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*Oil for
Tomorrow*



WHEN, late in 1942, fuel oil and gasoline were added to the nation's list of rationed goods, the effect on the average American was that of an icy shower bath.

Gasoline, to the man on the street, had always been something he got by stopping at almost any corner and telling a station attendant to "fill her up."

Fuel oil, whenever needed, was pumped from a truck at the curb into a tank in the basement—then automatically converted into heat by a modern, efficient burner. Most consumers never even saw the wondrous liquid that kept their homes warm and cozy.

What do you mean, oil shortage! Didn't the United States control some three-fifths of the world's supply? Weren't wells still spouting the stuff from vast underground pools scattered across the country? Haven't we, in past years, had to hold production down because of surpluses on hand?

Even under the impact of war, it was hard to sell the thought of scarcity in connection with something we had come to consider as plentiful as water!

The idea, however, was no news to the great petroleum industry which has floated us to unparalleled power and productivity on a tide of oil. Nor to the geologists and other experts whose business it is to find oil, get it above ground, transport it, refine it and put it to work.

This booklet is an attempt to set down a few of the facts about oil, and to interpret them in the light of the latest knowledge and opinion.

In these facts, it must be admitted, there is no excuse for a do-nothing attitude about future supply with relation to future demands.

There are, on the other hand, many reasons for confidence and long-range optimism. Certainly something must be done about oil. Much, however, is already being done, and much more will be done.

America is awake to its problem and its needs. And if America's past resourcefulness is any measuring stick, this precious heritage will not be allowed to slip away, leaving us stripped of the blessings it has brought us.

OIL HEAT INSTITUTE OF AMERICA, INC.

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Oil of Yesterday

Oil has served mankind, in one way or another, since the dawn of civilization.

Oil helped bind the mortar of the walls of Babylon. Herodotus describes the pitch springs of Zante. Early historians relate that oil burned in the lamps of Agrigentum, Sicily, long before the Christian era. Petroleum, or "burning water," was known to the Japanese of the seventh century.

Getting nearer home, Sir Walter Raleigh referred in 1595 to the pitch lakes of Trinidad. In 1748, Peter Salm, a Russian, made a map of the oil springs of Pennsylvania.

Centuries before the first white settlers arrived on this continent, the Red Man scooped oil from surface seepage to rub on his rheumatism. Later, early pioneers used oil outwardly as a liniment and inwardly as a mild but awful purgative.

Oil in the 1800's

The history books do not record when, where or how oil was first used for light in America. But we do know that in the early 1800's considerable cargoes of crude oil were being shipped down Oil Creek, a tributary of the Allegheny, for sale in the eastern markets; and that in 1828 the City of Pittsburgh considered a change from coal gas to petroleum for lighting.

Then, less than a century ago, came a stupendous happening—the first re-



corded steps in the refining of petroleum.

It caused almost no stir at the time. Even the two men responsible for it—strangers living two thousand miles apart—understood only a tiny fraction of its meaning. Yet it was to change the destiny of nations and remake man's way of living, the world over.

Kerosene from Crude Oil

In 1850, James Young of England, an amateur dabbler in chemistry, took out his now-famous patent for the distillation of kerosene from crude petroleum.

At almost the same time, a certain Samuel M. Kier, of Tarentum, Pa., built a refinery in Pittsburgh, bottled his purified oil as medicine and distributed promotional literature. In one of his mailings he mentioned that his oil was obtained at a depth of 400 feet.



Eastern capitalists pricked up their ears. They visioned quick returns from a moderate investment and formed the Petroleum Rock Oil Company.

Stockholders, however, were at loggerheads, and things did not go well with the company. Within a year, a 45-year lease of the field was granted to two men of initiative and vision—E. E. Bowditch and Col. E. L. Drake. They were the fathers of today's vast petroleum industry.



With the lease of America's first oil field in his pocket, Colonel Drake wasted no time in developing it. If Kier found good oil at 400 feet by digging, Drake thought he could find more good oil by drilling.

The First Oil Well

Of course, nobody had ever drilled for oil, but hundreds had drilled for water. So Drake hired water driller "Uncle Billy" Smith and his two sons.

They set up their primitive equipment and swung into action—and their drill struck oil at 69½ feet. Ten feet down from the surface they could see the liquid gold glistening. America's petroleum industry was on its way.

Equipped with a steam-powered pump, the first drilled oil well in the

world gave up 40 barrels a day for a time, but soon dropped off to 15 barrels a day.

The product sold for 50 cents a gallon. Figure that against today's fuel costs for your automobile and your oil burner!

But compare, also, Drake's puny well and its 15-barrel output with today's average oil production in the United States of 4,800,000 barrels daily from more than 400,000 wells. All this within the memory of living man!

"Uncle Billy" Smith's bit struck oil at 69½ feet. Today, U. S. drills are biting at depths of over three miles. They may go much deeper—and be coupled with new recovery techniques—before the liquid treasures of the Americas are fully tapped.

Gasoline Goes to Waste

From Drake's well, the tide of oil discovery rolled across the land like a prairie fire. It was irresistible, like nothing ever recorded in any other country.

Fanned by modest success of the Oil Creek venture, the rage for oil, and more oil, spread through Pennsylvania and pushed steadily westward, leaving a train of oil fields in its wake.

Still, petroleum was far from its full development as a pillar of civilization. From the outpourings of those first 19th century wells came only kerosene as a product. Volatile hydrocarbons, such as gasoline, escaped into the air. Valuable lubricants were looked upon as useless sludge.

Then came the bicycle, ball bearings, closer tolerances between moving parts,



greater precision in everything our factories built. Americans began to slap oil instead of animal fat into their squeaking wagon hubs.

Manufacturers discovered that machines could be run faster with oil as a lubricant and coolant—that there was less wear and tear on bearings and opposing metal surfaces.

The Horseless Carriage Arrives!

Internal combustion engines arrived on the scene. Wheels began to turn faster and faster. Agricultural-minded America turned eagerly toward industrialism—able at last to compete with industrial Britain.

With the dawn of the 20th century came that strange contraption on wheels—the horseless carriage, complete

with whip socket. Incredibly, this one-lunged monster coughed its way along at the impossible speed of 12 miles an hour, to the terror of farmers' nags and to shouts of "Get a horse."

This forerunner of the modern automobile started another revolution. Man began to move, not drawn a few miles by plodding, hay-fed animals, but over great distances in motor vehicles.



Far places came near. Country was linked with city. The earth shrank in size—as it was to shrink again with the arrival of the airplane. The Age of Gasoline was here.

Again the American petroleum chemist had made good. He had discovered the secret energy hidden in the volatile hydrocarbons that once were wasted. He had harnessed the power of petroleum to transportation—and changed the face of the world.



Oil in Peacetime America



Think back to the years before Munich, when America pursued its happy-go-lucky way, worrying little, if at all, about the black clouds that were rolling up across the seas.

We took for granted our amazing industrial progress, and the bean-stalk growth of motorized transportation. Most people had only a vague understanding of the miracle of oil which, within the span of two generations, had revolutionized our lives and made the American standard of living the envy of the world.

It was the genius of the petroleum industry that kept the family car rolling—the car which, to the average man, had become a necessity of life ranking with shelter, food and clothing.

Without petroleum the internal combustion engine could not have been developed. Petroleum made possible the airplane, motor boat and submarine—greedy consumers of gasoline and lubricating oils.

Oil for Clean, Convenient, Comfortable Home Heating

Petroleum, in the form of fuel oil, gave America the comfort of clean, economical automatic heating for its homes.

Petroleum converted passenger ships,

cargo vessels and warships from coal burners to oil burners.

Petroleum lubricated factory wheels, electric power machinery and the bearings of electrically driven trains. Petroleum made possible the Diesel engine.

It was petroleum that transformed the mud-and-dust roads of yesterday into the paved highways of today—the “tracks” that carry the freight of farms and cities to every corner of the continent, bringing far horizons close to the salesman, commuter and pleasure seeker.



Tractor-drawn implements primed with gasoline and powered by kerosene plowed the fields and helped in their harvesting. Oil-fed plants lighted the rural home and provided power for the farmers' pumps, saws and silo fillers.

Petroleum for Many More Products

Oil that the Red Man once collected and used for medicinal purposes gave his successors many hundreds of new products—high octane gasoline, naphtha, benzine, kerosene, illuminating oil, fuel oil, fluid lubricants and a vast

variety of greases. From crude oil came soaps, medicinals, asphalt for paving, and a multitude of variations of these products for special uses.

Millions of gallons of petroleum distillates found use in the cleaning industry. Gas oil enriched the artificial gas used in millions of cook stoves.

These are but high spots of a picture so tremendous—so complex—that it baffles the imagination. They are mile-

stones in the progress of a nation whose entire mode of life is geared to petroleum.

But, more than that, they are evidence that long before World War II the chemists, engineers, drillers and refiners of America's petroleum industry were ready to show an astonished Axis that a “decadent” democracy had the power to fight—not only with men and weapons, but with oil.



Oil—War's Mightiest Weapon



It goes without saying that modern war is a stupendous consumer of petroleum and petroleum products.

With the firing of the first shot in World War II, Axis torpedoes began to sink American tankers—not singly, but by dozens and scores. Basic pipelines to take the place of tankers were lacking. Railroads and canals were not yet readied for the task.

That was America's crisis—not an immediate lack of available petroleum, but the problem of getting vast supplies immediately to the fighting fronts without a breakdown on the home front.

The petroleum industry rose grandly to the challenge. It achieved miracles of transportation. It built new and greater pipelines, routed more tank cars over the rails and more barges through the canals.

Civilian Consumption Cut

Civilian consumption was perforce rigidly rationed—but oil went through to our tanks, planes, ships and engines of war in an ever-increasing flood. Oil talked the only language Hitler & Co. could understand—bullets, planes, ships and tanks in an unending stream.

Oil companies forgot that business could be competitive. They pooled their technical knowledge, their for-

mulas and their production facilities. A lesson in teamwork by a great industrial democracy—which Fascist-minded nations may not soon forget!

Oil spells power in this modern world of ours.

Ludendorff is credited with the statement that the German high command, in World War I, asked for an armistice when it became apparent that dwindling oil and gasoline supplies would soon ground their planes and immobilize their U-boats.

Lord Curzon of England declared that the United States and her Allies "floated to victory on a wave of oil."

A Toast to the Oil Industry!

"This," toasted Premier Stalin of Russia at a recent banquet to American and British representatives, "is a war of engines and octanes. I drink to the American auto industry and the American oil industry."

Oil is not only the power that makes wars, as we know them, possible. It is the inspiration to bandit war by "have nots" against those who "have."

Not the need for *lebensraum*, but the desire for oil and power through oil, set Hitler's hordes marching through Russia toward the oil of the Caucasus. Rubber, tin and oil inspired Japan's invasion of Malaya, Burma, the Netherlands East Indies and the infant oil fields of Borneo and New Guinea.

Rubber from Oil!

Deprived of 85 per cent of her natural rubber supplies by the Japanese

invasion, the American petroleum industry made good most of the deficiency by producing butadiene, the most important single item in the synthetic rubber program. It is common belief today that our country leads the world in technical knowledge and application of synthetic rubber manufacturing.

Required to supply high explosives to American forces 10,000,000 strong and to the vast armies, navies and air



armadas of our Allies, the petroleum industry readily diverted quantities of petroleum to making TNT (trinitrotoluene) for filling shells, bombs and depth charges. Other high explosives, still military secrets, also are being obtained from petroleum.

Oil for Overseas Needs

According to Petroleum Administrator Ickes, 60 per cent (or nearly 2 out of 3 tons) of the supplies sent overseas to our expeditionary forces over distances from 3,000 to 10,000 miles are oil. President Roosevelt tells us that a thousand-plane raid into Europe consumes an average of 1100 gallons of fuel per bomber, more than a million gallons of aviation gasoline, or one-fifth the cargo of a modern tanker.

Added to the list of the oil products which are clinching victory are new lubricants which defy the oven heat of the desert and remain smooth, supple

and unfrozen at the sub-zero heights at which our combat fliers fight.

Gasoline for mechanized units has been improved beyond pre-war belief. Aviation gasoline has long since surpassed the 100 octane goal of pre-war petroleum chemistry. Plastics from petroleum are supplementing the lighter metals. Fuel oil for Navy Diesels and liquid coolants for airplane engines are meeting all military demands.

Even the surgeon is being supplied with new petroleum-born anesthetics; yet with all these extra demands made upon the industry there has been no vital letdown in the gasoline and lubricant supplies essential to domestic transportation and industrial use.

Rationing Is Sharing

True, the home front has felt the pinch. No longer do highways resound to the joyous honk of horns on a Sunday. But America still motors to and from its work. Buses run. Trucks and trains deliver the nation's freight.



Thermostats in oil-heated homes are set a little lower than in pre-war days. We regulate the heat with one eye on the coupon book. But our homes are warm and cozy indeed, compared with those of even our most fortunate Allies. A small price to pay for the mighty punch that American petroleum has put behind United Nations' arms!

How Much Oil in the World?



There is a wide difference of opinion among even the highest authorities on the subject of world petroleum supplies, how they can be recovered and how long they will last.

This, by the way, is no reflection on the authorities. Remember, they are dealing with a substance that lies buried, unseen and unmeasurable, under the earth's crust. They are reckoning with future demands that cannot be even approximately forecast. And they can only guess as to the part that new technical research may play in the whole drama of oil.

On one point, at least, there is complete agreement. We must tighten our belts for the duration, because the war must be won, and oil is vital to its winning.

But what about tomorrow, and the infinity of tomorrows stretching beyond it?

Oil from Coal

Dr. P. K. Frolich of Esso Laboratories, in a recent article in *Industrial and Engineering Chemistry*, states that at some future date—whether in the immediate future, or in the next generation, or in a much later generation—a shortage in natural petroleum will occur.

But, says Dr. Frolich, there is nothing to indicate that this should result in any sudden change insofar as our supply and consumption of gasoline and other petroleum derivatives are concerned.

He points out that advances in engine design will make for better efficiency in the utilization of fuels and lubricants. Increased drilling on a world-wide basis will bring to light new sources of oil. Improved distribution will make for the freer movement of oil from centers of production to centers of consumption.

According to Petroleum Administrator Ickes (and he has access to all the known facts) if every oil well, present and future, should run dry, America's available coal reserves could provide the synthetic petroleum products we need for a thousand years, and still leave enough coal for other everyday purposes.

Plenty of Oil in the Earth

Wallace E. Pratt, widely quoted geologist, states in "Oil in the Earth," published by the University of Kansas Press. "There is no apparent lack of

oil in the earth that need give concern to society—at our present rate of consumption the probable ultimate oil resources of the globe, made available and freely distributed, should meet humanity's needs for 300 years to come."

These figures suggest the size of our ultimate reserve of oil in the earth. They are all the more impressive when you consider that since Col. Drake's discovery of oil less than 45-billion barrels have been used in the entire world!

All this is on the credit side of tomorrow's ledger—but oil in the geologist's note book is not oil in the refiners' tanks. There are question marks beside all these estimates and predictions.

New Sources of Supply

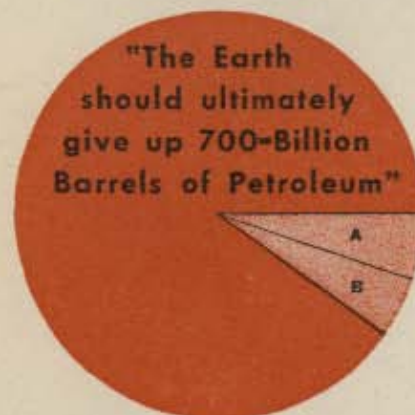
There seems to be general agreement that whatever pleasant surprises nature has hidden under the earth's crust, it is high time that science and industry attacked with vigor the problem of developing alternate sources of supply.

Many such sources are now under discussion—recovering oil from shale, liquefying natural gas, working the tar sands, hydrogenating or liquefying coal. Each has its champions, and the earnestness of the debate is a promise of action.

There seems no doubt, either, that chemistry must work new magic in developing processes which will differ in major respects from those in current use by industry. These new processes, it is expected, will continue to yield the conventional hydrocarbons now obtained from crude oil and natural gas.

It doesn't take a scientist to see that importation of oil may also figure more prominently in our future economy than in the past.

After all, where we get our oil, or by what process need not concern you as a user of oil.



- A. 44-Billion Dbls. already discovered in U. S. A.
- B. 37-Billion Dbls. found in rest of world.

He points out that, "If exploration by drilling is finally carried out all over our country with the thoroughness our more developed states have enjoyed, and if we assume per acre yields equal to the average for the areas already proved for production in the United States this country should ultimately give up at least 100-billion barrels of oil, including the 44-billion barrels already discovered. On the same basis the rest of the world, with some 6-million square miles of known reasonably favorable sedimentary rock area, would ultimately produce some 600-billion barrels of oil, including the 37-billion barrels already found."

War and wartime demands have been a potent spur to new research and new activity. The nation is aroused to the problem. And in this America of ours, awareness of a need has always been the best guarantee that the need would be met.

Fortunately for us, the United States is not only by far the largest producer of oil, but the U. S. petroleum industry has consistently encouraged exploration and development in foreign fields.

The full color map inserted in the back of this book shows the location of only the surveyed potential oil areas in the world. It does not include regions which have not been surveyed even though oil has been discovered in many such areas. This map also shows the major active oil fields and the major oil shale deposits in the world.

From this you can get a clear picture of the location of the discovered oil areas and the sources available to us, provided, of course, we have fair access to the fields and reasonable protection for our investments.

U. S. Control of Foreign Fields

Including United States oil reserves, American companies control 60 per cent of the discovered world total of oil; Great Britain controls 25 per cent and Russia 10 per cent.

Of proved oil reserves outside the United States, American control ranges from 25 to 30 per cent, with about 50 per cent in control of the British and about 20 per cent in Russian hands.

We Americans are indeed fortunate. The history of oil clearly points out that Americans excel at oil-finding and the development of oil fields. Many other nations, realizing this, have employed Americans with marked success to organize and carry out the technical job of finding and developing new oil fields.

We can look upon the oil supplies of the world as coming from three giant pools, from which radiate tanker routes and pipelines linking every part of the civilized world. Chief of these three oil pools is the Caribbean basin, extending roughly from the northern coast of South America to the oil producing areas of the Central U. S. This pool has a normal production of 1,500,000,000 barrels a year.

The second most important pool is the Mediterranean and Middle Eastern area, including Rumania, the Caucasus, Iran and Iraq. This pool contributes about 360 million barrels annually.

The third pool—only about 56 million barrels—is the Netherland East Indies and Sarawak, an island off the coast of Borneo.

Less significant is the production from fields in Argentina, Peru, California, Canada and Russo-Japanese Sakhalin.

This, in brief, is the picture we piece together from fragments of fact and trends of opinion. What does it promise for the future of America and America's way of living?

Oil for Tomorrow

So long as free enterprise flourishes, progress will not die. That is a common creed in an America which is still driven by the pioneer spirit of its forefathers.



With the return of peace there will be an inevitable scramble for oil supplies and markets. Wildcatters, given the opportunity, will be busy the world over. Exploratory wells will be drilled by the thousands. Exploitation of oil fields will be improved, and a vast army of petroleum chemists will let loose their energies in research to provide a flood of new war-inspired products. Some of these are already reaching the market, and many more are in the secret formula files of leading oil companies.

Exploration for oil has already made great strides through improved techniques the geologist has employed for oil-finding.

One method has followed another in cycles of mounting success: mapping of surface structures from outcrops; core drilling to determine sub-surface structure; micropaleontology for identification and correlation of strata; the use of the torsion balance; the advent of the refraction seismograph for de-

ciphering the structure of deeply buried rocks; the coming of the simpler reflection seismograph; and finally the development of the geochemical technique for exploration.

This new development of the geochemists in oil-finding methods is designed to detect even the vaguest evidence of the "iron hat" or mantle overlying deeply buried oil accumulations.

Postwar Plans in the Oil Industry

From war, too, have come many improved processes in the manufacture of petroleum products, and higher efficiency and economy in their use in transportation and heating.

Extensive postwar developments are planned in Latin America and the Persian Gulf. Reports on production already show increases in Venezuela, Mexico, Colombia, Trinidad and Peru.



Drilling Oil in Trinidad

American capital has 160,000,000 acres under concession in Arabia, and oil rights in 300-square mile Bahrein Island. Rehabilitation of the Far East fields is assured, including those in the

Scientists have already solved the problem of producing oil from coal. Our enormous coal deposits are capable of supplying at reasonable cost, sufficient petroleum products for all our needs for hundred of years to come, and at the same time meet all our usual requirements for coal.



Who knows what new wonders will emerge from the laboratory, once the full conversion possibilities of American natural gas are realized?

This gas is about nine-tenths methane, and methane is one of the most important hydrocarbons. Its chemistry gives the clue to many fascinating products for the postwar world.

Eminent petroleum chemists affirm that any known synthetic can be built up from a base of hydrocarbon gases. Methane can be oxidized to make for-

maldehyde which is an important feed stock for bakelite and urea.

From gas hydrocarbons can be obtained fatty acids for soap; and it is said that Germany is already producing "ersatz" edible fats from paraffin wax obtained from methane and combined with glycerin.

In Europe over 100,000 automobiles use as their source of power, methane gas compressed into steel tanks. Natural gas supplies the carbon black which imparts toughness to the new synthetic rubbers.

Ethylene, another petroleum gas, can be used instead of grain to make ethyl alcohol. It is a source of plastics and has the power to stimulate quick ripening of fruit and the growth of plants. It will also provide the surgeon with anesthetics.

Idle dreams, do you say? So they may appear, but all are based on sound scientific research, and many are now beyond the experimental stage.

They extend an irresistible invitation to a nation that has forged to world leadership in the service of its people through chemistry and industry.



The Oil Era Is Just Beginning



As sure as the sun rises, we are on the verge of momentous changes. They forecast a future as different from pre-war conditions as our present standards are from those of our grandfathers.

It is not to be expected that all the new wonders of petroleum will arrive, in full perfection, overnight. Radical changes do not come that way. Neither industry nor consumer can immediately scrap everything that is old for everything that is new.



Oil is as old as the earth in which it is stored, but its era is just beginning. Its future is not something to fear, but something to plan and work and strive for.

Certainly, oil will play a more important part in life after the war.

Already on the drawing boards are improved methods of domestic heating. They will turn into warmth and comfort a far larger proportion of the heat units in every gallon of fuel oil. They will set new standards of effi-

ciency and economy. New methods of home construction, new materials and better insulation will keep your post-war home warmer, require less fuel.

This is a promise for your home of tomorrow.



Oil in the Postwar World

What can we conclude, in broad terms, when we look at all these facts, figures and expert opinions on the subject of oil? These four things, certainly:

First—that when the war is over, there will be plenty of oil available for the peacetime needs of the world, as far ahead as they can be forecast.



Second—that science will continue to advance, in techniques of discovery and recovery, to utilize every known source of liquid fuels. Some of these,

even now, await only the release of men and materials.

Third—that after Victory, oil imports from foreign fields can supplement our domestic supplies without jeopardizing our national economy.

Fourth—that the genius of the chemist and geologist will be constantly



seeking, and finding, new sources of heat and power, making the world gradually less dependent on the bounty of nature.

"Before our oil in the earth is exhausted," says geologist Wallace E.



Pratt, "we shall be making oil for ourselves just as well as Mother Nature made it for us.

"In the first stages of this substitution of synthetic for natural oils, we shall appropriate our raw materials from the coal beds and other fossil stores of hydrogen and carbon.

"But eventually we shall surely come to draw currently upon the ultimate source of our energy, *sunlight*, if not directly, then through the intermediate step of growing plants.

"Thus in the end will we outgrow our dependence on fuels stored in the earth."

NOTE

The map inserted in the back of this book shows the location of the surveyed oil areas in the world where oil has been discovered.

It does not include regions which have not been surveyed, even though geologists know that oil deposits exist in many such areas. These include large areas in the islands north of Western Canada, also areas other than those shown in Alaska and other parts of the world where oil has been discovered but where surveys have not been made.

The map also shows the major active oil fields and the major oil shale deposits which are located principally in the United States, Chile, Great Britain, Sweden, Finland, Russia and Australia.

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