The value of an oil lease depends upon the profits that can be made from producing any petroleum that may be discovered thereon. The fundamental problem of managing the private development of public lands is to determine how these profits, if any, are to be shared between public landowner and private developer. In making this determination, Alaska has an interest in obtaining the highest possible returns from publicly owned oil lands.

It is not always easy to know what means can best assure this. In petroleum development, the profits expected from production can only be estimated. Since these estimates are subject to adjustment as production proceeds, the ideal petroleum policy would provide for continuing incorporation of new information and a self-correcting system of profit assessment.

Alaska's present petroleum development policy, enacted in 1959, though certainly not ideal, does rely on just such a system, the market, to determine the price of competitive petroleum leases.
Competitive and Non-Competitive Leasing

Of all objections advanced to Alaska's present leasing policy, the most fundamental comes from those who object to the use of the market system, i.e., competitive bidding, as a means of transferring petroleum leases into the hands of private developers. This issue came to a head in 1969 when the Commissioner of Natural Resources reclassified as "competitive" most of the state-selected land south of the Prudhoe Bay oil discovery on Alaska's North Slope. Technically, these lands were frozen in federal ownership because of the Native land claims, but they had been selected by the state prior to (and soon after) the Prudhoe Bay discovery. Despite the fact that these lands were likely to pass immediately into either state or Native ownership on resolution of the land claims, private individuals, sensing speculative gain possibilities, submitted lease applications at the Fairbanks office of the Bureau of Land Management under the federal non-competitive leasing laws. Such offers, however, were not acted on by the Bureau, but simply were kept on file pending resolution of the land claims. What Commissioner Kelly's action essentially did was to wipe out any hope of speculative gain from such offers. Contrary to popular belief, the only loss of private investment to the government was the $10.00 filing fees paid on each 2,560 acre parcel. (See Note No. 1.)

In arguing against the commissioner's action, speculators posed the issue of competitive versus non-competitive leasing as one of large versus small enterprise. They argued that the independent oil producer—the little guy—would be effectively denied the opportunity to participate in the development of Alaska's petroleum resources if competitive leasing was allowed. Presumably, the acquisition of such leases would require larger sums of money than such independents could possibly raise. The smaller firms, it was contended, have a right to continued existence, which right would be extinguished by the commissioner's actions. It was also argued that dominance of Alaska's petroleum industry by the major oil companies would result in their eventually "owning" Alaska, an eventuality that could be precluded by the nurturing of a healthy group of smaller companies through non-competitive leasing.

Alaska's Petroleum Leasing Policy

While there may be an element of truth in these arguments, they would never have been seriously proposed in regard to the public interest had it not been for the substantial private interest at stake. Despite the efforts of these private interests in the political sphere, it seems clear that the State of Alaska is firmly committed to a petroleum development policy that has as its objective the maximization of public revenue. The transfer of any substantial interests to the hands of private developers on either a first-come, first-served basis or by lottery, the two means by which non-competitive leasing could be implemented, runs counter to such a policy.

Legislation and Administration

The legislation embodying Alaska's present oil land policy was closely modeled after federal leasing laws on the assumption that industry's familiarity with these would render it acceptable. In framing Alaska's petroleum law in 1959, the lawmakers were conscious of the fact that Alaska had but one producing oil field, and that not even located on state land. The state was faced with the specter of a serious financial crisis in the immediate future. Many felt then that the only way to avoid such a crisis, and indeed the key to the state's financial security, would be the rapid exploration of the state's several petroleum provinces, and the development of the resources that it was hoped existed there. They argued, correctly it would seem, that the state had little to lose by offering private developers a fairly large share of the fruits of the development of these publicly owned resources. (See Note No. 2.)

Most criticism has not been levied against the general laws under which Alaska's petroleum lands are leased and developed, but rather the methods by which the commissioners of natural resources have chosen to implement those laws. In addition to determining how Alaska's petroleum lands will be leased, i.e., whether competitively or non-competitively, the commissioner, acting for the administration, has almost complete authority to determine which lands shall be made available for competitive leasing, and the rate at which they will be leased. Both the Egan administration and the
Hickel-Miller administration have been criticized, the former, for moving ahead too slowly with their leasing arrangements, the latter for moving too quickly.

Petroleum Lease Market

In determining policy with regard to the rate at which prospective petroleum lands are leased, Alaska's natural resource administrators have had to take account of the market in which they were attempting to operate. This market is one in which Alaska enters as a seller, competing to various degrees with our own federal government, the Canadian federal and provincial governments, other states of the United States, and other foreign governments, in roughly that order of importance. The buyers in this market are all those who wish to purchase the right to explore and develop the petroleum resources that may be discovered on lands that, although presently non-productive, hold promise of such production. By far the greatest part of this demand is generated by the world's thirty or so fully integrated petroleum companies.

Alaska's petroleum policy makers are likely to be influenced in the future, as in the past, by conditions in this market. Of particular concern to Alaska over the past decade has been the federal government's policy of leasing offshore petroleum lands. A conscious attempt has been made to program Alaska's lease sales so as to compete as little as possible with the comparatively far more valuable offshore lease offerings. Fortunately for Alaska, the federal government during this period has been conscious of its dominance of the market for prospective petroleum lands in the United States. In an apparent attempt to maximize revenue, the federal Bureau of Land Management has leased its offshore lands at a relatively slow rate so as not to spoil its own market. This has had the effect of keeping prices for prospective petroleum lands at a high level and consequently increasing the bids oil firms were willing to submit on Alaskan land. Prior to Alaska's $900 million dollar sale in late 1969, Alaska was a very small operator. This can be seen by comparing the total of $97.6 million Alaska received in all 22 competitive sales through 1969 (see Table 1) with the more than $600 million realized by the federal government in its single lease sale in the Santa Barbara Channel in 1967.

<table>
<thead>
<tr>
<th>Sale No. and Date</th>
<th>Acres Leased</th>
<th>$/Acre</th>
<th>Bonus Received</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dec. 10, 1959</td>
<td>77,191</td>
<td>$52</td>
<td>$4,020,342</td>
</tr>
<tr>
<td>5. May 23, 1961</td>
<td>95,670</td>
<td>75</td>
<td>7,170,465</td>
</tr>
<tr>
<td>6. Aug. 4, 1961</td>
<td>13,257</td>
<td>8</td>
<td>110,672</td>
</tr>
<tr>
<td>8. April 24, 1962</td>
<td>1,062</td>
<td>5</td>
<td>5,997</td>
</tr>
<tr>
<td>10. May 8, 1963</td>
<td>141,491</td>
<td>29</td>
<td>4,136,225</td>
</tr>
<tr>
<td>11. Cancelled</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. July 15, 1965</td>
<td>403,000</td>
<td>15</td>
<td>6,145,473</td>
</tr>
<tr>
<td>15. Sept. 28, 1965</td>
<td>301,751</td>
<td>15</td>
<td>4,674,344</td>
</tr>
<tr>
<td>17. Nov. 22, 1966</td>
<td>18,590</td>
<td>7</td>
<td>136,280</td>
</tr>
<tr>
<td>19. Mar. 29, 1967</td>
<td>2,560</td>
<td>1</td>
<td>517</td>
</tr>
<tr>
<td>22. Oct. 29, 1968*</td>
<td>60,272</td>
<td>7</td>
<td>1,042,220</td>
</tr>
</tbody>
</table>

**TOTALS & AVERAGE** 3,586,588 $ 278(Av.) $997,817,985

*Competitive sale bonus received included 1/3 bonus from forfeited leases.
Source: Alaska State Department of Natural Resources, Division of Lands.

Timing Lease Sales

Alaska's resource administrators have had to weigh carefully the effects produced by leasing practices on potential revenue. Alaska's need for immediate revenue and economic development argued for placing large amounts of land on the market as quickly as possible. Another consideration was the effect of leasing in stimulating economic development. Some argued the state would develop more quickly if much land was leased. Immediate sales would encourage exploration and increase the likelihood of successful oil discoveries. Yet, such success, if it came, would undoubtedly increase the value of adjacent leased lands by many fold. Thus, the leaseholders rather than the state would gain.
Others insisted that most of the land be held until a higher lease revenue could be anticipated. Proponents of the latter view cite the experience of the Tyonek Indians, who originally had offered their land at a competitive auction that brought high bids of less than $1 million. These bids were rejected, and sometime later the lands were again put up for sale and brought several times that amount as a consequence of nearby petroleum discoveries. If the state leased only a very limited amount of land of high potential, therefore, it would be in the hope that an oil discovery would spark a land rush. If this occurred, the profits from the increased value of the adjacent leased land would accrue to the state rather than to some private leaseholder.

The state has generally followed a middle course. Beyond a certain point, offering additional acreage does not significantly increase the probability of discovery as there are obvious limitations on oil companies’ exploration budgets. The most likely and first leased prospects will be drilled regardless of the total available acreage.

**Spoiling the Market**

Since the discovery of the tremendous reserves on Alaska’s North Slope, Alaska’s relationship to world markets has become far more complicated. Alaska is no longer considered a small operator. For instance, the more than $900 million spent by the oil industry on acquiring North Slope leases in 1969 is more than 50 per cent of the total expenditures of the U.S. oil industry on acquiring such rights in the United States during 1968. It must be an even higher percentage of the 1969 expenditures. Indeed, the $900 million spent in Alaska in 1969 is better than 10 per cent of all capital expenditures of the United States oil industry in 1968.

Thus, Alaska can no longer afford to ignore the effects that its own leasing policies have on the market. In disposing of petroleum lands, Alaska faces competition from only two other significant sellers—the Canadian and U.S. federal governments. In 1969, at least, Alaska dominated this market.

**Alaska’s Petroleum Leasing Policy**

This dominance is significant for Alaska’s leasing policy in several ways. First of all, now Alaska can clearly spoil its own market by disposing of too much land too rapidly. On the other hand, leasing at too slow a rate may provide an opportunity for Alaska’s competitors—particularly the Canadians—to recapture some of the initiative that they lost subsequent to the Prudhoe Bay discovery. Recent discoveries in northwestern Canada and the subsequent increase in oil industry geophysical activity there indicate that this is happening now. These events tend to support the position of Alaska’s Commissioner of Natural Resources, Thomas Kelly, who argued against postponement of the 1969 lease sale. Kelly thought that postponement might permit Alaska’s competitors an opportunity to draw bid money away.

**Corridor Leasing**

Some critics of Alaska’s petroleum administration, while not specifically objecting to the rate at which lands were leased, suggest that the state’s interests would be better served by some form of “checkerboarding” or corridor leasing. In effect, such plans would require the state to reserve unto itself every other acre or tract of land in an area leased. For every tract that would be made available for private development, another equal and usually contiguous tract would be reserved to the state. This practice originated in Texas and has been followed in Alberta and elsewhere. The Canadian experience with corridor leasing has generally been a favorable one (see Table 2), and Canadian visitors have often urged Alaska to adopt a similar policy. (See Note No. 3.)

<table>
<thead>
<tr>
<th>TABLE 2</th>
<th>Petroleum Revenues in Alberta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue Source</td>
<td></td>
</tr>
<tr>
<td>Royalties &amp; Fees</td>
<td>38.5</td>
</tr>
<tr>
<td>Royalties</td>
<td>56.5</td>
</tr>
<tr>
<td>Bonus Bids</td>
<td>53.0</td>
</tr>
<tr>
<td>TOTALS*</td>
<td>148.0</td>
</tr>
</tbody>
</table>

Source: 19th Annual report of the Alberta Department of Mines and Minerals.
Almost all industry representatives, on the other hand, particularly those from larger companies, are vehemently opposed to such schemes. They contend that this pattern would seriously reduce their companies' interest in exploration in Alaska, where one of the prime attractions has been the ability to combine a large group of tracts to assure that any oil discovered will be within the confines of the discovering company's leaseholds. Their contention has some weight. Yet, losses resulting from this reduced interest might be compensated for by the increased revenue derived from the subsequent leasing of the reserved parcels. Naturally, the value of the reserved parcels would be affected by their proximity to either productive acreage or dry wells.

Although oil companies have been allowed to acquire fairly large contiguous tracts, the state has, in many cases, reserved itself large areas of land adjacent to these tracts. Figure 1, showing the North Slope lands leased in the 14th, 18th, and 23rd competitive sales (including lands in the area of Prudhoe Bay), demonstrates how this policy has worked. This same figure and Table 3 show the many thousandfold increase in land values that can result from a discovery. Of course, it is possible that under a checkerboarding system the Prudhoe Bay discovery would not have been made, for lack of oil company interest.

**TABLE 3**

<table>
<thead>
<tr>
<th>Date of Sale</th>
<th>Acres Leased</th>
<th>$/Acre*</th>
<th>Bonus Received</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec. 9, 1964</td>
<td>466,180</td>
<td>9</td>
<td>$4,375,523</td>
</tr>
<tr>
<td>July 15, 1965</td>
<td>403,000</td>
<td>15</td>
<td>6,145,473</td>
</tr>
<tr>
<td>Jan. 24, 1967</td>
<td>37,662</td>
<td>39</td>
<td>1,469,645</td>
</tr>
<tr>
<td>Sept. 10, 1969</td>
<td>412,548</td>
<td>2,182</td>
<td>900,218,590</td>
</tr>
<tr>
<td>TOTALS &amp; AVERAGE</td>
<td>1,319,390</td>
<td>$691 (Av.)</td>
<td>$972,210,231</td>
</tr>
</tbody>
</table>

* Rounded to nearest dollar.  
Source: Alaska State Department of Natural Resources, Division of Lands.

Even though strip leasing may reduce incentives, many economists believe it is the optimum means by which the state can assess and take its share of the oil profits. The system does tend to compensate for the defects inherent both in systems of early payment for exploration rights and those of deferred payment.
Taxation and Import Quotas

Another matter of concern to Alaska's petroleum policy makers and to the entire world petroleum industry is the future direction of the United States policy with regard to taxation and import quotas. Changes unfavorable to the domestic oil industry, like a further reduction in the depletion allowance or a reduction in the restrictions to the free flow of foreign oil into North America, would depress prices for subsequent production from Alaska's oil fields. This would, in turn, lower the prices that oil firms would be willing to pay for Alaskan land. If an oil policy maker in Alaska sensed that these changes were coming, he would rapidly lease as much land as possible prior to the recognition of such changes by the oil industry.

Severance Taxes and Royalties: Resource Allocation

Great debate rages over Alaska's legislative policy regarding severance taxes and royalties. Both these provisions are devices for delaying the determination of the state's share of the profits until it is produced. Such delay can be advantageous to both parties, but the severance tax and the royalty provision are imperfect devices for determining the amount of "economic rent" due to the state. This rent is the residual that is left over after all the costs of production have been deducted from the market value of the crude oil. If the state wished to maximize the long-run returns from the exploitation of its publicly owned resources, it would be advantageous to collect from the oil companies no more and no less than this residual. Setting the charges too low is obviously undesirable. But if oil companies find that they are not able to meet their expenses of exploitation and production as a consequence of excessive rental charges, then they will search for oil elsewhere.

If every barrel of oil cost every operator exactly the same amount to find and produce, then the severance tax and royalty provisions would be appropriate methods for determining the economic rent due and available to the state. Unfortunately, this is far from the case. Costs of production in the state's known Cook Inlet oil fields vary from somewhere in the neighborhood of 25 cents per barrel up to about $3.00 per barrel. Consequently, severance taxes and royalties are inefficient in that they overcharge some producers and undercharge others.

The Premature Shutdown Effect

When the landowner's royalty take, as a percentage of the gross income of the producer, is much less than the producer's profits, due to very low per barrel cost of exploration, development, and production, the losses to the landowner are obvious. What is less generally realized, however, is that the landowner will also lose when his total percentage recoveries from royalties are greater than the net profits available to the producer. At the date when the total costs of production, plus royalty payment, exceed the value of the crude oil, the private operator will shut down his operations and stop paying royalties altogether. Under such circumstances the landowner will be losing potential revenue. Had the royalty been reduced, production would continue and the landowner would have continued to receive some return that would have otherwise been lost. Rigidity in royalty or severance tax rates calculated as a fixed percentage of the gross value of production results in losses not only to the landowner but also to society. This is true because the real cost in labor and materials of continuing production will still be less than the real value of the oil produced. (See Figure 2.)

It can be argued that the premature shutdown effect is not much of a problem in Alaska because of the very high productivities and low per barrel cost of Alaskan oil. Even the most expensive fields in the Cook Inlet Basin are worth keeping in operation for another few years at the present rate of tax and royalty. In the more highly productive fields in northern Alaska, it would be at least a generation before the present levies could force one of the field's operators to shut off production. Nevertheless, the time will come when any system relating Alaska's revenue to gross production will be detrimental to the state.
Most of the controversy over severance taxes and royalties focuses on profit allocation. Clearly, the higher the severance tax rate or royalty, the greater the share of the profits that is likely to be taken by the state. Yet, royalties and severance tax differ in a very important respect. Royalties are a matter of contract between the state, acting as a landowner, and the private developer. This contract is enforceable in the courts, and the state has no special rights or privileges under the contract that a private landowner would not have under the same circumstances. As specified in the lease document, the royalty rate is fixed for the life of the lease and can be changed only by mutual consent. In a sense, then, the oil companies know what they are getting into with regard to royalties. No matter how high or low the royalty, the oil companies will at least theoretically take it into account when calculating their bonus bids. Any leases which specify a very high royalty rate would elicit relatively low bids; leases on equally favorable land with low royalty rates would bring forth much higher bids, assuming a competitive market.

Economists differ in evaluating the efficiency of royalties. While it is widely acknowledged that higher royalties will mean lower bonus bids, there is no way of predicting confidently how much lower those bonuses will be, or whether the amount lost in bonuses will be more than made up for in future royalties.

Part of this confusion arises because the bidder and the offerer may be using different discount rates in measuring the time value of money. The discount rate is essentially an expression of the fact that a dollar today is worth more than a dollar tomorrow, the rate being an indicator of how much more that dollar is worth today.

If the bidder uses a lower discount rate than the lessor, then both parties may find it advantageous to eliminate the royalty completely, with the landowner’s share of the profits thus determined entirely by the bonus bid. The landowner may feel that he can “invest” the value of the lease, which he receives as a bonus
bid, and earn a higher rate on that investment than the bidder himself believes that he could earn.

The converse is also true. If the oil company has a time value of money higher than that of the landowner, in theory at least, it will be to the advantage of both parties to eliminate the bonus bid entirely, with the landowner collecting his share of the profits only after production is under way.

Economists are not in clear agreement about the discount rates that a government such as the State of Alaska should use in evaluating the economic development of its natural resources. While this point may seem somewhat obscure, it is undoubtedly a matter of great relevance to the proper evaluation of Alaska’s petroleum policies, and is one that depends as much upon political and social outlooks as upon technical sophistication in economics. Individuals who believe in a high social discount rate (and, by implication, in a relatively low royalty) are those who believe that the state should divert a greater proportion of its total wealth towards spending in the public sector. In a sense, such individuals thereby indicate that they believe “investments” in the public sector can generally be expected to earn more than those in the private sector.

Unfortunately, a problem arises in doing away with the royalty completely. Oil developers may systematically underestimate the value of the lands that they are trying to obtain, or they may have to reduce its value because of the risk of total failure. Royalty provisions in Alaska’s leases clearly provide a way to remedy possible underestimation and the consequent loss of revenue.

The Speculator Problem

Complete reliance on royalties or any other system of deferred profit evaluation creates the problem of speculative bidding. Since payments to the landowners depend upon actual production, the state is left with no satisfactory means of determining who should obtain the lease. Schemes such as royalty bidding or bidding on net

profit percentages have been proposed as a way around this difficulty, but they do not provide a completely satisfactory solution.

Of course, royalty bidding raises the specter of premature shutdown, but both net profits bidding, which avoids this difficulty, and royalty bidding effectively make it possible for anyone, no matter how qualified or how serious, to bid upon the lease. Because no actual expenditure of resources is required to gain control of the leasehold, such situations will attract speculators who do not have the ability to undertake actual exploration investment and may result in a very low rate of development. The percentage rates, whether they be of profits or gross production, will be bid up to very high levels. At such high levels, few if any developers will find it profitable to explore. The speculators themselves, of course, will have lost nothing.

All in all, it is probable that neither the elimination of bonuses in favor of deferred forms of payment nor the complete reliance on bonus bids to the exclusion of deferred forms constitutes an appropriate policy for disposing of the public’s petroleum resources. Whatever criticisms may be directed against Alaska’s present leasing policy, it is clear that any modification of it will still combine both methods of payment.

Severance Tax

Most Alaskans are less concerned with methods of profit calculation and the time of payment than with the amount of the state’s share in the development of oil resources. Much attention has been given to whether the severance tax rates imposed will be fair and appropriate. Unlike the royalty, this rate is subject to unilateral change by the state legislature. Few people recognize that the uniform imposition of a severance tax is an attempt to collect payments for the right to produce publicly owned resources on a basis that does not depend on the profits derived from the exploitation of these resources. The severance tax creates ticklish
problems in petroleum leasing policy simply because no one can know what it might be fixed at in the future. Even if a legislature were so inclined, it could not legally bind itself to refrain from increasing the tax rate at some later date. Quite understandably, the oil industry mistrusts a game in which the rules can be changed at any time by the state.

Alaskans cannot assume that this severance tax flexibility is altogether to the state’s benefit. Oil executives do not ignore the possibility of such tax increases. This factor increases the uncertainties of the complex calculation of production costs, and there is ample evidence that most industry evaluators are very conservative in calculating how much of their profits or gross production they will be allowed to keep for themselves. While predictions of future severance taxes vary from company to company, and are not made public, it is probable that few companies figure on a tax rate of less than 12½ per cent of the gross value. Thus, they expect the state to be taking in taxes and royalties, at a minimum, 25 per cent of the gross value of their production. Their bonus bids are naturally reduced accordingly.

Assuming that oil industry assessments of the amount of oil to be discovered are reasonably accurate and that the market system works to maximize the bonus paid, as it theoretically should, Alaska will receive bonus bids that are still considerably less than the true value of the land, given the present tax rate. The only means whereby Alaska can recoup this loss is to raise the severance tax rate to a level which approximates the oil industry’s expectation.

Ironically, such increases fulfill those expectations. If the state attempts to make good its loss by increasing the severance tax rate, it naturally influences future oil industry expectations with regard to the political climate in Alaska. Thus, subsequent bonuses are reduced by an even greater amount, requiring even greater increases in the severance tax to avoid new losses. What could very easily develop would be a severance tax rate at such a high level as to make premature shutdown a very real problem, with a drastic reduction in the attractiveness of Alaskan ventures. Of course, it may be that Alaska has had as much oil industry investment as it wants, and that this latter eventuality would not be too discomforting. However, existing fields will be producing very little revenue for the state under this situation, an eventuality which even those unfavorably disposed to the oil industry are not likely to countenance. Alaska is, in effect, put in the position of being the loser in either the short or the long run.

Industry’s Expectations

If this is to be the scenario for future developments in Alaska’s petroleum leasing policy, the oil industry’s recent large scale investments in Alaska would appear to be somewhat imprudent. While very much aware of this problem, the oil industry people certainly do not think so. As one official put it, 

“You can’t legislate stability, it has to be in the minds of the legislators and the people. We’ll probably have this tax uncertainty in Alaska until the oil industry has been here long enough for people to become accustomed to it. It happens the same way in almost every new oil area. It’s kind of a natural cycle and there is really not much people can do about it except wait it out.”

Oil industry confidence is based on experience gained in working in other states. Apparently this background leads the industry to believe that at some point of the lower bonus bids/higher taxes/lower bonus bids cycle the legislature will, as has been the case in other states, lose its taste for a larger share of the oil pie.

Only time can test the validity of this argument. At least a part of the oil industry has invested a great deal of money in the expectation that such stability will develop. Nevertheless, there are some good reasons for having serious doubts in this regard, reasons which perhaps even the oil industry itself has failed to consider adequately.
“Taxation stability” in the other states of the United States is a
direct derivative of political influence. It is essential to note that the
immediate source of this influence has not been the oil companies
themselves. Other states have tax stability because in every state
there exists a small, well-organized army of private landowners with
oil wells in their backyards. These landowners believe—quite
correctly—that any increase in the rate of severance taxation will
ultimately work to decrease their incomes.

Prior to the imposition of a severance tax, the profits from oil
production are shared between the producing organization and the
individual landowners. The assessment of a severance tax cuts the
state in for a share of the profits. It is the landowners who must
reduce their shares to accommodate the government. Under such
circumstances, landowners have an interest in keeping severance
taxes at a relatively low rate.

Yet, Alaska does not now have, nor is it ever likely to have in
the foreseeable future, an analogous group of politically influential
landowners. Alaska has virtually only two landowners, the state and
federal governments, with by far the greatest part of the oil
development on state lands. This tremendously significant fact makes
Alaska unique among the 28 oil producing states.

Foreign Examples

Alaska’s situation more closely parallels that of underdeveloped
countries where oil has been discovered and exploited. Alaska has
every option available that a Middle Eastern oil producing nation has
except the right of expropriation without compensation. Like
Alaska, these oil-rich countries have the ability to alter the terms
under which their petroleum resources are exploited. To one degree
or another, however, these countries are limited in the extent to
which they can exercise this power for they, like Alaska, are
dependent upon the producing firms for capital and technology and
for access to world markets. In these countries, as in Alaska, the
public’s greatest concern in regard to petroleum policy is that the
government’s share of the profits resulting from natural resource
exploitation be appropriate and fair.

In all situations, including Alaska’s, the determination of profits
is very difficult. The precise value of petroleum resources cannot be
known until they are marketed. Since profits depend directly upon
market value, there is no way of calculating them prior to the time
that the oil is actually produced. As a consequence, as soon as one is
certain about the respective profit shares of producer and
government, it is too late to alter the sharing arrangement. The
vested interest that the oil industry has in making the profits appear
small (and by contrast, making the state’s share seem large)
complicates the problem of gathering data for making reliable
estimates of profits. Alaska encountered this difficulty head-on in
1968, when oil industry executives appearing before the legislature
on the severance tax issue adamantly refused to disclose profit
information.

Despite difficulties of evaluation, a government’s share of
petroleum profits depends largely on the degree of dependence upon
the producing firms’ capital, technology, and markets. Although
nationalism and political demagoguery play their part, most of the
efforts by the petroleum exporting countries to reduce this
dependence can be related to their desire for an increased share of
the profits. The history of overseas petroleum developments makes it
clear that producing countries have given a high priority to the
attainment of self-sufficiency in these areas. It is also obvious that
the rewards accruing to a country that obtains a measure of this
self-sufficiency can be very great, as can be seen in the changing
terms of the agreements between oil firms and Middle Eastern
countries and Venezuela. (See Note No. 4.)

Parallel to the growth of the government’s profit share in most
oil producing countries there has arisen the phenomenon of the
“National Oil Company,” a government owned and operated firm for
developing, either independently or in partnership with foreign firms,
the country’s petroleum resources. An example of the latter
arrangement is the Canadian federal government’s 45 per cent
ownership (making it by far the largest single stockholder) of
Panarctic Oils, Ltd., a private enterprise which holds almost all exploration permits available in the Arctic Islands area of northern Canada. The arrangement is unusual, however, in that the Canadian government does not participate very actively in the firm's management. (See Note No. 5.)

The extent to which Alaska's relationships with petroleum developing firms will parallel those of other countries is not certain, but it is perhaps significant that at the 20th Alaska Science Conference in August of 1969, Dr. Robert Weeden, a respected Alaskan biologist and conservationist, suggested that Alaska establish for itself just such a company. Members of the state legislature have made similar proposals. (See Note No. 6.) It was Dr. Weeden's contention that without such an organization, Alaska would be unable to exercise the control over petroleum resource development that he felt was essential to the proper management and protection of the state's environment and other natural resources. If the petroleum exporting countries have attempted to gain independence of the large firms for reasons of economics and national pride, it may be that Alaska will attempt to achieve the same independence for reasons of economics and environmental control.

It should be noted that the economic returns to such independence are not unlimited. The achievement of freedom from the need for oil company help in the areas of providing capital, technology, and access to markets is only profitable if those factors of production can be supplied independently at less expense. Particularly in the area of providing markets, it may be that the international petroleum companies have inherent advantages.
cents per acre. The fee for filing a non-competitive lease application is $20 in cash, certified check or money order, and is not refundable.

The initial opening of newly acquired general grant lands for petroleum leasing is done by means of a non-competitive opening. Such openings are scheduled as required depending upon the amount of general grant acreage received by the state. Leases on these lands can be applied for within a 30-day simultaneous filing period.

Non-competitive leases are also offered through the terminated lease list, which is posted monthly. The list describes the lands on which oil and gas leases have recently terminated because of relinquishment, expiration, default, or cancellation. Lease applications can be made within a 30-day simultaneous filing period.

After the close of the simultaneous filing period, a drawing is held to determine the priority of applicants for those tracts receiving more than one application.

Any lands not leased as a result of applications filed during a simultaneous filing period become available for leasing over-the-counter on a first-come, first-served basis.

(Absorbed from the leaflet, "Information About Alaska State Oil and Gas Leases," published by the Alaska Department of Natural Resources, Division of Lands.)

NOTE NO. 2
DISCOVERY INCENTIVES

In order to stimulate exploration interest in areas that had no prior oil discoveries, the legislature reduced the royalty rate on oil produced from the actual leasehold where a new "structure" containing "paying quantities" of oil had been discovered. For ten years from the date of discovery, the producer paid only 5 per cent rather than the normal 12½ per cent royalty rate. It is impossible to determine the extent to which this stimulated the search for oil in Alaska, but it is generally credited with eliciting some additional effort.

By the middle 1960's, this discovery incentive appeared unnecessary for Cook Inlet development. State officials were finding the provision difficult to administer because the specific meaning of "discovery," "structure," and "paying quantities" had not been defined in the law. Whether this vagueness resulted from legislative oversight, or was a deliberate attempt to give the Commissioner of Natural Resources as much freedom as possible, is not clear. At any rate, discovery rights were requested for wells that might have been located in the same field or structure or might have penetrated the same oil-bearing sands. Consequently, discovery incentives were abolished for Cook Inlet leases in 1968 and for the rest of the state in 1969. However, because the incentive provision was still in effect during the early North Slope sales, similar disputes can be expected regarding the recent discoveries there.

NOTE NO. 3
THE ALBERTA "CHECKERBOARD" SYSTEM

The so-called checkerboarding system of petroleum leasing employed in the province of Alberta works in the following manner. For the payment of an annual fee, which starts at 20 cents an acre and escalates over the years to $1 per acre, oil companies are allowed to acquire exploration rights on a first-come, first-served basis over just about any part of the public domain. Such permits may include up to 99,840 acres and run from five to seven years. At any time during that period the permit holder may lease, at $1 per acre, up to one-half of the land in each township (36 sections) within any particular permit. The land so selected, however, may not be in one contiguous block but must be made up of separate lease parcels, none of which may be larger than a square three miles on a side, or a rectangle two miles wide and four miles long. Each such parcel must be separated from any adjacent selection by at least one mile.
Thus, it is the oil company that within the statutory time limits must decide when and what to lease, and which parcels to return to the government. As lease selection proceeds, the 50 per cent which is not selected reverts to the government as reserves, and, when the permit lapses, all unselected lands become reserves as well. These reserves are, by law, subject only to competitive bidding. If, at the time the reserves are established, oil company interest is very high, as indicated by requests to offer the reserves for sale, the government will ordinarily auction them immediately. In other cases, it may await the results of drilling which the original permit holder may be expected to undertake in the near future.

Offering large parcels without bids, at low rentals, provides substantial incentive for exploration, yet the corridor requirement assures that parts of the acreage which are proven or semi-proven by the exploratory work will revert to the state for competitive leasing. The system provides a mechanism which leaves judgment and initiative with the individual oil operator and calls mainly for automatic responses from state administrators.

(The above summary has been abstracted from “Policy Choices in Petroleum Legislation—Canada/Alaska Comparisons” by A.R. Thompson, a paper presented at the 20th Alaska Science Conference.)

NOTE NO. 4
PROFITS PARTICIPATION—A PRACTICAL ALTERNATIVE

Because royalties and severance taxes do not distinguish between profitable and unprofitable producers, many Middle Eastern countries have abandoned them as the primary means of collecting oil revenues. Instead, they have generally instituted “profits participation,” or net profits taxation. Rather than taking a small percentage of gross revenues, the government participates in up to 75 per cent or 90 per cent in the new profits.

Although it occurs mainly overseas, profits participation is practiced in this country, particularly in agreements between private landowners and private developers. Indeed, the agreement between the Cliff Burglin interests in Fairbanks and the General American Corporation calls for General American to pay the former landowners a sizable percentage of all net profits realized from production on those lands.

Generally, however, profit participation is not favored by domestic oil explorers. Their reluctance probably results from ignorance of the operation of such schemes, an ideological abhorrence of government participation in business, and a preference for keeping their profits secret.

While avoiding the host of problems raised by royalties and severance taxes, net-profits taxation does have one possibly unfavorable attribute. In order to assess the amount of tax due from a producer, it is necessary that the government have a clear idea of how much money the oil producers are making and, more importantly, what their legitimate expenses have been. It has often been argued that this knowledge will be very difficult to obtain without a disproportionate investment in a small army of accountants, auditors, and field inspectors to keep the oil companies from padding their expenses, overstating overheads, and other subterfuges.

Yet, well-written agreements could provide for the reporting of necessary information without resort to such extensive investigations. After all, the net profits of every firm in the United States are evaluated once a year by the Internal Revenue Service, and in Alaska by the State Department of Revenue.

A simple method of assessing allowable deductions must be formulated before net-profits taxation will be acceptable. For example, Alaska might find it desirable to restrict the allowable expenses to the lease bonus and actual on-site expenses. The on-site expenses would be relatively easy to determine since almost all drilling is done under contract. Depreciation deductions under such a system would be allowed only on equipment actually installed on the leasehold.
Higher bonus bids might result from this arrangement since much of the uncertainty regarding future taxation could be eliminated by a contract provision stipulating that subsequent increase in the severance tax would be offset by a corresponding decrease in the state's profit share.

The net profits taxation arrangement could be easily made on future leases. Changing existing leases, however, would be more difficult. One possible method might be to renegotiate the leases, offering the owners approximately equal terms under the new system. Leaseholders fearing drastically increased severance taxes would be induced to sign new leases relatively favorable to the state.

**NOTE NO. 5**

**NATIONAL IRANIAN OIL COMPANY (NIOC)**

For purposes of comparison, the terms of a typical "Middle Eastern" type agreement (Iran, 1965) are summarized:

**EXPLORATION RIGHTS**

The country is divided into concessions. Exploration rights over individual concessions are sold to oil companies on a negotiated basis. Payment for these rights has been in the neighborhood of $3 per acre. After five years, 25 per cent of the land must be turned back to the government, 50 per cent after 10 years. After 12 years, only those areas that are producing oil can be retained. A minimum exploration expenditure is required, usually about $1.75 per acre.

**DEVELOPMENT**

All development must be conducted in partnership with the government-owned National Iranian Oil Co. (NIOC), usually on a 50-50 basis. In other words, once oil is found, NIOC pays half the costs of development and gets half the production.

**NOTE NO. 6**

**COMPETITION VS. ENVIRONMENT**

A biologist speaks his mind:

"Much of the abuse of the landscape at Prudhoe Bay can be traced directly to the competition among companies to find and lease the best ground in the shortest possible time. The State of Alaska's haste to get in on the bonanza — as evidenced by the eleventh hour selection of nearly three million acres south of the discovery area just before the federal land freeze went into effect and by the lease sale to be held in a few days — has contributed to the problem.

"The implication is that there has to be adequate control of the pace of development, and that this control evidently has to come from government. When rock strata under public lands are favorable for oil accumulation, and after government determines that new fields should be developed, shares should be advertised in a government-controlled exploration venture. Shares would be unlimited, and companies could bid what they think can be
invested into that particular venture. Then exploration would proceed in an orderly way, with complete sharing of geophysical and test-well data. When exploration is completed, the companies would operate under a unit plan to develop the field, with shares in proportion to the original exploration bids. This process (and I admit that I will have to leave details for others to work out), would reduce competition from the exploration and drilling phases of petroleum development; those who dislike this un-American idea can take comfort from the fact that manufacture and market processes could be just as competitive as now."

(From “Arctic Oil and Environmental Degradation,” a paper presented at the 20th Alaska Science Conference, August 24-27, 1969, by Dr. Robert Weeden.)

ADDITIONAL READING

Adelman, M.S. “The Alaskan North Slope Discoveries and World Petroleum Supplies and Costs,” in Rogers (ed.).


Hedland, John S. “Economic Considerations in Oil and Gas Development,” in Rogers (ed.).


Thompson, A.R. "Policy Choices in Petroleum Legislation," in Rogers (ed.).

Tussing, Arlon R. "An Alaskan View of the Economics of Petroleum Development," in Rogers (ed.).
Alaska's Petroleum Leasing Policy: A Crisis of Direction

GREGG ERICKSON

The oil leases overlying and adjacent to the Prudhoe Bay field were acquired by Atlantic Richfield (Arco), Humble, and British Petroleum at a total cost of about $5.6 million. If the bidding for these tracts was truly competitive and geologic knowledge reasonably complete, this sum could be assumed to be an accurate reflection of the tracts' worth at the time of their sale. Such ideal conditions did not exist, of course, because the number of potential and actual bidders was small, and because free access to existing geologic information was not equally available to all prospective purchasers. Given the conditions of imperfect competition and knowledge under which these bids were tendered, however, it might have been said at the time that the results were as close an approximation to the true value as could be hoped for. As it turned out, this was not very close. A conservative estimate based on the industry's own figures puts the value of the Prudhoe Bay acreage at something over two billion dollars, or better than 360 times the amount that the oil companies spent to acquire it.

It is not unusual for the value of an oil lease to appreciate considerably in response to a discovery or the availability of new information, but the size of the apparent windfall in this case is so great that it is difficult to believe that Alaska's system of bonus bid leasing actually worked to maximize the state's income from these lands in either the long or short term.

The bonus bids Alaska will receive in the forthcoming September 10, 1969, competitive sale may also bring the state far less than we might expect, considering the acreage being offered. Factors that could bring about this result include the possibilities of covert collusion and overt limitations on competition through mergers and joint bidding. A more likely eventuality, however, is that the present worth of these tracts is so great as to make it impossible for the firms to bid their true value.

The acreage now being offered for lease (including, according to a Fairbanks consulting geologist, the most favorable onshore acreage of all the unleased state lands on the North Slope), is likely to contain at least one and probably more than one petro-

2. The calculations and assumptions underlying these and subsequent figures are contained in the appendix to this paper. The figure above assumes a 15 percent rate of return and an increase in the severance tax from its present 3 percent level to 12 percent. If the severance tax were to stay at its present level, net worth would be considerably higher—about three billion dollars.

3. To assume otherwise is to assume that the purchasing firms thought their chances of finding a Prudhoe-size field were far less than 1 out of 360. If the expected present value, \( E(X) \), is $5.6 million and the largest possible value is $2 billion, then

\[
E(X) = P(x_0)x_0 + P(x_1)x_1 + P(x_2)x_2 + \ldots + P(x_n)x_n = $5.6 \text{ million}
\]

Where:

\[ x_0 < x_1 < x_2 < \ldots < x_n \]

\( P(x_i) \) = the probability of making a discovery with a value \( x_i \).

If the probability of making a discovery worth $2 billion or more was 1 out of 360 (.0028), then all the other probabilities would have to be 0. Since this is very unlikely, if not impossible, it is clear that unless the prior probability of discovering such a giant field was very much less than .0028, windfall profits would be obtained. If the probability value function is continuous, the above summation becomes \( E(X) = \int_0^x P(x)dx \).
leum accumulation similar to and possibly part of the Prudhoe Bay complex. The director of Alaska's Division of Oil and Gas stated, "There is no reason why Prudhoe Bay should be the only giant field in a sedimentary basin of that size." If so, the per acre value of this acreage should be at least half that of the nearly 200,000 acres already held by the A-B-H Group (Arco, British Petroleum, and Humble) in the vicinity of Prudhoe. Since more than 400,000 acres are being offered in this sale, its present expected net worth is probably between $2 and $4 billion. Such a price tag is unprecedented, to say the least, and it is doubtful that the bidders will have either the ability or the will to raise this much money in today's tight capital markets.

The most compelling reason for firms to bid less than full value on these tracts is the justifiable uncertainty they must feel with respect to Alaska's severance tax. It is actually a misnomer to call this "taxation." Taxes are the means whereby the members of society provide the resources to sustain government and other collectively provided services. The classical criteria for levying taxes have been based on the one hand on the "equal sacrifice" or the "ability to pay" principle and on the other hand on the "benefits received" principle. The severance tax satisfies neither. Since it is not at all inconceivable that a producer who was just breaking even in his operation or even operating at a loss would be required to pay exactly the same amount of tax as a producer who was making a very large profit, "sacrifice" is clearly not equalized. Since the amount of oil produced has little if anything to do with the extent to which a firm or its employees benefit from collectively provided services, the second criterion is not satisfied either.

In reality, severance taxes and the royalty provisions of petroleum leases are both devices for delaying until production actually occurs the determination of and payment for the right to exploit a publicly owned resource. They are imperfect devices for determining the amount of "economic rent" due to the state


5. Assuming that the state's severance tax stays at a "reasonable" level and that the land now up for lease is worth, on an acre for acre basis, 50 to 100 percent of the acreage held by the A-B-H Group around Prudhoe.

(i.e., the residual that is left over after all the costs of production have been deducted from the dollars and cents value of the crude oil). If the state wishes to maximize the long-run returns from the exploitation of its publicly owned resources, then it is to its advantage to collect from the oil companies no more and no less than this residual. Setting the rent too low is obviously undesirable, but setting it too high can cause the oil companies to search for oil elsewhere.

If every barrel of oil cost every operator exactly the same amount to find and produce, then the severance tax and royalty provisions would be appropriate methods for determining the economic rent due and available to the state. Unfortunately, this is far from the case. Costs of production in the state's known oil fields probably vary anywhere from about 25 cents per barrel to $3.00 per barrel in the case of the northern oil pools in the Cook Inlet field which are now in production. As a consequence, severance taxes and royalties are inefficient, overcharging some producers and simultaneously undercharging others. These effects may partially balance out, but the costs of increased uncertainty remain and the original objective in deferring the determination of the rent is defeated.6

Many oil men and state legislators have considered that the severance tax could and probably would eventually reach some sort of a ceiling at a point just below the level at which it plus the royalty would cause the owners of the least profitable oil field in Cook Inlet to shut in their production. This ceiling was obviously descending as productivity in these fields declined with age and as the legislature progressively raised the tax rate to meet it. Within two to five years these two trends probably would have converged, stabilizing the severance tax rate at around 10 percent.

Since Prudhoe Bay, however, we are playing a whole new ball game, and any oil man who claims to be that optimistic today is either woefully uninformed or a victim of his own wishful thinking. A glance at the taxation-profit function implicit in Table 5 at the end of this chapter tells why. At about the present level of tax, plus royalty, the A-B-H Group's overall twenty-year rate of return on investment will be about 43 percent. This is usually high for this type of enterprise, but the most startling fact in this context is that the state's severance tax/royalty can be raised to the vicinity of 85 to 90 percent and still leave the oil companies a better than 10 percent rate of return.

To be absolutely certain that I had not made some terrible blunder in my assumptions and/or calculations, I took the precaution of asking an executive acquaintance in one of the firms most directly concerned, to point out any unjustified assumptions or erroneous computation. The company's corporate headquarters reviewed my rate of return model, but did not comment on it beyond advancing two reasons why the severance tax plus royalty could not or should not rise to the 40 percent or 50 percent level. They are worth examining since I think others in the industry will respond similarly when confronted with this same suggestion.

It was argued, first of all, that such tremendously profitable fields are only discovered once in a generation; that if firms are to be persuaded to continue searching for them through the unsuccessful years, then we must offer them extraordinary rewards when such a rare discovery is made. Secondly, such a tax would cause most, if not all, of the state's other oil fields to be shut in.

The first argument fails to take into account that a 1 1/2 percent increase in North Slope royalty or tax revenue in 1974 is equal to the entire royalty income from Cook Inlet today. In other words, the increased revenues from the North Slope fields would greatly exceed revenue loss in Cook Inlet due to a tax increase.

7. This means that after twenty years of production, A-B-H will each year have recovered 43 cents on every dollar invested—and recovered the original dollar as well. The numbers are, of course, approximate, but given the price and volume assumptions made by industry spokesmen, they should be within ±5% and probably closer. See the appendix of this paper for details and assumptions.

The second argument overlooks the fact that having one Prudhoe Bay field, Alaskans might decide that Alaska has little to gain and possibly a great deal to lose from a continuation of today's rapid pace of exploration. As things stand right now, without leasing another acre, a 62.5 percent severance tax plus a 12% percent royalty will bring Alaska $5 billion per year in 1974, and a cumulative total of over $14 billion in the first twenty years of operation. It is true that these revenues will not start until 1972, and that we desperately need money now to solve the housing, health, and education deficiencies of rural Alaska. But how much money can we use wisely? I doubt if we can absorb, this year at least, much more than $100 million. If so, why not lease only until we reach that or some other reasonable target, or even borrow the money against our assured future income?

These are radical suggestions but they bring us to the fundamental problem. If we wish to maximize our revenue without regard to other long-range goals, then we must overhaul our leasing policy to eliminate or at least reduce the impact of tax uncertainty, and we must do it before we lease much more land. It follows from this that the upcoming lease sale should be moved ahead at least six months to allow the legislature time to act.

On the other hand, if Alaskans feel that too much of a good thing can be a bad thing, that too much money and too much oil development might, indeed, make this state a worse rather than a better place, then we need to start thinking about goals other than the pursuit of the almighty severance tax and royalty dollar.

8. There are a number of ways this could be done: state participation in profits with the participation rate as a bid variable seems to have a number of distinct advantages, but checkerboarding of some sort, or making the royalty rate a bid variable also deserve consideration.

9. The fact that Alaska received only $900 million in the twenty-third lease sale seems to confirm the fears expressed in this paper. Subsequent conversations with persons within the industry and study of the sale results indicate that severance tax uncertainty was the most significant factor in reducing the bids. The most aggressive bidders were those such as Amerada Hess, Phillips, the Hunt Group, and Getty, whom one would expect to be relatively unfamiliar with the Alaskan "Political Climate." Those firms with long Alaskan experience such as Standard of California and Union were generally cautious in their bidding. Also oil stocks generally de-
APPENDIX

The assumptions underlying the cash flow calculations summarized in Table 5 are as follows:

Methodology Rate of return is calculated by the net discounted cash flow method, and is the most generally accepted method of evaluating enterprise profitability. Rate of return is derived by netting out income and expenditures in each year and discounting their value to some fixed date (1968 in this case) at various discount rates until the rate is discovered that brings the present value of the expenditure stream into exact balance with the subsequent income stream.

Production Levels Production levels are those presented in testimony by L. K. Cheney, Arco executive. My maximum estimate of 1.8 million barrels per day is below that of M. A. Adelman and the President's Oil Import Advisory Committee, and is generally consistent with other estimates made in the oil press and at this conference. The yearly decline rate after 1981 is assumed to be 7 percent per annum, which is somewhat worse than that experienced in the best United States fields (5 percent) and somewhat better than would be experienced under flush production (10 percent).

Prices A realization price of $2.50 per barrel is assumed at Tidewater (Valdez, other Alaska shoreline or Canadian Border). Royalties and taxes are computed on the basis of $2.00 per barrel at the wellhead.

Listing Costs (variable production costs) Assumed to be $.06 per barrel.

Development Costs Development investment expenditures are calculated on the basis of $200 per daily barrel capacity. (Productivity assumed to be less than 10,000 barrels per day per well. Well costs assumed to be about $1.2 million per well.)

Subsequent information indicates that $700,000 might be a more realistic figure.

Pipeline Operating Costs (variable costs) Assumed to be $.10 per barrel.
Royalty and Taxes The royalty is assumed to be at 12% percent, that is, no account is taken of the reduced discovery incentive rate. Severance taxes are assumed at 4 percent.
### TABLE 5
**Calculation of Net Operating Income before Royalties, Taxes, for Arco, BP, and Humble North Slope Production, 1972-92**

<table>
<thead>
<tr>
<th>Year</th>
<th>Daily Production (Million bbl.)</th>
<th>Annual Gross Income* (Millions of dollars)</th>
<th>Operating Income† (Millions of dollars)</th>
<th>Less: Capital Expenditures‡</th>
<th>Net Income (Loss) before Royalties, Taxes, etc.</th>
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</thead>
<tbody>
<tr>
<td>1969</td>
<td>...</td>
<td>...</td>
<td>(40)</td>
<td>(50)</td>
<td>(30)</td>
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<td>1970</td>
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<td>1971</td>
<td>...</td>
<td>...</td>
<td>(5)</td>
<td>(60)</td>
<td>(300)</td>
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<tr>
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<td>256</td>
<td>(60)</td>
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<td>(60)</td>
<td>(100)</td>
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<td>1981</td>
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<td>957</td>
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*Annual Gross Income calculated at $2.50 per barrel.
†Operating expenses calculated on basis of lifting costs at $0.06 per barrel and pipeline operating costs at $0.10 per barrel.
‡(A) = exploration expenditures; (B) = development expenditures; (C) = pipeline expenditures; (D) = other capital expenditures.
TABLE 6
CALCULATION OF EFFECT OF TAXATION, ROYALTIES, AND OTHER GOVERNMENT PAYMENTS ON FIRMS' RATE OF RETURN— ARCO, BP, AND HUMBLE NORTH SLOPE PRODUCTION, 1972-92
(In Millions of Dollars)

<table>
<thead>
<tr>
<th>Year</th>
<th>Net Income (Loss) Before Royalties, Taxes, etc. (Table 5)</th>
<th>Less: Total Taxation, Royalties, and Other Government Payments at:</th>
<th>Net Cash Flow to (from) Firm with Government Payments at:</th>
</tr>
</thead>
<tbody>
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<td></td>
<td>15%</td>
<td>20%</td>
<td>25%</td>
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<td>...</td>
<td>...</td>
</tr>
<tr>
<td>1971</td>
<td>(375)</td>
<td>...</td>
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</tr>
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<td>352</td>
<td>(66)</td>
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<tr>
<td>1974</td>
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<td>(187)</td>
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RATE OF RETURN 43% 41% 40% 38% 32% 21%