

## APPENDIX 3

AN ECONOMIC ANALYSIS OF ALTERNATIVE  
OUTER CONTINENTAL SHELF PETROLEUM LEASING POLICIES

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V. Exploration Externalities and Risk Reduction

The previous sections have *emphasized that* risk characterises and dominates many of the problems associated with OCS leasing policy. This section addresses why risk reduction through exploration tends to be suboptimal under current leasing policy and investigates alternative approaches for minimizing this problem.

The federal government could more efficiently plan overall the scheduling of energy leases if the production potential of the OCS were better known. The development of environmental safeguard production constraints could be more easily planned if the type and likelihood of environmental hazards were known for unleased areas of the OCS. Petroleum firms could bid more competitively for petroleum leases if the uncertainties associated with drilling costs and payoff could be reduced. To the extent that risk can be reduced by the collection of information through exploration, the severity of these general problems and the need for complex leasing strategies are decreased.

While the GS performs basic geological research on the OCS, nearly all geological and geophysical exploration, which is specifically directed toward petroleum discovery, is initiated and carried out by the petroleum industry. Unfortunately, due to the difficulty of maintaining proprietary rights to and hence control of information firms in a competitive system tend to invest suboptimally in and prefer to delay exploration. The returns to exploration are lower to an individual firm than to society because a firm is unable to capture all of the gains from exploration information. The firm that drills the first exploratory well in a new area of the OCS inadvertently provides

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 1/ The GS is now contributing to the expenses and sharing raw data for many OCS exploration programs but is still taking little or no part in the initiation and direction of the exploration effort. In addition, the GS has insufficient funds to adequately process and interpret the data available.

some information for all firms on surrounding tracts. If the first firm could charge the others for this information it would invest optimally in exploration. But once the information is sold to a second firm, the second firm can pass it on to others at a reduced rate every firm hopes some other firm will be the second firm, and the first firm knows this, the initial sale is rare. In the meantime geological and discovery information is leaking to others through employees and subcontractors individual firm, knowing that it will not capture all of the gains from exploration, will invest in exploration until the incremental gains to the firm alone equal the incremental cost.

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costs of the exploratory drilling are uncertain. Confronted with these uncertainties, a risk averse firm will invest less in exploration than it would if its expected returns could be realized with certainty, the appropriate Criterion for a risk neutral society.

The problem is even more complex in that each firm is also uncertain as to when its neighboring firm will explore and provide information of external benefits for the firm. Such information can change the firm's own exploration plans and reduce its costs. Hence, each firm will tend to postpone exploration in order to increase the likelihood that it will benefit from exploration in surrounding areas. Hence firms will tend not only to underinvest but also to delay investing. Given the combination of uncertainties and the externality problem, industry exploration behavior has been difficult to predict. Clearly, the tendency to both underinvest in and delay exploration provides substantial justification for diligence requirements under the present leasing

system. The expending for tax purposes of exploration cost., especially geophysical and wildcat drilling costs, may also be justified by the existence of information externalities.

Directed efforts during the past few years toward a national energy policy have made clear the OCS exploration benefits more than the petroleum firm involved on the OCS. Exploration reduces the uncertainty about the production potential of the OCS and thereby enables energy policy-makers to direct energy R&D and energy leasing programs more effectively. As uncertainty is reduced, diversity and flexibility in other energy technologies become less necessary, and real savings in research manpower, labor, and materials can be attained.

From the petroleum industry's point of view, this reduction in the uncertainty of future energy supply amounts to a reduction in future price uncertainty. Such a reduction increases the efficiency of the industry and reduces the problem discussed in the previous section with respect to the divergence between the optimal private and social response to risk. In addition, environmental management can be improved with better information. Currently, major leasing commitments are being made before sufficient information has been acquired to weigh material benefits against environmental costs. Industry exploration thus confers an external benefit on society as a whole. Since private firms receive no revenues for providing this service, they do not consider this external benefit in their exploration planning. In turn provides an additional incentive to underinvest in exploration.

The current approach to OCS leasing leaves no opportunity for the federal government to increase exploratory activity in order to reduce the range of estimates of OCS production potential--without simultaneously increasing production from the OCS soon after. Exploration is closely tied to development and production. While some geophysical exploration occurs prior to

the announcement of the BLM's intention to lease an area several years in the future, most geophysical work occurs after such an announcement. Except for rare exceptions, exploratory drilling--the only way to discover if oil is really there--does not occur until after the lease sale. Diligence requirements force the lessee to initiate drilling within five years of the sale. If oil is discovered, the firm has a tremendous incentive to develop and extract the resource in order to start earning a return on its leases bonus and exploration capital. As a result, the BLM's announcement of intention to lease an area stimulates exploration because of the firm's interest in production profits. This link grows stronger as the firm sinks capital into geophysical exploration, lease bonus payments, exploratory wells and production platforms, development wells, and transport facilities.

Several changes in leasing policy have been advocated to increase exploration externalities and reduce risk. These include (1) larger tracts, (2) large exploration leases with smaller development selection rights, (3) checkerboard leasing, (4) increased financial incentives to explore, and (5) contract exploration. Each of these proposals would presumably involve exploration stipulations, i.e., clauses in a contract between government and industry, which specify minimum exploration performance and reporting of findings, in order to improve performance. But the mature and relative importance of stipulations vary considerably between the approaches. An approximation of each of these proposals and of some of their advantages and disadvantages follows.

#### 1. Larger Tracts

The OCS Act limits tract size to a maximum of 5,760 acres, an area of 9 square miles. Lease tracts typically have been this maximum or 5,000 acres. Occasionally, tracts of about one-half and one-fourth this size have been offered.

Larger tracts, perhaps in the 20-50 square mile range, would increase the probability that oil discovered by the lessee would largely be contained within its tract rather than on an adjoining lease. The likelihood that the lessee would confer external benefits on a neighbor is reduced. The increased returns to exploration would induce increased investment and reduce delays in exploration.

A. Advantages

- (1) Exploration would approach the private optimum as tract size increases. This would lead to increased government revenues (but see B.2).

B. Disadvantages

- (1) This approach, in itself, is insufficient to induce socially optimal exploration behavior, i.e., the provision of information which can assist energy and environmental policy-makers at the appropriate time
- (2) As tract size increases, competition would decrease since smaller firms would not be able to meet the capital requirements necessary to explore and develop larger tracts. Joint bidding would become more common. Government revenues would tend to be less with less competition.

2. Large Exploration Leases with Development Selection Rights

several countries including Canada have leased tracts of hundreds or thousands of square miles for exploration and then allowed the lessee to select a portion of this area for development. The remaining acreage with exploration information is relinquished to the government which then leases the land again.

for further exploration and development selection or in smaller tract. directly for development. Typically, large firms, which are capable of bearing risk and which have sufficient capital to carry out exploration, win the first round; they pay nominal sums to the government per acre explored and amounts per acre selected for development. In effect, the government pays for the initial broad exploration out of revenues it could have received from the first development tract if its existence had been known and it had been leased directly. In subsequent lease sales on the relinquished tracts, medium and small firms compete. Government revenues per acre are higher because of the exploration information and reduced risk.

A. Advantage

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- (1) By leasing large acreages, broad-scale exploration, which could generate information suitable for energy and environmental policymakers, can be generated at an appropriate time.
- (2) Except for the initial leasee's right to develop a portion of the exploration lease, this approach separates exploration from production.
- (3) Competition and opportunities for smaller firms are increased in subsequent sales on relinquished tracts.

B. Disadvantages

- (1) The approach depends on the existence of very large firms or joint ventures to undertake the first exploratory lease with development selection rights. Competition for and government revenues from this sale are thus likely to be low.
- (2) Exploration stipulations are necessary to induce the initial lease to explore the entire tract optimally rather than follow a strategy which most efficiently determine

the best parcel for it to select for development. These stipulations will entail administrative and enforcement costs to the government.

- (3) The initial lease bears the risk burden that the development parcel it selects will have insufficient production capacity to support storage and transport facilities and that the government will not lease additional acreage in the vicinity for many years in the future. This problem will tend to reduce total government revenues.

### 3. Checkboard Leasing

The government of Alberta has experimented with checkerboard leasing. In this approach every other tract is leased in an initial sale, and the remaining tracts are leased as information accumulates from the initial tracts.

#### A. Advantages

- (1) Risk is reduced in subsequent lease sales leading to increased competition for and government revenues from these tracts.
- (2) The area of the OCS, on which socially valuable information could be gathered, could effectively be doubled for a few years. Since exploration is still tied to development and production and optimal production cannot occur with "checkerboard development," this doubling effect cannot be extrapolated.

B. Disadvantages

- (1) **Risk to initial lessees is greater** than with the current approach since the length of delay before subsequent sale, making development of a petroleum deposit possible, probably could not be specified by the government.
- (2) **Exploration stipulations would be essential since this approach assures that the initial leasee will confer external information benefits on his neighbors but not vice versa.**
- (3) **Except for the small effect noted in .A(2), this approach does not open up possibilities for exploration which would substantially assist energy and environmental policy-makers.**

4. Increased Financial Incentives to Explore

Nearly all exploration costs are now treated as current expenses rather than as capital investments for income tax purposes. Exploration expensing can be thought of as an existing subsidy to exploration. Whether this tax advantage is sufficient to induce the optimum private level of exploration depends on the particular situation and the leasing strategy. Since research and development expenditures on competing and potential energy technologies are also expensed, it is unclear whether exploration expensing should be thought of as a subsidy to compensate for externalities. In any case further "special" tax treatment--for example, exploration tax credits--could be utilized to induce exploration toward the private optimum. Such an approach in itself appears to be a poor way to encourage exploration which would be of value to energy and environmental policy-makers.

Another approach would be for the GS substantially to increase its level of participation in the broad "group shoot" geophysical exploration programs in new areas of the OCS now initiated by private firms and jointly financed by up to 20 companies. If GS financed 50 percent rather than its current level of about 5 percent of the costs of this geophysical exploration, Industry might be interested in exploring area in greater detail. This could provide policy-makers with somewhat better information through more exploratory drilling is really what is needed. Industry's interest in stepping up geophysical exploration would depend on how information was shared between government, participating firm, and the industry as a whole.

Clearly, other financial incentive schemes to increase exploration can be envisaged including subsidy payments and federal purchasing of exploration information. These approaches quickly make complex contractual and enforcement arrangements between industry and government. If high contractual and enforcement costs are acceptable, than contract exploration in which the government initiates exploration according to its needs appears to be a superior alternative.

##### **5. Contract Exploration**

Contract exploration is appropriately receiving increasing attention. In this approach the government would contract with and pay "the Lowest bidder" for OCS exploration work. The area to be explored, level of exploration, collection of environmental information, and time period would be stipulated in a contract. Exploration firms and petroleum companies would submit bids. The government would award the contract to the firm with the lowest bid among those firms who "qualified." This approach represents a complete separation between exploration and development.

A. Advantages

- (1) Government would have the greatest ability to direct exploration in those areas and in a manner most suitable to energy and environmental policy needs and thereby improve subsequent decisions on energy R&D and leasing over time.
- (2) Risk in subsequent lease sales could be reduced to almost any level desired by more intensive exploration, thereby increasing competition and government revenues and substantially reducing the need for complex risk sharing leasing strategies on development leases.
- (3) Environmental data collection could be more easily integrated in this approach than in the next best alternative.

B. Disadvantages

- (1) Exploration costs, especially exploratory drilling costs, are highly variable. In the process of exploring, information is acquired which suggests how further exploration should be carried out. Optimum exploration cannot be specified in advance. If bidding were on a fixed cost basis, the bidder would confront tremendous risks or explore suboptimally. The winner of a cost plus bid is not necessarily the most efficient. Mixed bidding schemes would be costly to administer. Negotiated leases increase the possibilities for favoritism and corruption.

- (2) In the absence of profit-maximizing signals, may not fight exploration dimensions of importance to petroleum production as contrasted with those which assist energy policy making. This would result in a loss of revenues from development leasing, but this loss would not necessarily change exploration contractual terms.

#### Summary and Recommendations

Risk, and thereby many problems of OCS leasing, can be reduced through the collection and utilization of more information on the petroleum production potential of the OCS. In addition, overall energy and environmental policy can be substantially improved with better information. Unfortunately, information is difficult to "own," difficult to define, and the costs of acquiring the "appropriate amount" cannot be assessed in advance. These characteristics are inherent. They do not appear to stem from or be associated with other factors which can be varied through leasing policy. Given information needs, one strategy seems to interface with these characteristics better than others. Contract exploration produces the desired public benefits from information directly. Its disadvantages are great and obvious, simply because the inherent characteristics of information are confronted directly. Other approaches obscure the inherent problem through circumvention. Inefficiencies, resulting from indirect or a poor interface, have been noted. In the analysis no situations have arisen in which the inherent problem has been alleviated by complex strategies. Serious consideration should therefore be given to contract exploration, perhaps even direct government exploration, for the purposes of better assessing the resource potential of the OCS and of identifying those which it would be desirable to encourage more intensive exploration by industry leading to development and production.