facilities, the agricultural machinery needed to meet the lack of man power on our farms, and the relation of our merchant marine program to oil, we can understand how vitally necessary an adequate supply of petroleum will be to us.

OUR PETROLEUM RESOURCES

The United States was the first country to produce oil in large quantity by the modern system of drilling wells and, except during a few years, has led all the countries of the world in the quantity of its production. In 1914, when the World War began, the United States was in first place and produced approximately 266,000,000 bbl. of oil, or about 66 per cent. of the total output of the world. Russia was second, with an approximate production of 67,000,000 bbl., or about 17 per cent. of the world's total. Mexico came third with about 21,000,000 bbl., or a little over 5 per cent. of the world's production. Rumania, the Dutch East Indies, India, Galicia, Japan produced comparatively small amounts of oil, totaling approximately 12 per cent.

In 1914, therefore, the United States was far ahead of any other nation as a producer of oil. It was also far ahead of any other in the development of its oil fields and in the utilization of oil products. The vital importance of petroleum had not been fully recognized by the leading countries of the world, so the United States occupied a unique position, practically without competitors. Foreign countries had not begun to consider seriously future supply and there was less rivalry in gaining control of possible oil fields. Yet signs of an awakening interest were evident. Great Britain, because of having adopted fuel oil in the Navy, had begun taking steps to assure, through British nationals, an adequate supply of oil from Mexico and to encourage development in British domains. The British Government had also entered into partnership with the Anglo-Persian Oil Co. to exploit a huge concession in Persia.

The point of real importance, however, is the relative position of the United States as a consumer rather than a producer of oil. To produce the bulk of the world's production is of small consequence in comparison with producing enough to meet our present and probable future needs. In 1918, the output of crude oil in the United States was 356,000,000 bbl. Mexico had taken second place with 63,000,000 bbl. The production of the United States for the past several years has been approximately 65 per cent. of the world's total. The approximate consumption of the United States for the year 1918 was 418,000,000 bbl., or more than 80 per cent. of the world's production. This figure of consumption, however, includes the oil that was refined or partly refined in the United States and

exported for consumption abroad. The exports of petroleum products approximated the imports of crude petroleum from Mexico and other foreign countries. But in addition, some 20,000,000 bbl. of oil were withdrawn from domestic storage. In substance, therefore, the United States, in 1918, was living beyond its means. The year 1919, because of the present flush production from Texas fields and the increased imports from Mexico, finds the United States in a somewhat more favorable condition, not having to draw on stocks; yet it must be remembered that the stocks have not only decreased actually but have decreased in proportion to our production and consumption. Thus, in 1915, there was over six months' supply of oil in storage, whereas at the end of 1918 stocks had been reduced to less than four months' supply.

The U. S. Geological Survey has given the following figures of the marketed production and consumption in the United States. The figures for marketed production approximate, but are not the same as, actual production:

	MARKETED PRO- DUCTION, BARRELS	CONSUMPTION, BARRELS
1916.....	301,000,000	329,000,000
1917.....	335,000,000	384,000,000
1918.....	356,000,000	418,000,000

Evidently the production of the United States, in spite of its having risen steadily during recent years, is not rising as rapidly as it should and is not keeping pace with the increase in consumption. The sources from which we can draw for our future needs of petroleum and its products are: Our own oil fields, foreign oil fields, oil shales, and substitutes for petroleum products. Engineers and geologists who have investigated the possible oil underground in our developed and undeveloped oil fields agree in making pessimistic reports. This is particularly true of the U. S. Geological Survey, the organization that has given most attention to our petroleum resources and has the most facts. The U. S. Geological Survey estimates our unproduced but recoverable oil in January, 1919, at 6,740,000,000 bbl. This, could it be produced as needed, would not continue our present production of oil for more than 20 years.

Many persons, especially non-technical oil men, are inclined to question these estimates and call them too pessimistic, saying that whenever in the past more oil was needed new discoveries were made and unexpected fields brought forth new supplies. However, our best-informed engineers have given this estimate, and their belief should outweigh the vague optimism of those who question it. Of course, in view of the fallibility of estimates, the figures may prove to be too pessimistic. Even if the estimates of the supply of unrecovered petroleum were 50 to 100 per cent. too low, the situation would still not be satisfactory. And the fact remains that no

matter how much oil there may still be in the ground, we have not been and are not getting it to the surface as fast as it is now needed.

Clearly, we must seek other sources of supply to make up the balance between domestic production and domestic needs. Enormous deposits of oil-bearing shales occur in the western states, in the Cretaceous formations of the Rocky Mountain region. The U. S. Geological Survey estimates that the shales in the states of Colorado, Wyoming, and Utah alone contain many times the recoverable oil present in our oil fields before well drilling began. But the oil in these shales is not immediately available. The extraction of oil from the shales on a commercial scale under existing conditions in the United States is still in an experimental stage. We do not know, as yet, whether these shales can be developed profitably under present conditions, nor under what conditions they can be developed. Furthermore, it will take many years, even under favorable conditions, to obtain from these shales enough oil to replace a considerable part of that now obtained from wells.

I do not wish these statements to be interpreted as reflecting on the prospects of the shale industry, but simply wish you to realize that the production of oil in the quantities demanded by present-time needs would require development on a tremendous scale and would require the mining of hundreds of millions of tons of shale each year, the annual amount being more than half the annual tonnage of coal now mined. There is no evidence that shale oil can be produced on such a scale at present prices and, therefore, to satisfy our petroleum needs by oils from shales involves higher prices for petroleum products. Moreover, our oil shales occur in sparsely populated regions, remote from centers of large consumption. Oil shales constitute a reserve that, fortunately, seems to provide ample protection against an ultimate future but they cannot be used to meet the present situation.

SUBSTITUTES

The products from the destructive distillation of coal can be used, in so far as they are available, to replace gasoline; but quantitatively it seems out of the question to expect more than a minor alleviation from them. Coal can largely replace fuel oils. Alcohol can replace gasoline and has the advantage that it can be made from replaceable material—that is, from plants, but because of its cost, it cannot compete in a large way with gasoline at present. Moreover, the difficulty and expense of replacing any considerable part of the gasoline supply by alcohol is not generally appreciated. Finally, no substitutes are now known that will satisfactorily replace mineral lubricants in the quantities needed.

Thus, the facts indicate that we must inevitably seek foreign supplies in order to meet our needs and to compete in the world's markets with-

out too great a handicap. However, we should not rely upon any one solution of the problem, but should seek to put into effect every feasible means that promises to help, and should strive to anticipate our future needs rather than to go along blindly with the inevitable result of suddenly being confronted at some future date with a shortage of oil. Steps should be taken to conserve our developed supply. This supply is tangible; we already have it, and common sense dictates that we take the best possible care of it. By conservation I do not mean the tying up of resources, but a wise utilization, the working out of methods that will yield us the greatest quantity of oil at the least cost and will enable us to refine and use the oil with the highest efficiency. This phase of the question is peculiarly a part of the work of technical men, and I believe that this Institute should seriously endeavor to further, in every possible manner, the application of engineering methods to the oil business, for the oil industry is probably more backward in applying engineering knowledge than any other mineral industry. This statement is not a criticism of the oil industry for being backward in taking up engineering, any more than it is a criticism of the engineer in being backward in taking up the oil industry. Until recently there were few engineers who were qualified, by actual experience in the oil fields as well as by engineering training, to be of real assistance to the industry. Happily, this condition is rapidly improving. Yet there is today an under supply of competent petroleum engineers equipped to deal with practical problems.

In addition, we should further the oil-shale industry and, regardless of our individual opinions, should endeavor to determine as soon as possible under what conditions the oil-shale industry is commercially feasible, and thus be prepared for a future emergency.

In the same way, petroleum substitutes should not be neglected. These lie mainly in the field of the chemical engineer rather than of that of the mining engineer.

FOREIGN SOURCES OF SUPPLY

Recently, the U. S. Geological Survey has shown a particular interest in questions of foreign supply, and has rendered a splendid public service by collecting all possible information on the subject. This information has been placed at the disposal of the government and also of those individuals who contemplate entering foreign fields.

In the opinion of the U. S. Geological Survey, enormous resources await development in various parts of the world; but these resources have not been developed as intensively as those of the United States. The premier position of the United States to the present time has been due, perhaps, more to an intensive development of resources than to any supremacy in the resources themselves. Enough information is available about foreign countries to know that oil occurs in many places, and that

there are partly developed fields of high promise. It may well be that in vast areas which have not been studied by the geologist or tested by the prospector there are undiscovered fields of great magnitude. For these reasons I believe that there is not nearly as much danger of a world shortage as there is of a domestic shortage. Fortunately, the situation requires nothing more than the developing of foreign fields as supplies are needed and the accessibility of those fields to our nationals. The problem that presents itself, therefore, is whether the United States can obtain an adequate share of oil from the known and potential fields of the world, or whether it is going to be excluded by the political and economic policies of other nations and thus find itself, so far as petroleum is concerned, at the mercy of those nations.

The key to the future is access to the sources of supply. The strong financial position of the petroleum industry, in this country, the refining and marketing facilities of the strongest American companies will not, by themselves, suffice if we are at the mercy of the citizens of other nations for our crude supplies.

STRONG NATIONALISTIC TENDENCY OF FOREIGN COUNTRIES TO EXCLUDE OTHER NATIONALS

One result of the war has been an accentuation of nationalistic spirit; the nations that were combatants and those that were neutral have shown increasingly a tendency to exclude other nationals from their domains and to develop their own resources by their own interests. This tendency is a natural result of an awakened knowledge of the need of self-protection and of a desire to conserve for themselves the materials now essential to the world's civilization.

The United States is not an imperialistic nation, and, exclusive of Alaska, its foreign possessions are with small potential resources. Thus we find no political control of consequence over other than the domestic sources of supply within the United States proper.

When we turn to the developed or prospective oil fields in other parts of the world, we find that their political control may be grouped under two heads: colonies and domains of such nations as England and France, and domains of smaller nations, such as the Latin-American countries, China and Persia; under present chaotic conditions perhaps Russia could be included. The most promising oil districts now known outside of the United States are in Mexico, in the South American countries bordering the Caribbean, in Equador, Peru, Bolivia, Argentina, northern Africa, Egypt, Persia, Mesopotamia, Palestine, Russia, India, East Indies, and China. There are other localities of smaller promise or about which less is known, and doubtless some of these will develop fields of the first magnitude when explored and prospected.

When one reviews these potential oil fields, one is struck with the

fact that Latin America, Great Britain, France, and the Netherlands, apparently control the main potential sources of supply, and particularly those that are of the most concern to the United States. Thus, the policies of these countries are of the greatest interest to America. We find England and France adopting policies, already in part incorporated into laws or regulations, that now virtually exclude other than their own nationals from developing the resources within their own realms. Of course I do not mean to insinuate that the policies of these countries are aimed directly at Americans; the policy of each country is to look after its own citizens; hence it is directed against the citizens of all other countries, and thus affects Americans. For a detailed statement regarding the policies of these countries I refer to a memorandum by myself to the President, which was disclosed to the United States Senate by Senator Phelan of California. Copies of this document appear in the Congressional Record of July 29, 1919. Those interested in the various political phases of the situation can obtain information there, or from the American Petroleum Institute.

The members of this Institute are well informed as to the situation in Mexico. Mexico is considering stringent regulations as to oil concessions which, if enacted into law will be very detrimental to the just interests of nationals other than Mexicans, including ourselves. The policy of Argentina has been, practically, the nationalization of its petroleum resources. Other Latin-American countries have shown some uncertainty as to what their policies are to be. Japan has adopted a policy that practically excludes other nationals from its own fields in Japan, Formosa, the Island of Sakhalin, and from the fields of China so far as its control extends. The Netherlands Government has also adopted a policy of exclusion that practically restricts developments within its domains to its own nationals. France has adopted policies that are not so evident on the surface, but in effect, these policies are proving restrictive, and are seemingly intended to exclude other nationals.

RECIPROCAL PRIVILEGES SHOULD BE GIVEN TO AMERICAN NATIONALS

A review of the foreign situation, therefore, discloses the fact that whereas other nationals can enter our oil fields, acquire properties there, and work these properties on an equality with ourselves, our nationals are not receiving reciprocal privileges from many foreign governments now controlling the most important oil regions of the world, and thus in time we are likely to be largely dependent on those governments for our domestic needs. Moreover, conditions in the Latin-American countries are not as satisfactory as they might be. The question comes, therefore, as to what should be done toward removing discrimination under which Americans are practically excluded from foreign oil fields. It is not for

me to discuss here such a question in detail, but it is perfectly obvious that in all fairness our nationals should be accorded the same privileges that we accord other nationals. It has not been the policy of the United States to exclude foreign corporations or individuals; in fact, they have been welcomed, as it has been recognized that the capital brought in has been, in a large way, helpful to the United States even though the profits went mostly to the benefit of other nationals. It would be, in my opinion, a mistake to forsake this policy, just as I believe it is a mistake on the part of other nationals to have put into effect such policies. It would be desirable if all countries adopted the same open policy as that which has prevailed in the United States.

In regard to individual Americans, and particularly to the members of this Institute, it seems to me that it is the duty of all to interest themselves in the situation and to do what they can to educate the people of this country and their representatives as to the situation, and to urge such wise and necessary steps as would best relieve it.

Another help that the members of this Institute can render is to transmit to the government such information as it acquires on the foreign situation, including information on the possibilities of oil fields, on laws, regulations, and policies that tend to discriminate against American nationals entering foreign fields, and on actual cases of discrimination. This information built up from many sources will prove invaluable to the government, and thus to yourselves and those interested in the foreign oil fields. I do not know whether the furtherance of such work could be made properly a part of this Institute collectively, but I see no reason why the members of this Institute should not render this service to their government.

I may also urge the opportunities and national importance of American concerns entering foreign oil fields. Evidently this country is going to need foreign sources of supply, and it will be to its great advantage to obtain these through its own nationals. Heretofore, American methods, American machinery, American brains have been employed by foreign capital to develop foreign resources. It will be more desirable if our brains and abilities are employed under our own nationals. It is desirable that every engineer realize before accepting employment with any foreign corporations competing against ours, just what this means. I believe it should be made a policy of the members of this Institute to see that the younger engineers and those unacquainted with foreign conditions, are informed on this matter.

DISCUSSION

LEONARD WALDO, New York, N. Y.—In Mexico, there are huge oil resources, but the only means of transmitting that oil to the United States is by ship, and ships seem to be forgotten on all occasions. Those

we had at the beginning of the war for carrying oil were almost all under foreign charters, which were soon recalled and the ships used for transporting oil from Mexico and other points to Europe. Consequently, now we have a scarcity of ships for carrying oil; that is the most important defect in fueling the Atlantic seaboard. Every effort should be made to bring the shipping interests into line, including the government shipping. Oil is the one way of fueling the Atlantic seaboard and taking care of our steel plants, our boiler plants, our heavy industries that take oil, and ships must be used to relieve the pressure from the oil lines, which are only capable of supplying the higher uses of oil at 20 or 30 cents a gallon. For fuel, the marketable value of oil should be about 2 cents a gallon; before the war, large contracts were made at 1.8 cents per gallon for Mexican fuel oil delivered at the docks for the steel works to use.