ENGINEERING

Will Uncle Sam's Gas Tank Run Dry?

The United States Uses Twice as Much Petroleum As Drinking Water Each Year; How Long Will it Last?

By ANSEL E. TALBERT

PETROLEUM experts of all kinds, including geologists, chemists and statisticians, are in wide disagreement over the question of whether or not there will be a gasoline shortage in the United States within the next five or six years. Each is vehemently voicing his own opinion in the matter.

The opening guns have already been fired. At the recent national meeting of the American Chemical Society in San Francisco, Dr. Benjamin T. Brooks, consulting chemical engineer, and L. C. Snyder, geologist, both of New York, predicted that a serious shortage will arise some time between 1940 and 1943.

Going even further, these two predicted that with a little help from American motorists, the gasoline drought may come even sooner. In fact, should consumption increase, the shortage might develop within two or three years.

A petroleum shortage at any time is no laughing matter. Coming as soon as five years, it might be a national calamity. There would be no end of difficult industrial complications in an industry involving billions in the form of investments, and employing hundreds of thousands of workers.

Tripling of gasoline prices, the widespread use of low-powered "Tom Thumb" automobiles, and an added burden on the Navy and air forces of the United States to protect our import trade-routes would be only a few of the probable results of a petroleum shortage.

War Would Cripple

We would be forced to import much of our crude oil from Persia, Russia, South America, and other foreign lands. This might be possible in peace times—but suppose we became involved in another war? If the enemy should succeed in cutting off our foreign trade, our entire transportation system might be crippled—practically a sentence of defeat.

"A serious dislocation of industry would result if imports were to be interrupted," the Brooks-Snyder report prophesies. "The manufacture of substitutes such as shale oil or oil made by the hydrogenation of coal could not possibly be developed quickly enough to be of importance in a national emergency such as war, which would be settled one way or another long before any large part of our gasoline demand could be supplied from the auxiliary sources."

Even if we start right away, Dr. Brooks and Mr. Snyder do not believe we can do anything to stave off the predicted oil shortage. They are of the opinion that the manufacture of shale oil could not check the rise of petroleum prices until they have risen to two-and-a-half to three times the present level, and after the shortage had lasted at least several years.

Any attempts to conserve the use of present petroleum resources, they believe, will be looked upon as a political move inspired by oil companies to raise gasoline prices.

Substitutes Expensive

Alcohol and Diesel oil, two widely suggested substitutes for gasoline as motor fuel, offer little hope, as they see it. Both are too expensive to produce and distribute, with alcohol "not an economic substitute for gasoline except at price levels for gasoline about five times the refinery cost of gasoline during the next five years."

All of this is only one side of the argument, of course.

Speaking before the same meeting of the American Chemical Society, Dr. J. Gustav Egloff, a Chicago petroleum expert, contradicted reports that a shortage of petroleum was imminent. According to him, there are reserves of oil of 13¼ billion barrels, equivalent to over 15 years' supply at the 1933 rate of consumption, which was close to 900,000,000 barrels for the year.

Secondary Supply

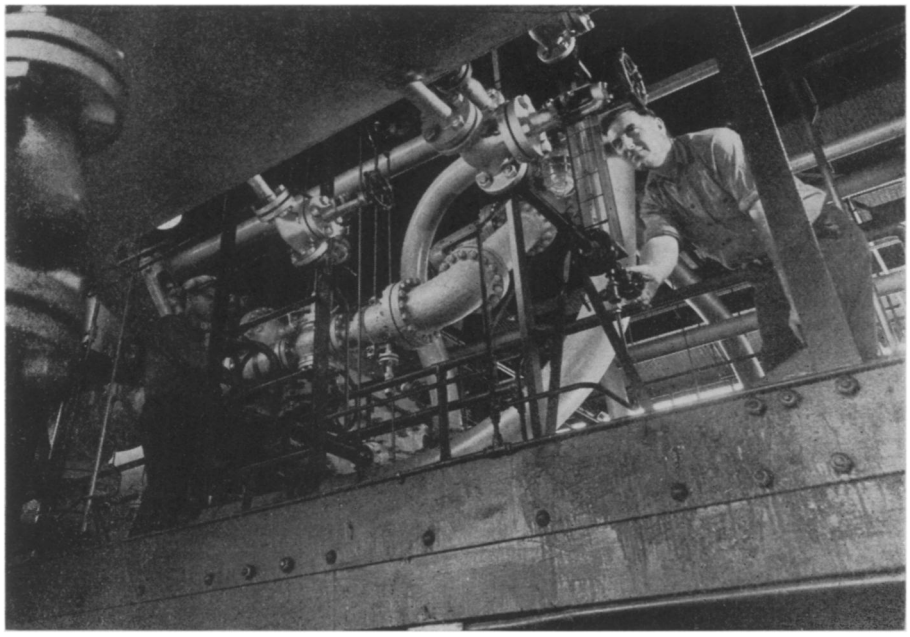
In addition, he estimated that there exists a secondary supply of oil in known fields, amounting to between 38 and 115 billion barrels of oil, not recoverable by present methods of drilling, flowing, and pumping, but available by other methods should economic conditions make its production profitable.

These reserves are equivalent to between 45 and 124 years' supply, he estimates.

Government economists, statisticians, and petroleum specialists of the Petroleum Administrative Board, the Geological Survey, the Bureau of Mines, and other government departments in Wash-

BENT ROCK

This deposit of oil-bearing shale in the state of Washington is so rich that the rock bends without breaking. Note the section which has come loose and bent, but not fallen, in the center of the picture.



THE SOURCE

The heart of a huge motor oil refining plant at Paulsboro, N. J. Here, more than 3000 or more barrels of lubricating oils are turned out each day to grease the motors of American automobiles.

ington, are inclined to take a position somewhere between these two extreme viewpoints.

While believing that any predictions of an imminent shortage are exaggerations, they agree that known reserves of natural petroleum are being exhausted at a rapid rate, and new discoveries are failing by a large margin to replace petroleum consumed each year.

According to the U. S. Geological Survey, the known petroleum reserves of the United States, excluding unproven areas and unknown potentials, are about 13,250,000,000 barrels. Although we use up approximately a billion barrels a year normally, this supply would last at least 14 years, if no new fields were discovered.

Rate Not Constant

It would not be possible to extract all of the petroleum reserves at that rate, however, even if we wanted to. After a few years of high oil production, oil wells have the habit of slowing down to a trickle, and continuing at this rate for a considerable length of time, so that a well might give up half of its petroleum during the first two years of production and then slow down to a dribble and take ten years or so to run dry.

Thus, if we were depending on our known oil reserves alone, a prediction of a shortage within five or six years might not be improbable, because the wells now in operation might all have slowed down by that time. We are not standing around and waiting for this to happen, however.

New oil fields are being discovered all the time, government statisticians report, averaging an addition of 600,000,000 barrels of petroleum each year. This may not be enough to supply our demand of nearly a billion barrels without tapping our reserves, but it should make them last a great deal longer than 14 years. Figure it out for yourself.

Skeptical

As for a rise in price to three times the present cost of gasoline, and tiny, low-powered cars, in case of a shortage or attempts at conservation, government scientists are skeptical.

Prices in the gasoline field are competitive prices, and are not based on supply, demand, or anything else. The only marked rise or fall in price during recent years has been due to either the addition of taxes, or to local gasoline wars between competing companies, they say.

Even this rise and fall seems to have little effect on gasoline consumption. In fact, government statisticians, whose job it is to trace the relations between price levels and consumption, have not been able to find that rise in prices, including federal and state taxes, has any relation to consumption.

For example, in Alabama the taxes on gasoline are in the neighborhood of nine cents a gallon, and yet there has been no drop on gasoline consumption in that state. Midget automobiles used in England and other European countries appear to be more the result of taxes on horsepower than of high gasoline prices.

Regardless of whether or not there will be a gasoline shortage within the lifetime of any automobile now on the road, the fact remains that it is high time to start looking for natural petroleum substitutes "just in case."

Our natural petroleum cannot last forever. We use twice as much petroleum each year as we do drinking water. Every day enough crude oil is taken from the ground to cover Manhattan Island—twelve miles long and averaging a mile wide—to a depth of a foot and a half.

Something Must Be Done

Barring the finding of natural petroleum in unexpectedly large quantities in the United States during the next few years, something must be done to develop new processes for utilizing the secondary oil reserves of our oil fields, untouched by present methods of recovery, and to discover cheap synthetic substitutes.

"Sooner or later a substitute for natural petroleum as the principal source of motor fuel must be found, but what it is, or when it will be commercially practical, I don't know," said a prominent official of the Department of Interior recently.

Shale oil is one possibility. Oil-bearing shale occurs in large quantities in Utah, Wyoming, and Colorado, as well as several other western states. It has been known for years that oil could be distilled from these rocks and used as fuel. They are so saturated with oil that often a huge boulder will burn like a piece of coal.

Brigham Young and his Mormon followers distilled shale oil for use in lamps, soap making, and other domestic uses more than fifty years ago. Many of the primitive stills used more than fifty years ago are still in existence and some are used even now for the same purpose.

Can't Recover It

Admitting that shale oil is a great potential source of motor fuel, government officials say that there is no technical process at present capable of recovering it in sufficient amounts and at a low enough cost to make it a substitute for natural petroleum.

Some obscure and unknown inventor or technician now at work over his test tubes may eventually discover a process capable of taking over the job of feeding American motor cars, but so far, his identity is unknown.

Alcohol is another possibility. It is

now widely used in Europe to dilute gasoline. All German gasoline must now contain about ten per cent. of alcohol by law, and varying percentages are used in Austria, Sweden, Czechoslovakia, and other neighboring nations.

Although it can be used in a pure state as well, its high cost has so far prevented this. Two recently developed German processes, the Scholler-Tornesch saccharization process and the Bergius wood hydrolysis process, are claimed to be capable of producing alcohol more cheaply and in larger quantities for use as motor fuel. Whether this is true or not remains to be seen.

Dilution

A number of proposals have been made and have received some support in Congressional circles in Washington for making dilution of all American gasoline with one or two per cent. of alcohol compulsory. This would conserve our petroleum resources and benefit the farmer, it is claimed, since alcohol can be distilled from corn, potatoes, and many other farm products.

Many chemists, however, feel that the first step in providing a real substitute for natural petroleum will be the synthetic production of gasoline from coal by a process known as hydrogenation of coal.

Several commercial processes have been developed for coal hydrogenation in Germany, which is almost entirely lacking in natural petroleum resources, and are being put to more increasing use with the help of government subsidies. Last autumn the Reich government organized a joint cooperative company known as the "Braunkohlen Benzin A.G." with money contributed pro-rata by the Central German brown coal companies, for the production of synthetic gasoline from coal on a large scale, using the Bergius process of hydrogenation.

In England as well as in America, a number of oil companies, have been experimenting with the production of synthetic gasoline, and a number of synthetic gasoline laboratories have already been built.

Price Double

So far, it has been impossible to produce it at a market price of much less than twice what an ordinary gallon of natural petroleum gasoline now costs. In other words, synthetic gasoline costs about 32 or 33 cents a gallon, although large-scale production would undoubtedly lower this figure.

What chemistry, spurred on by necessity, can accomplish can be seen by a glance at what is now happening in Germany, struggling to be free of foreign imports. Automobiles are being driven increasingly by illuminating gas, alcohol, benzol, Diesel oil, and a variety of non-liquid gases including propane, butane, methane, coke and wood gas.

Propane and butane are available in large amounts in the United States, as well as natural illuminating gas, which is mostly methane. Both of the former are now used in liquid form as solvents to remove impurities from motor oil in U. S. refineries. Their great versatility makes it possible to use them first as a solvent and then as motor fuel, without great additional cost. These could undoubtedly be used in an emergency, although they require additional equipment to that used in gasoline burning automobiles. Liquefied propane tanks are shown on the front cover of this week's SCIENCE NEWS LETTER.

Electricity should not be overlooked as a possible source of power for automobiles. When the automobile industry was still young at the beginning of the century, there was a great deal of competition between electric and gasoline automobiles to capture the new automobile-buying public. Although the struggle was a close one for a number of years, gasoline finally won out because of its superior speed and convenience. It took less time to say "fill 'er up" to a filling station proprietor than to wait for a battery recharge, every 75 or 100 miles.

A few electric automobiles, relics of 15 to 25 years ago, are still occasionally seen, operated by persons to whom speed is not a major consideration. The invention of a new storage battery, capable of storing much larger quantities of "juice," might enable the electric car to stage a come-back.

Scientists, on the whole, are not too greatly worried about what is going to happen after our natural resources have given out, whenever that is. Science has come to the rescue too many times in the past to fall down in this situation.

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PHYSIOLOGY

Reports Feeling No Sensation During a 1200-Foot Fall

AN ARMY doctor has fallen 1,200 feet in space just so he can tell how it feels. The strange result of the experiment is that there is no sensation to the fall, "except a very gentle, evenly distributed pressure something like being lowered slowly into a great bed of softest down."

The reason Capt. Harry G. Armstrong, of the U. S. Army Medical Corps, is alive to record his sensations (*Journal, American Medical Association,* Oct. 5) is that the premeditated fall was really a delayed parachute jump from an airplane. When he was 1,000 feet from the ground he pulled the ripcord and came to earth with parachute open.

During part of the fall, Dr. Armstrong kept his eyes closed. When his eyes were shut he felt no sensation whatever. It was as if he were suspended at rest in midair. When still about 1,900 feet up, he opened his eyes and sighted ground. Then for the first time he had a definite sensation of falling. This sense of fall increased rapidly and when, at 1,000 feet, the parachute was opened, "there was a fully perceptible vertical velocity."

The practical importance of the delayed parachute jump in both civil and military aviation led to the experiment. Dr. Armstrong is director of the physiological research laboratory of the Materiel Division of the Air Corps, and is stationed at Dayton, Ohio.

The Army doctor's jump was from the rear cockpit of a two-seated biplane. It was flying on a straight and level course at 2,200 feet and at an air speed of 110 miles an hour when he jumped.

The jump was a sort of slow tumbling fall and the doctor's body somersaulted every two seconds. Careful note was made of all sensations until he pulled the ripcord. Attendants on the ground timed the free fall, and from this and a series of photographs calculated the distance of the fall. It took 11 seconds for him to fall the 1,200 feet.

As soon as he was clear of the airplane, his previous fear and excitement disappeared, the doctor states. His "consciousness was unclouded and ideation was rapid, precise, penetrating and clear." Although twelve airplanes were near, the doctor cannot recall any noise or the sound of the rush of air past the ears. He does not know whether this loss of perception in hearing was due to inattention or because atmospheric conditions.

Dr. Armstrong could see normally as he fell. There were no consciously per-