Market Demand Prorationing and Waste—A Statutory Confusion

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In this Article on the state regulatory systems controlling the production of crude oil in the United States, Professor Vafai asserts that this vital, nonrenewable natural resource is being wasted by unscientific production policies. Focusing primarily on Texas—the leading oil-producing state—he examines the regulation of production through market-demand prorationing, and shows why this technique fails in its purported goal of petroleum conservation. He also examines a more efficient scientific technique for oil production control, but indicates why the present confused statutory framework of incongruities, exemptions, and special rules prohibits effective implementation of this needed conservation mechanism.

Petroleum is one of the most important natural resources in the world, supplying more than seventy-five percent of the primary energy requirements in the United States and sixty percent of the energy requirements in the rest of the world. The economic significance of these reservoirs is obvious. With little publicity, the petroleum industry spends about eight billion dollars per year in the United States alone for exploration and capital expenditures to meet the nation's increasing energy demands. By contrast, the American space program has generated intense controversy over its cost while spending only one-fourth as much per year.

In view of the importance of petroleum as a source of energy, the regulation of its production should be of great concern to many Americans. This Article examines the production system within the

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2. Id.

3. Osment, The Structure of the International Oil Industry: Recent Developments and Future Trends, in id. at 141.
United States, 4 emphasizing an analysis of production control rather than a detailed discussion of the problems of energy conservation as such. 5 The Article (1) focuses on state prorationing laws and questions whether they have created an acceptable system of production, 6 (2) reviews the justifications for waste prevention through prorationing techniques and examines procedures adopted by state regulatory agencies responsible for controlling production, 7 (3) compares different production methods and offers reasons to show why the present


5. Thus, the questions related to spacing, pooling and unitization will not be discussed here, except a brief mention of mandatory unitization as it relates to market-demand prorationing. See Part V D & E infra. The discussion of the prorationing system is limited to the questions of efficiency in the management of the system and of reservoir pressure drop under different methods of production.

6. Prorationing is defined as the method used by a state regulatory agency to determine total crude oil production for the state and to allocate this total among the various oil reservoirs and the producers in each reservoir. W. Lovejoy & P. Homan, Economic Aspects of Oil Conservation Regulation 127 (1967) [hereinafter cited as Oil Conservation].

7. The basic justifications for prorationing are the prevention of waste and protection of correlative rights. Such protection is designed to secure an individual landowner's rights on an equitable basis. See 1 W. Summers, The Law of Oil and Gas § 63 (perm. ed. rev. 1954). A society's energy resources could be utilized without considerations of correlative rights; this Article will not examine that subject.
system of prorationing is, ecologically, an improper method of production, (4) examines exemptions from the prevailing production system, and (5) reviews recent developments in production control.

When a drill penetrates into a petroleum reservoir, it releases tremendous built-up pressures and converts a passive, static condition into an active, dynamic force. The rate of production of the petroleum in the reservoir directly affects the efficiency of this dynamic force. To be more specific, the displacement mechanism in the reservoir, the ratio and mixture of oil and gas in the reservoir, the effect of the relative specific gravities of oil, gas, and water, and the capillary resistance to the flow of oil toward the well, all change as the rate of production changes. Part I describes the mechanics of this process.

The question whether determining the rate of production by market-demand prorationing provides the most efficient pattern of production and the minimum waste has not been sufficiently addressed either from an analytical or from a critical viewpoint. Part II of this Article discusses this question in terms of production control and the degree of its efficiency in minimizing waste.

Another series of questions has not been adequately and convincingly discussed in the literature. Under what circumstances does market-demand prorationing present itself as a scheme of conservation? Why is this scheme misleading? How should market-demand prorationing be distinguished from a genuine conservation mechanism? Part III analyzes the concept of coincidental parallelism to clarify these issues.

Even at those times when the production rate determined by market-demand prorationing coincidentally parallels the maximum efficient rate—at which point genuine conservation is momentarily achieved—the numerous exemptions granted from market-demand prorationing undermine this happy coincidence so severely that it becomes impossible for production based on market demand to reflect either efficient production or genuine conservation for any length of time. Part IV examines these exemptions and their impact upon production.

In recent years, some of the inefficiencies inherent in market-demand prorationing have been substantially reduced. Part V looks at some of these new developments and explains why, although steps in the right direction, they are still so hampered by the old systems that they cannot achieve the goal of maximum efficient production.

I

MECHANICS OF PRODUCTION

A rational analysis of production control and its ecological impact is impossible without some preliminary knowledge of the characteristics of reservoir fluids and production mechanism. Thus, a brief and oversimplified description of the structure of a reservoir and the sources and behavior of reservoir energy follows.

A petroleum reservoir is characterized by a porous and permeable zone of rock containing oil and gas. Specifically, oil and gas are mainly contained within small, open spaces in sands and sandstones, and in limestones within a variety of openings. In the reservoir there is a limited amount of natural pressure that serves as a force to drive oil and gas to the surface. Production is a function of the difference between the high pressure of the reservoir region and the low pressure of the well area. This pressure-differential mechanism functions in three different types of reservoir situations: (1) the dissolved-gas drive (solution-gas expansion), (2) the gas-cap drive, and (3) the natural water drive (water-edge drive).

A. The Dissolved-Gas Drive

Before being penetrated by a drill, the reservoir maintains a retentive force and a static equilibrium under high pressure and temperature. Under these circumstances, oil is frequently saturated with dissolved gas. When a drill penetrates the reservoir it introduces a low-pressure region, alters the equilibrium, and creates mobility within the reservoir. Because of the pressure differential between the reservoir and the well, the reservoir fluids flow toward the well, reducing the pressure in the reservoir and permitting the partial release of the dissolved gas. As the process continues, the reservoir fluids undergo a physical expansion and the post-penetration volume becomes much larger than the original. As a result of the expansion and the force of liberated gas, the oil is forced through the pores of the reservoir.

9. For details see id. at 1-201; G. Govorova et al., Development and Exploitation of Oil and Gas Fields 19-156; E. Zimmermann, Conservation in the Production of Petroleum, A Study in Industrial Control 49-109 (1957); Petroleum Conservation 15-27 (S. Buckley ed. 1951) [hereinafter cited as Petroleum Conservation]; Interstate Oil Compact Comm’n (IOCC), Oil and Gas Production 3-81, 115-22 (1964); K. Landes, Petroleum Geology 123-324 (1951).

10. Oil and gas can also be found in buried caves, irregular solution cavities (which may or may not be related), open joints, fractures, and bedding planes. IOCC, supra note 9, at 16.

11. Gravitational forces are another factor in drainage of petroleum from reservoir rocks. L. Uren, supra note 8, at 59.
rock toward the low-pressure area at the well bore. Each bubble of gas escaping from the solution displaces some oil, and consequently forces the oil into the well bore. This process is known as dissolved-gas drive, or solution-gas expansion.

As pressure continues to decline due to oil extraction, the liberated gas, which is distributed throughout the reservoir pore spaces, moves toward the well bore, still accompanying some oil. The reservoir pressure continues to decline as more gas is liberated. Because gas is more fluid than oil, it moves toward the well bore more rapidly than the static oil. When the gas in solution has dissipated or escaped, production of oil decreases substantially because the displacing force of the dissolved gas no longer exists.

B. The Gas-Cap Drive

The dissolved-gas drive is not always the dominant mechanism during the producing life of the reservoir. During the period of accumulation of petroleum, gravitational forces affect the formation of the reservoir. As a result, natural gas, oil, and buried sea water are concentrated in separate zones according to their relative specific gravity: the natural gas zone at the top, the oil zone, and the water zone at the bottom. The natural gas accumulated in this fashion is called the gas cap. When a drill penetrates the reservoir and the natural pressure falls, the reservoir's expulsive forces start to function. Declining pressure transmitted through the oil zone to the gas zone causes the gas cap to expand and the oil to flow toward the low pressure region of the well bores. If the expanding gas is properly conserved and not allowed to escape, the high pressure gas cap in the crest of the reservoir will allow more effective production of the oil as well as ultimate recovery of the gas. Unlike the dissolved-gas drive, the gas-cap mechanism does not allow the gas to move along with the oil to the well, and thus the expulsive gas energy is not depleted. This results in a greater percentage of oil and gas recovery per reservoir than the dissolved-gas drive mechanism.

C. Natural Water Drive

An oil reservoir is composed of a porous and permeable rock formation in which water occupies those pores which are not occupied

12. Id. at 54-55.
13. W. Murray, Conservation in the Production of Oil and Gas 5-6 (paper delivered at the Centennial of Engineering Convocation, Chicago, Sept. 12, 1952). Mr. Murray is a former chairman of the Texas Railroad Commission.
14. IOCC, supra note 9, at 22.
15. L. UREN, supra note 8, at 53.
16. E. ZIMMERMANN, supra note 9, at 63.
by gas or oil. Pressure differentiation causes water to flow into porous rocks containing oil, displacing the oil and driving it toward the well bores. Eventually water reaches the well, inundates it, and renders it useless.¹⁷

II

PRORATIONING SYSTEMS

A. Market-Demand Prorationing and Its Justification

Market-demand prorationing is a mechanism for restricting production of crude oil to a level commensurate with estimated demand.¹⁸ Various rationalizations for state prorationing policies have been advanced in the United States. The concept of prorationing as a conservation policy, which is foremost among these rationalizations, is aimed at the prevention of waste, especially waste resulting from the "law of capture."¹⁹

Waste and the law of capture are integrated and inseparable concepts not only because of the impact of the production rate and mechanism upon reservoir behavior, but also because of the effect of dense drilling on ultimate recoverability. Waste is inevitable in the absence of laws requiring proper spacing, pooling, and unitization,²⁰ because of the reservoir's structure and the mechanics of energy recovery. Oil and gas in the reservoir have a fugitive character, and dense drilling causes uncontrolled movement of oil and gas. For example, as a result of unnecessarily dense drilling in a gas-cap drive reservoir, either the expulsive force of gas will dissipate, or the gas will escape through the rock pores to the well bore without displacing oil, leaving increasing amounts of unrecoverable oil.

In addition to the general waste, improper well-spacing affects the correlative rights of different oil producers. One of the major factors prompting waste of oil and gas is the individual landowner's right to "capture" all the petroleum produced from wells on his prop-

¹⁷. Petroleum Conservation, supra note 9, at 121-22.
¹⁸. For an excellent analysis of market-demand prorationing see Oil Conservation, supra note 6, at 126-238.
¹⁹. The law of capture is defined as a rule by which the owner of a tract of land acquires title to all of the oil or gas which is produced from the wells on his land despite the fact that a portion of the oil or gas migrated from a reservoir underlying adjoining land. Bernard v. Monyahela Natural Gas Co., 216 Pa. 365, 65 A. 801 (1907). See generally Hardwicke, The Rule of Capture and Its Implications as Applied to Oil and Gas, 13 Tex. L. Rev. 391 (1935).
²⁰. Unitization is simply a coordinated approach to oil production which treats each separate reservoir as a control unit so as to minimize conflicts among various production methods and to maximize recovery. See Oil Conservation, supra note 6, at 62-67.
Dense drilling in general, and offset wells in particular, disturb the static pressure balance in the pool. Oil naturally flows in the direction of reduced pressure, and a well, especially an offset well, inevitably drains reserves from adjacent property. In the absence of legal protection, the only recourse for the adjoining landowner is to drill his own offset wells as quickly as possible to obtain a maximum share of the pool. In this competitive process, so many wells are drilled that reservoir pressure drops uncontrollably and a large proportion of the oil or gas cannot be extracted.21

The main concern of this Article, however, is the loss resulting from an improper rate of production and not loss due to improper spacing. In seeking a solution to production-rate waste, various states have adopted conservation measures limiting production from each well to a fraction of its capacity. The constitutionality of these statutes has been upheld by the Supreme Court on the ground that they provide a method of preventing physical waste of petroleum resulting from the law of capture or from any other cause.22 A more positivistic judicial analysis than the Supreme Court’s concluded that “uniform restriction of production in the various fields is essential to prevent waste and conserve the oil and gas; [and] that production and outlet to market should be on a fair and ratable basis.”23

Without having articulated a scientific or even a rational legal basis for their having upheld a “uniform restriction of production” as a valid means of waste prevention the courts have simply assented to this policy of the regulatory agencies. In the absence of congressional guidance or legislation, the regulatory agencies have been able to exercise very broad discretionary authority in both the adoption and enforcement of production regulations. Thus, the present autonomy of the regulatory agencies of most oil-producing states is the legacy of both statutory and judicial permissiveness.

The Texas statute, for example, indicates that production of crude oil should be allocated “upon a fair and reasonable basis among the various pools in the state,”24 leaving the whole matter of interpretation


22. Champlin Refining Co. v. Corporation Comm’n, 286 U.S. 210 (1932); see also Moses, The Constitutional, Legislative and Judicial Growth of Oil and Gas Conservation Statutes, 13 MISS. L.J. 353 (1941); Hardwicke, supra note 19.


to the Texas Railroad Commission's discretion.\textsuperscript{25} Considering the immense authority encompassed in the discretionary power of the Commission and considering the magnitude of Texas petroleum deposits,\textsuperscript{26} the statement that "[t]he Commission [is] the most powerful administrative body in the United States today"\textsuperscript{27} does not seem exaggerated. The only qualification may be that regulatory agencies in other states possess equally broad power in formulating and implementing production policies within their states. These agencies can prevent production of petroleum in any field or pool; they can deny a petition to increase allowable production; they can allow limited flaring of natural gas; they can regulate spacing in a certain field; and they can use their discretion to increase the market-demand factor, directing a field to produce up to capacity.\textsuperscript{28}

\textbf{B. Regulatory Agency Procedures in Market-Demand Prorationing}

Analysis of the procedures adopted by state regulatory agencies to conserve petroleum is important in understanding the justifications for market-demand prorationing and its validity. Since Texas produces by far the most petroleum of any state,\textsuperscript{29} its prorationing system is useful as a basis for study.

Market demand is the aggregate amount of oil required to meet the estimated consumption for an ensuing period of time. The mechanism of adjusting a state's total production to market demand is called market-demand prorationing. Such adjustment is implemented in two phases: first, the determination of the state's share of national production (state allowables); and second, the allocation of that share among the pools and wells of that state (field and well allowables).

\textbf{1. Determination of the State Allowables}

The basic problem in administering production in each state is to determine the "proper" share of a restricted aggregate output which that state should be allowed to produce. Should Texas, for example, be allowed to produce fifty percent of the total national volume, and Louisiana and Oklahoma an aggregate of thirty percent, with the remaining twenty percent divided among less important oil producing states?

\begin{itemize}
\item \textsuperscript{26} \textit{See} \textsc{Oil Conservation}, \textit{supra} note 6, at 103.
\item \textsuperscript{27} Comment, \textit{Proration in Texas: Conservation or Confiscation?}, \textsc{11 Sw. L.J.} 186, 187 (1957).
\item \textsuperscript{28} For a general evaluation of the statutory authority of regulatory agencies see \textsc{P. Garfield \& W. Lovejoy, Public Utility Economics} 260-93 (1964).
\item \textsuperscript{29} \textsc{Oil Conservation}, \textit{supra} note 6, at 103.
\end{itemize}
One method of determining each state's production is to determine its "production potential." However, the potential of a well can be altered by completing new wells in the reservoir or by applying modern production techniques, and such measures would surely result in excessive drilling. Another method of determining a state's production would be to use "historical factors"—the amount of oil that the state has produced over the years. But there is no certainty that the past practices represent a "fair share" of production. A third method is to base a state's production on its reserve capacity. But again, the problems of continuous measurement of the reserve and of what constitutes a sufficient reserve under different cost situations are encountered. Other criteria have been suggested, such as well depth—which does not have anything to do with production capacity—and cost—which in the oil industry is almost impossible to quantify or even to define.

Of the various proposed methods, only market demand has received widespread acceptance and application among the producing states. The avowed purpose of the mechanism is to prevent production of oil in excess of demand by determining the production of each state according to short-run forecasts of consumption of the crude oil produced in that state. A general consensus is obtained by holding public hearings. At these hearings, all parties concerned—particularly the purchasers of the crude oil—must produce evidence of their future consumption. For example, the regulations in Oklahoma state that

[t]he [Corporation] Commission shall, on due notice and hearing, find and determine the reasonable market demand for oil . . . for the ensuing proration period that can be produced from each common source of supply on a statewide basis without avoidable waste with equitable participation in production and markets by all operators and other interested parties.

The "reasonable" market demand expressed in the above rule is based on indications by the crude-oil purchasers of their expected future purchases. These indications are called "nominations." There is no statutory requirement that the purchasers must buy all the nominated oil, yet the tradition of doing so has been respected. Another

31. See text accompanying notes 50-52 infra.
33. In 1964, twelve of the thirty-two oil-producing states, including five of the seven largest producing states which account for about seventy percent of United States oil production, operated under market-demand prorationing. Oil Conservation, supra note 6, at 129.
relevant factor in determining market demand is the amount of above-ground stock in storage, in pipelines, and in tanks. Depending on the level of this stock, the regulatory agency may adjust the aggregate production of the state.

The federal government does not have any statutory authority to interfere with the level of production of a state. In determining their future output, however, the producing states consider the estimates of the United States Bureau of Mines. These estimates indicate the future consumption of crude oil from each state for an ensuing period.

The ultimate decision concerning a state's total production is made primarily by considering the aggregate of nominations, adjustments due to the above-ground stock situation, and the estimates issued by the Bureau of Mines. Thus, in any statewide market-demand mechanism, four basic production figures result: (1) the purchasers' nominations, (2) the Bureau of Mines' estimates, (3) the state allowables determined by the regulatory agency, and (4) the actual production in the past. However, these figures often vary widely from one another. The larger the discrepancies, the less successful the state is in operating its prorationing mechanism.

2. Determination of the Field and Well Allowables

Having established the total production for the state, the next task of a state regulatory agency is to determine the allowables for each field (reservoir) and, within a field, the allowables for each well. For example, the agency must determine separate standards of allowables for a well "located behind [a] home on a 50-foot city lot or in the center of a 20-acre farm," and must determine the amount of oil originally beneath the owner's property.

There is no uniform method by which a state quota is allocated among pools and wells. There are, however, general rules by which allocation takes place. The most important formula is the depth-
acreage schedule, known as the "yardstick" or "top allowable." It is a means of determining the allowable granted to a well according to the depth of the well and the surface acreage which that well site covers. The purpose of the depth-acreage schedule is to discourage excessive drilling of wells in the same reservoir.

The mechanism of determining the actual rate of production based upon depth-acreage is complicated and varies from state to state. For clarity, an oversimplified explanation is necessary. The regulatory agency determines the allowable of each reservoir according to the procedures of market-demand prorationing. In the absence of other conditions or regulation, the pool would produce one hundred percent of what is allocated to it under the basic market demand: this is the base allowable. For example, under the depth-acreage constraint alone, an 8,200-foot well on a forty-acre site might produce 133 barrels daily if no other restrictions applied. That is, in the absence of the market-demand factor the base allowable of the well would be the entire amount of produceable oil—133 barrels daily. The actual production share of the well may be much less than the base allowable, however. If the regulatory agency determines that the market-demand factor is thirty-five percent, then the actual allowable of the well would be only forty-seven barrels daily—thirty-five percent of 133 barrels.

Thus, when the regulatory agency combines the market-demand factor with the depth-acreage factor to determine the actual allowable of a well, only a certain percentage of the base allowable production will be authorized. However, the rate of production will increase as the depth and the acreage of the well increase. For example, under the Texas system adopted in 1947, the proportion of the depth and acreage factors to actual production in Texas for any given depth bracket was calculated on a ten-acre unit. For larger units, one barrel per day of allowable was added for each acre over the ten-acre unit.

In addition to the depth-acreage schedule, the regulatory agency uses other factors in allocating production on a reasonable basis. These include: the number of wells in a tract, the number of acres in a tract, the production potential of wells, the gas-oil ratios, the bottom hole pressures, the thickness and depth of the formation, the type of water encroachment, and the effective drainage area for a well. The regulatory agency then proceeds to establish field allowables by modifying field nominations, inserting several additional var-

38. See Oil Conservation, supra note 6, at 142-53.
40. Oil Conservation, supra note 6, at 143.
41. W. Lovejoy & P. Homan, supra note 32, at 68.
iables such as historical factors (allowables and actual production during the preceding month), receiving the testimony of interested parties with regard to the allowables of particular fields, and making seasonal adjustments. By weighing all these factors, the agency arrives at the field allowables. This method, theoretically, is not a scheme to curtail production and fix the price of crude oil, but is rather a scheme for the "prevention of waste." 42

3. Validity of the Depth-Acreage Schedule

The most articulate and succinct statement concerning the depth-acreage schedule was made by the late Professor Lovejoy:

The rationale of the [depth-acreage schedule] is clear. Since costs rise with depth, deeper wells should be given higher allowables to compensate for greater costs. 43

Since, as an economic concept, oil conservation is the science of exploring, developing, and producing oil at the lowest cost over the life of the reservoir, the depth-acreage rationale is diametrically opposed to the notion of conservation. Such a system misallocates resources by encouraging increased production by the inefficient, high-cost producer at the expense of both the low-cost producer and the total reserves of oil.

The depth-acreage schedule is not justified by any conservation rationale and is formulated by highly arbitrary standards, such as the ten-acre unit system. Assume that a well on a ten-acre unit was given an allowable of ninety-one barrels per day. Using the ten-acre unit system, one extra barrel of oil could be produced per day from that well for each extra acre of surrounding land. Thus, a well on eighty acres would be allowed to produce ninety-one barrels plus seventy barrels, or 161 barrels daily. 44 It is obvious that under this system the additional barrels—seventy barrels per day in the above example—do not allow sufficient production from an eighty-acre site to discourage drilling another well. 45 As a result of using the depth-acreage schedule of 1947, the number of producing wells in Texas increased while the level of production reserves remained relatively static. 46 Such unnecessary drilling was wasteful, costly, and harmful to the res-

42. See Interstate Oil Compact Comm’n, A Form for an Oil and Gas Conservation Statute, § 1.1.1 (1959).
44. Oil Conservation, supra note 6, at 143.
45. I.e., one well on eighty acres might have an allowable of only 161 barrels of oil per day, whereas if the owner drilled one new well and allocated forty acres to each of the two wells, he would be permitted to produce 121 barrels per day from each well (91 + 30), or a total of 242 barrels per day.
46. Oil Conservation, supra note 6, at 143.
ervoir's efficient performance. The depth-acreage schedule of 1947 was so wasteful that even the Commissioner of the Texas Railroad Commission had to concede in 1962:

[W]e are doubling the reserves which an oil well will recover when we double spacing. But the barrel-an-acre provision of the present yardstick adds only a small percent more allowable. And the economic incentive is for closer spacing.47

In 1965, after eighteen years of inefficient production, the Texas Railroad Commission adopted more geologically rational criteria for the depth-acreage schedule, in which fewer incentives for dense drilling were included.48 Nevertheless, allowables are still partially determined by the depth and spacing of the wells. The initial cost of drilling deeper wells is high, and owners request compensation through more generous allowables. Although deeper wells do cost more than average ones, the increased cost does not adequately justify increasing the allowables. As costs, prices, or technology change, the depth-acreage schedule no longer reflects market conditions and the system no longer meets the needs of the deep, high-cost wells.

Two basic problems exist with the depth-acreage system: first, the proportion between the capacity of the wells and their production is inappropriate, and second, the system has encouraged closer spacing of wells.49 The schedule promotes inefficiency because there is absolutely no relationship between the depth of a well and its production capacity.50 There is no way to determine what rate of production is most appropriate for a given depth without considering the specific characteristics of each pool or well. If such established scientific knowledge existed, then, under similar reservoir conditions, producing states would recognize the depth factor as a uniform standard, and they would not apply different allowables for the same depth-acreage.51 Authorities in petroleum economics have indicated that

[t]he differences in regulations among states have no rational basis for the simple reason that depth-factor schedules adjusted for spacing patterns also have no rational theoretical basis. All are arbitrary

49. This is particularly true in Oklahoma where the depth-acreage schedule is similar to the old Texas system abolished in 1965. See Oil Conservation, supra note 6, at 142-50.
50. Lovejoy, supra note 48, at 81 n.40. To be sure, oil in the reservoir is highly compressed, with pressure generally being proportional to depth. But this has nothing to do with the maximum efficient rate of production. See Murray, Engineering Aspects of Unit Operation, in Proceedings of the Third Annual Institute on Oil and Gas Law and Taxation 1, 6 (1952).
systems in the sense that they have no firm and continuing bases in fact.\textsuperscript{52}
The depth-acreage system cannot be justified on the basis of conservation. The continued existence of the system can only be explained as an instrument for more effective supply control.

\subsection*{C. Patterns of Production}

\subsubsection*{1. Production Under Market-Demand Prorationing}

The greatest impact of market-demand prorationing is its effect on reservoir behavior, and more specifically on reservoir pressure. Reservoir pressure is the most significant factor in the production of petroleum from any kind of reservoir.\textsuperscript{53} The efficiency of reservoir performance depends on maintenance of its pressure: the higher the differential between reservoir pressure and surface pressure, the more readily oil flows toward the well bore.\textsuperscript{54} The inefficiencies involved in the operation of wells under the law of capture\textsuperscript{55} and market-demand prorationing are caused by non-scientific use of reservoir pressure. An excessive production rate in reservoirs of non-uniform porosity and permeability may permit the less viscous fluids such as gas and water to flow into the well, reducing pressure and leaving the oil behind.\textsuperscript{56} On the other hand, too slow a rate of production may cause an inadequate pressure differential for sufficient drive of oil toward the well bore.\textsuperscript{57} Only a scientific system of production will maintain the efficiency of the dominant driving mechanisms of the reservoir, and allow maximum conservation of petroleum resources.

Given the differing energy forces within a particular reservoir and between different reservoirs, a uniform production-control policy cannot also be a conservation policy. The use of market-demand prorationing standards makes all the eligible\textsuperscript{58} reservoirs in a given area subject to one uniform standard of production control. Under such control, the importance of the different physical characteristics

\begin{itemize}
\item \textsuperscript{52} Oil Conservation, \textit{supra} note 6, at 152.
\item \textsuperscript{53} The combination of pressure and temperature in the reservoir is the most important force driving the crude petroleum into the well bore. A. Levorsen, \textsc{Geology of Petroleum} 389 (2d ed. 1967).
\item For a description of the types of reservoirs, see Murray, \textit{supra} note 50, at 6-10.
\item \textsuperscript{54} IOCC, \textit{supra} note 9, at 31.
\item \textsuperscript{55} See note 19 and text accompanying notes 20-21 \textit{supra}.
\item \textsuperscript{56} A. Levorsen, \textit{supra} note 53, at 476.
\item \textsuperscript{57} G. Govorova et al., \textit{supra} note 9, at 62. This is particularly true for dissolved gas reservoirs where the pressure release must be timed to allow the gas to expand and drive the oil into the well bore. IOCC, \textit{supra} note 9, at 37.
\item \textsuperscript{58} Marginal wells are exempt from market-demand prorationing. See notes 123-24, \textit{infra}.
\end{itemize}
of different reservoirs is diminished or ignored and the uniformity of the market-demand factor is emphasized. One authority states that reservoirs

habitually vary so greatly in their physical characteristics that any assumption of uniformity based on average properties for the reservoir rock, or even continuity of beds between wells, is open to serious question.  

Two conclusions may be drawn from this analysis. First, despite all the assertions made by the domestic producers of crude oil, automatically reducing production by the use of set standards or restricting production to the level of market demand will not result in genuine conservation. Operation of some or all reservoirs at an inefficiently low rate of production is not a conservation measure. Second, to the extent that marginal and inefficient wells are exempt from market-demand prorationing, other fields will have to reduce their production in order to maintain the constant volume of market demand at a given time. Such a uniform reduction of production is wasteful; a true conservation policy would not limit efficient reservoir production in order to maintain other more costly and inefficient production.

2. Production Under MER Prorationing

The most effective way to maintain the driving pressures of a reservoir, and thus to conserve petroleum resources, is to employ a scientific system of production, such as the "maximum efficient rate" (MER). Under this method, production is scheduled in such a way that the efficiency of the driving pressures in the reservoir will be maximized, thus increasing the percentage of oil recoverable. In most reservoirs the rate at which oil moves toward the well is proportional to the pressure differential between the reservoir and the well. This rate of movement is also proportional to the thickness and permeability of the reservoir rock. Production under the MER system takes into consideration such physical characteristics and regulates the production rate so as to conserve the natural energy drives within the reservoir. For example, in a reservoir having a dissolved-gas drive, the MER system prevents the dissipation of free gas and water, and consequently avoids the early exhaustion of the reservoir.

59. L. UREN, supra note 8, at 71.
60. See PETROLEUM CONSERVATION, supra note 9, at 151.
61. See text accompanying note 142 infra.
62. E. ZIMMERMANN, supra note 9, at 69.
63. L. UREN, supra note 8, at 72.
64. See text accompanying notes 12-13 supra.
65. PETROLEUM CONSERVATION, supra note 9, at 152-58.
In a reservoir having a gas-cap drive, the system maintains a continuous segregation between the enlarging gas zone and the diminishing oil zone. In both these types of energy drives, the rate of production is controlled so that specific gravity becomes a significant factor in production. In a reservoir having a natural water drive, the MER system maintains the balance between the rate of water influx and the rate of oil withdrawal.

The rate of production under the MER system would be determined without using factors such as market demand, transportation facilities, or the special interest of a group of producers. MER should be used not only as an engineering concept, i.e., maximizing the number of barrels recoverable from the given reservoir, but it should also be used as an economic concept, i.e., including consideration of present and future prices and costs, as well as engineering factors. Employing these latter factors does not entail recovery of every drop of oil regardless of the cost, but it does permit recovery of a significantly greater amount than under market-demand prorationing, and hence, a greater conservation of petroleum resources. If there were this same kind of consistency between market-demand prorationing and conservation of petroleum, it would follow that any

reduction in rate of flow [would result] in smaller consumption of reservoir energy and that, if a producer were content to take his oil less rapidly, he would conserve formational energy and thereby ultimately produce more oil. However, such a conclusion rests on the assumptions that we are dealing with a product of uniform physical characteristics and that it is feasible to apply reservoir energy with equal efficiency at all rates of flow.

Neither of these assumptions is correct. As noted earlier, the oil in a given reservoir may be found in different kinds of formations. The proper production rate depends on factors such as well spacing,

66. See text accompanying notes 14-16 supra.
67. The ultimate recovery of the gas-cap reservoir "is very nearly proportional to the degree of oil desaturation of the reservoir." Petroleum Conservation, supra note 9, at 159.
68. MER production is rapid enough to avoid dissipation of free gas, and slow enough to avoid inefficient displacement of gas. A proper reservoir pressure avoids release of dissolved gas and the establishment of a gas zone over the oil zone.
69. In MER production under natural water (or water edge)-drive (see text accompanying note 17 supra), the rate of water influx must be substantially equal in volume to the withdrawal of the oil. To obtain this equality a proper pressure differential must be maintained. The efficient rate of production can be determined by the quantitative relationship between the degree of reservoir pressure and the rate of water influx. Petroleum Conservation, supra note 9, at 161.
70. L. UREN, supra note 8, at 84.
71. See text accompanying notes 12-17 supra.
the driving mechanism of the reservoir, the physical characteristics of
the rocks and formation fluids, and the type of reservoir energy drive—
gas-cap drive, dissolved-gas drive, or water-edge drive. Since
market-demand prorationing does not give priority to these factors,
it cannot possibly function as an effective conservation policy, and the
wisdom of its use as a production scheme is highly questionable.

The MER production mechanism, on the other hand, is consistent with conservation principles, no matter what the basic physical characteristics of the reservoir are. Figure 1 illustrates this consistency by showing the relationship among the three patterns of production—production under the law of capture (curve A), under market-demand prorationing (curve B), and under MER prorationing (curve C) and proper reservoir pressure. Neither the law of capture nor market-demand prorationing allow reservoir pressure to be utilized to the greatest extent possible. With a minor exception (the time 1 curve), at any given pressure loss or time, more production is achieved from a well under the MER system than under either market-demand prorationing or the free and haphazard production resulting under the law of capture. Furthermore, the productive life of the reservoir under the scientific MER production mechanism (11 time units, is longer than under the law of capture (5 units), or under market-demand prorationing (8 units).

72. G. GOVOROVA et al., supra note 9, at 62.
73. See PETROLEUM CONSERVATION, supra note 9, at 258; L. UREN, supra note 8, at 84.
74. The dashed, numbered curves each represent a given unit of time after production under any of the three systems has commenced.
75. The pressure in most cases is at its maximum when the well is first drilled and declines as the oil and gas are extracted. A. LEVORSEN, supra note 53, at 459. In the early stages, production will be faster under the law of capture, and the corresponding pressure drop will be higher than production under market-demand prorationing. This illustrates that at the early stages of production the law of capture yields more cumulative production than market-demand prorationing. Thus, the three systems will yield the following results after the first time unit of operation:

<table>
<thead>
<tr>
<th>SYSTEM</th>
<th>CUMULATIVE PRODUCTION</th>
<th>PRESSURE DROP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Law of Capture</td>
<td>OG</td>
<td>25%</td>
</tr>
<tr>
<td>Market Demand</td>
<td>OE</td>
<td>10%</td>
</tr>
<tr>
<td>MER</td>
<td>OF</td>
<td>4%</td>
</tr>
</tbody>
</table>

76. Because production under market-demand prorationing is ultimately determined by the wish of the refiner-purchasers rather than by neutral standards of reservoir behavior, it is quite foreseeable that different aggregate levels of production are probable under the systems. Since there is a price stabilization motivation in market-demand prorationing, it is reasonable to assume that the rate of production under that system is usually lower than under the MER system, which is neutral to price motivation or politically motivated pressure groups. See M. DE CHAZEAU & A. KAHN, supra note 6, at 183.
D. Application of MER Prorationing

1. Present Procedures in Texas

To determine the allowables of a well or a field, the Texas Railroad Commission, the responsible state regulatory agency, theoretically applies MER criteria based upon hearings held under its authority. However, because the procedure used results in an inaccurate or inappropriate calculation of the MER, the allowables based on that calculation often do not promote maximum production efficiency. The MER hearings are essentially based upon the calculations presented to the Commission Examiner by the owners and operators of the wells. These calculations state the maximum rate at which their reservoirs can produce "without causing waste." The Examiner, a member of the engineering department of the Commission, subsequently submits a report on the hearing to the Commission. The order of the Commission determining the maximum rate of production of a well is issued pursuant to the Examiner's report. Thus, the "scientific" basis for determining the MER is often the owner's own testimony with respect to the MER of his well. Furthermore, most small operators lack both the scientific equipment and the financial means to calculate the MER of their wells with any accuracy. Although genuine MER prorationing considerably reduces the waste inherent in the market-demand prorationing system, the procedure applied in Texas for the determination of MER prorationing is so ob-

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77. See note 25 supra.
78. See text accompanying notes 75-76 supra.
viously defective that it is doubtful that the system approximates genuine MER prorationing with any reasonable accuracy.

To implement the purpose of the hearings, the Commission Examiner must know the market demand for the subsequent period as well as the well owner's estimate of his own MER. A purchaser of crude oil submits his request, a "nomination," to the regulatory agency. The Commission decides the allowances for each field or well based upon the nominations received from purchasers and the MER estimates of the well owners. In many cases the nominations have been put in writing to the Commission prior to the hearing. Furthermore, the speakers at the hearing, who are usually the purchasers of the crude oil, are not considered witnesses; they are not under oath; and they are not subject to any cross-examination. Their sole obligation is to announce how much crude oil they intend to purchase for the coming month and to file these nominations with the Commission. Clearly, the Texas procedure cannot approximate genuine MER because the Commission uses market demand as well as MER to calculate allowables, and there is no effective way for the Commission to determine the accuracy of the operator's MER calculation—especially in view of the large number of producing wells in Texas.

2. Recommendations for Change

Several changes in procedure are required in order to establish more rational and meaningful MER hearings. First, broader state participation must be provided in order to oversee the hearings. A legally trained representative of either the attorney general or other appropriate state agency should be present, at least for significant production decisions. The representative should monitor the hearings to insure that they are carried out in an administratively systematic manner, and on a judicially acceptable basis.

Second, representation must be provided by the federal government, e.g. by the Interior Department's Bureau of Mines or Office of Oil and Gas. Experience has shown the utility of such federal involvement in production decision-making during the energy crises of the past two decades. Systematic collaboration between federal and

79. See text accompanying note 34 supra.
81. Comment, supra note 27, at 187.
82. Although these recommendations are keyed to the particular deficiencies of Texas MER hearings, they are for the most part applicable to hearings in any oil-producing state using a prorationing system.
83. Systematic collaboration between the Government and state agencies has taken place during nationalization of petroleum in Iran (1951), nationalization of the
state agencies occurred during these crises in order to insure a more coordinated production policy among the states. In fact the states themselves sought federal collaboration when they desired such a coordinated policy involving domestic production control and limitations on oil importation. The results of such federal involvement indicate that the time-honored tradition of exclusive state administration of domestic production is no longer valid. Furthermore, the federal participation included collaboration with domestic oil companies themselves, and thus was to some extent effective in modifying the states' traditional oligopolistic production policy and forcing consideration of broader national concerns. However, it must be noted that federal participation is authorized only in limited instances under present statutes, necessitating further legislation in order to permit the degree of involvement recommended here.

Third, the Interstate Oil Compact Commission (IOCC) should be represented at the hearings both to observe and to give testimony. Fourth, there should be provision for the administrative review of

Suez Canal (1956), and during the Arab-Israeli War of 1967. For example, during the latter crisis a liaison mechanism was established between the federal government and the various state regulatory agencies "to link with oil companies, trade associations and conservation officials." Office of Oil and Gas, U.S. Dep't of the Interior, Middle East Emergency of 1967, at 49 (1967).

84. Id. at 33-34.
86. Federal participation in oil production decision-making during the energy crises was pursuant to the Defense Production Act of 1950, 50 U.S.C. §§ 2061 et. seq. (1970). However, such collaboration was generally intended to be authorized only in cases of emergency. See J. Vafai, supra note 85, at 15-20. The Act also permits coordination between businesses without incurring antitrust liability during such crisis periods. 50 U.S.C. § 2158(b) (1970).
87. The IOCC, of which Texas is a member, is composed of state representatives. It was formed pursuant to the Interstate Compact to Conserve Oil and Gas, Pub. Res. No. 74-64, 49 Stat. 939 (1935). For an analysis of interstate compacts in general and the Interstate Oil Compact in particular, see Comment, 45 Yale L.J. 324 (1935). See also Oil Conservation, supra note 6, at 33-47.
The IOCC serves primarily to investigate and recommend programs and policies to its member states to enable greater petroleum recovery and waste prevention. Id. at 44-45.
88. The IOCC's authority to participate in hearings can be inferred from Article VI of the Compact:
The Commission shall have power to recommend the coordination of the exercise of the police power of the several states within their several jurisdictions to promote the maximum ultimate recovery from the petroleum reserves of said states, and to recommend measures for the maximum ultimate recovery of oil and gas.
[Pub. Res. No. 74-64, 49 Stat. 939 (1935)], and from Article II which establishes the IOCC's purpose: "[T]o conserve oil and gas by the prevention of physical waste thereof from any cause." Id.
questionable decisions. However, review by the IOCC would probably be ineffective. The IOCC is limited to *recommend*ing state actions; therefore the most it could do would be to render an advisory opinion.\(^8^9\) One method of providing for more effective administrative review of agency determinations without the necessity of amending the Compact would be for each of the IOCC's member states to establish its own review board, and agree that it would review any decisions which the IOCC objects to. If the regulatory agency's decision was considered erroneous by the IOCC because it granted an allowable resulting in waste, the IOCC would then call for review by the state review board.\(^9^0\) The review should include expert testimony by independent petroleum geologists and engineers, whose opinions might carry substantial weight with the appeal board.

3. Remaining Problems

Implementation of these suggestions in MER hearings would assist in insuring determination of allowables on a more scientific basis than in the past. However, the use of the suggested procedures will not solve the problems related to the prediction of market demand. One difficulty with prorationing is that it presupposes the accuracy of market-demand predictions. Practical experience demonstrates that a precise market-demand figure is difficult, if not impossible, to obtain, and that in anticipating such figures regulatory agencies have committed serious errors. A look at market-demand prediction in 1970 confirms this observation. In that year the petroleum industry experienced a substantial increase in market demand. Most of the time, the regulatory agencies' predicted figures were not accurate. For October 1970, for example, the Conservation Commission of Louisiana had predicted a 30,000-barrel daily increased production over the preceding month. The actual increase reached nearly 70,000 barrels daily.\(^9^1\) In fact, the actual market-demand figures were so different from the anticipated ones that the Commissioners became confused and stated that they did not "entirely understand what [had] happened to their figures for October."\(^9^2\)

\(^8^9\) See note 88 supra.

\(^9^0\) Admittedly, the IOCC might not ask for the review of a hearing where the magnitude of the allowable is such that a revision might affect prices—for example, the field allowable sought in 1970 by Mobil Oil Corp. to produce 400,000 barrels daily on the basis of 100 percent market demand. *Oil & Gas J.*, Sept. 7, 1970, at 56 and Sept. 14, 1970, at 56. All major oil-producing states, which are members of the Compact, would like to maintain high prices. The IOCC is unlikely to disturb this price policy by requesting a review.

\(^9^1\) *Oil & Gas J.*, Oct. 12, 1970, at 70.

\(^9^2\) *Id.*
Different explanations may be given for the regulatory agencies' inability to predict an accurate market-demand figure.93 First, the figures are submitted by the refiner-purchaser who foresees his future demand (nomination) and relays his forecasts to the regulatory agencies. But the refiner-purchaser is under no contractual obligation to limit his subsequent purchases to the level of his nomination.94 Second, on occasion the regulatory agencies receive requests from purchasers after the monthly allowable hearings are concluded.95 This naturally offsets the intended balance between supply and demand.

Administration of supply through establishment of allowables has also been a basic problem for the management of prorationing. During the Suez Crisis of 1956, demand for crude oil from the Gulf Coast fields in Texas increased considerably. The Texas Railroad Commission expressed its inability to meet such demands on the grounds of a statutory requirement that allocation of production must be established on a "fair and reasonable basis."96 To be "fair and reasonable" would have required a proportionate increase of allowables not only in the Gulf Coast, but also in West Texas fields. As the Commission indicated, "[o]ur rule is that [allocation] must be straight across the board; every field must share ratably in the production."97 Since the West Texas pipelines were operating at their maximum capacity, additional production from this region was impossible. This situation was sufficient reason for the regulatory agency to deny the badly needed additional production from the Gulf Coast.

A more recent example reveals the difficulties that the regulatory agencies experienced during 1970-71. As a result of domestic and international developments in the latter part of 1970 and early 1971, a general shortage of fuel oil was felt throughout the United States.98 On many occasions purchasers reported to the Conservation

93. These reasons are all related to the procedure by which market-demand prorationing is anticipated. The basic problem, common to all commodities, is the difficulty of forecasting markets under changing economic variables.

94. See text accompanying note 34 supra.


96. TEX. REV. CIV. STAT. ANN. art. 6049d, § 6 (1962).


98. In the United States, cold weather markedly increased the demand for oil. The international developments were more complicated and resulted from a cutback on Libyan oil, blowout of the Trans-Arabian pipeline, and, in particular, the unanticipated pressure on the part of the OPEC (Organization of Petroleum Exporting Countries—Iran, Iraq, Saudi Arabia, Quatar, Abu Dhabi, Algeria, Libya, Kuwait, Indonesia, Nigeria and Venezuela) concerning international prorationing and price increase. For background on the international developments see G. STOCKING, MIDDLE EAST OIL: A STUDY IN POLITICAL AND ECONOMIC CONTROVERSY 349-92 (1970).
Commission of Louisiana and to the Texas Railroad Commission that despite an increase in allowables they were still having difficulty obtaining sufficient supplies. Although the shortage of petroleum was caused by other factors in addition to market-demand prorationing, it is clear that the present production system has been unable to cope with the problem.

III

PRORATIONING AND CONSERVATION

A. Confusion Concerning Waste and Market Demand

Proponents of market-demand prorationing justify it primarily as a means of preventing waste. However, the proponents of the system have failed to define waste in terms unambiguously reflecting conservation principles. Various definitions of waste are possible in the oil-production context: (1) Using petroleum energy when it would be less costly to use another energy source, thus giving it an improper priority over other resources, (2) failing to extract the maximum economically recoverable yield of petroleum from a reservoir, or (3) using petroleum energy on "inferior uses" when such a policy is either detrimental to the economic production of other more appropriate energy sources (e.g. coal), or when the present use is inappropriate in view of the need to conserve petroleum resources for future generations. Thus far the oil industry and oil-producing states have resisted consideration of definitions (1) and (3) above, since those would entail conservation of oil by limiting not only its production,

240-54 (1971) concerning settlement of the disputes between the Persian Gulf members of the OPEC and the international oil companies.


Another rationale for the system is the adjustment and protection of the correlative rights of landowners. E. ZIMMERMAN, supra note 9, at 24; see OIL CONSERVATION, supra note 6, at 26-30.

but its use.\textsuperscript{102} Therefore the valid conservation goal has been limited to the maximization of reservoir yield, waste being regarded as petroleum which is needlessly left unrecoverable due to an improper rate of production.

State legislation enacting schemes for the regulation of petroleum production often has failed to give priority even to this limited and legitimate conservation goal. Rather, most state statutes have defined waste so as to encompass not only the proper conservation meaning of the term, but also to promote production at the market-demand rate. Thus, in seeking to prevent "waste," the regulatory agencies may in practice conform production to market demand, notwithstanding the fact that ultimately this will often produce waste in the conservation sense, \textit{i.e.} unrecoverable oil.\textsuperscript{103} The Texas statutory definition of waste clearly indicates this confusion between market demand and true waste prevention. On the one hand waste includes:

\begin{quote}
[L.]oss incident to, or resulting from, the unnecessary, inefficient, excessive, or improper use of the reservoir energy thus leaving unrecoverable oil.\textsuperscript{104}
\end{quote}

However, the statute goes on to include within waste:

\begin{quote}
The production of crude petroleum oil in excess of transportation or market facilities or reasonable market demand.\textsuperscript{105}
\end{quote}

The Louisiana statute contains a similar confusion:

\begin{quote}
"Waste," in addition to its ordinary meaning, means "physical waste" as that term is generally understood in the oil and gas industry. It includes: (a) the inefficient, excessive, or improper use or dissipation of reservoir energy; and [exploitation of petroleum] in a manner which results . . . in reducing the quantity of oil or gas ultimately recoverable from a pool; and (b) . . . the producing of oil or gas from a pool in excess of transportation or marketing facilities or of reasonable market demand . . . .\textsuperscript{106}
\end{quote}

The courts have likewise displayed inconsistency and confusion in their treatment of prorationing and waste prevention.\textsuperscript{107} However, the trend of the decisions has been to uphold the validity of market-

\textsuperscript{102} See \textit{Id.}.
\textsuperscript{103} See text accompanying notes 112-22 \textit{infra}.
\textsuperscript{105} \textit{Id.}
\textsuperscript{107} \textit{Compare} Macmillan v. Railroad Comm'n, 51 F.2d 400 (W.D. Tex. 1931), which held that limitation of production to a reasonable market demand had no reasonable relation to the prevention of physical waste, \textit{with} Danciger Oil & Refining Co. v. Smith, 4 F. Supp. 236 (N.D. Tex. 1933), which upheld the validity of "reasonable" market demand as a waste preventive method. Also, in Danciger Oil & Refining Co. v. Railroad Comm'n, 49 S.W.2d 837 (Tex. Civ. App.), \textit{rev'd on other grounds}, 122 Tex. 243, 56 S.W.2d 1075 (1933), the court distinguished economic waste from physical waste and pointed out that the Texas Railroad Commission has authority only to prevent physical and not economic waste. Paradoxically, the court
demand prorationing against constitutional challenges, and it has been defended on the basis of being a waste-preventive measure.\textsuperscript{108}

Like many of the states, the IOCC\textsuperscript{109} has also attempted to combine the goals of conservation and market-demand prorationing. The Compact Commission has defined waste as "[t]he inefficient, excessive, or improper use, or the unnecessary dissipation of reservoir energy."\textsuperscript{110} Later the Commission adds to the definition of waste: "[t]he production of oil or gas in excess of . . . . reasonable market demand."\textsuperscript{111}

This confusion between waste—in the proper conservation sense—and production "in excess of reasonable market demand" creates the impression that as a conservation measure, production must be limited to market demand. This notion, despite its emotional appeal in the industry, is logically untenable and conceptually indefensible.

**B. Coincidental Parallelism and Waste**

The three curves in Figure 2 illustrate the fact that market-demand prorationing only occasionally results in true waste prevention and thus is not a rational conservation technique. Under the abso-

upheld the Commission's authority to determine the prorationing order based upon "market demand." Presumably the court considered market demand a measure to prevent physical and not economic waste.


\textsuperscript{109} See note 87 \textit{supra}.

\textsuperscript{110} IOCC, \textit{supra} note 42, at § 1.1.1.

\textsuperscript{111} \textit{Id.}
lute market-demand curve—where the rate of production has been decided by market-demand prorationing—\(^{112}\) the initial pressure drop has produced a certain quantity of oil (O1). Suppose that after reaching production point I the market demand changes and that such change requires a new rate of production which coincidentally is equal to the MER rate. Thus, the regulatory agency will change the market-demand factor so that AB—the coincidental market-demand curve—will be parallel to CD—the MER curve. To the extent that this coincidental parallelism in rates of production continues, waste—in the conservation sense—has been prevented.\(^{113}\) But there is no guarantee that such parallelism will continue. Any change in market demand will affect the rate of production. For example, if market demand reverts to its original value at point B, production will cease to parallel the MER curve and will instead parallel the absolute market-demand curve (BG parallel to EF).\(^{114}\)

![Figure 2: Prorationing and Waste Prevention](image)

112. For the purpose of this figure MER production will be considered to be the greatest level of scientific production possible.

113. For example, note that if production had continued under the absolute market-demand curve to cumulative production point \(j\) pressure would have dropped to \(P_c\), whereas under the coincidental demand curve an even greater amount of production (to \(m\)) causes a pressure drop only to \(P_b\), thus conserving the driving force and permitting greater ultimate recovery.

114. It is possible that as a result of new market-demand prorating the allowable of a well might be established between the \(G\) and \(H\) curves. That is, the new curve would follow neither the MER nor the absolute market-demand curves.
This coincidental parallelism of production rates under MER and market-demand prorationing may occur under the present conservation laws of most producing states. As previously noted,\(^{115}\) the statutes speak in terms of "obtaining . . . the largest ultimate recovery of oil,"\(^{116}\) i.e., in terms of true conservation. Clearly, production at rates parallel to the MER curve yields that goal of maximum ultimate production, since the pressure drop is minimized. However, as also discussed previously,\(^{117}\) the statutes confuse waste prevention with market demand, and attempt to attain both goals simultaneously. But to adjust production so as to destroy parallelism with the MER curve defeats the conservation goal.\(^{118}\) Thus, under the present in-

115. See text accompanying notes 104 & 106 supra.
117. See text accompanying notes 103-06 supra.
118. An examination of the effects of production control in different types of reservoirs exemplifies the distinction between genuine waste-prevention measures and market-demand prorationing. In natural or edge-water drive reservoirs [see text accompanying note 17 supra], the oil pool is something like an island in a sea of edge water. This edge water possesses kinetic energy in the form of pressure which it exerts whenever differential pressure conditions permit. L. UREN, supra note 8, at 62. In many reservoirs the high pressure of the edge-water zone declines as production proceeds, eventually dropping to that of the well bore. Under these circumstances, maximum production would require effective scientific control of the production rate in order to obtain maximum benefit from the kinetic energy—or pressure—of the edge water. Id. at 62, 76, 175. Production control under market-demand prorationing might coincidentally preserve maximum edge-water pressure, but not because of the need for efficient production. See Figure 2.

In gas-cap drive reservoirs [see text accompanying notes 14-16 supra] there is a zone of natural gas overlying the oil zone. Here, recovery efficiency is very sensitive to the rate of production. An excessively high rate of production causes rapid encroachment of the free gas into and throughout the oil zone, with a consequent excessive drop in reservoir pressure. PETROLEUM CONSERVATION, supra note 9, at 159. This also causes the oil and gas to mix and create a dissolved-gas drive zone, which, even under favorable pressure conditions, is less productive than gas-cap or water-edge zones. E. ZIMMERMANN, supra note 9, at 63. Even if such a dissolved-gas drive zone is not created, an excessive production rate in gas-cap drive reservoirs may cause oil displacement to take place only along the most permeable channels, leaving the oil undisplaced by gas in most of the remainder of the formation. PETROLEUM CONSERVATION, supra note 9, at 159.

Under these circumstances, sound conservation practices would dictate restrained production. IOCC, supra note 9, at 49. One authority states that under turbulent flow conditions, the pressure loss increases as the square of the flow velocity; hence if we were content with a rate of production of half the open flow capacity of a well, this rate could be realized with considerably less than half of the energy consumed under open flow conditions.

L. UREN, supra note 8, at 39. But controlling the flow through market demand can only coincidentally conserve reservoir pressure, and if market demand changes, such conservation ceases.

In dissolved-gas drive reservoirs [see text accompanying notes 12-13 supra] the oil is saturated with dissolved gas, and again, production at full capacity results in a rapid pressure decline. As with the other types of reservoirs, restriction of production to a scientific MER would result in genuine conservation [IOCC, supra note 9, at 39]
congruous statutory system, coincidental parallelism between the MER and market-demand curves is likely to be only a temporary phenomenon.\footnote{119} (This coincidental and inconsistent identity between production control based on market demand and MER is advanced as the most persuasive justification for market-demand prorationing). Genuine MER, on the other hand, consistently prevents waste by eliminating—or reducing—the intra-field competition and maximizing the oil-displacement mechanism by maintaining a proper reservoir pressure differential at all times.\footnote{120}

Even when the rates of production under the two systems are coincidentally parallel, the reservoir pressure-drop rate might be higher under market-demand prorationing than under MER. Conversely, even when the rates of pressure drop are coincidentally parallel, there might be greater cumulative production under MER than under market demand. Thus, oil which is not presently recovered as a result of a market-demand restriction may never be recoverable. It is reported that in some fields in Rumania, production capacity after a period of restricted flow does not return to its original strength “and the ultimate production is apparently diminished.”\footnote{121} The reason for this production diminution is that an unscientific production pattern preceding the period of coincidence may result in relatively low pressure, making it too late thereafter to achieve the maximum efficient rate of production even if secondary recovery techniques are applied.\footnote{122}

IV

EXEMPTIONS FROM MARKET-DEMAND PRORATIONING AND THEIR IMPACT UPON PRODUCTION

A. Exemptions From Market-Demand Prorationing

Uniform application of market-demand prorationing would have the incidental benefit of controlling the rate of production in both efficient and inefficient wells. Uniformity is not the general rule, how-

\footnotetext{119}{Even with the occurrence of coincidental parallelism between MER and market-demand production rates, there will probably be a greater cumulative production for any given pressure drop under MER than under market demand. Thus in Figure 2, for a pressure drop from $O$ to $P_c$, despite the temporary parallelism in rates, cumulative production under MER is $O_1$ while cumulative production under market demand is only $O_5$.}

\footnotetext{120}{A. Levorsen, supra note 53, at 458-84.}

\footnotetext{121}{L. Uren, supra note 8, at 178.}

\footnotetext{122}{Secondary recovery is a method of supplying new energy from outside to the well through some medium such as water, air, gas or underground combustion. See A. Levorsen, supra note 53, at 481-84; IOCC, supra note 9, at 50.}
ever. Wells with low producing capacity, *e.g.*, marginal wells,\(^\text{123}\) are usually exempted from the limitations of market-demand prorationing. Since allowables determine a fixed amount of oil to be produced over a given time, flowing wells, *e.g.*, wells with a higher production capacity, have to reduce their production to compensate for the production by the exempted wells. Therefore, these exemptions not only make MER production an academic matter, but also augment the waste inherent in prorationing. The major exemptions from market-demand prorationing are discussed below.

### 1. Marginal Wells

The first and most significant exception to the prorationing system is that made for marginal wells. A marginal well is defined by statute in Texas as "any oil well which is incapable of producing its maximum capacity of oil except by pumping, gas lift, or other means of artificial lift, and having a maximum daily capacity [of a specified rate based on depth]."\(^\text{124}\) There are a vast number of wells in this category, and they are located in every producing state.\(^\text{125}\) The majority

\(^{123}\) In Texas, according to the Marginal Well Act of 1949, "no rule or order . . . shall be entered requiring restriction of the production of any 'Marginal Well,' [below the marginal limit]." TEX. REV. CIV. STAT. ANN. art. 6049b, § 2 (1962).

\(^{124}\) Marginal Well Act, TEX. REV. CIV. STAT. ANN. art. 6049b, § 1 (1962). Statutory marginality is a function of production relative to well depth, as the following tabular representation of the Marginal Well Act indicates.

<table>
<thead>
<tr>
<th>Depth of Well (feet)</th>
<th>Maximum Production to be Considered Marginal (barrels per day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 2000</td>
<td>10</td>
</tr>
<tr>
<td>2000 - 4000</td>
<td>20</td>
</tr>
<tr>
<td>4000 - 6000</td>
<td>25</td>
</tr>
<tr>
<td>6000 - 8000</td>
<td>30</td>
</tr>
<tr>
<td>over 8000</td>
<td>35</td>
</tr>
</tbody>
</table>

OIL CONSERVATION, *supra* note 6, at 154.

Where not defined by statute, marginal wells are generally considered those wells which are incapable of production except by artificial lift methods, and even then having very limited production. H. WILLIAMS & C. MEYERS, OIL AND GAS TERMS 225 (1964).

Although the term "stripper well" is often treated as synonymous with "marginal well," the former term has a more restricted meaning in many contexts. The National Stripper Well Association defines a stripper well as one with an average daily production of less than 10 barrels (or in a field averaging less than 10 barrels per well per day). OIL CONSERVATION, *supra* note 6, at 185. Both marginal and stripper wells are exempted from the application of market-demand prorationing. *See id.*, at 186.

\(^{125}\) The total number of wells classified as marginal or stripper wells is significant. The 1971 survey placed the number of stripper wells (as defined in note 124 *supra*) at almost 360,000. IOCC & NAT'L STRIPPER WELL ASS'N, NATIONAL STRIPPER WELL SURVEY 4 (1971). Marginal and semi-marginal wells (including stripper wells) recently constituted well over 2/3 of the producing oil wells in the United States. PETROLEUM PRESS SERVICE, Nov. 1967, at 407.
of these wells yield no more than a few barrels each day.\textsuperscript{126}

As a result of the exemption of marginal wells, prorationing penalizes efficient wells in order to limit total production to market demand. The extent of this penalization is very significant in many cases, and is contrary to the interests of conservation.\textsuperscript{127} In one case 17,600 flowing wells, each with an average daily capacity of more than one hundred barrels, had to curtail their average scheduled daily allowables to twenty-one barrels per well as a result of the application of the prorationing formula. Moreover, they were only permitted to produce for sixteen days out of the month, resulting in an average daily production of twelve barrels per well (averaged over the entire month). On the other hand, nine hundred local marginal wells, producing at their full capacity every day of the month, had a daily average production per well equal to that of the flowing wells.\textsuperscript{128} Another example has been cited to the effect that a marginal well in a particular field might be able to produce over six hundred barrels per month, while the field's most efficient flowing well would be limited to only two hundred barrels per month.\textsuperscript{129} And in 1965, despite the enormous productive capacity of flowing wells in Texas, the penalizing effect of that state's market-demand prorationing system limited the average production per well to only thirteen barrels a day.\textsuperscript{130}

2. \textit{Discovery or Exploratory Wells}

The second exception to the prorationing system is the "discovery" or "exploratory" well. The "discovery allowable" is a special allowable assigned to the first few wells completed in a particular oil pool for a specified period of time. Until 1966 the discovery allowables in Texas were limited to the first five wells completed in a given field within an eighteen month period. Since that year the Texas Railroad Commission has become more generous in exempting discovery fields from market-demand prorationing. The number of exempted wells has doubled and the duration of the exemption period has been increased to two years.\textsuperscript{131} Discovery allowables may


The situation ranges in extremes from Pennsylvania, where over 36,000 stripper wells produced a daily average of only .3 barrels per well, to Montana, whose 1,900 stripper wells had a daily average of 10 barrels per well. IOCC & NAT'L STRIPPER WELL ASS'N, \textit{supra} note 125, at 4.

\textsuperscript{127}. See text accompanying note 57 \textit{supra}.

\textsuperscript{128}. Comment, \textit{supra} note 27, at 188.

\textsuperscript{129}. PETROLEUM PRESS SERVICE, Nov. 1967, at 407.

\textsuperscript{130}. AMERICAN PETROLEUM INST., \textit{PETROLEUM FACTS AND FIGURES} 29 (1965).

\textsuperscript{131}. OIL CONSERVATION, \textit{supra} note 6, at 159.
exceed the usual per-well allowable for non-discovery (ordinary) wells; in addition they are not subject to the scheduled allowable production days per month which the ordinary reservoirs generally must follow. To the extent that discovery wells are allowed unprorated production, the prorated wells in the same field must reduce production. In other words, the production by the discovery wells in excess of their otherwise prorated allowables is achieved at the expense of ordinary wells, irrespective of the reservoir capacity of the latter. In periods of high market demand for Texas oil, such as during the Suez Canal closure in 1967, the discovery allowable does not have an appreciable adverse effect upon ordinary reservoirs because the latter's allowables are shifted upward and their production is closer to capacity. But in periods of ordinary or depressed market demand, the penalizing effects of the discovery allowable are substantial, since the discovery wells will be permitted to produce more than other wells with similar reservoir capacity.

3. **Special Orders**

The third category of exemption from market-demand prorationing is "special orders." The Texas Railroad Commission has the authority to grant special allowables to any field which it deems to be entitled to them "to assure orderly development and production operation in such fields."\(^{132}\) This exemption is above and beyond the depth-acreage formula\(^{133}\) when the latter is deemed inadequate.

4. **Hearing-Type Exemptions**

The fourth type of exception to prorationing is granted as a result of hearings at which owners of producing tracts in particular types of geologic formations can file petitions for exemptions.\(^{134}\) Examples are Piercement salt dome fields and capacity water-flood fields. Piercement salt dome fields are "located on the flanks of salt domes that have pierced upward through overlying formations."\(^{135}\) The production rate of each Piercement field differs depending on the Railroad Commission's decision at each hearing. Generally the shallow Piercement fields are exempted from the application of market-demand prorationing.\(^{136}\) Capacity water-flood fields are fields which

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133. See text accompanying notes 37-40 supra.
134. Both special orders and hearing-type exemptions are general discretionary exemptions. However, a hearing is not mandatory when an exemption is granted by special order. **H. Williams, et al., supra** note 54, at 685.
135. **Oil Conservation, supra** note 6, at 155.
136. **Id.**
cannot produce oil without the application of a secondary recovery system such as fluid or gas injection. Because of their insignificant production, these wells are usually considered marginal. Despite the fact that no statutory exemption applies to them, these types of wells can be exempted from market-demand prorationing with Commission approval after a hearing.

5. County Regular Fields

"County regular fields" are shallow and relatively old pools which are exempted from market-demand prorationing. These pools have a low production capacity—normally about 16 barrels per day. Since there are numerous "county regular fields" in Texas, their cumulative production may affect the allowables of ordinary wells.

B. The Effect of Market-Demand Exemptions

Due to the rising petroleum demand in the United States, in 1970 and early 1971 the regulatory agencies had to increase the allowables of different fields in their respective states. Mr. Ben Ramsey, Chair-

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137. See note 122 supra.
138. OIL CONSERVATION, supra note 6, at 155.
139. Id. at 154-55.
140. Aside from these basic exemptions there is one additional exemption, which is related more to the issue of spacing than production. Although, in effect, the Commission's general rule disallows drilling in small tracts, courts have held the owner or leaseholder of a tract, however small, to be entitled to one well. The primary basis for the exception is to prevent confiscation, the court recognizing the doctrine that every operator or landowner is entitled "to a fair chance" to recover the oil in place beneath his property. Dailey v. Railroad Comm'n, 133 S.W.2d 219 (Tex. Civ. App. 1939); Marrs v. Railroad Comm'n, 142 Tex. 293, 177 S.W.2d 941 (1944). Texas courts have emphatically endorsed this economically unwarranted exception as a requirement of substantive due process. Gulf Land Co. v. Atlantic Ref. Co., 134 Tex. 59, 131 S.W.2d 73 (1939); Brown v. Humble Oil & Ref. Co., 126 Tex. 296, 83 S.W.2d 935 (1935). One court concluded that the owner of a small tract could not be denied the right to drill at least one well on his tract "however small it may be" and, therefore, "his allowable cannot be cut down to the point where his well would no longer produce . . . nor below the point where it could not be drilled and operated at a reasonable profit." Railroad Comm'n v. Humble Oil & Ref. Co., 193 S.W.2d at 824 (Tex. Civ. App. 1946). Fortunately, small-tract drilling has been considerably reduced in many states and the introduction of mandatory unitization has been a disincentive for such drillings. See Whittier, Compulsory Pooling and Unitization, 15 KAN. L. REV. 307 (1967). However, many fields are still operating under the traditional system. Considering all these statutory and nonstatutory exemptions, it is fair to conclude that, except for the areas where compulsory pooling and unitization applies, there are few tracts of land in Texas without any oil production potential (whether or not such production is economically feasible). See Ryan Consol. Petroleum Corp. v. Pickens, 266 S.W.2d 526 (Tex. Civ. App. 1954). Thus, conservation is circumvented by a prorationing system of production which encourages inefficient marginal production and, in effect, subsidizes the operation of marginal wells.
man of the Texas Railroad Commission, stated that such an increase of allowables was possible because:

[T]he commission has disregarded economists who want stripper wells shut in and production limited to high MER wells. This once again proves the wisdom of the market-demand production... 141

Basically, there are two implications of such a protectionist policy towards inefficient and marginal wells. First, it reduces the rate of production for the flowing wells. Such a reduction is inevitable because the total amount of crude oil required for production at any given time is fixed by the Commission. Since the more efficient wells are subject to prorating quotas, they must produce less in order to allow for production by wells which are exempted. As a result, the efficient well produces below MER. The non-MER production damages the reservoir's energy-generating forces (e.g., the driving pressure), and the ultimate recovery of oil from the reservoir is reduced. 142

It might be argued that since inefficient wells have, by definition, a limited production capacity, their operation cannot significantly change the allowables of the efficient wells. This argument is untenable. Although individually the marginal wells are not very productive, their cumulative production is considerable. For example, some two-thirds of the 500,000 producing wells in the United States are marginal or semi-marginal wells. They produce twenty-one percent of the total national production and lower the average daily production for all wells to fourteen barrels per well. 143

The second implication of granting exemptions from market-demand prorating is that they provide an incentive for close spacing and the costly and unnecessary drilling that goes with it. 144 Dense spacing is almost unavoidable when certain wells are exempted both from market-demand prorating and spacing regulations. For ex-
ample, spacing regulations are not applicable to discovery wells for a two-year period and until after ten wells are drilled. Since each discovery well receives a specific allowable irrespective of its distance from other wells, the producers are encouraged to space them as densely as possible (subject to such laws as the forty-acre per site limit imposed in Texas). Such overcrowding is costly and usually reduces the ultimate cumulative production of the reservoir.

V

RECENT DEVELOPMENTS

Developments which have taken place in the last few years have, to some extent, reduced the inefficiencies inherent in market-demand prorationing. The effect of some of these developments upon market-demand prorationing should be noted.

A. Lease Allowables

An important development in the production policy of Texas was connected with the Arab-Israeli conflict of 1967. In order to make sufficient crude oil supplies available to Europe, Texas had to raise its market-demand factor from about thirty-four to fifty-four percent. This change in allowables permitted increased production by some wells to a rate closer to their capacity. On the other hand, certain wells could not meet their new allowables. Therefore, the Railroad Commission permitted production on a lease basis rather than on a well basis, and in 1968 lease allowables were permanently established in Texas.

The lease-allowable system is an improvement in market-demand prorationing. Under this improved system, the wells included in a particular lease are allowed different amounts of production. Rather than imposing an arbitrary market-demand factor on each well, the Commission allows wells with a lower production capacity to reduce their production. To the extent that a low-capacity well's production is reduced, a more efficient well can produce additional crude oil. However, the inefficiencies of market-demand prorationing are only reduced under the lease allowable system, not eliminated. The Commission does provide hearings to determine the allowables of each

145. Lovejoy, supra note 48, at 83.
146. Despite this change, even under the compulsory pooling system, questions concerning production share, royalty interests and cotenancy remain to be resolved. See, e.g., Lange, The Production of Oil and Gas and Some of the ProblemsReached By It, in PROCEEDINGS, 22ND ANNUAL INSTITUTE ON OIL AND GAS LAW AND TAXATION 113, 128-34 (S.W. Legal Foundation 1971).
lease, but makes the determination according to market demand, and not necessarily according to the total production capacity of the wells within the lease.147

B. Gas-Oil Ratio

As explained earlier, natural gas is one of the main energy generating factors in producing petroleum.148 The pressure created by the expansion of gas released from solution eventually drives the oil to the well bore.149 By relaxing the gas-oil ratio requirement and permitting greater production of reservoir gas, the Texas Railroad Commission has increased the allowables in certain dissolved-gas drive reservoirs.150

C. Calendar Day Testing

Calendar day testing was introduced in Texas in 1968.151 Under this system, flowing wells are allowed to produce somewhat closer to capacity than under the previous system, with proportionately less production opportunity for inefficient marginal wells. However, there are two basic problems with the calendar day testing systems of Texas and Louisiana which diminish their effectiveness. First, calendar day testing bases the calculation of a flowing well's top schedule allowable on depth-acreage,152 and therefore does not necessarily result in the most efficient production rate, or MER.153 Second, under the present statutory protection, marginal wells enjoy exceptional freedom at the cost of more efficient flowing wells and are not directly affected by calendar day testing.

D. Mandatory Unitization

Unitization is the development and operation of an entire petroleum pool as a unit, rather than the separate development of each op-

147. OIL CONSERVATION, supra note 6, at 114-15.
148. See text accompanying notes 14-16 supra.
149. A. LEVORSEN, supra note 53, at 463.
150. See note 141 supra.
151. See Lovejoy, supra note 48, at 81-82.
152. See text accompanying notes 12-15 supra.
153. Since the market-demand factor is almost always below one hundred percent, the well must produce less than its capacity. The higher the market-demand factor the closer is the well's production to its capacity. A comparison of market-demand factors indicates that the Texas fields generally have produced closer to capacity in 1970 than in 1969. The market-demand factor ranged between forty-three and sixty-three percent in 1969 but averaged about seventy-five percent in 1970. Louisiana's market-demand factor also increased significantly, rising from below fifty percent in 1969 to above sixty-six percent in 1970. See TEXAS RAILROAD COMM'N, ANNUAL REPORT OF THE OIL AND GAS DIVISION 675 (1970); OIL & GAS J., July 20, at 45; July 27, at 68; Aug. 10, at 9; Aug. 17, at 33; Aug. 24, at 32 (all 1970).
erator's own wells. Under unitized operation the conflicting or competing interests in a reservoir (e.g., the interests of operators on adjacent lands), can be eliminated and operation can become more efficient. The following are examples of procedures which can increase efficiency under unitized operation: Use of secondary recovery measures, minimum well drilling, elimination of offset drilling, consideration of scientific factors (rather than surface property lines) in determining the location of wells, selective production of wells, lowering of development and operating costs, and increasing per-acre oil yield.\textsuperscript{154}

The effect of unitization on production efficiency can be illustrated by looking briefly at one of the legal problems which can be encountered when using secondary recovery methods. In the absence of unitized operation, a cause of action may lie for trespass if one operator attempts secondary recovery through gas or water injection into an improperly spaced well and thereby causes the premature destruction of the adjacent operator's producing well.\textsuperscript{155} The problem is complicated by the fact that, in the absence of unitization, it is not at all clear the extent to which a lessee operator—seeking to maximize production and protect his lessor's rights—is obligated to exercise due care to avoid interfering with an adjacent operator's interests.\textsuperscript{156} In each case the court must weigh the interests of society and the petroleum industry as a whole against the interests of the individuals involved, in an ad hoc balancing process.\textsuperscript{157}

Mandatory unitization has done much to alleviate this and other problems by regulating such things as production rates and well spacing on the basis of the needs of an entire pool rather than the desires of individual operators.\textsuperscript{158} Furthermore, unitization fosters conservation of petroleum by making it possible for reservoirs to produce at the maximum efficient rate of production. One reason for this is that a single high-pressure system throughout a particular reservoir allows a greater percentage of oil ultimately to be recovered.\textsuperscript{159} Recognizing

\textsuperscript{155} Elliff v. Texon Drilling Co., 146 Tex. 575, 210 S.W.2d 558 (1948).
\textsuperscript{156} See Railroad Comm'n v. Manziel, 361 S.W.2d 560 (Tex. 1962). Concerning the tort liability of the operator, see Keeton & Jones, Tort Liability and the Oil and Gas Industry, 39 Tex. L. Rev. 253, 268 (1961).
\textsuperscript{157} See Wadkins v. Wilson Oil Corp., 199 La. 566, 6 So. 2d 720 (1942).
\textsuperscript{158} Some economists believe that "all of the significant evils of unregulated petroleum production sprang from non-unitized operation," and that by establishing a unitized system the question of conservation could be left in the hands of private operators who would make the necessary adjustments. S. McDonald, The Economics of Conservation 16 (paper presented at the Rocky Mountain Petroleum Economics Institute, Boulder, Colorado, June 1964). See also Oil Conservation, supra note 6, at 75.
\textsuperscript{159} This is illustrated by the MER curve in Figure 2 supra.
the value of this "single pressure" concept, some courts have ordered unitized production of whole reservoirs. In addition, at least one recent statute has called for unitization where there is "a single and separate natural reservoir characterized by a single pressure system [so that] [p]roduction from one part of the pool affects the reservoir pressure throughout its extent."

Recognition of the efficiency of unit operation is not new. Almost a quarter of a century ago Professor Rostow, a staunch advocate of mandatory unitization, concluded:

[T]he rule of capture has proved . . . a socially undesirable rule of law and . . . should be changed as the root idea of our system of oil law . . . . [Compulsory unitization] would . . . permit the number of wells to be kept to a minimum, and the flow from individual wells to the field to be determined by geological criteria rather than the accidental pattern of ownership of the land over the oil. The unitary operation of the oil fields is the only course of action which . . . could permit high standards of conservation practice to be seriously followed.

Professor Rostow's policy recommendation received widespread approval by students of the petroleum industry, and strong support for mandatory unitization of all producing pools throughout this country was evident among industry economists.

E. Unitization and Market-Demand Prorationing

The policy Rostow advocated in 1948 was adopted by Texas in 1965. Today all important producing states have adopted mandatory unitization. Yet inefficiencies in the existing structure and accepted policies of the industry continue for two basic reasons: (1)


161. KAN. STAT. ANN. § 55-1302 (Supp. 1967). See also note 154 supra.

162. E. ROSTOW, A NATIONAL POLICY FOR THE OIL INDUSTRY 45 (1948). It must be noted that others had advocated a mandatory unitization system before Professor Rostow did. See Hardwicke, supra note 19, at 391; Walker, The Problem of the Small Tract Under Spacing Regulations, in Proceedings, 57th Ann. Sess. Tex. Bar Assoc., TEX. L. REV. 157, 167-69 (Bar Ass'n No., Oct. 1938). The distinguishing characteristic of Professor Rostow's mandatory unitization proposal was his recommendation of public administration of unitization throughout the country by the federal government.

163. See OIL CONSERVATION, supra note 6, at 75-81; M. DE CHAZEAU & A. KAHN, supra note 6, at 6, 242-43, 252; Nelson, Prices, Costs and Conservation in Petroleum, 48 AM. ECON. REV. 514 (1958); Davidson, supra note 6, at 97-100; But see Bain, Rostow's Proposal for Petroleum Policy, 57 J. POL. ECON. 55 (1949).

164. See M. DE CHAZEAU & A. KAHN, supra note 6, at 252.

the neutral position of unitization toward market-demand prorationing, and (2) broad exceptions to unitized operation.

1. Neutrality of Unitization

The most significant advantage of unitization is that the operator is free to seek the optimum recovery from the entire reservoir on a scientific basis, without having to worry about conflicting with the interests of adjacent owners. Ideally, the reservoir will therefore produce at the rate which is geologically most appropriate for optimum recovery. In practice, this seldom happens. Because market-demand prorationing is one of the policies involved in determining the unitized rate of production, such factors as price motivation, pressure groups, and political considerations become part of the production-rate equation. Under these circumstances the unitized production system is effectively emasculated.

2. Exceptions to Unitization

As now applied, the mandatory unitization system provides for many exceptions which constitute the greatest limitation on its effectiveness. The following examples illustrate a few of the existing problems.

First, contrary to general belief, mandatory unitization is not always mandatory. The consent of certain parties is often necessary in order to establish a unitized pool. For example, under the Kansas conservation laws, unitization of a reservoir may not take place without the approval of the owner of a working interest. The laws of many other states have similar provisions. Moreover, a court may occasionally require contractual authority in order to give a lessee the right to seek compulsory pooling and unitization. This requirement, if frequently imposed, may effectively make mandatory unitization voluntary by precluding the lessee (in the absence of

166. The Texas Railroad Commission has emphatically denied that it considers the price implications in determining allowables. According to Ernest Thompson, then the Chairman of the Commission: “We have nothing to do with price. We are forbidden to consider economics. . . . I know nothing about price.” Hearings on 1957 Outlook—Oil Lift to Europe—Price Increases Before the House Comm. on Interstate and Foreign Commerce, 85th Cong., 1st Sess. 187 (1957).
168. See OIL CONSERVATION, supra note 6, at 70-71. In each state, approval of a specified percentage of the working interest is necessary in order to make unitization possible (e.g. sixty percent in New York; seventy-five percent in Kansas). See Smith, supra note 154, vol. 17, at 138 n.32.
the lessor's consent) from entering into any unitization plan which would affect the lessor's interest.\textsuperscript{170}

Second, the effectiveness of unitization may be hampered by not including those operations which were established before the unitization order. For example, the Texas unitization statute became effective in August, 1965.\textsuperscript{171} Since Texas courts have rejected the retroactive application of unitization,\textsuperscript{172} there is little reason for a small producer to seek a mandatory order if he is not compelled under the statute to do so. To the extent that mandatory unitization is not applicable to all the producing wells of a reservoir, the possibility of inefficient production exists.\textsuperscript{178} Indeed, some authorities believe that great damage has already been done to most reservoirs, and that the need for mandatory unitization may have been greater in past decades than it is today.\textsuperscript{174}

Third, the unitization regulations are not applicable to certain types of oil pools. Thus the Texas statute "would not apply to previously undrilled or unexplored areas."\textsuperscript{175} Also, certain types of reservoirs, such as Piercement salt domes,\textsuperscript{176} and certain operations, such as wildcatting, are not subject to unitization.\textsuperscript{177} And the Texas lands (lands in which the state of Texas has established an interest,\textsuperscript{178} or in which it has maintained title over oil and gas in place)\textsuperscript{179} are not included in unit operation.

If an allowable has been previously established for a well and has received court approval, the allowable will not be subject to unitization even if it is based on an inappropriate rate of production according to unit operation standards.\textsuperscript{180} And in cases where a minimum allowable has been established statutorily or by order of the


\textsuperscript{172} For any oil or gas pool to be subject to mandatory unitization it must be discovered or produced after March 8, 1961. Smith, \textit{The Texas Compulsory Pooling Act}, 43 \textit{Tex. L. Rev.} 1003, 1009 (1965). \textit{See Railroad Comm'n v. Aluminum Co. of America}, 380 S.W.2d 599 (Tex. 1964).

\textsuperscript{173} \textit{See Smith, supra note 172, at 1009-17.}

\textsuperscript{174} \textit{M. De Chazeau & A. Kahn, supra note 6, at 242.}

\textsuperscript{175} Smith, \textit{supra note 172, at 1011.}

\textsuperscript{176} \textit{See text accompanying notes 135-36 supra.}


\textsuperscript{178} Smith, \textit{supra note 172, at 1015.}

\textsuperscript{179} \textit{See Green v. Robinson}, 117 Tex. 516, 8 S.W.2d 655 (1928).

\textsuperscript{180} \textit{Railroad Comm'n v. Humble Oil & Refining Co.}, 193 S.W.2d 824, 832 (Tex. Civ. App. 1946).
regulatory agency, the well may continue to produce a few barrels a day, the unitization standards notwithstanding.\textsuperscript{181}

These exceptions to the unitization system explain to a certain degree the reasons for its limited effectiveness. Even in the absence of such exceptions, however, the efficiency of this production system has been seriously hampered under the present market-demand prorationing system.\textsuperscript{182} As long as the wasteful and politically motivated regime of market-demand prorationing continues to exist, mandatory unitization can never realize its maximum conservation potential.

CONCLUSION

There is widespread confusion between genuine conservation and market-demand prorationing as a waste-preventive measure. The doctrine of prevention of waste through market-demand prorationing has even received the Supreme Court's approval on the ground that producing more than the market demand will cause above-ground waste.\textsuperscript{183} But a careful analysis of market-demand prorationing demonstrates that it can never function as a genuine and consistent conservation measure, even if the market-demand production rate does at times coincidentally parallel the maximum efficient production rate (MER). There has been some progress in the form of new regulations concerning mandatory unitization, the lease allowable system, the gas-oil ratio, and calendar day testing. But as long as market demand continues to be an important part of these new concepts, they will be unable to function as genuine conservation measures. Even if market demand could somehow reflect true conservation principles, the numerous exemptions granted in such cases as marginal wells, wells established prior to unitization orders, wells in certain kinds of formations, wildcat wells, and discovery wells, destroy whatever chance may have existed for consistently achieving a maximum efficient production rate. For example, according to the Texas Railroad Commission's own report, of the 1,413 applications for exemptions to spacing regulations in a given year, only thirty-five were denied.\textsuperscript{184}

One of the reasons why market-demand prorationing continues to exist is that it is supported by a powerful group of economic interests.

\begin{itemize}
\item \textsuperscript{181} See Smith, supra note 154, vol. 16, at 570.
\item \textsuperscript{182} See text accompanying note 166 supra.
\item \textsuperscript{183} Champlin Refining Co. v. Corporation Comm'n, 286 U.S. 210, 230-31 (1932); See also Thompson, The Texas Market Demand Statute on Oil and Gas and Its Application, 39 Tex. L. Rev. 139, 145 (1960).
\item \textsuperscript{184} Texas Railroad Comm'n, Annual Report of the Oil and Gas Division 45 (1962).
\end{itemize}
which now effectively controls the single most important source of energy in the United States. Given the fact that market-demand prorationing is not only basically inimical to genuine conservation of our diminishing petroleum resources, but that it has also proven itself incapable of responding effectively to emergency petroleum needs—such as during the oil shortage of 1970-71—it seems more and more obvious that the broader needs of the nation as a whole must take precedence over the narrower economic interests wishing to preserve market-demand prorationing. Unitized production based on genuine MER must soon become the basic guiding policy of the American petroleum industry and those who regulate it.

185. For the impact of the United States prorationing system upon world production, see Vafai, Participation, Pricing and Production Control in the International Petroleum Industry, 5 NATURAL RES. LAW. 82, 98-103 (1972).