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FEDERAL ENERGY RESOURCE LEASING POLICY*

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It is generally believed that the greater part of this country's remaining undeveloped energy resources—oil and gas, coal, and oil shale—is to be found on lands subject to federal jurisdiction.¹ Such lands are normally made available to private persons for possible discovery and production of mineral fuels by means of leases, the terms and conditions of which are prescribed by responsible federal agencies, chiefly the Bureau of Land Management and the Geological Survey of the Department of the Interior. In addition to conditions included in lease contracts, the federal government, chiefly through the Geological Survey, imposes operating regulations designed to protect the environment and conserve natural resources. It is obvious that the policies followed by the government in leasing lands for mineral fuels production have an important bearing on the future of the nation's energy economy.

In this article we shall discuss a number of issues relating to leasing policy, from the basic objective(s) in leasing to the incidental regulation of oil production for conservation purposes. Some issues, such as the manner of bidding in lease sales and regulation for environmental protection, we shall barely touch upon for reasons of space. We shall devote most of our attention to the basis of bids (e.g., lease bonus vs. royalty rate), the rate of leasing, and conservation regulation in the case of oil. We begin with a discussion of what ought to be the objective in federal land leasing.

THE BASIC OBJECTIVE(S)

As present law is officially interpreted, the major objectives in the management of publicly owned mineral resources are: "(1) to assure orderly and timely resource development; (2) to protect the environment; (3) to insure the public a fair market value return on the

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1. *Federal Leasing and Disposal Policies*, hearings on S. 2727 Before the Senate Committee on Interior and Insular Affairs, 92d Cong., 1st Sess. 35-37 (1972) (statement of Harrison Loesch).

disposition of its resources.”² No one of these objectives dominates the others, and it is not clear from the law or official pronouncements how they are to be reconciled if they conflict in application, as they may. For instance, sufficiently strong measures to protect the environment may delay development and may also unduly reduce the value of resources to prospective lessees. Sufficiently rapid offering of leases may result in less than fair market value being received. It is not clear in any case just what “orderly and timely” development means in practice. On the other hand, these three objectives may be mutually consistent if we can integrate them into a single decision rule, such as the one we shall now propose.

We suggest that the federal government should seek to capture a maximum of the present value of pure economic rent arising from minerals production on its lands, where “pure economic rent” is the income which tends to accrue in the long run, under conditions of perfect competition and the absence of externalities, to the owners of raw natural resources.

There are several reasons for this proposed rule. First, it gives a concrete meaning to “orderly and timely” resource development and “fair market value,” while recognizing the need to internalize externalities such as environmental damages. Second, it is equivalent, in effect, to the rule that the government should seek to maximize the present value of resources to society; assuming the labor and capital employed in minerals extraction have alternative uses, the present value of pure economic rent as defined *is* the present value of the mineral resources to society. Third, pure economic rent is an economic surplus, the capture of which by the government does not affect output, the price level or relative prices, and the allocation of resources. Fourth, as a form of governmental revenue, economic rent received substitutes for taxes which *would* affect output, prices, and resource allocation. Thus, following the rule would promote economic efficiency and tend to maximize the value of resources to society.

Of course, the government cannot measure pure economic rent *a priori* and set the price of leases accordingly. Rather, to follow the rule it must create conditions conducive to its satisfaction in the normal process of marketing leases. Thus, conditions which reduce uncertainty, increase competition, promote the optimum rate of extraction of minerals, internalize externalities, and relate the rate of leasing to the capacity of the affected industries all tend to satisfy the rule. Note that the rule is not the same as that of maximizing the

2. *Id.* at 38.

present value of land revenues, for the latter would call for the disregard of environmental costs and lead to the exploitation of some minerals whose social cost exceeded their social value. Let us now see what the rule implies in regard to the several issues noted earlier.

THE MANNER OF LEASE BIDDING

Present law requires that bidding for oil and gas leases on the outer continental shelf be in the form of sealed bids, but it allows either sealed bids or oral auction, or a combination, in the competition for coal or oil and gas leases on the onshore public lands.³ In the only sale of oil shale leases sealed bids were required.⁴

Under conditions of uncertainty, which typify especially the leasing of lands for oil and gas production, sealed bids are to be preferred to oral bids. In contrast to oral bidding, sealed bidding is characterized by (1) the absence of certain knowledge by any bidder at the time he commits himself as to the number and identities of his competitors for a given tract; (2) the inability of bidders to react to competitive bids; and (3) by the inability of bidders to give implicit signals or to engage in punitive bidding. Lacking knowledge of either the lessor's reservation price or the size of others' bids, the bidder with the highest valuation cannot tailor his bid to be just above the reservation price or the second highest valuation, but is motivated to bid his actual valuation. When bidders are uncertain of the underlying quality of mineral deposits, valuations tend to differ widely. Consequently, the winning sealed bid is likely to be substantially higher than the winning oral bid would be.⁵ If uncertainty causes bidders to bid conservatively anyway, the government tends to capture a larger proportion of the pure economic rent available if sealed bids are required.

One disadvantage of sealed bidding as presently practiced relative to oral bidding arises from the fact that, for a given set of tracts in a sale, all bidding is closed before any individual bids are opened. The result is that a bidder of limited capital must select a few tracts to bid upon and, if he fails to be a winner on one or more tracts, has no opportunity to use the freed funds to bid on other tracts in the same sale. (Note that the very large bidder may be able to bid on every

3. Onshore oil and gas leases on lands not overlying a known geological structure of a producing oil or gas field are granted noncompetitively to the first qualified applicant. Where there are two or more simultaneous applicants, the winner is determined by a drawing.

4. Interview with H. Roy McBroom, Bureau of Land Management, Denver, June 27, 1975.

5. The definitive discussion of this subject is Mead, *Natural Resource Disposal Policy—Oral Auction versus Sealed Bids*, 7 NAT. RES. J. 194 (1967).

tract put up for lease.) Consequently, (1) small bidders are at a disadvantage in securing leases and (2) the average number of bids per tract in a sale is less than it might be. In short, the present system limits competition in both the short and the long run. The remedy is to permit what may be called sequential bidding. After a tentative closing of bidding in a sale, bids would be opened for individual tracts in the order of the number of bids per tract. Drawings would be held in the case of ties. The winning bid for each tract would be announced, but not the identity of the winner; the losers (or winner) would be permitted to submit new bids on other tracts in the sale before bids on the latter were opened. This system would increase the cumbersomeness of a large lease sale, but it would increase the average number of bids per tract and tend to result in higher winning bids under uncertainty, to say nothing of increasing the scope of opportunity for relatively small firms.⁶ The effective increase in competition would make it more likely that the government captures all the pure economic rent available.

When there is greater certainty as to the underlying value of mineral deposits, as is usually the case in coal leasing, sealed bidding offers less relative advantage. Where all parties, including the lessor, are knowledgeable, the reservation price, the second-highest valuation, and the highest valuation cannot differ much; and the government may lose nothing from truly competitive oral bidding. But it would gain nothing either, relative to truly competitive sealed bidding with sequential bidding allowed.

THE BASIS OF BIDS

At present mineral leases on federal lands are granted to the highest bidder of a lease bonus, the royalty rate being specified in advance by the lessor.⁷ The law covering outer continental shelf leasing allows royalty bidding also, the lease bonus being specified in advance; there have been a few experimental sales of oil and gas leases on this basis. Pending legislation would permit bonus bidding, royalty bidding, profit share bidding and work commitment bidding based on a dollar amount for exploration.⁸

6. The advantage to small firms is two-fold: it allows them to bid on more tracts and this makes fuller use of available capital; and it reduces pressure on such firms to over-commit themselves on a few key tracts in a desperate attempt to win at least some.

7. Note the exception given in footnote 2.

8. S. 9, 95th Cong., 1st Sess. (1977) *Outer Continental Shelf Lands Act Amendments of 1977*. This bill was passed by the Senate July 15, 1977; the corresponding bill in the House failed to be reported out of committee in the 1977 session.

The essential characteristics of bonus bidding are (1) it gives rise to an often large front-end payment; (2) it settles a heavy burden of risk and uncertainty on the lessee rather than the lessor; and (3) the bonus, once paid, becomes a sunk cost that is irrelevant to exploration, development, production and abandonment decisions—except that the immediate tax write-off of a bonus on surrendered leases tends to bias decisions in the direction of abandonment of marginal properties. Only the sunk cost characteristic is favorable to the objective of maximizing the capture of pure economic rent.

Pure economic rent is the surplus of value over labor and capital costs. Since no rent is paid by the marginal activity, pure economic rent does not affect the margin of exploration, development and production. A lease bonus has precisely these characteristics (abstracting from the noted inducement to abandon marginal tracts to secure an immediate tax write-off of the lease bonus). With certainty and perfect capital markets, it would be the ideal form in which to capture all pure economic rent.

But, of course, there is great uncertainty facing minerals producers at the point of leasing. The lessee's exposure to this uncertainty is maximized by bonus bidding. Uncertainty means, among other things, that operators cannot finance the proving of deposits exclusively with borrowed funds, e.g., from banks. A substantial proportion of equity capital is required, and given an imperfect equity capital market, small firms cannot raise such capital on equal terms with large firms. Small firms must depend more than large firms on retained earnings. Thus the often large front-end payment associated with bonus bidding is a barrier to entry and a restraint on competition in bidding.

This barrier and restraint is reduced by the practice of joint bidding, under which two or more potential lessees submit a single, common bid for a given tract. Joint bidding allows the smaller operator to tailor the size of his front-end commitment to his means. It allows him to spread uncertainty by bidding on a larger number of prospects. It allows a group to assemble sufficient capital to participate in the bidding for the most promising, and hence most valuable, leases.

The question is whether joint bidding increases or decreases the number of independent bids on the typical tract. It could do either, of course. Span and Erickson have recently tested several hypotheses concerning the competitive effects of joint bidding for outer continental shelf (OCS) oil and gas leases over the period 1954-1973, during which joint bids rose from about 10 percent to about 85

percent of bids cast.⁹ They found that (1) the average number of bidders per tract increased substantially over the period; (2) shares of the larger companies in leases acquired varied widely from sale to sale, contraindicating collusion designed to fix market shares; (3) the percentage of winning bids in joint ventures involving nonmajor companies substantially exceeded that involving major companies; (4) the percentage of winning groups containing no major companies increased significantly, while the percentage of winning groups containing only majors declined over the period; and (5) there were few cases of nearly identical bids, and in no such cases were groups involved containing major producers. The authors interpret these findings as supporting the view that joint bidding has increased, not decreased competition. We know of no conflicting findings by other students of the problem. Accordingly, we have reason to believe that joint bidding significantly reduces the disadvantages of bonus bidding.

The disadvantages are further reduced when bonus bidding is combined with a modest specified royalty, as is the present practice. A required royalty tends to shift some uncertainty from the lessee to the lessor. It reduces the associated lease bonus and lowers the barrier to entry by smaller firms. In these ways it tends to increase the capture of pure economic rent. In other ways it has contrary effects, however, as we shall discuss in our analysis of the question of royalty bidding.

For reasons just suggested, royalty bidding tends to reduce uncertainty borne by the lessee and otherwise facilitates entry and competition in comparison with bonus bidding. It has the major disadvantage, however, of adversely affecting the margin of development and production. Unlike a bonus, a royalty is a variable operating cost. The higher it is, the more likely it will result in some discoveries not being developed and in the early abandonment of all. This is because a royalty represents a negative cash flow in the evaluation of expected proceeds from development and production. The higher the royalty rate, the lower the present value of expected net cash flow, *cet. par.*; thus the fewer discoveries that can be economically developed, and the less complete the exhaustion of deposits when they can no longer sustain economical production.¹⁰

In defense of royalty bidding it may be argued (1) that the government has the authority under existing law to reduce royalty rates

9. Spann and Erickson, *Energy, Risk Sharing and Competition in Joint Ventures for Offshore Petroleum Exploration*, unpublished manuscript (1977).

10. Note that where there is salvageable equipment abandonment occurs when the present value of expected cash flow from operation falls below net salvage value.

that are too high to permit economical development and production of mineral deposits, and (2) that contractual rates established in royalty bidding are unlikely to be so high as to make early abandonment a problem.

With regard to the first point, if the government were to adjust freely royalty rates that turned out to be too high, then the competitive system of establishing the winning bidder would tend to break down. As a record of "appropriate" adjustments was established, prospective lessees would tend to bid higher and higher, regardless of their expected costs, and winners would not necessarily be the most efficient operators. Moreover, the government would have to go into the business of systematically measuring the costs of winning bidders, a task that would be costly and would invite charges of favoritism.

With regard to the second point, the winning royalty bids in the experimental oil and gas sale of October 1974 were quite high.¹¹ They ranged from a low of 51.8 percent to a high of 82.2 percent of the value of production. The bids by tract were consistent also with great bidder uncertainty. On the tract valued most highly by the Geological Survey the bids ranged from 0.5 percent to 82.2 percent. Such uncertainty is often likely to lead to bids so high as to make ultimate discoveries uneconomical to develop without readjustment by the lessor.

Profit share bidding is similar in effects to royalty bidding. It involves no front-end payment and it reduces the uncertainty borne by the lessee relative to the bonus bidding system. In the same relative sense it encourages entry and competition and avoids discrimination against small firms. In these respects it tends to result in the full capture of economic rent generated. But also like royalty bidding, it may preclude the development of socially economical discoveries, and it may lead to the premature abandonment of producing properties. With a profit share as a negative cash flow, fewer discoveries would be economical to develop than under bonus bidding; similarly, the present value of expected cash flow from continued operation of a producing property would sooner fall below the net salvage value of equipment than under a bonus bidding system.

The importance of these last effects would, of course, depend in part on the definition of profit employed in the profit share system. They are likely to be most adverse if the IRS definition of profit were employed, for a normal return on investment would in no way

11. OSC Sale No. 36. The results of the sale are given in *An Analysis of the Royalty Bidding Experiment in OSC Sale No. 36*, U.S. Department of the Interior (mimeo.) (1975).

be sheltered. They are likely to be least adverse if the British definition were employed. Under the British system, the lessor shares in gross revenue less operating costs, but only after the total capital investment times some factor greater than one has been recovered from operating profits. In any case, the early abandonment effect would be less severe than under royalty bidding, for a profit share acts rather like a diminishing royalty as depletion occurs and operating profits per unit decline.

Work commitment bidding, under which the bidder commits himself to a specified dollar value of exploration effort, could only lead to waste. With effective competition, bidders tend to bid away to the lessor all of the pure economic rent in a prospect. Pure economic rent, in turn, is a surplus of value over the labor and capital costs of efficient exploration, development and production. Consequently, on the typical prospect where there is such a surplus, winning bidders will tend to commit themselves to more than the efficient amount of exploration effort; that is, the amount such that marginal cost equals the marginal value of information acquired. Since operators must either spend their commitment or forfeit the unspent balance to the government, they are led to push exploration beyond the point where marginal cost equals marginal value of information.

All of the above considerations lead the present writer to conclude that the present system of bonus bidding, with joint bidding and sequential bidding allowed, and with a modest royalty of $1/8$ or $1/6$ specified, is preferable. Profit sharing, using the British definition of profit, is a close second best. Royalty bidding is next, and work commitment bidding least acceptable.

THE RATE OF LEASING

Aside from the strategy of reducing dependence on foreign sources of energy in the intermediate run, the present value of pure economic rent should be maximized by pushing the rate of leasing to the point where the marginal gain from earlier receipts equals the marginal loss from increased uncertainty and reduced competition. In practice such a rule would be imprecise, of course. Alternatively, consider the issue in this way: assuming the government has unduly restrained the rate of mineral leasing in the past, to what degree should the rate of offering lands for lease be accelerated? With regard to oil and gas leases on the OCS, we conclude that after a gradual transition period, during which plans are fully publicized, the final sustained rate should be that which exhausts leasable lands over a long enough period of time to justify increasing proportionately the

capacity in the affected industries. As for coal and oil shale leases on the public domain, we conclude that the rate of leasing should be governed by the number of and trend in nominations by extractor firms. Before giving our reasons for these conclusions, let us explain why sudden "dumping" of leases would be inappropriate.

If the government accelerated the leasing of mineral lands sharply and unexpectedly, we could expect several short-run effects that would tend to depress realized rents below the pure economic rent available. First, with additional lands to explore and develop, short-run marginal costs in the lessee industries and supply industries would tend to rise above long-run marginal costs. Second, except where an effective price floor exists, as in the case of oil, short-run demand inelasticities would tend to depress mineral prices with a faster growth of output.¹² Third, due to imperfect equity capital markets and the necessity of small firms to rely heavily upon internally generated equity capital, such firms might be unable to generate equity capital at a rate corresponding to the rate of leasing. As a result, competitiveness of bidding for leases would be lessened. Fourth, the mineral industries in question might be unable at first to perform desired predrilling exploration on all lands put up for lease. Consequently, uncertainty in bidding would be increased. Fifth, short primary lease terms might reduce the expected thoroughness of exploration, thus increasing uncertainty at the time of leasing. All of these considerations suggest a gradual build-up of the rate of leasing toward a new higher sustainable rate, with perhaps a transitional increase in primary lease terms.

Aside from the considerations just given, there are relatively few factors to hamper accelerated leasing of oil and gas lands on the OCS. Except along the interface with state lands, where oil and gas reservoirs may overlap the border, all the lands involved are federal lands; there is no checkerboarding with state or private lands, as is frequently encountered in the onshore public domain. There is no serious problem of competing or multiple uses of the lands, since shipping and fishing are scarcely impaired, if at all, by oil and gas operations. The price of oil cannot be depressed by accelerated leasing; additional production simply displaces imports at the going world price set by OPEC. The situation is similar in the case of gas. Additional production simply reduces shortages at the regulated price. The only significant impediment is environmental considera-

12. The demand for domestic oil is perfectly elastic at the OPEC price so long as some part of domestic consumption is supplied from foreign sources. It is unlikely, therefore, that accelerated leasing of oil lands would depress prices.

tions and resistance to leasing in new areas on these grounds. Subject to this restraint, the government has great freedom to determine rate of leasing.

The key to capturing a maximum of pure economic rent in the long run for the OCS is an increase in the capacity of the lessee and supply industries along with the increase in the rate of leasing. The industries affected would willingly increase capacity appropriately if the target rate of leasing were certain, and if that rate could be sustained long enough that a normal rate of return could be earned on the additional capacity without artificially depressing rents. Hence, we conclude that the target rate of leasing should be that rate which would exhaust leasable lands in such a period.

Accelerated leasing of coal lands in the public domain presents a number of problems not present in the case of OCS oil and gas lands. The federally owned lands are often checkerboarded with state or private lands; the willingness of potential lessees to bid for federal lands, and the size of their bids, may depend upon the ownership of or terms of securing extraction rights on adjacent nonfederal lands. This problem is intensified where the blocking up of an economical mining unit requires rights on both federal and adjacent nonfederal lands. The lands in question often have several alternative uses (e.g., forestry, grazing, recreation), not all of which would fit into a multiple-use plan that includes coal mining. In many cases the federal government has only mineral rights, having disposed of the surface rights to private interests. Where it is necessary to use or alter the surface in extracting coal, especially in the case of strip mining, the necessity to acquire surface rights separately from and in addition to sub-surface mineral rights may impede competitive bidding for the latter. Due to environmental restraints on coal use, bottlenecks in transportation, fixed investments in oil or gas burning equipment, the short-run price elasticity of demand for coal is low. Consequently, accelerated leasing of coal lands accompanied by similarly accelerated mining might unduly depress coal prices and rents. Finally, privately owned coal resources, in the East as well as the West where federally owned resources are concentrated, are relatively more abundant than privately owned oil and gas resources. Federal restraint in leasing need not "starve" the economy for coal.

All these considerations argue against the approach to accelerated leasing suggested for OCS oil and gas lands. Instead, we suggest a rate of leasing that (1) allows the coal mining industry to secure rights to federal coal deposits when the latter are richer (yield higher rents) than alternative state or private deposits; (2) entails no sacrifice of competition in the bidding for leases; and (3) reserves federal lands

for that use or combination of uses that promises the greatest present value of economic rent. The first condition would tend to assure efficient development and use of the nation's total coal resources: utilization of deposits in the order of their rent-yielding capacity. The second condition tends to assure receipt of fair market value for coal lands, while the third tends to assure that all federal lands are allocated to their most valuable uses.

To make such an approach operational, we believe the government should rely primarily upon nominations in selecting the lands for lease and choosing a rate of leasing. The more nominations for a particular tract, *cet. par.*, the more valuable the tract is likely to be, and the more competitive the prospective bidding. The more nominations for federal lands in the aggregate, *cet. par.*, the more attractive such lands would seem to be relative to alternative state or private lands. A trend of increasing nominations in the aggregate would suggest undue restraint in leasing; decreasing nominations would suggest the reverse.

Of course it is not necessary to offer for lease all lands nominated. Considerations of competition may suggest that only those tracts receiving, for example, three or more nominations should be offered for lease. Even if offered and bid upon, leases need not be granted when, in the judgment of lessor officials, bidding is not sufficiently competitive or the high bid falls substantially below independently estimated fair market value. (Note that it is usually easier for the government to determine fair market value in the case of coal than in the case of oil and gas.)

As with coal, we believe that the numbers and trend in nominations should guide the pace of future oil shale leasing. It is highly uncertain that the existing leases, resulting from the single 1974 sale, will lead to profitable production of shale oil in the near future. Given this uncertainty, it is doubtful that the government could secure as much present value of economic rent if new leases were offered "now," as if it waited until profitable production is demonstrated and the extractive industry shows renewed interest in the form of nominations. When given tracts receive a sufficient number of nominations to assure competition in bidding—for example, in the order of three or four, given the government's ability to make an independent determination of a fair market value reservation price—such tracts may be offered for lease without loss to the lessor. An upward trend in nominations, per tract and in the aggregate, may be taken as a signal to increase the rate of leasing. As with conventional oil, there is no danger of "unduly" decreasing the price of shale oil by too rapid leasing. Since shale oil is a close substitute for conven-

tional oil, its price is effectively set by OPEC, and additional domestic output would only displace imports.

ENVIRONMENTAL PROTECTION

The capture of pure economic rent through competition assumes an identity of private and social costs. This in turn implies that externalities in the form of environmental damage should be internalized. Otherwise, the rents received by the government would include an element which would be the equivalent of a tax on environmental amenities, and the government's leasing program would not maximize the value to society of the mineral resources.

The ideal way to internalize environmental externalities would be to levy fees corresponding to environmental damage at each level of output and allow mineral operators to choose that combination of prevention, correction or compensation which maximizes profits. This would assure efficiency of resource use in environmental protection while causing mineral prices to reflect full social costs. It is recognized that in some instances a second-best approach may be required. Without the knowledge that would allow us to equate marginal cost with marginal benefit, standards that are more or less arbitrary and that require preventive or corrective actions could be imposed.

CONSERVATION REGULATION IN OIL PRODUCTION

The fact that unregulated competition among multiple operators in a common oil reservoir leads to wasteful exploitation of the resource is familiar enough. It results from the rule of capture as the effective law of ownership, the ability to attract oil and gas across property lines by accelerating the rate of extraction on a given property, and the negative dependence of ultimate recovery on the overall rate of extraction. Almost as familiar is the standard remedy: regulatory restriction of the rate of extraction from an oil or gas reservoir to the "maximum efficient rate," or MER. In current OCS regulations MER is defined as "the maximum sustainable daily oil or gas withdrawal rate from a reservoir which will permit economic development and depletion of that reservoir without detriment to ultimate recovery."¹³ This has been officially interpreted to mean the rate of withdrawal that maximizes ultimate recovery, subject to an acceptable rate of return on the total investment.¹⁴

13. Geological Survey, Conservation Division, Gulf of Mexico Area, *OCS Order No. 11* at 2.

14. *Petroleum Industry*, hearings before the Subcommittee on Antitrust and Monopoly, Senate Committee on the Judiciary, 94th Cong., 1st Sess. 75-78 (1975) (statement of Jack W. Carlson).

While this definition is distinctly superior to that typically employed by state conservation authorities, which runs in terms of maximizing ultimate recovery without reference to economics, its application in practice does not assure that operators would be able to maximize the value of the resource in question and thus maximize pure economic rent. To do this, operators should be permitted to increase the rate of withdrawal from a reservoir to the point where incremental value is zero, that is, where the rate of return on the *incremental* outlay is just acceptable, regardless of the possible loss of ultimate recovery and regardless of the overall rate of return. Redefinition of MER as the *optimum* rate of withdrawal, or that which maximizes the value of the reservoir, would further the objective of maximizing the economic rent generated and, being anticipated, bid by prospective lessees for federal leases.

But if this principle is recognized, there is a superior alternative to regulation based on redefined MER. That alternative is compulsory unitization of oil and gas reservoirs, with operator freedom as to the rate of extraction. If left free, operators would choose that extraction rate and associated investment which promised to maximize the value of the reservoir. Since under unitization their costs would coincide with social costs, they would in their own interest tend to maximize the value of the resource to society and hence maximize pure economic rent. Anticipating freedom to maximize value, prospective lessees would tend to bid away the available pure economic rent in competitive bidding. Thus the objective of maximizing the capture of pure economic rent would be served by requiring all reservoirs on federal lands to be unitized, and by giving operators in each reservoir freedom to select the extraction rate. No new legislation is required; the federal authorities have the power under existing law to compel reservoir unitization of federal leases.^{1 5}

SUMMARY

In summary, we submit that the federal objective in mineral leasing should be to capture a maximum of the present value of pure economic rent. This objective would best be served by sealed bidding in competition for leases; by granting leases on the basis of bonus bidding, with joint and sequential bidding allowed, and with provision for a modest royalty; by offering leases on the OCS at the highest rate sustainable for a period long enough to induce a corresponding capacity in the affected industries; by offering leases on the public domain in response to nominations; by internalizing the costs

15. 30 U.S.C. § 226(j) (1976) and 43 U.S.C. § 1334(a)(1) (Supp. V. 1975).

of environmental damage, preferably by means of taxes that measure damage; and by compelling the unitization of all oil and gas reservoirs discovered on federal lands, while granting operators freedom to select the rate of extraction.