CHAPTER II

THE CONTRIBUTION OF PETROLEUM TO CIVILIZATION, PAST AND FUTURE

(1) Oil in The Service of Men.
The outstanding success of the world petroleum Congress throughout its history is proof of how much community of interest exists even in such a highly competitive industry as the oil industry. The interests we share are to a great extent scientific and technical. But we also share a broader interest in the well-being of the civilization in which petroleum is a basic commodity. It is appropriate, therefore, that we should estimate the contribution which petroleum has already made to civilization, and that which it may make in future.

In its first hundred years the petroleum industry has grown to a great size. Today oil and gas supply are about half of the constantly mounting energy requirements of the world, as well as an ever-increasing volume of non-energy products. Movement of petroleum between nations is the biggest single item in world trade, almost 9 per cent of the total world trade directly employs well over a million people and indirectly creates employment for many millions more.

These figures suggest something of the size of the oil industry's vital involvement in the world today. But to grasp the nature of that involvement, we have to remember the history of the development of the use of oil.

Men have noticed small amounts of oil, asphalt, and natural gas seeping out of the earth since the dawn of history. They have used the tar to caulk ships and even to make bricks and pave streets. But petroleum is not the same kind of resource
as water or food or timber. In its raw state its usefulness is very limited. Furthermore, almost all of it lies concealed and barricaded in the depths of the earth.

Our ancestors had not the faintest idea what vast amounts of oil the earth contained. They had no way of finding it or of bringing it to the surface; and in any case they had no real knowledge of what to do with it. Before petroleum could play an important part in the process of civilization, somebody had to learn how to find and recover it on a large scale. To move it all over the world to places where it was needed; to convert it into usable forms, especially as fuel; and to build machines that would transform that fuel into work.

By today's standards, petroleum was still an unimportant world resource in the Koresene age less than a century ago. We may laugh at the Roman naturalist Pliny, who called naphtha "quite unfit for use" because it was so highly inflammable. But to the men of the late nineteenth century who drilled into the ground to meet the growing demand for lamp oil, gasoline was still a useless and dangerous by-product.

The decisive moment for petroleum came when it was discovered that it was a form of energy. Then it began to supply heat and work. Before that moment could arrive, many technical advances had to prepare the way. Major petroleum discoveries by drilling, first stimulated by the demand for illuminating oil; the atomizing oil burner which made oil a practical fuel for shipping industry, and space heating; and most far-reaching of all the extremely versatile internal combustion engine - first the carburettor type, then the diesel engine and
now the gas Turbine - which created a still more tremendous demand for petroleum fuels of high grade and for which no competing fuel has been found.

Such a flowering of technology could have happened only in a time of dynamic economic growth. This period saw the emergence of large scale industrial organizations, rapid progress in the technique of mass production, rising wages and living standards, mass markets, expanding international trade, and, equally essential, the investment of capital in amounts not known to any earlier ages.

There are good reasons why petroleum, of all fuels, should have played such a big part in the energy revolution. The resources are abundant, petroleum is chemically versatile and can be easily transported. Perhaps most important of all, because of its high ratio of energy delivered per unit of weight and its liquid form petroleum power has strong advantages wherever mobility is a factor by land, sea, air, and even in outer space. To a great extent because of petroleum, modern man has experienced a "quantum Jump" in his ability to control and apply physical energy, a jump comparable in importance to the domestication of animals in prehistoric times.

Now big a jump this has been can be seen from one of two examples. In the days of the horse and buggy, a man could drive himself and his family with much effort, not more than 40 miles in a day. Today it is by no means unusual, and a good deal less strenuous, for the family automobile in one day to cover ten times that distance.

Or consider freight transportation. Official figures in
the United States - and I believe the figures in Europe would be very similar - show that a modern diesel freight train for every gallon of diesel fuel it consumes, moves a ton of freight 238 miles. It would take a strong man, by his own physical exertion, about eight months to perform that gallon's worth of work.

Has petroleum Technology been confined to the energy fields? As often happens in research, progress in one line of development prepared the way for progress in another. Organic chemists, studying hydrocarbons as fuels and lubricants, discovered in those same molecules a veritable Treasury of raw materials. Thus the Technology of petrochemicals was born, bringing into the world, among other things, many different kinds of synthetic rubber, fibers, fungicides, solvents, fertilizer and an endless variety of plastic compounds.

Suppose you or I, by some miracle, were carried back through time a hundred years and had to try to explain to a European or an American of those days what results were destined to flow from this petroleum from which men had just begun to drill into the earth. How could we express it in human terms? We might tell him something like this:

"Try to imagine an energy revolution through the industrial regions of the world. In that revolution the first key word will be work. A hundred years from now, machines will run on petroleum fuel. They will do hard or back-breaking work. Thousands of times more than what the human body or draft animals can do. When you walk through a city or a farm you will scarcely see horses, or gangs of people reaping with
scythes or excavating with pick and shovel. Machines will do all that.

"The second word is products. With his greater leisure and higher wages, the twentieth-century worker and his family will enjoy a world of products such as many an ancient king would have envied. Petroleum lubricants and fuels will reduce the cost of manufacturing and distribution so that almost every imaginable product is within everyone's reach. With the aid of chemistry a list of products will actually be made of petroleum textiles, containers, paints, fertilizers, cosmetics, furniture and many other things.

"The Third word is heat. We may not abolish severe winters but convenient oil and gas will heat homes, factories and offices and greatly increase people's comfort and their ability to function in cold weather. In industry these versatile, cheap, and easily controlled fuels will supply heat for new processes and open new vistas of progress in all directions.

"The last word, mobility, is perhaps the most important of all. Petroleum will be the vital fuel in a fantastic transportation revolution in which both horse power and coal fuel will be almost entirely replaced. Not just the rich, but hundreds of millions of people, will move by gasoline-powered automobiles and buses over a vast network of roads. Every village on the continent will become accessible to the family car. Country people will gain ready access to the cities. Factories will begin to be located in the country as workers drive themselves to their jobs. Cities themselves will spread out and open up, becoming less congested. Mass markets will develop. The ordinary citizen will attain a standard of livi-
ne, of education and of political importance such as his ancestors never dreamed of.

"Even between continents travel will become commonplace. Commercial aircraft, flying close to the speed of sound, will cross the Atlantic between breakfast and dinner".

At this point, if not before, our nineteenth-century friend would probably tell us to stop trying to make a fool out of him. And no wonder. It is an old story to us, and yet it is still a little bit incredible how, in less than a hundred years, this petroleum-based technology has transformed life in our industrial society.

Such is the picture of petroleum technology as it now stands in the United States, Europe and other highly developed areas. But unfortunately this picture would be accurate today only in less than half of the world. For the rest, the uses of petroleum have only begun to be experienced.

However, the technology is spreading irresistibly. The farmer in a pre-industrial country who had acquired a kerosene lamp would never willingly go back to using wood torches. The people of back country regions who have acquired motor roads and airlines by which to travel, and to get to know other communities beyond their own valleys and thus acquired a wider sense of nation, will never go back to their old isolation.

It is the keen desire for such advantages as these, made possible by petroleum, that makes nations willing to go through the growing pains of economic development.

Upto this point I have been speaking only of the products of petroleum. But in the history of oil and civilization,
products are by no means the whole story. Behind the products are the industry and its people. The widespread occurrence of oil in nature, usually for distant from the principal markets and the risks and great capital expense of finding, producing, refining and moving it to market, have all combined to create the largest international industry in history. We in the oil companies have pioneered in building business organizations capable of absorbing these risks and expenses. Starting with tapping the hidden resources deep in the earth, it is our job to deliver (only oil resources can deliver) many products of petroleum where, when, and in the amounts needed literally anywhere in the world where we are free to operate.

In carrying out this function, our efficiency has been kept sharp, and our technical progress rapid by constant competition, not only with other fuels but among ourselves. We have been leaders in efficient business administration and in advanced personnel relations and we remain so today.

Our industry is also a major source of revenue for the governments of both producing and consuming nations. Unfortunately, in some cases these excisions increase to a point that tends to defeat their own purpose. Excessive taxes on production discourage investment in exploration and development of new reserves. Excessive taxes on imported petroleum products can prevent them from competing with other fuels, and when that happens the whole economy must pay a higher price for energy. But the oil industry is always willing to pay its fair share to governments through taxation.

Finally, our industry is playing an important part in the
development of nations. In fact we were doing this, as a natural outgrowth of our international business, long before the development of nations became the great preoccupation of governments that it is today. Oil enterprises in any countries have helped to adapt business techniques and organization to a great variety or cultures. For example the foreign affiliates of my own company employ over 1,00,000 people, most of them highly skilled, only 2 percent of whom are United States nationals, practically all the rest, including most of top management, are citizens of the countries where they operate.

Distinctions of nationality or race or cultural background are less important to our industry than talent. Just as the geologist looks for oil wherever nature has hidden it, we in the petroleum industry look for talent everywhere and we try to create conditions of freedom and progress and of educational opportunity, in which talent is likely to come to the surface.

Such are some of the achievements of petroleum and its products - for human benefit. Of course, all this accelerating progress has brought with it many problems. Some are technical problems. Others are human problems, and perhaps not entirely new, but they have been made more urgent by the speeding up of communications and travel. Our world is shrinking notions of time and space have been abolished. Inevitably this has brought new confrontations between strangers, and new challenges to their understanding.

Truly petroleum has wrought an amazing transformation in our civilization in the relatively brief space in world history of single century. These words of mine cannot do justice to
such change.

With this tremendously vital and successful historical perspective in mind, let us now attempt to look into the future for oil. Will the next hundred years be as fruitful and as thrilling? What economic and technical prospects does our industry fact? And will the human and political environment be favourable for us to give mankind the service we are capable of?

Petroleum will be a growing energy source for a long time to come. Between now and 1980 we estimate that the world will consume somewhere near 270 billion barrels of oil per day.

Since this figure is not far below the world's present estimated reserves, which are to the order of 300 billion barrels, some might be concerned about the adequacy of petroleum resources for the future. I do not share this concern. Ever since petroleum became a major fuel, proved reserves have been rising from one year to the next, through new discoveries and better methods of recovery, even faster than the increase in oil production. For instance, in the 1930s there were 14 barrels of proved reserves for each barrel of annual production. Today the ratio is better than 30 to 1.

It seems certain that enough new proved reserves will be developed to provide for the rising oil consumption which we anticipate for many years to come. This will be accomplished not only by the discovery of new oil fields, which is sure to take place, but also by greater recovery from fields already known. We are constantly finding ways of "squeezing the sponge" a little harder and recovering a greater percentage of the oil
we know is there. This progress has already come to a point where the industry might well claim reserves one half again as great as those now stated. Even this may be conservative in view of more advanced recovery techniques (still to be developed) that are being developed.

In the still further distance are the enormous reserves of oil shale and Tar sands - equivalent to several times today's reserves of crude oil - for which competitive extraction methods are sure to be available when they are needed. Indeed, such methods are well advanced even now. All this will make constant demands on our research, as well as on our capacity to invest; but these challenges the industry is prepared to meet.

Refining technology too can be expected to progress further to meet product requirements of the future. Supersonic civilian jet aircraft will need new fuels with higher thermal stability (to absorb much of the extreme heat generated by air compression and friction). Soon we may have to produce both new fuels and new lubricants for automobile engines with compression ratio much higher than those of today. We must continue work on liquid and solid rocket propellants for space vehicles, and on new means of tapping the energy of oil such as the fuel cell.

Surveying all these prospects, we can see that petroleum fuel has many years of growth ahead of it. The assurance of this lies both in the ever-rising world demand for energy, keyed to rising population and increasing living standards and in our continuous research to adopt petroleum, with all its inherent advantages to changing energy requirements.
But energy demand is far from being the whole story. Dramatic growth lies ahead for the uses of petroleum outside the energy field. The range of applications is already enormous, and more are being added every day. The exploitation of petroleum as a raw material is one of our great industrial frontiers.

The word "Petroleum" has become a part of our language only in the past generation. Yet the ordinary citizens of many nations are already as familiar with synthetic rubber, synthetic textile fibers, and plastics like Polythene and Polypropylene as they are with natural rubber and paper. Soon building materials made from petroleum will be equally familiar.

In both industry and agriculture we see the same rapid growth. Iron-making blast furnaces have begun to operate more economically by injecting fuel oil or natural gas. Nitrogen fertilizers, pesticides, fungicides, waxes to increase crop yields — all these and other petroleum products are indispensable in modern farming. There have been promising tests of a petroleum spray to stabilize sand dunes for a year or two, during which time we can plant forests, build soil on them, and reclaim them from the desert.

We should remember that future growth in the uses of petroleum is not going to be confined to the already highly industrialized regions, nor to complex and sophisticated machinery. Our industry had its first great success with a simple kerosene lamp and it is still in use in many areas. If we study the needs of peoples in the developing countries today, we may find that petroleum has an unsuspected future in its applications,
as simple and as important as the kerosene lamp. Small vehicles, pumps, generators, heating units, building materials, farm equipment—all of simple, low-cost designs and requiring no advanced technical skills—may have a great part to play in the development of many countries and the adaptation of their people to the mechanical age.

But of all the potential uses of petroleum, especially in regions where hunger and malnutrition are an ever-present problem, perhaps the most revolutionary of all can be summed up in one phrase: the most revolutionary of all can be summed up—in one phrase “food from oil”.

I refer to the new culture process called biosynthesis, by which petroleum is transformed into a protein-rich food. This type petroleum is transformed into a protein-rich food. This type of food has been produced in the laboratory and is now in the pilot plant stage.

Think of what this could mean. The diet of perhaps a billion people, chiefly in Asia and Africa, contains less animal protein than the target of 15 grams a day set by the United Nations Food and Agriculture organization. If this entire protein deficiency could be supplied by protein made from oil, it would require a mere 2,000,000 to 3,000,000 barrels of oil a day, a little over 1 per cent of our current world oil production and there would be no problem of supply at all. But this one means we could go far towards wiping out undernourishment from the face of earth.

Petroleum's place in history is already high but I believe it has a still greater future. We have no cause to fear com-
petition from the new energy sources which are being developed. The world's total energy needs are so great that these new sources will only supplement petroleum, not displace it. If we can keep our cost down - and I believe we can - there will be a tremendous share for petroleum both as fuel and as raw materials. Realizing that potential will be the chief task of the petroleum research laboratories of the world.

In conclusion, I turn from the future of petroleum and its products to the future of the industry itself.

There are a number of features of our industry which are not likely to change quickly. One of these is the vigorous competition not only within our industry but also with other energy sources. This competition has several important consequences. It brings the customer the best product at the fairest price. It makes for wider markets and a greater volume of business.

By all means the pressure of competition has important results for the organization. It breeds a certain style of management, not rigidly controlled from the top but flexible and decentralized. In such an organization, individuals at every level are encouraged to think and act on their own initiative, and thereby find out better ways of doing their jobs.

In purely economic terms, this type of organization is the most effective and the quickest to adapt to changing situation. In human terms, seen from the point of view of the employee, it is the most interesting and the most challenging freedom, for those who work in such an enterprise, is not just something enjoyed in leisure time. It is a daily experience on the
But the oil industry's place in our civilization is wider than all these things. Our products have changed ways of life. Our employees have often been the first in their areas to learn certain basic technical skills. In many remote places the first elementary schools and the first medical clinics have been those set up by oil-producing organizations.

It is a striking fact that two of the most basic aspirations in the world today are also fundamental interests of a healthy oil industry. One is peace. The other is the economic and social development of nations. By peace I mean more than the absence of open war. Any kind of international conflict or tension causes governments, in the name of national security to obstruct competitive trade across frontiers. Only where there is reasonable freedom from such tension can international trade be carried on as it should be for the consumers' sake - on the basis of economic efficiency instead of political considerations.

As for the development of nations, a cause which has now become a primary goal for a third of the people of the world, we in the petroleum industry will continue to be involved deeply in this process for a long time to come. As producers we will continue exploring and operating in many such countries. As marketers we see in that entire region a vast need for products and services. And it is here that we may make some of our greatest contributions to the civilization of the future.

This, then, is the petroleum industry which has become such a force in the energy revolutions, in the freedom of movement...
of countless millions of people, in the widening of their horizons and their expanding enjoyment of consumer goods.

It cannot be mere coincidence that by far the greatest part of the 140 billion barrels of petroleum which the world has thus far consumed yearly was discovered, produced, processed, and brought to market by private, nonpolitical, international, and highly competitive oil companies. The companies, in turn, have been able to perform this enormous and extremely complicated task because most governments in both producing and consuming countries have wisely left them the basic freedoms of decision and action to do their job efficiently.

The interest of government and the interests of such a basic industry as ours rather than being opposed are generally in harmony. Peace, security and higher living standards for the people are important to both. The legitimate needs of governments for revenue, foreign exchange, assurance of supplies, training of citizens, development of the oil industry for the national economy - all these needs have proved time and again to be better attainable by co-operation with the international oil industry than by efforts to dominate or displace it.

I believe the private oil industry, wherever it is given the change, will continue to prove itself unequalled in its ability to transform petroleum into creative service for the people of the world. Thereby countless doors will be opened to the greater dignity and freedom of man's daily life in the centuries to come.
Title: Study in to commercial aspects of oil industry in Iran.