Conservation of Natural Resources and Legal Control

Furman Rinehart
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By Furman Rinehart*

Up to the time of the passage of the national industrial recovery act, the anti-trust laws have practically bounded the field of government regulation of business, and the emergence of more extensive regulation may at this time render of some interest a discussion of conservation of natural resources.

The recovery act, it may be noted, does not repeal the federal anti-trust laws. Their operation is merely suspended in certain instances while the law is in effect and for a period of sixty days thereafter. The duration of the statute is limited to two years or less, should the "national emergency," upon which it is predicated, cease.

There will yet remain, either as practical necessity or as a matter of political controversy, the problem of conservation of natural resources. Government control of business unquestionably will continue to be influenced by the anti-trust laws. It is important, then, to study the relationship of these laws and the conservation of raw materials.

What was heresy yesterday often is the accepted truth of today; what is conservation today may well be waste tomorrow. These concepts change as do conditions and as knowledge advances. It will suffice to say that conservation as it is here used not only, has its general meaning—the antithesis of waste—but includes further the idea of saving for the use of posterity those raw materials which we find necessary and convenient in our present mode of living.

There has been for some time an undercurrent of agitation for repeal or amendment of our federal anti-trust laws. One of the

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*Of the New York and Massachusetts bars.
†The body of this paper was prepared as a requirement for Professor James A. McLaughlin's course in Federal Anti-Trust Laws at Harvard Law School, (1932).
‡For a discussion of the technical aspects see Handler, The National Industrial Recovery Act, (1933) 19 A. B. A. Jour. 442; see also (1933) 47 Harv. L. Rev. 85, 101 et seq. It is interesting to compare the more popular approach in an article by Hugh Johnson, Magazine, New York Herald Tribune, Aug. 13, 1933, Putting America Back to Work.
arguments for repeal or amendment has been based on the ground that the policy of the anti-trust laws in fostering competition tends to waste and that if something is not soon done about it our country will find itself in the near future stripped of its natural resources.

But do the present federal laws bear such an essential relationship to the conservation of natural resources as has commonly been assumed? It may seriously be contended that they do not.

** Metals **

Consider first the case of copper. Those who would have us believe that a too early exhaustion is forthcoming and use "conservation" as the basis for an argument to repeal or amend the present anti-trust laws are likely to cite a mass of figures showing a table of production with a parallel table of consumption to prove their contentions. Yet they must admit that an accurate estimate of its reserve is not now possible. The mining engineers do not seem to be worried about the copper situation from the standpoint of saving this metal and apparently look forward to ample supply. One eminent engineer, when secretary of commerce, in discussing the status of the mining industries put it this way:

"... within our lifetime we can remember when 5% copper ore was not in most localities considered to be an extraordinary richness, and yet improvement in extraction methods alone has made 2% ore in most localities extremely valuable and the volume of 2% ore is many thousand times that of 5% ore. I have no doubt that with moderate increase in the price of copper and with improved extraction which we can look for at the hands of our chemists and metallurgists, the day will come when the contents of a fraction of this will be considered within the estimates of future supply."

In the case of metals (and other minerals) there is an essential difference from other natural resources—they are not renewable, as is the case with agriculture, forests, water power, and so on. However, this difference is not one that need give rise to present apprehension because as a practical matter the question is one of time which must be measured in generations, and any fear of exhaustion should be tempered with many probabilities, includ-

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3 Hoover, Status of Mining Industries, (1928) 9 Min. and Mt. 4.
ing the advances of technical methods. Just what these advances will be we can not say definitely but we can obtain a fair idea of what may be expected in the future from what has already been accomplished in the science of chemistry and allied fields, where advance goes forward at a rate comparable to a geometric progression.4

In the present state of our knowledge it seems as fair to argue that “the mind of man will find means” to overcome the difficulty should one arise as to argue that a too early exhaustion is forthcoming. After all, either contention must be based on the probabilities of the future. Yet Darius Greene preceded the Wright brothers; Jules Verne has had the last and best laugh; and the chemist has long since made the “silk purse out of a sow’s ear,”5 and sausage casings out of shirt tails.6

Those of us who do not believe that the destruction of the atom may bring true the alchemist’s dream of transmutation of metals can not deny that the goal is nearer.7 However, we are sure that in many cases aluminum, the most abundant of industrial metals, can be substituted for copper; glass, made from sand, can be substituted for tin; zinc, for lead, and there are many other substitutes and combinations of these.

What has been said of copper is generally true of all the metals—limited but unknown resources; new sources being discovered, more efficient extraction methods being developed; one being substituted for another; combinations of metals for specific characteristics, tending to more efficient use;—the chain is endless.

How, then, is legal control, whether expressed through the anti-trust laws, the recovery act, or similar legislation, related to


5A silk purse was made by Arthur D. Little Co., chemists, by converting sows’ ears into a gelatin which was processed in a manner similar to that now used for rayon. The thread so made was dyed and then knitted into a bag.

6The process of making viscose sausage casings from cotton linters was developed at Mellon Institute, Pittsburgh, Pa., leading finally to the now popular skinless frankfurters. The viscose casing not being affected by the smoke and consequently not tanned to the sausage makes possible the skinless frankfurter. In 1930 the daily output of such casings—those just right for the “hot dog”—would equal 150 miles long. Slosson, Creative Chemistry, 2nd ed., 122.

7New York Times (Nov. 6, 1931) reports a large generator of cheap construction building up voltage higher than ever before obtained with predictions of force enough to divide the atom.

the conservation of metals? The relationship is very remote, or at least their importance to conservation is overshadowed by other pertinent considerations.

It becomes more apparent that the problem is not one to be solved one way or another by government control, as we ordinarily understand it, if consideration is directed more specifically to the case of iron. The United States Steel Corporation largely controls this situation from raw materials through finished steel, and the anti-trust laws have not struck it down nor has the real problem of conservation of the raw material been solved. Every year blast furnaces of the world release some 75,000,000 tons of iron from its oxides and every year a large part estimated to be a quarter of this amount by rusting reverts to its primeval forms. To save a pound of iron from corrosion is of as much benefit practically as to produce another pound from the ore, especially when it takes about four pounds of coal to make one pound of steel.

That the laws relating to federal government control are of little import in the solution of the material problems of conservation is shown to a great extent by this example of the steel industry. The high grade ore is in the hands of comparatively few, and production fairly well controlled, yet "at the present rate of increase in pigiron production, recent estimates indicate that the high grade ores of the United States (if used in the present proportion) will last only 50 years and that the whole potential ore supply will be exhausted in 250 years."

The question of conservation of the metals is not one to be answered by legal control through the anti-trust laws, the recovery act, or similar legislation; it is more an engineering problem of overcoming corrosion losses, and making the same quantity of raw material go further.

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10Slosson, Creative Chemistry, 2nd ed. 271.
12"Industry's annual corrosion bill is enormous. Loss due to corrosion of metals in the United States, according to Dr. Gustav Egloff, Universal Oil Products Co., is $1,000,000,000. In the American oil industry alone the corrosion bill for 1928 is estimated at $135,000,000. This is equal to a levy of one cent on each gallon of gasoline consumed.” Lee, New Metals of Construction Reduce Corrosion, (1931) 38 Chem. and Met. 153.
TIMBER

It might have been said a few years ago that the rate of using our timber would soon find us without adequate supply, but with recent forestration programs, the new artificial and synthetic woods, and wood substitutes, the tide has turned and we need have no fears in regard to future supply.

COAL AND PETROLEUM

Coal and petroleum (including natural gas which is made up of the lighter ends of the same chemical series) are similar in some respects to the metals but in certain characteristics essentially different. Coal remains stationary in the earth, so to speak, as do ores until removed by hand, while petroleum is migratory. Coal and petroleum are important sources of energy, which is not so of metals.

The coal situation should not give us immediate concern as regards sources of raw material. Estimates up to twenty centuries' supply have been made. Any connection that coal has with present laws expressing a policy of legal control might deal with "lean earnings for investors, insecure employment for miners," and a sickened state of the coal industry, with possible reflection upon general business conditions, and these considerations might be grounds for changes in anti-trust legislation or a basis for agreement with the purpose of the recovery act, but by and large the United States demands a certain quantity of energy to keep pace with industrial progress, and there will be a diminishing proportional depletion of resources because we never have, and most likely never will, discover how to "have our cake and eat it."

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13 Smith, (1930) 36 Am. Jour. Soc. 884. Forest conservation that is being promoted under the Clark-McNary Law is the distribution of forest tree seedlings to landowners. Twenty-five million young forest trees were thus planted in thirty-nine states and Hawaii in 1929.
15 Celotex from bizarre (sugar cane) is an example.
16 This distinction may be clearer from this example: Suppose A owns Blackacre adjoining Whiteacre owned by B, under which there is a vein of coal and a common oil pool. It is possible for A by drilling a well on Blackacre to extract oil underlying Whiteacre owing to the mobility of the oil, but A can not likewise get possession legally of the coal under B's land.
If we must have energy and go to coal as a source, the common-sense way to save is by increasing the efficiency of its use, and here, as in the steel industry, the real problem of conservation lies with the engineer. This is so whether our social policy be expressed by anti-trust laws, laissez-faire, the recovery act or complete government control.

If the problem is one of engineering rather than one of laws, obviously the approach is different. The engineer does not achieve his results by jailing people, or by having them enjoined or by heaping triple damages upon them. He looks to get more out of what he has. For example, formerly three or four pounds of coal were used to produce a horse power hour of energy. Now it may be done with fourteen ounces, no more than one may hold in the hollow of the hand, and this is not all that may be expected.

The case of petroleum differs in many respects from any of the other natural resources. The peculiar characteristics of production under the present subdivision of the surface land, the migratory nature of petroleum and the rule of common law which considers oil analogous to animals ferae naturae have brought about an almost unrestrained competition. To get possession of the oil before a neighbor gets it has led to immediate intensive drilling in the vicinity of a "discovery" well, and in many cases this has resulted in "flush" fields which flood the market, often with consequent demoralization of the whole industry.

It has been said that this state of affairs tends to waste on the ground that "basic mineral industries can not, under the present law (the Sherman Act), limit production regardless of how beneficial, necessary or reasonable, such limitation may be, if, by so..."

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18A horse power hour of energy means that it can raise 33,000 pounds 60 feet in an hour. A horse power is the power required to do 33,000 foot pounds of work per minute.

19Thom, Petroleum and Coal 178.

20The fugitive property of oil and gas was recognized in decisions early in the history of modern petroleum production. See Brown v. Vandergraff, (1875) 80 Pa. St. 142; in Westmoreland N. Gas Co. v. DeWitt, (1899) 130 Pa. St. 235, 18 Atl. 724, 5 L. R. A. 731, the court refers to oil and gas as "minerals ferae naturae."

Petroleum has been an important commodity for thousands of years, dating back centuries B. C., but the present oil industry was born in 1859, at Titusville, Pa., when Colonel E. L. Drake drilled a well by a method similar to that now used.

21Some examples of flush fields: 1923, Long Beach, Santa Fe Springs, Huntington Beach, Powell, Burbank, Tonkawa. 1924, Seminole, West Texas. 1931, East Texas. "Twenty-four 'bonanza fields' have yielded almost half of the output of the United States." Thom, Petroleum and Coal.
doing, they, ipso facto, restrain commerce among the several states. But, as will be pointed out later, petroleum production may be limited to prevent waste, and, further, the proposition quoted above relates to only unreasonable restraint on interstate commerce. This situation is considered hereafter. Is not the United States Steel case an example of what may be done under the law in limiting production in a "basic mineral" industry?

Also it has been said that "the law-enforced competition which the statute (the Sherman Act) compels results in the creation of an excess supply that bears no relation to demand. This surplus is waste." But in these situations where the disastrous effects of the law are pointed out the discussions go to the question of profits or return on investment. The word "waste" is used without differentiating between economic and physical waste.

With reference to conservation of raw materials, we are dealing more particularly with physical waste rather than duplication of work in drilling wells, building refineries, filling stations and other aspects relating to expenditures and money losses which tend to economic waste. Since conservation of the raw material deals essentially with physical waste, what, from this point of view, is the significance of over-production of petroleum? One consequence is lower price, which tends to a further replacement of oil for coal as a fuel. But this is an aid to the petroleum industry in that it gives an outlet for excess oil tending to lessen economic waste but at the same time, broadly speaking, has an equally serious and undesirable effect on the coal industry. In any event, it may be said that the extended use of petroleum in times of over-production is compensating, because when oil is used for fuel there is a corresponding saving in the reserve of coal, and, as will be shown later, coal and petroleum are in the final analysis interchangeable sources of energy.

It has been argued further that "flush" oil gets to the consumer with less refining (usually less cracking) than would otherwise


23Sutro, Sherman Law an Economic Impediment, (1931) 30 No. 20 Oil and Gas Journal 16.

24Then, too, there is evidence that the price of crude oil and its derivatives has had little effect on the demand. As a general rule, it appears that consumption goes on regardless of cost. See Osgood, Increasing the Recovery of Petroleum 824.

25"Cracking" refers to those processes designed to convert hydrocarbons of medium to high molecular weight into hydrocarbons of lower molecular
be the case. But it is unfair to lay this unfortunate situation at the door of the anti-trust laws, because they do not prevent cracking. In fact the decision upholding the cracking patent cross licensing agreements in the *Standard Oil of Indiana Case* tends to encourage it.

It would seem in comparing the present estimated petroleum reserves with the present rate of consumption that the supply is soon to be exhausted. Hastily arriving at such a conclusion on these facts alone is not justified because as estimates have been made from time to time, they have become larger and larger. This is due partly by reason of the discovery of new fields (including deeper drilling), and more efficient production methods. There is still a very wide margin for increased recovery in those fields already opened, some of which are now abandoned because the “economic production limit” under present conditions has been reached. Estimates based upon sound and exact reasoning indicate that from four-fifths to seven-eighths of the oil actually present in the producing horizons remain in the earth under our present production methods. The eighty per cent left in the ground is not weight. In this way fractions of the petroleum which upon simple fractional distillation do not yield gasoline are converted into gasoline by thermal decomposition and chemical reaction, and the yield of gasoline from crude oil can be increased. For a chemical treatment of cracking of petroleum, see Gruse, *Petroleum and Its Products* 164.

The terms “pyrolysis,” “pyrogensis,” or “thermolysis” have been suggested as more descriptive, but the term “cracking” is more commonly used. The first estimate (Day), made in 1908, gave a minimum and maximum quantity of oil remaining under ground, roundly 8,015,000,000 barrels, and 33,515,000, respectively, allowing for error a latitude of 280%.

Another (Committee of Eleven, A. P. I.), in 1925—Estimate of future production by present methods, 5,300,000,000—from existing wells and acreage, these wells prove to be productive. After flowing and pumping of these shall have ceased, there will remain 26,000,000,000 (barrels), a considerable portion of which can be recovered through known methods. Estimates based on known areas. These do not take into consideration oil fields that may be discovered in the future. (1928) Handbook, *Am. Pet. Inst.* 131.
a case of "water everywhere and not a drop to drink" because those
deposits not recovered by present operating methods constitute a
reserve in the sands that will come out through flooding,\textsuperscript{31} repres-
suring,\textsuperscript{32} mining,\textsuperscript{33} and whatever other recovery methods which
may be developed when conditions will permit a return on capital
invested.\textsuperscript{34}

The problem of conservation is one of engineering in the refin-
ing of petroleum as it is in production, rather than a problem
materially affected by our present federal laws. This will become
apparent upon a consideration of refining methods and develop-
ments. Where, before, the only gasoline produced was "straight
run" (simple fractional distillation), now, by the cracking process,
the yield of gasoline from crude oil has been increased. In 1916
cracked gasoline made up 10\% of the gasoline used; in 1923,
19\%; in 1926, 31\%;\textsuperscript{35} and the proportion is increasing from year
to year. The total gasoline yield per barrel of crude oil increased
from 39.6\% in 1929 to 41.99\% in 1930.\textsuperscript{36} It is possible, if not at
present economically feasible, by a combination of cracking and
hydrogenation, to convert crude oil 100\% into gasoline.\textsuperscript{37}

But the problem of conservation does not end with 100\% con-
version of crude oil into gasoline. There is a wide margin for
increased efficiency of the automotive engines which use practic-
ally all the gasoline consumed. Thermal efficiency may be raised
by increasing the compression ratio in the cylinders,\textsuperscript{38} which is

\begin{table}
\centering
\begin{tabular}{|l|l|l|l|l|l|l|}
\hline
Compression Ratio & 5.0 & 5.5 & 6.0 & 6.5 & 7.0 & 7.5 & 8.0 \\
Gain per cent & 0.8 & 1.7 & 2.9 & 3.1 & 4.1 & 5.7 & 9.0 \\
\hline
\end{tabular}
\caption{Gain in power due to compression ratios above 5 to 1}
\end{table}

The manufacturer can produce a car with greater power and better per-
formance with practically very little redesigning and almost no retooling of
his plant by increasing the compression ratio of the engine. This increase
in economy is probably a matter of secondary importance to the manufac-
turer.\textsuperscript{39}

\textsuperscript{31}The Bradfield field of Penna. has been successfully "flooded" for a
number of years. Better expressed as "Water Drive" method.
\textsuperscript{32}Repressuring by introducing gas or air into the sands has been suc-
sessful in a number of fields.
\textsuperscript{33}Mining has been successfully operated in Peshelbrom, France, and a
number of United States patents have been issued covering mining of pe-
troleum.
\textsuperscript{34}See Osgood, Increasing the Recovery of Petroleum 830.
\textsuperscript{36}Staff Report, Petroleum Engineering in Review, (1931) 38 Chem.
and Met. 156.
\textsuperscript{37}Kirkpatrick, Catalytic Hydrogenation, (1930) 37 Chem. and Met. 558.
\textsuperscript{38}Street and Lichty, Internal Combustion Engines, 3rd Ed., pp. 304, 198.
\textsuperscript{39}Ziegenhain, What Do You Mean Octane Number, (1931) 30
No. 29 Oil and Gas Journal 22.
made possible by reason of the progress made in the development of motor fuels.\textsuperscript{39} It is obvious that if the thermal efficiency is increased the gasoline will, at the present rate of consumption, last proportionately longer. As a matter of fact, the number of miles in a barrel of petroleum is being gradually extended. The compression ratio in many models has recently been increased, and even now 40% more miles per gallon of fuel is promised.\textsuperscript{40} A hint has already been given to manufacturers of motor cars, trucks and tractors that the problem of adoption of alcohol and alcohol containing fuels should be considered by them.\textsuperscript{41}

The extraction of petroleum from shales, found in both the eastern and western part of the United States, has passed the experimental state. Although it is not economically feasible in the United States now, Scotch thrift has made commercial operation a reality in that country. Recoverable oil from shales in the United States has been estimated at 92,000,000,000 barrels.\textsuperscript{42}

Having set forth accomplishments actually within our view, the line of development shows a tendency sufficient for extrapolation. With the progress already made in cracking and hydrogenation of petroleum and liquefaction of coal,\textsuperscript{43} we may say with assurance that coal and petroleum are interchangeable sources of energy and extend as far in the future as we need inquire into for present purposes. This still leaves for further consideration the magnitude of other possible sources of energy which may be utilized if necessity demand.\textsuperscript{44} Before this time arrives, however, the pre-

\textsuperscript{39}The use of tetra ethyl lead in motor fuel (Ethyl Gasoline) is probably the outstanding commercial development. Also certain cracking processes yield gasoline with an anti-knock rating higher than straight run gasoline.
\textsuperscript{41}Ellis and Meigs, Gasoline and other Motor Fuels, ch. XXV, p. 545—“Alcohol as a Motor Fuel.”
\textsuperscript{42}Estimate of Dean E. Winchester, (1928) Handbook, A. P. I. 78. Supply and Demand, American Pet. Inst. estimate is even greater.
\textsuperscript{44}Calorific Value of Energy Sources—calculated from Prof. Arrhenius, 4 Transactions of First World Power Conference 1308.

(Thom, Coal and Petroleum 212—Table VIII)

Comparative Energy Values—using World’s Oil Reserves as Calorific Index Value of 1.00

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total energy of world’s oil reserve</td>
<td>1.00</td>
</tr>
<tr>
<td>Total energy of world’s coal deposits</td>
<td>367.00</td>
</tr>
<tr>
<td>Energy of coal consumed annually</td>
<td>0.08</td>
</tr>
<tr>
<td>Energy stored annually by growing plants</td>
<td>1.25</td>
</tr>
<tr>
<td>Energy of air currents (annual figure)</td>
<td>0.33</td>
</tr>
<tr>
<td>Solar radiation of heat to earth’s surface (annual figure)</td>
<td>442.00</td>
</tr>
</tbody>
</table>
dictions of some scientists may be borne out which will make it possible to control the atoms so that from a thimble full of matter energy may be released equivalent to a whole coal field.\textsuperscript{45}

All of the foregoing considerations should be taken into account before concluding that “the supply of petroleum will last only a few years.”

Looking again at the practical problems relating to conservation which presently confront the petroleum production engineer: The most important one is the utilization of the potential and kinetic energy in a reservoir during its natural productive life, and herein lies the most important phase of conservation today. To put this situation more concretely: Former production methods paid little attention to gas production in flowing an oil well; often the gas was permitted to escape into the atmosphere without any effort to control it. Suppose that for every barrel of oil produced 4,000 cubic feet of gas were produced (in a new field greater quantities of gas compared to oil are a common occurrence). Now, suppose it is found that by proper control of the well a barrel of oil can be produced with the production of only 1,000 cubic feet of gas (this situation is often found in actual practice). What is the significance? Since it is now known that the energy of the gas is the main propelling force in bringing the oil to the surface,\textsuperscript{46} the “life of the well,” other things being equal, should be four times as great without the addition of artificial (as distinguished from natural) forces. The supposititious example represents fairly the actual facts and indicates the savings which are possible.

If this gas energy is properly controlled, the reservoir will be developed in an orderly manner which will obviate the necessity of a wild scramble of operators to get their oil out with break-neck speed; each operator may get his just portion; and the “ultimate” production of the pool will be correspondingly greater. In the

\textsuperscript{45}Clark Tibbets, Inventions and Discoveries, (1930) 36 Am. Jour. Soc.: “The speed and energy of the protons of hydrogen atoms have been increased so that it may be possible to use them as atomic projectiles for smashing the hearts of atoms, transmuting them into other substances or releasing enormous quantities of atomic energy.” Work done by Drs. E. O. Lawrence and E. D. Edlefson, Univ. of Cal. (Sci. News Service). See also Ridell and Lidell—(1931) 12 Min. and Met. 41, 42.

\textsuperscript{46}While different locations involve different factors (as, for example, hydrostatic pressure found especially in the southern fields of Mexico), the supposed conditions will suffice for explanatory purposes.

See Osgood, Increasing the Recovery of Petroleum.
early life of the pool the rate of production will be slower, which will have a tendency to balance supply with demand.

The true gage to conservation of the nation's oil and gas resources, from a production standpoint, is the extent of the utilization of this natural energy. The greatest conservation will result from the gas-oil ratio which produces the most oil with the smallest amount of gas. Conservation of the gas energy in this sense is not to be confused with the wasting of the gas after it is brought to the surface.47

Since engineering plays such an important role in the conservation of our petroleum resources, what is the effect of the federal anti-trust laws on the reduction of engineering ingenuity to actual practice?

In Standard Oil of Indiana v. United States,48 holding valid the patent cross licensing agreements, we have a case in point on the cracking situation. The opinion of the Supreme Court in this case is representative of how its decisions, under the anti-trust laws since the "rule of reason" was pronounced in 1911, conform with economic and social conditions. The obvious effect of reaching an opposite conclusion in this case would have been to stifle extended use of cracking, as there is much overlapping of many broad claims in the avalanche of cracking patents issued in the last two decades. This overlapping of claims would have led to almost endless litigation, and the outcome would have driven some refiners back to simple distillation. Consequently, less gasoline per barrel of crude oil would have been produced.

The production problem if it relates to the federal anti-trust laws and conservation is not so easily disposed of but presents no insuperable difficulty, especially in view of the recovery act which some contend has completely ousted the anti-trust laws.

Production control did seem to get a setback when the chairman of the Federal Oil Conservation Board requested the opinion of the attorney general upon the legality of an agreement limiting production, and the reply was that the board had no authority to relieve parties to such an agreement from the operation of the anti-trust laws.49 Even if permitted under the recovery act, an


48(1931) 283 U. S. 163, 51 Sup. Ct. 421, 75 L. Ed. 926.

49McLaughlin, Cases on Federal Anti-Trust Laws 210 footnote.
agreement solely to limit production would not necessarily solve
the conservation problem. The natural effect of such an agree-
ment would be a rise in price. The effort to control the relation
between supply and demand in the petroleum industry meets a
peculiar difficulty, in that even a slight rise in price encourages
the bringing back to production former wells which were, at the
former price, below the "economic production limit," the applica-
tion of newer methods of increasing recovery, the initiation of
new drilling programs, and, most important of all, the general
"wildcatting," leaving the conservation problem, from this angle,
in the same place it was at the start. It must be remembered that
from its beginning production of petroleum has been an extremely
individualistic business. Producers have always desired "to go
it alone." One reason for this tendency is that a man with a rela-
tively small capital, if he makes a strike, may have his money
returned many fold in a short time. The farmer, the barber, the
insurance agent, or the country doctor often is transformed over
night into a big oil producer, to knock the petroleum industry off
its balance again.

As was pointed out, true conservation of petroleum resources
lies in the utilization of the natural energy of the gas in the pro-
ducing horizons. If it is not used to the fullest extent, this is
waste pure and simple. The principle involved here is somewhat
analogous to punching a hole in the boiler of a power plant where
a great deal of the steam pressure would escape, instead of being
directed to perform the desired work. The quantity of this nat-
ural energy is appalling. Potential energy of the compressed gas
can be expressed in foot pound units by multiplying the volume of
gas by its pressure in pounds per square foot, and, while this is not
the true expression of the work which can be extracted from it,
at least it is a fair indication of its magnitude.

It would seem that the public has a right to have this energy
utilized, which, in other terms, means that it has a right to have
this waste prevented. There is a line of cases establishing the
constitutionality of state statutes regulating the taking of oil and

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\[50\] In the Santa Fe Springs (Cal.) field alone there was in September
1929 a wastage of gas to the extent of approximately 500,000,000 cubic
feet per day. See People v. Associated Oil Co., (1930) 211 Cal. 93, 95;
294 Pac. 717; Ambassador Pet. Co. v. Superior Court, (1930) 208 Cal.
667, 670, 284 Pac. 445.

With this quantity of gas it is obvious that even a slight increase in the
efficiency of its use would represent a very worth while saving.
gas from a common pool for the purpose of protecting the public from waste and to protect all the correlative owners by securing just distribution of the products.\textsuperscript{51} Is it not probable that a court in applying "the rule of reason" would uphold a production agreement based upon these fundamental grounds?

Would agreements to utilize this underground energy be an unreasonable restraint upon interstate commerce? It would seem not, upon the following considerations:

First, petroleum production is analogous to mining and might very well be considered to be without the purview of interstate commerce. A number of cases seem to establish the proposition that until the oil has been produced it is purely a local transaction and is no more interstate commerce than is the production of wheat, or coal, or cotton.\textsuperscript{52}

Secondly, even if petroleum production is interstate commerce,

\begin{itemize}
\item \textsuperscript{52}In Hammer v. Dagenhart, (1918) 247 U. S. 251, 272, 38 Sup. Ct. 529, 62 L. Ed. 1101, the Supreme Court said, "The making of goods and the mining of coal are not commerce, nor does the fact that these things are afterwards to be shipped or used in interstate commerce, make their production a part thereof."
\item In Coronado Coal Co. v. United Mine Workers, (1921) 259 U. S. 344, 407, 42 Sup. Ct. 570, 66 L. Ed. 975, the Court said, "Coal mining is not interstate commerce, and the power of Congress does not extend to its regulation as such."
\item In Heisler v. Thomas Colliery Co., (1922) 260 U. S. 245, 249, 43 Sup. Ct. 83, 67 L. Ed. 237, the Court points out that the result of holding such to be interstate commerce, "... would nationalize and withdraw from state jurisdiction and deliver to federal commercial control, the fruits of California, ... the shoes of Massachusetts, ... hides and flesh of cattle yet 'on the hoof,' wool yet unshorn and coal yet unmined, because they are in various percentages destined for and sure to be exported to states other than those of their production."
\item In Champlin Refining Company v. Corporation Commission, (1932) 286 U. S. 210, 235, 52 Sup. Ct. 559, 76 L. Ed. 1062 the Court said: "Such production [of crude oil] is essentially a mining operation and therefore is not a part of interstate commerce even though the product obtained is intended to be and in fact is immediately shipped in such commerce."
\end{itemize}
when it is considered that from 2% to 2.6% of all the wells in the United States produce half of the total production, that there are 250,000 wells on settled properties, and that there are thousands of wells now abandoned because lifting costs are presently greater than the price of oil, it is apparent that agreements to conserve the gas pressure in those fields where it still exists would still leave ample margin for oil production to meet the demand. It would seem, then, that such agreements would not be construed as an unreasonable restraint of trade.

Ohio Oil Co. v. Indiana and Walls v. Midland Carbon Co. deal specifically with the utilization of the gas after it is brought to the surface, and the court lends a kindly ear when waste is to be prevented. Should not this gas energy now known to exist under the ground be protected from waste as has been that which is above the surface? The attitude of the Supreme Court in the recent case of Bandini Petroleum Co. v. Superior Court which deals with underground waste indicates that the use of this gas energy will be protected.

Legal authorities with few exceptions concede that agreements among operators for unit and cooperative development of a single pool do not violate the federal anti-trust laws. Some think agreements among operators in the several states might be a violation; but is this not doubtful if the agreements are based upon the fundamental grounds here set forth?

On the other hand, from a production point of view of conservation of this natural energy under the ground, interstate agreements are not necessary.

It follows then that there would seem to be no legal impediments in the federal anti-trust laws to prevent the reduction to practice of these engineering principles. Furthermore, the recov-

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60There are some 318,000 producing oil wells in the United States (1928) Handbook, Am. Pet. Inst. 147.
61"Settled properties": refer generally to those wells which have practically ceased to flow naturally, and artificial forces, such as pumping, air lift, etc., are resorted to in lifting the oil to the surface.
62When a well is abandoned, it is often said to be exhausted, yet in reality it is not the oil but the expulsive forces which have been exhausted. Osgood, Increasing Recovery of Petroleum 41.
63(1900) 177 U. S. 290, 20 Sup. Ct. 576, 44 L. Ed. 729.
64(1920) 254 U. S. 300, 41 Sup. Ct. 118, 65 L. Ed. 276.
65(1931) 284 U. S. 8, 52 Sup. Ct. 103, 76 L. Ed. 136.
ery act does not solve the ultimate problem of conservation of petroleum, if for no other reason than that it is limited in duration to two years.

**Conclusion**

In many instances discussions of conservation of natural resources in its relation to the laws expressing our policy of government control have confused the concept of current economy with the broader concept of conservation. Whether our social policy be expressed by anti-trust laws, laissez-faire, complete government control or such legislation as the recovery act, intelligent pursuit of the ultimate solution of the problem of conservation of raw materials requires a further study and adequate comprehension of the practical engineering possibilities involved.