The REVIEW is published periodically by Imperial Oil Limited, in the interests of employees and shareholders. Articles, photos and news items dealing with the petroleum industry are welcomed.

Vol. XXV. No. 2

The World’s Oil Supply - Where it Comes From

Save Ships for Britain by Saving Gasoline

As a Matter of Fact

Directional Drilling

Gasoline Made-to-Measure

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During August and September, Imperial Oil billboards from coast to coast will appeal to motorists to conserve gasoline in order to meet a situation arising out of Britain’s need for more tonnages.

Editorial Offices - 56 Church Street, Toronto, Canada
PORTLAND-MONTREAL

New 236-mile Pipeline will Release Tankships for Britain

A 236-mile pipeline, capable of carrying 50,000 barrels of crude oil daily, will be in operation between Portland, Maine, and Montreal East, Quebec, before the year ends. This is the determination of the sponsors of the line although construction did not actually begin until early July.

The American portion of the line is being built by the Portland Pipe Line Company, organized by the Standard Oil Company (New Jersey). The Canadian section will be constructed by the Montreal Pipe Line Company Ltd., also a subsidiary of Standard New Jersey. The route for the line was surveyed by plane from a height of 17,000 feet.

Photographs taken from this altitude were assembled in "mosaics" and from these, with the aid of elaborate stereoscopes, the engineers were able to determine accurately the contours and select the route for the line. Right-of-way crews hastened into the field to make the necessary arrangements with land owners and in the meantime the manufacture of the 12 1/2-inch seamless steel pipe began.

Actual construction of the line was begun near Garham, N.H., by two crews of approximately 250 men each, one working east and the other west. Great ditching machines, bulldozers and all the other paraphernalia of a big, high-speed digging and filling job were rapidly assembled along the route.

The pipe line will rise to a height of 1,556 feet above sea level in the White Mountains and will cross the St. Lawrence to the Island of Montreal at a depth of some 15 feet under the river bed. Right pumping stations, two of which will be in the Province of Quebec, will drive the crude through the line. Thirty-two thousand, seven hundred tons of pipe will be used and the total cost of the project, which will be completed in near-record time, is estimated at $8,000,000.

The function of the Portland-Montreal pipeline in relieving demands for tankships which are urgently needed for carriage to Britain is indicated in the map on the opposite page. The long trip around Cape Breton and up the St. Lawrence will be eliminated and the requirements of the refineries at Montreal East will thus be served by fewer tankers.
SAVE SHIPS for BRITAIN...

by saving gasoline

THE next time you are out driving and a long straight stretch of road tempts you to "step it up to 60," think of this—it will cost you 45 per cent more to drive that stretch at 60 miles an hour than if you drove at 30 miles an hour.

The average car gets 21.6 miles to the gallon of gasoline at 30 miles an hour. At 60 miles an hour the same car gets only 15.1 miles to the gallon! In other words, if it costs you one dollar in gasoline to drive a certain distance at 30 miles an hour, it will cost you $1.41 to drive the same distance at 60 miles an hour.

In other days, motorists had the privilege of driving at whatever speeds they liked, subject only to the speed limits of the highways they travelled. Certainly, high speed was expensive, but if the motorist felt he could afford this luxury, he was free to drive at whatever speeds he pleased.

Now we are asked to save gasoline. Because tank ships which ordinarily handle the transporting crude oil to our country are now engaged in the delivery of vital oil supplies for Britain, the Government of Canada has asked Canadian motorists to save gasoline whenever possible. One way in which motorists can cooperate is by making sure their driving habits permit their cars to obtain the maximum of operating efficiency.

It has been pointed out already how high speed wastes gasoline. There are other ways motorists can effect savings of gasoline.

We have heard much about "jack-rabbit" driving and its effect on gasoline consumption. To find out how much gasoline is wasted through this type of driving, the General Motors Corporation made tests at its proving grounds. It was found that the test car ran 20 miles on a gallon of gasoline when driven at 20 miles an hour in a normal manner. The test driver then started his "jack-rabbit" driving. He jammed the accelerator to the floor boards at 35 miles an hour, held it there until the car reached 30 miles an hour, and then allowed the car to decelerate to 15 miles an hour without using the brakes. He repeated this process until the gallon of gasoline in the tank was exhausted and the car ran 147 miles.

Again a gallon of gasoline was put in the tank and the driver repeated the process. This time, however, he used the brakes to decelerate rapidly, and the car ran 8.6 miles on the gallon of gasoline.

The third test was to show the effect of quick getaways in second gear. The car was started in second gear and the driver pressed the accelerator pedal right down until the car reached 25 miles an hour, and then shifted it to high gear for 2.2 miles. He stopped and repeated this process until the gallon of gasoline was used up. The car gave 9.9 miles to the gallon.

The next time you feel you're in a hurry to get through the city, think for a minute. If you race your car away from the stoplight, you're wasting gasoline. If you run right up on a line of waiting cars and slam on your brakes, you're wasting gasoline. If you think you see an opening and step on the gas to get through in a hurry, you're wasting gasoline. What is more you'll be giving your car a lot of unnecessary wear and tear.

The Oil Controller has asked motorists to use cars only when they need them and then to use them as most efficiently as possible. To help Canadian motorists to do this, Imperial Oil Limited has published a booklet "A Three Point Plan to Save Gasoline." This booklet gives the motorist detailed information about gasoline economy. It contains pages for recording gasoline purchases, mileage, etc., so that the motorist can ration his own motor fuel. This booklet is obtainable, free, at the stations of all Imperial Dealers throughout Canada.

HIGH SPEED WASTES GASOLINE

<table>
<thead>
<tr>
<th>Speed (mph)</th>
<th>Gasoline Consumption (miles/gallon)</th>
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<tr>
<td>35</td>
<td>22.7</td>
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<tr>
<td>20</td>
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Imperial Oil Review

SUMMER NUMBER • 1941
DIRECTIONAL DRILLING

“Slanting” wells now tap oil deposits formerly out of reach!

OIL DRILLERS are now drilling crooked holes on purpose! From 1939 when the first oil well was completed until quite recently the driller’s objective has been to penetrate to the oil sands with a minimum of deviation from the vertical. Now, however, he has developed a new technique of directional drilling. With this technique he is able to penetrate to oil reservoirs that do not lie directly below the point at which the drilling rig is set up. He can drill up to 45° off the vertical. It is claimed he can go down through feet in one direction and then point the drilling tools in another direction. As a result oil today is being recovered through wells bored on shore from sands that lie under the sea and also the driller now has to dig wells that lie below buildings and parks and other obstructions to the placing of a rig.

Strangely enough directional drilling is an offshoot of the elaborate techniques developed during many years to hold wells strictly to the vertical. The drilling rig always has a tendency to stray from the vertical. Equipment and methods that were developed to hold it straight can now be used to guide it away from the vertical when so directed.

With tools developed that would hold a bit in a vertical course the operator naturally asks why could tools not be devised to guide the bit off at any desired angle and so the “whipstock” came into being. It is about five feet long and looks like a ground banjo with a sharp point. When it is desired to direct the bit away from the vertical the whipstock is lowered into the hole in such a way that the groove turns the bit off onto the desired direction.

The same instrument which determines if a well is being drilled straight is used in directional drilling to make sure that the bit is boring in the right direction. This tool consists of a metal cylinder into which are inserted a compass, a plumb bob and a camera loaded with special graph film. It is lowered into the hole and at regular intervals photographs of the face of the compass and the plumb bob are taken. These photographs indicate the direction in which the bit is boring and the degree to which it has deviated from the vertical.

Directional drilling has made possible the development of new oil fields which were hitherto practically inaccessible. Marine drilling is one instance of this. On the ocean front in California, Louisiana and Texas, where oil fields extend for thousands of feet under the water, wells now go down and out under the bed of the ocean. The heavy expense of drilling from piers, jetties and barges is saved.

In Louisiana, directional drilling was called on to develop the oil fields under the lands of a university, without disturbing the university’s normal activities. From one site, where the disturbances would be at a minimum, three wells were drilled. The first was drilled straight down to the oil formation. The second went slantwise in one direction, ending up 2,000 feet away horizontally and thousands of feet from under the college campus. The third was drilled in the opposite direction, hitting the oil sand under the university campus. On the surface the wells are only a few feet apart. Under ground, in the oil formation, they are separated by thousands of feet.

Directional drilling has been called upon to combat oil field fires. In the Conroe Field near Houston, Texas, directional drilling was given a spectacular test. Here a well had blown up from a subterranean gas explosion, forming a huge crater 200 feet across and as deep, boiling with oil and throwing off flames as dangerous as dynamite.

The inventor of directional drilling, H. John Eastman, was called in and told that if he could hit within 30 feet of the well he could be checked. Eastman promised to do better than that — to go within 25 feet.

Setting up his derrick behind a fireproof screen about 400 feet from the crater, Eastman began to shoot at his invisible target. He drilled straight down for 1900 feet, then on a slant which took the hole 300 feet southward and 300 feet westerly, and then straight down again. Six weeks later, he figured he was within six feet of his target. Water under 1800 pounds pressure was pumped into the slanting hole, and within six minutes, a full in pressure showed that the water had broken through into the bottom of the well. For 24 hours the oil men watched the geyser. At 600 pounds the flow of the wild well suddenly ceased, checked by the column of water.

Buildings, canals, lakes, are no longer a barrier to the oil man’s drill. Obstacles, man-made or natural, now rest undisturbed, yet the oil formations beneath them are tapped easily and exactly by directional drilling.
exactly what could be called gasoline. These definitions have left room for the immense amount of engineering and experimentation which has been responsible for present-day fuels of excellent quality.

Gasoline was originally defined as a petroleum distillate which gave off inflammable vapor at a temperature of 75 degrees Fahrenheit or higher. Next below gasoline in this property and obtained from the same base—petroleum—are naptha and kerosene, both of which require higher temperatures to vaporize properly.

It is not so many years since volatility (the ease with which liquid can be converted into vapor) was regarded as the only really important characteristic of a motor fuel. As the automobile engineers became interested in gasoline as an engine fuel and began to build motors to use it, and the vehicle ran, gasoline was considered satisfactory if it could be vaporized quickly and ignited readily.

But not anymore! Just as the modern automobile engine tries to produce a smooth-running, flexible and balanced mechanism, so the objective of the modern refiner is to design gasoline so that they are sufficiently volatile to permit easy starting, but not volatile enough to vaporize too readily and result in vapor-lock; so that they will deliver good power and milage per gallon; so that they can be put under high compression without causing the engine to knock or detonate; so that they can be produced and marketed as uniform products; so that they can be stored for long periods and transported over great distances and remain stable as to ability and operating characteristics; so that a minimum of gum sediment is precipitated during long periods of storage or during operation; so that difficulties arising from sulfur are kept at a minimum. One of the most important accomplishments of fuel engineering has been the production and distribution of gases which operate well under given climatic conditions according to geographic location and season of the year.

Modern gasoline must be "designed" just as do the modern motor car, and some of the chief elements required of it travel under the same names as those required of the automobile, in which fuels have been designed to incorporate these qualities, in fact, has been an important element in determining the degree to which the automobile itself could exhibit them to its owner.

Despite these new elements of design which have entered the fuel picture in the last two decades, problems relating to volatility have continued to be dominant in one way or another. This is because the factors power, distribution, ease of starting, rapidity of acceleration, likelihood of trouble from crankcase oil dilution, vaporlock and loss by evaporation are influenced by the volatility characteristic of the fuel.

Certain portions of a given volume of gasoline, we find, will evaporate at lower temperatures than others. Explicitly, a certain sample of regular gasoline will start to distill (initial point at 90 degrees Fahrenheit) 10 per cent of the sample will be distilled at 130 degrees, 50 per cent at 352 degrees, 90 per cent at 354 degrees.

Technologists have found that operating characteristics of fuels are approximately determined by the 10, 50 and 90 per cent points mentioned above. Starting and acceleration performance, are determined by the 10 per cent point, whereas general performance attributes such as power and miles per gallon are related to the 50 and 90 per cent points.

Consequently, the refiner of gasoline has a basis for preparing a versatile and properly balanced fuel to operate well in modern combustion engines.

Volatility has been greatly influenced by economic considerations as well as technical requirements. In 1935, available gasolines were highly volatile for the interesting reason that the lighter, more easily distilled portions of the crude petroleum were a drug on the market. Kerosene, an intimate but heavier petroleum component, was in demand in those days and it is unsafe to have gasoline mixed with it. So, the newly born automobile found nourishment in the easily digestible and highly volatile "light ends" that formerly had been damped into the river as a hazardous waste product. But this situation was destined to be short-lived as increasing numbers of automobiles consumed the available supply of volatile gasolines and forced refiners to cut deeper into the crude to satisfy the greater demand. So, from 1938 until around 1929, the average volatility sank and the engines con-
plained. Car owners did likewise. Engine and fuel technologies saw the need for improvement and took action.

The use of barrier fuels was seen from the economic standpoint, but something drastic had to be done to modify the complaining engines. Improper assimilation and faulty elimination were eliminated by such things as hard starting, particularly in cold weather, and dilution of the crankcase oil by unburned portions of the fuel. Additional heat, applied to the intake manifold, and crankcase ventilation were the primary remedies applied by automotive engineers to relieve these ailments.

Still, the increasing demand for automobile fuel taxed the supply. Fortunately, during the World War, the "cracking" process, perfected commercially, was brought to the rescue. By "cracking," the crude petroleum is subjected to high temperatures and pressures which break up the heavy oil molecules into lighter ones which make suitable gasoline. Whereas the old method of simple distillation had produced about a quart of gasoline from each gallon of crude petroleum, the "cracking" process more than doubled this yield and provided also a means for better control of the fuel's composition.

Since the advent of cracking, increasing amounts of fuel have been produced by this process. Natural gasoline extracted from natural gas has also found use in greater quantities and our supply of gasoline meets present demands. For the future, gasoline produced by introducing hydrogen into the refining process, called hydrogenation, offers great possibilities as to high yield and control of gasoline characteristics.

As a corollary to this situation of greater gasoline availability, the lighter constituents of fuels have increased in volatility since 1920; so much so that car manufacturers have had to make alterations in fuel systems to prevent vaporization of the gasoline before it reaches the carburetor and intake manifold, the condition known as vapor-lock.

Summarizing the volatility trends, it may be said that conditions have progressed from a beginning that was favorable by accident, through a period of troubles due to difficulties in matching engine design with economically available fuels, to a present situation of real satisfaction to the owner. Certainly the knowledge thus far gained and accumulating daily should smooth paths into the future, even through the dwindling stages of crude petroleum's availability as well as the finding and application of new fuels.

Although highly satisfactory in most respects, gasoline has one notable eccentricity—its dislike too much crowding and when jammed too hard into a cylinder it rebels by causing the engine to knock. Technologists tell us that this disturbance is caused by pressure waves that come from high velocity burning of the fuel mixture. Unfortunately, this bad feature of gasoline prevented engine designers

Around 1890, when gasoline was an unwanted by-product, this cheese box still was the latest in refinery equipment. Today's quality gasoline requires the most modern equipment. This is a new unit of the Imperial Oil refinery at Sarnia.

To meet the demands of the increasingly popular automobile, Imperial Oil built Canada's first service station in 1908. Today's modern service stations combine beauty with utility—render complete service to the motoring public.

With only the simplest of equipment at its command, petroleum research was exceedingly limited 30 years ago. The petroleum industry today employs the most scientific methods to test and improve its fuels and lubricants.

Increased use of motor cars forced the development of surfaced roads.
THE WORLD'S SUPPLY OF OIL — where it comes from...

LEADING OIL PRODUCING COUNTRIES 1948

<table>
<thead>
<tr>
<th>Rank and Country</th>
<th>Barrels Production</th>
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<tbody>
<tr>
<td>1. United States</td>
<td>1,381,848,000</td>
</tr>
<tr>
<td>2. Russia</td>
<td>216,930,000</td>
</tr>
<tr>
<td>3. Venezuela</td>
<td>184,761,000</td>
</tr>
<tr>
<td>4. Iran</td>
<td>193,151,000</td>
</tr>
<tr>
<td>5. Romania</td>
<td>42,888,000</td>
</tr>
<tr>
<td>6. Netherlands</td>
<td>40,628,000</td>
</tr>
<tr>
<td>7. Mexico</td>
<td>40,000,000</td>
</tr>
<tr>
<td>8. Colombia</td>
<td>25,892,000</td>
</tr>
<tr>
<td>9. Iraq</td>
<td>24,228,000</td>
</tr>
<tr>
<td>10. Argentine</td>
<td>20,609,000</td>
</tr>
<tr>
<td>11. Trinidad</td>
<td>20,218,000</td>
</tr>
<tr>
<td>12. Borneo</td>
<td>14,006,000</td>
</tr>
<tr>
<td>13. Peru</td>
<td>12,988,000</td>
</tr>
<tr>
<td>14. Germany &amp; Poland</td>
<td>9,270,000</td>
</tr>
</tbody>
</table>

DESPITE wartime conditions which restricted production in some countries, world production of crude petroleum in 1949 reached a record figure of 2,144,463,000 barrels — a net increase of 67,971,000 barrels over the previous year.

More than 35 countries produce the world's oil. Lack of official confirmation from some countries leaves a certain margin of error in total estimates, but where such conditions exist figures used are based on estimates secured from the best available source of information.

The United States of America leads the world. Soviet Russia ranks second, and Venezuela third.

The principal factor in increased world production was a 6.87 per cent increase to 1,351,849,000 barrels in the United States, which offset reductions elsewhere. Russia showed a small increase of 182,000 barrels over 1939 output. Hungary had the biggest percentage of increase, its 1940 production of 1,755,000 barrels nearly doubling 1939 figures.

Of the first thirteen major sources of world oil supplies, Iraq showed the heaviest percentage of decline, dropping from over thirty million barrels in 1938 to 24,228,000 in 1949.

Other leading oil-producing countries whose production has declined were Venezuela, Netherlands India, Romania, and Peru.

In continental terms, North America leads. European production led South America's by a fractional percentage, while Africa ranked last among oil producing continents.

Canada's production was 8,718,000 barrels in 1949, an increase of 881,000 barrels over 1939.
CANADIAN RESEARCH ON THE
UTILIZATION OF FARM PRODUCTS

At a conference held under the auspices of the Canadian Chamber of Commerce in November of 1939, the National Committee was or-
ganized as a national activity with the purpose of creating new wealth and opportunity. One of the several important tasks that it undertook was a survey of Canadian research on the utilization of farm products and naturally in this connection the question of power alcohol received particular atten-
tion. A report on this survey by Dr. W. D. McFar-
lane of Macdonald Agricultural College has now been published and is in view of the wide interest which attaches to the question of gasoline blends with agricultural alcohol for motor fuels, the chapter devoted to this subject is reproduced here together with the report of the Sub-Committee on Power Alcohol to the National Chemurgic Committee.

ALCOHOL-GASOLINE BLENDS FOR MOTOR FUELS

The biggest proposal in the chemurgic field is, of course, the production of motor fuels from agricultural materials and although the proposal has attracted much attention the facts are that it is not generally known. The use of alcohol as a motor fuel has been studied ever since the automo-
BILE industry was born; but it made little progress for many years because of difficulties involved in manufacture. About 1906, however, it became pos-
sible to make it (99.6%), almost as cheaply as ordinary alcohol. Since that time power alcohol has been produced in 40 countries at the rate of 200,000,000 imperial gallons annually and since the war began there has been a signifi-
cant expansion of the industry in Queensland, Australia, and South Africa. For reasons which are complex, Canada has no power alcohol industry; some technical problems relating to the perform-
ance of the product and meteorological conditions may be involved but economic questions are the principal issue.

reasonable differences exist in the conclusions reached regarding the purely technological phases of the proposal, the results apparently depending on where the investigators' interest lies. Alcohol is generally used in admixture with gasoline in a 10 to 20% blend and experience in other countries has shown that little technical difficulty is involved in its use as a fuel. Alcohol-gasoline blends, properly prepared, are good fuels; they differ only slightly in certain respects from gasoline in general. There is generally giving fully equivalent performance (1); blended fuels con-
taining up to 20% alcohol will give as good the age, power and acceleration as straight gasoline of equivalent octane rating (7, 8, 9, 10). Although Canadian conditions are more severe than those in other countries, blended fuels can be used in auto-
mobiles now operating on our highways. Alcohol blended with gasoline acts as a good anti-knock agent for fuel and controls combustion in a similar manner to tetra-ethyl-lead. The effectiveness of alcohol as an anti-knock agent is approximate nine points in octane rating per 10% addition. During the last 15 years the compression ratio of automobile engines has been increased over 30% and the anti-knock character of fuels correspondingly improved.

The arguments which have been presented in favour of the alcohol industry in Canada are briefly as follows:

1. Petroleum reserves are being used up and cannot last indefinitely, and it may be argued that the time has come to use more of the annual income (farm products) and less of the stored capital (petroleum and coal).
2. It would provide an entirely new market for Canadian agricultural products.
3. It is the only chemurgic project which could contribute significantly to the relief of the surplus farm products situation. Motor fuel consumption in Canada in 1940 was probably close to 900 million gallons. If one-tenth of this quantity of gasoline were replaced by alcohol made from alcohol made from 40 to 60 million bushels of grain, the product, from 25 to 30 million gallons. Future developments might indicate the use of 20% alcohol blends.
4. Since any starchy products can be used as raw material the project would assist in main-
taining a balanced market for different crops and hence reduce the surplus of some crops if and when they occur.
5. It would have a beneficial influence on our trade balance with the United States and con-
serve foreign exchange. Canada imports 1 1/2 billion gallons a year of crude petroleum and gasoline which is worth about 40 million dollars and these imports are steadily increas-

ing. In addition, over 2 million dollars' worth of tetra-ethyl-lead are imported for blending. The fact that Canada is a large importer of gasoline is often overlooked when considering the relative merits of the project in this country as compared with the United States.

The arguments against the project are briefly as follows:

1. The best available information indicates that the production of alcohol from farm products would be at prevailing wholesale prices for gasoline, only an incon-
squential amount of farm products could be used to produce the required quantity of power alcohol without a substantial subsidy of some sort. Technical developments may reduce this sub-
sidy, but for large scale production they cannot remove it entirely. Although the techni-
cal problems in the production of power alcohol have been mastered in recent years, alcohol cannot be made as cheaply as gasoline by any process known at the present time. There is no such thing as "the cost" of making alcohol since it may vary with the size of plant, cost of raw material and price of alcohol and utilization of by-products. The approximate cost figures under pre-war conditions were estimated (2) to be 18 cents per gallon at the distillery if wheat, at 60 cents per bushel, is used, and 16-15 cents per gallon for gasoline if corn is used.
2. If alcohol possesses technical or economic advantages, over gasoline as a motor fuel, it is said that it can be produced, by chemical processes, from coal at a much lower cost than from vegetation.
3. If a power alcohol industry were instituted in Canada, Canada's industries would face an em-
phatic increase in the costs of their operations,' and no logical and economic procedure to follow would be to plant a certain acreage with those crops which would give the highest yield of fermentable carbohydrate per acre at the lowest cost. As a source of alcohol in Canada the most attractive material is the sugar beet (2) because only 60 to 65 million gallons of alcohol, (the amount required for a 10% blend, if the annual consumption of gasoline in Eastern Canada is assumed to be 600 million gallons) it would take 3 million tons of sugar beets, the produce of about 300 thousand acres. It was estimated that at least 1500 acres would be allowed for raw material and give a reasonable return on the in-
vestment if the alcohol sold for 60 cents per gallon.

It would be logical to plant large quantities of sugar beets could be grown in Ontario and Quebec and that a fairly stable industry could be built. The price of sugar beets does not fluctuate exces-
sively, large quantities may be grown in a small area so that the cost of transportation is low and there is no difficulty with respect to fermentation. This would appear to be a feasible undertaking, but there are other considerations which would bear heavily on the practical aspects of producing 300,000,000 acres of sugar beets. The human element is important since it is the farmer who is qualified to grow sugar beets, which requires the exercise of great care and judgment. The labour situation involved in the production of sugar beets is not one of minor importance, and moreover, the acreage of sugar beets grown on any one farm must be limited to a practical extent. The programme employed, for it is always hazardous for a section of the country to indulge in over-
expansion of a special crop.

In the final analysis the whole proposition resolves itself into a question of economics. The expedience of instituting a power-alcohol industry in Canada depends upon whether the net advant-
age to agriculture and to the country as a whole outweighs the immediate and temporary benefits. The question of manufacturing power alcohol from wheat has been thoroughly investigated by a sub-committee appointed by the National Chemurgic Committee and their report is presented below. It is shown that there would be a wide difference between the cost of the blended fuel and the cost of gasoline. The average does not exceeds any pre-
vious estimate (1, 2, 7, 8) and the reasons for this are given in the report. It has generally been conceded that the production of power alco-
hol from farm products in Canada would have to be subsidized but it was hoped that it might be indicated that it would be less to the promotion of alcohol from wheat than to carry that wheat in storage for an indefinite period which at the most favourable calculation will entail consid-
erable public expense.

Notwithstanding the critical nature of the wheat problem and the necessity for a policy of subsidization under prevailing conditions, the project cannot be justified from any standpoint whatsoever. Wheat is a bulky commodity, delicate in its transportation and, since its economic value is determined by its value as a human foodstuff. In the fermentation of alcohol from carbohydrates, the starch, is converted to alcohol. Instead of ferment-
ing the whole wheat kernel it might be more logi-
cal to utilize 60% of the carbohydrates and the remain-
ers of particular value such as the bran, germ, and gluten, and manufacture alcohol from the residual starch. Some research in this connection has been done by a Canadian firm and the results suggest that a more economical utilization of the wheat might be effected along the following lines:

A short milling process could be employed and the shorl shorts would be used for livestock feed after recovering as much of the germ as possi-

ble.
sible. The oil could be extracted from the germ and, by distilling, further purified, particularly with respect to vitamin B. After fermenting the flour for a short period the gluten could be extracted by adding lime water; the starch could be separated from the residue and marketed as such or the fermentation could be continued to convert the starch into alcohol. The slurry remaining after distilling off the alcohol would probably be of little value so that the equipment used to dry distillers grains would not be required. The gluten separates as a sticky mass which is difficult to dry directly but if the material is frozen it can be reduced to fine powders which are readily dried in a current of warm air and can be pulverized to a fine white powder. Dry ice, prepared from the carbon dioxide evolved in the alcoholic fermentation could be used to freeze the gluten. Low grade flours fortified with gluten, prepared in this manner, gave good results in baking tests. Further research will obviously be necessary to work out technical details, processing costs, etc., so that the economic feasibility of the scheme can be established.

Motor fuel consumption in Canada in 1940 was nearly 900 million gallons. If one-tenth of this quantity of gasoline was replaced by alcohol made from wheat about 45 million bushels would be required. A project operated on this scale a rough estimate indicates that at least 400,000 tons of bran, shorts and middlings; 160,000 tons of gluten meal, and 850,000 tons of alcohol (or about 80 million gallons of alcohol) would be produced. The greatest difficulty would probably be experienced in the development of the gluten but a considerable quantity might be used to fortify flour and an export market might be created on this basis. The use of gluten to manufacture plastics could provide a large market but price considerations are likely to be unfavourable unless wheat gluten is shown to possess special plasticizing properties.

Sources of Information
1. Memorandum from W. Kuhlmann, Department of Agric. Engineering, Woodbridge College, Ont.
4. "Report of Cooperative Fuel Research Committee to the National Research Council", 1940

REPORT OF SUB-COMMITTEE ON POWER ALCOHOL TO NATIONAL CHERMICUS COMMITTEE

Introduction
Owing to the existence on this continent, during recent years, of large surpluses of starch-containing agricultural products, attention has been focussed on various proposals for the removal of these from the market. To some extent also the hope has existed that a more permanent solution might be found to the problems in chemistry and engineering, creating new markets for agriculture and increased returns to those engaged in it. The suggestion which has received the most attention is that which can be conveniently covered by the expression 'power alcohol'. It is a matter of common knowledge that, for some years, large volumes of alcohol manufactured from potatoes or other agricultural products (and not仅 as additions to gasoline in Germany, France and other countries. Having regard to the present situation in Western Canada, it is natural to ask: "Is it not the solution for the West, and what is preventing immediate action?"

Before any attempt to suggest an answer is made, we feel it is well to point out that the ground by commenting on certain aspects of the problem, particularly in relation to the discussions which have taken place in the past. We are able to conclude that the company would pay no duties on equipment and all forms of taxation payable by a private corporation engaged in the same form of industry. This company would enjoy an absolute monopoly of producing, in Canada, ethyl alcohol for purposes of blending to produce a gasoline containing 10% alcohol with an octane rating of 75. It is further assumed that the petroleum industry would be allowed to maintain certain points of distribution, and incorporate it in their gasoline supplies without profit to themselves. Apart from the payment of proceeds charged and the setting aside of sufficient funds for depreciation, maintenance, etc., it is assumed that the policy of the publicly owned company is to adjust the selling price of alcohol without any consideration of profit.

There are obvious reasons why consideration should be given to the question as to the number and location of distilleries which might be engaged in this enterprise. After taking everything into consideration, our Committee decided that the facts justified a Western location and units of such size that the maximum efficiency in operation could be utilized. Depending on the fact that alcohol was to be restricted to the Prairie Provinces or extended to Eastern markets, the number of plants required naturally varied. The two locations which have been considered are: Calgary, Regina and Winnipeg. The unit which forms the basis of our calculations is one producing 10,000 Imperial gallons of anhydrous alcohol per day.

The time required to build such a plant is difficult to estimate under present conditions but, assuming that priority is granted by the authorities in Canada and the United States, your Sub-Committee estimates that at least one year, and probably eighteen months would elapse between a decision to proceed with the project and the initial operation of the plant.

At a time when, owing to the war, prices for equipment, buildings, and to some extent labour, are fluctuating and on the whole rising, it has not been easy to agree on a basis of cost for a plant of this size. We have finally adopted the standard which would be that of a commercial distillery using the technical methods which are common practice on this continent; buying much of the equipment, of necessity, in the United States, and meeting all Government and local legislation, additional and other regulations in regard to safety, fire protection and length of life. There is, however, at still room for legitimate differences of opinion as to what the final capital cost would be, and we would ask the Committee to regard our figure as a conservative one. As will appear from the Tables which are appended to this Report, even large
The essential data in the above tables is presented in graphic form in Figure 1, and shows the relation between price of wheat and cost of producing alcohol.
Ronald MacKinnon, Superintendent of the Imperial Oil Refinery at Norman Wells, received this letter from one of the Company's customers in the North West Territories. Business methods in the North West Territories are sometimes very informal as the above letter indicates.

Dr. Ronald MacLeod, Supervisor of Welfare for Imperial Oil Limited and International Petroleum Company Limited, has been appointed Chairman of the Benefits Committee of Imperial Oil Limited. Prior to joining the Company in December, 1936, to take charge of welfare activities, Dr. MacLeod spent more than twenty years in the ministry and served as Overseas Army Chaplain between 1916 and 1919.

Mr. R. D. Mercer has been appointed Secretary-Treasurer of the Royalite Oil Company Limited, succeeding the late Mr. T. E. Burns.

Mr. Mercer joined the Royalite Oil Company as an assistant accountant in 1920. In 1937 he was appointed Chief Clerk, and held this position until his recent appointment as Secretary-Treasurer.

This photograph shows the blanket made for the British Red Cross by the laundrymen, the seamstresses and the five nurses' aides of the hospital of International Petroleum Company Limited at El Centro, Colombia. The blanket was made at the suggestion of Miss Shamrose, the graduate nurse in residence to the desire of the staff to contribute to the British Red Cross.

Golf is a favourite pastime of members of International Petroleum Company Limited in Colombia, South America. These photos, taken on the steps of the Miramar Club House in Barranquilla, show the El Centro-Barranca and Bogotá teams which played in the tournament held there at Easter. The Bogotá team is shown in the photo on the left. Receiving from left to right, front row: T. Torralba (Professional), St. Alberto Gasbido, Captain (Colombian Champion); H. Sexton, N. Ireland. Back row: Sr. Rafael Gamboa, H. Tiller, T. Muhler, (Tropical Oil Company, Bogotá Office); R. Prestes. The El Centro-Barranca team is shown in the photo on the right. Receiving from left to right, front row, Hugh Grabsby, Barranca; Malcolm Neyler, El Centro; Harry Bryan, El Centro. Back row, O. L. Raymond, El Centro; Ben Zwik, El Centro; Ernest Trumper, El Centro (Professional); Alex Frame, El Centro.

Although believed to have been destroyed by enemy action off the West Coast of Africa early last April the fate of the tanker "Canadollie" remains uncertain. Reports from the International Red Cross at Genova received through the Department of External Affairs, state that the entire crew of 44 are in internment. The "Canadollie" had sailed from Freemantle, Bourke Line, in ballast for Venezuela, and it was presumed she met the same fate as the 'U.S. Potemka', sunk on April 4. The "Canadollie" had a rating of 11,309 gross tons and was built in 1926.
Alberta Division

British Columbia Division

Newfoundland Division

56 Church Street

Canadian Research (Continued from page 19)

In Table XXIII, we give the essential statistics with regard to the Usine de Meille process, based on figures submitted by Dr. Rotstein. Owing to war conditions, the members of the Committee have had no opportunity to appraise this process in the light of Canadian conditions. If this process is to be considered, your Committee recommends that the capital and processing costs be given careful study by competent authorities.

Conclusion

On the basis of Canadian conditions and prevailing plant practices, a comparison has been made of the costs of production of standard 75 octane gasoline and a blended gasoline containing 10 per cent of alcohol manufactured from wheat. Estimates have been made of the quantities of wheat which would be utilized in this manner.

In the light of the facts made available by this inquiry, your Sub-Committee is of the opinion that a power-alcohol project does not constitute an economic solution of the Western wheat problem.

We consider that this Report should facilitate a wider recognition of the urgent need for a careful recommendation of general policy, for constant and vigorous exploration of possible outlets, and for co-ordinating and expanding research work along these lines.

Dr. J. B. Rotstein, Dominion Bureau of Statistics, Ottawa.

Dr. A. R. Westman, Secretary, Ontario Research Foundation, Toronto.