

ALASKA



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ALASKA'S PETROLEUM INDUSTRY

Petroleum is Alaska's third most important extractive industry, ranking immediately behind fishing and timber. At the end of January, 1968, the crude production rate reached 154,000 barrels per day, worth, on an annual basis, over \$160 million per year. Alaska is now the nation's ninth ranked oil producing state.

Prospects for continued growth are excellent. Some observers predict that Alaska will eventually become the nation's number four producer, exceeded only by Texas, California and Oklahoma. Growing reserve figures lend credence to this view.

THE OIL RESOURCE

As of January 1, 1967, Alaska had 321 million barrels of "proven" crude oil reserves and an additional 132 million barrels of "indicated" reserves, according to the American Petroleum Institute's most recent published figures. The sum of these two categories places Alaska in the number eight position among the states, ahead of North Dakota and behind Kansas. These reserves, plus the 90 million barrels proven in Naval Petroleum Reserve No. 4 on the North Slope (not considered in state rankings), give Alaska a total of 543 million barrels. Preliminary 1968 estimates by the American Petroleum Institute's Committee on Petroleum Reserves indicate that Alaska's relative position has improved considerably during 1967.

Presently scheduled development drilling from existing platforms in Cook Inlet is almost certain to double the "proven" figure within the next several years. Most industry geologists predict the Cook Inlet basin alone will yield, at a conservative estimate, at least 1.5 billion barrels (at today's prices, worth almost \$5 billion). Should the so-called "Oil Alley" of northern Cook Inlet extend south into the practically unexplored lower inlet — con-

taining about 75 per cent of the basin's geologically favorable acreage — this figure could be scaled upward to as high as five billion barrels in the next ten years.

THE ECONOMICS OF ALASKAN OIL

The large sums being spent on exploration, land acquisition and development drilling indicate the high expectations of oil companies in Alaska. While oil firms have encountered unusual conditions and have made some expensive miscalculations, particularly in offshore operations, the overall profit outlook remains bright.

Although costs are higher in Alaska and the environment is hostile, it must be noted that the real costs of exploration and drilling are declining as the industry benefits from economies of scale inherent in the growth of transportation and communication facilities. Service and support activities being established by a growing number of specialized oil supply firms in the Cook Inlet area also tend to reduce costs. (The number of persons working for such firms in Alaska increased from 749 at the beginning of 1966 to 1,242 at the start of 1967, according to the Western Oil and Gas Association, Alaska Division.)

High wage rates in Alaska, often pointed out as having a negative effect on new industrial enterprises, are of only minor importance in the state's oil industry. Although wage rates for oil field workers reportedly exceed the California scale by 45 per cent, a large differential even for Alaska, wages and salaries paid in the state represented only 9.6 per cent of the industry's total expenditures on Alaskan operations in 1966, when 608 persons were directly employed by oil firms in Alaska. Lowering labor rates to California levels would have reduced total costs by only about 3 per cent.

The relative unimportance of wage rate differentials emphasizes a significant point in the regional economic pattern: only a small proportion of the industry's expendi-

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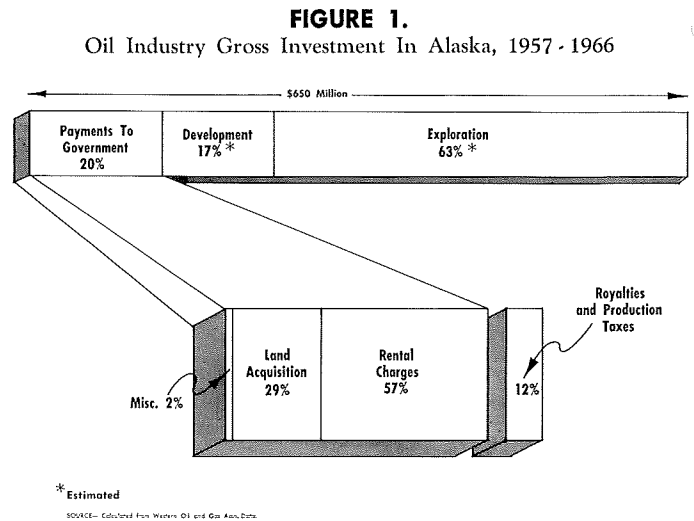
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tures on Alaska oil development is actually spent in Alaska. Definitive statistics indicating the percentage of goods and services actually obtained in the state and thus directly contributing to its economy are yet to be gathered, but it is obvious that Alaska has neither the manufacturing capacity nor the pool of skilled manpower to satisfy more than a small portion of the oil industry's requirements. This is true to some extent in all the state's basic industries, but due to the petroleum sector's technical nature, the percentage of out-of-state purchases is probably greater here than in other major resource-based activities, such as fishing and forest products.

On the other hand, the state owns or shares rights in almost all of Alaska's oil producing land, and a substantial portion of the oil industry's expenditures is for the purchase of these rights. Revenues to the state from this source since 1957 total about \$140 million. This sum constitutes about 22 per cent of all petroleum industry expenditures in Alaska (See Figure 1). A breakdown of this revenue source shows it is composed mainly of lease acquisition payments (57 per cent), rental charges (29 per cent), and royalty and production tax payments (12 per cent). As production increases from fields already developed, royalties (assessed at either 12.5 per cent or 5 per cent of wellhead value) are almost certain to become the state government's single most important source of revenue. At the end of January, 1968, these collections reached a rate of approximately \$50,000 per day.

As the magnitude of investment indicates, firms hunting oil in Alaska are willing to spend large sums on their Alaskan ventures. Though figures vary widely from source to source, indications are that sometime early this year cumulative expenditures on Alaska's oil development will pass the one billion dollar mark, of which more than 90 per cent is accounted for by only 20 firms.

While Alaskan oil firms collectively are expected to show a profit, a large investment is required to provide each company with reasonable assurance that it will actually share in that gain. For this reason, many companies pool their efforts, undertaking exploration, land acquisition and development in partnerships and combinations. While the chances of striking it extremely rich are



reduced (a bonanza must be shared), this strategy reduces the risk of total failure. For example, suppose a firm wishes to invest in an area where wildcat wells cost \$1 million each. If only one out of ten wildcats can reasonably be expected to find an oil field large enough to justify development and exploration costs, the 9 to 1 odds on failure of a \$1 million drilling program will probably be considered too high. A \$10 million drilling program faces a much better situation — the odds on total failure are 7 to 13. With a \$20 million program, the chance of total loss declines to only 1 out of 9.

The scale of operations necessary to reduce uncertainties to reasonable levels is the main reason why Alaska has been almost exclusively the hunting preserve of larger companies. However, there are indications that the smaller firms—the “independent” oil companies — may yet become a significant factor in the region's oil business, particularly in onshore operations. Increased geologic information and lower drilling costs would re-

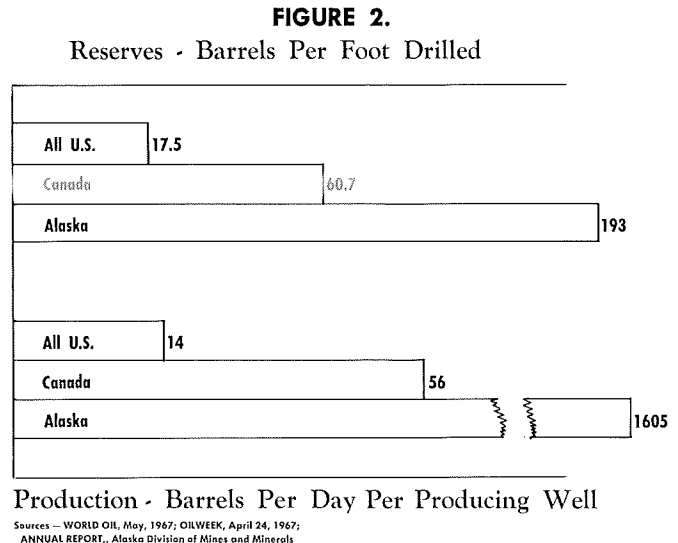
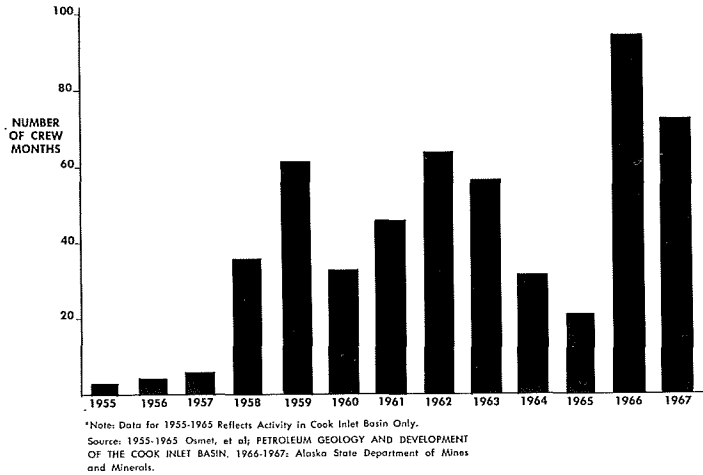


FIGURE 4.
Geophysical Activity In Alaska*



As each step in the exploration program is completed, oil companies evaluate their findings to determine the advisability of continuing work in a particular area. These decisions are critical because of the rapidly escalating costs of each succeeding phase. For instance, after completing preliminary geologic work, the firm must decide whether to bid on actual acreage. During the early exploration of Cook Inlet, there was only moderate competition for available leases. Today, because of the known high quality of inlet prospects, bidding tends to be intense and prices high—often more than \$1,000 per acre (these are the “bonus” bids; additional charges for yearly rentals are fixed at \$1 per acre on state lands). An investment of up to several million dollars is required to accumulate sufficient leases to form an average size drilling block—land enough to insure that any oil discovered will be mostly on company property.

Although much information on the geology of the upper Cook Inlet basin has been gathered since 1957, exploration in this area is still far from complete. While the general configuration of potential oil-bearing sediments can be predicted with some certainty, the data is not sufficient to allow precise mapping of the sub-surface strata.

Exact correlation of information from one well to another is made difficult by a general pattern of complex faulting. The faults displacing the Swanson River field into five separate pools across its six-mile length were only discovered after extensive drilling, at a density of approximately eight wells per square mile.

Climate, terrain, long distances and poor transportation facilities are often blamed for Alaska’s high drilling costs, but the fact that much of the present wildcat activity is in offshore areas requiring the use of floating drilling vessels is of possibly more importance. Present information suggests that exploratory offshore drilling costs in

the inlet are approximately one third higher per foot than in waters of similar depth off California or Louisiana, and three or four times as costly as onshore operations in the same areas.

Another reason for higher per-foot-costs is that the average well in Alaska — exploratory or developmental — is drilled deeper and tested more extensively than the average well in other states. All discovered oil pools in the Cook Inlet basin are below 5,000 feet, with the most prolific reservoirs, such as the Swanson River field, located from 10,000 to 11,000 feet underground. This compares with an average depth of 4,200 feet for all wells drilled in the United States, and is particularly significant since per-foot-costs increase rapidly with depth.

DEVELOPMENT

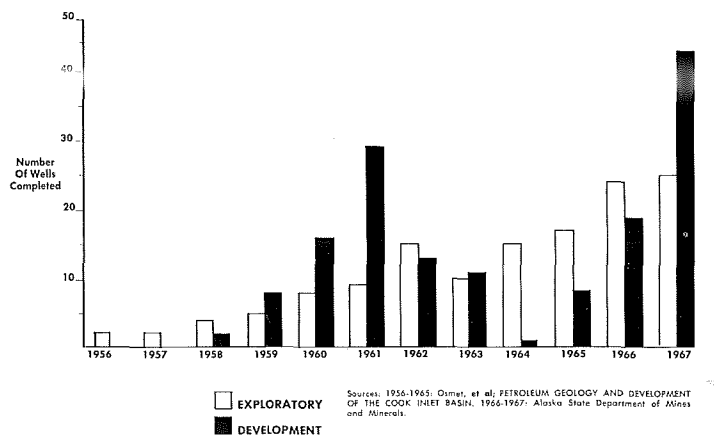
The discovery of oil does not necessarily insure development of a field. In each case, the costs of wells and facilities necessary for production must be weighed against the value of expected output. Because of the highly faulted nature of a field, the low permeability of its oil bearing rocks, or other factors, it may be abandoned or be developed only for its gas content, as is apparently the case in Pan American’s North Cook Inlet field.

While there are fewer uncertainties in development than in exploration, both the stakes and the costs are higher. In the Swanson River field, which has 50 wells capable of production, development drilling costs alone are estimated to have averaged \$400,000 per well, not including costs of the above ground facilities required.

Offshore development is even more expensive because year-round drilling platforms are necessary and must be built to withstand the ravages of the inlet’s winter ice. Although offshore platforms are found around the world, the Cook Inlet environment has necessitated un-

FIGURE 5.

Drilling - Exploratory and Development Completions



usual and costly designs. The 11 platforms now in place have an average value of approximately \$12 million each, although one structure is reliably reported to have cost over \$20 million. At least three new platforms are scheduled for construction in 1968.

Up to 32 wells may be drilled from a Cook Inlet platform, but, since only one or two drilling rigs may be working at any one time, the rate of well completions is limited to about five or six per year. The platforms are

capable of tapping portions of the reservoir located horizontally up to 11,000 feet away.

During the development phase, up to 60 men are housed and fed on the platform and work continues around the clock throughout the year. When the well begins producing, operations become more automated and only about five employees actually live on the structure. The need for extensive fleets of tugs, helicopters and other drilling oriented services also declines during the production phase, though this may be offset by expanded drilling elsewhere.

DEVELOPMENT VS. PRESERVATION

Alaskans traditionally have been jealous of the natural beauty of their state's outdoors. This, combined with the increasingly widespread concern over environmental quality, has created a number of potential conflicts between those who place high priority on the rapid development of Alaska's petroleum resources and those who would retain the region's "wilderness values." So far, at least, the oil industry, acting in its long-run self-interest, has shown that resource "development" and resource "preservation" are by no means incompatible. The Alaskan public's generally favorable attitude toward the industry is in no small part a consequence of this long-rang view.

Much of the credit for this desirable situation must go to Standard Oil Company of California and its partners, whose development of Swanson River field could well serve as a model for industrial and mining operations elsewhere. The Swanson River field is located in the Kenai National Moose Range. The development of this oil field has, in the opinion of many, actually increased the benefits of the wildlife refuge by making this previously remote area more accessible to motorists, hikers and canoeists. All brush cuttings, debris and discarded material have been carefully removed or buried. Cut-over areas have been seeded to create "moose pasture" and the wildlife population of the reserve has increased since the coming of the oil man.

Offshore exploration and drilling operations have also created potential conflicts in resource utilization. For instance, one of the most useful methods of geologic exploration, seismic surveying, involves the underwater detonation of explosives. Unfortunately, underwater blasting of any sort is also an extremely efficient method of killing fish.

To minimize the depletion of one resource in the search of another, exploration firms are required to schedule undersea blasting operations to avoid salmon runs and utilize explosives with low "fish kill" potential.

In addition to exploration, almost every other phase of offshore oil activity can, in some manner, threaten fishery resources. Water pollution and beach contamination resulting from accidental spillage or dumping of oil or other fluids is considered by conservation and fishing interests as the most serious danger. Despite precautions, incidents of this nature have occurred and the issue is a troublesome one. That the inlet operators are aware of this is evidenced in the effort and expense that they have invested in determining and eliminating possible sources of friction between themselves and those with whom they share the inlet. Housekeeping procedures on some offshore platforms reportedly require that nothing so much as a paper cup be discarded overside. Trash is sacked and taken ashore, often by helicopter.

Nevertheless, at least 68 instances of oil or refuse pollution have been reported to date in Cook Inlet. While many of these incidents have been minor in nature, or not directly related to oil activity, they have served to tarnish the industry's Alaskan image.

PIPELINES

All Cook Inlet offshore platforms are connected to the shore by dual underwater pipelines of either eight or ten inches in diameter. Although the construction of these underwater pipelines presents difficulties, several factors make it inadvisable or impossible to load tankers directly from the producing platforms. Shallow water, winter ice and the high cost of mounting storage and processing facilities on offshore platforms make it necessary to construct pipelines. These dual pipelines protect against costly shutdown in offshore production and provide for possible gas injection pressure maintenance in the future. About 105 miles of these lines have been completed at an estimated cost of \$50 million.

Because of ice and water depths too shallow to accommodate the large tankers that will be hauling Alaska's crude oil to market, it has been necessary to construct an onshore pipeline stretching 42 miles down the west coast of Cook Inlet to a newly completed deep water terminal at Drift River. The 20-inch line, completed last spring, is jointly owned by Atlantic-Richfield, Cities Service, Marathon, Mobil and Union. The terminal extends almost two miles into the inlet and at low tide can handle 100,000 ton tankers drawing up to 60 feet of water. Total cost of the onshore pipeline and terminal facilities is estimated at \$45 million.

In December of 1967, the pipeline company was granted an exemption from the state income and business license taxes. The tax break, granted under Alaska's Industrial Incentive Act, is scheduled to run for seven years, or until the firm's net rate of return reaches 7 per cent, whichever comes first.

Some estimate of the production expected from Cook Inlet can be inferred from the fact that pipelines existing or presently under construction have been designed to handle a maximum of 450,000 barrels per day — more than three times the present rate.

PRODUCTION

Underground energy, usually in the form of gas or water pressure, is of great importance in the life of an oil field. It is this energy that drives the oil to the well

and thence to the surface. Lack of reservoir energy means a rapid drop in production. However, preventive measures are usually available. The early injection of high pressure water or gas into the producing formation, through costly, can extend field life. So far, only two oil fields, Swanson River and Middle Ground Shoal, are using these "secondary recovery" techniques. In the case of Swanson River, the low level of reservoir energy, combined with the large size of the field, made early initiation of the program economically feasible. The extra cost of \$30 million is offset by the more than \$300 million worth of otherwise unavailable crude oil which will be produced over the life of the field.

It is too early to say definitely whether all Cook Inlet fields will require repressurization of some sort. However, their similarity to Swanson River in terms of crude oil type, gas saturation, and other characteristics indicates that "down hole" pressures will decline as production increases. Recent initiation of pressure maintenance measures at Middle Ground Shoal field is an indication that operators there are already experiencing this drop.

When natural gas is available, repressurization will present no overwhelming problem, but the costs will be higher at offshore locations. It may be possible to repressurize with water. However, the silt content of inlet water will necessitate costly water wells from the platforms or piped water from shore. Middle Ground Shoal operators are expected to start such operations later this year.

MARKETING

There are strong economic and political reasons for marketing Alaskan oil in the United States. Foremost among these is that the United States policy limiting foreign oil imports through quotas has increased the domestic price of crude oil about 50 per cent over the world market price. The quotas, initiated in 1959 to protect the industry from foreign competition, provide a strong incentive for domestic rather than foreign investment by United States oil companies.

Much of Alaska's present oil development has probably come about as a direct result of this incentive. A barrel of oil produced in Alaska is simply worth more than a barrel produced overseas. Since 1961, the wellhead value of Swanson River crude oil has increased from \$1.50 per barrel to its present price of \$3.06 per barrel. The latter figure compares with today's \$2.15 value of similar type crude oil in Indonesia.

Barring a major shift in United States energy policy, the price of domestic crudes (and Canadian overland imports, which are exempt from the quota system) is expected to increase as United States consumption expands faster than development of domestic reserves. Such a

trend will naturally enhance the profit margin of the Alaska oil industry.

Although the United States supplies about 88 per cent of its crude requirements from domestic sources,

BEYOND THE INLET . . . A SLOPE, A BAY, AND THE GULF

Only a small portion of Alaska's "possible petroleum provinces" has been explored, leaving the state with a wide open potential for future investment. Besides the Cook Inlet basin, there are three other areas which have attracted significant oil company interest: the North Slope, Bristol Bay and the Gulf of Alaska.

THE NORTH SLOPE: This area, located between the Brooks Range and the Arctic Ocean, has one proven oil field, Umiat, in and near Naval Petroleum Reserve No. 4. There has been considerable activity on the slope recently. In January, 1967, 23 offshore Arctic Ocean tracts were leased for \$1.5 million. One onshore rig has completed drilling a well in this area, at Prudhoe Bay. Although significant quantities of gas are known to have been found, other information is lacking. If this well has produced encouraging results, an increase in North Slope exploration may be expected. A number of firms are considering a plan under which they would pool their efforts and gain holdings to undertake a \$20 million, nine well exploration program in the area.

Because of its remoteness, wildcatting activity north of the Brooks Range is generally considered by the industry as a highly speculative hedge against the distant future. It is expected that at least five years would elapse between any significant discovery and the completion of transportation facilities between oil field and market.

Despite the delay anticipated between discovery and production, knowledgeable observers have ventured that a pipeline to ice-free tidewater would be a reality today had the Naval Petroleum Reserve No. 4 been opened to private leasing at the conclusion of federal drilling in 1953. Legislation to make this land available is under study by Congress. No serious obstacle is foreseen to its eventual passage.

BRISTOL BAY: Little is known about the geology of this large embayment of the Bering Sea, but one industry official has stated that offshore reserves in Bristol Bay are possibly in the billion barrel range. At least 20 firms have done seismic, gravity or magnetic surveys in the area during the past two years, and general opinion is that numerous prospects were disclosed. Most interest seems to be concentrated in the federally controlled portion of the bay, beyond the state's three-mile offshore land boundary. A state lease offering is planned for March. So far, the Interior Department has made no plans for leasing and development in the Bristol Bay area, making it likely that actual drilling on federal lands will be delayed until at least 1970.

THE GULF OF ALASKA: With a prospective expanse greater than the Gulf of Mexico, this mostly offshore area has seen the same sort of exploration interest as Bristol Bay. Judging from the high prices paid for tracts recently leased by the state near Middleton Island, it is expected that drilling activity will soon be underway in this section. Federal policy regarding the more than 90 per cent of the gulf's acreage under its jurisdiction is still in the planning stage; a lease sale is contemplated sometime in 1968. If oil fields are found under the gulf's 60 million areas of icy water, they will undoubtedly be very difficult to develop. Weather and sea conditions commonly encountered in the area can be compared to those experienced in the worst North Sea storms.

and has the capacity to supply them all in times of emergency, the western states constitute both a region of net petroleum deficit and an area of the most rapid increase in petroleum demand. California refiners, in particular, are faced with the necessity of making up this deficit with either foreign crude or crude shipped at high cost from the U.S. Gulf Coast via the Panama Canal. This situation provides additional incentive for Alaskan exploration. Shipping distance from Cook Inlet to Los Angeles is approximately half that from New Orleans to Los Angeles (2,500 miles vs. 5,000 miles), and unit costs can be further lowered on the Alaskan run by using supertankers too large to transit the Panama Canal. It is obviously no accident that three of the principal marketers of refined products in California — Richfield, Union and California Standard — have been among the leaders in Alaskan oil development.

Because of Alaska's relatively small petroleum consumption and the economies of scale inherent in large oil processing operations, it is unlikely that the near future will see any new refining facilities built in Alaska. California Standard's \$5 million plant at Nikiski is apparently adequate for its needs. Other Alaskan oil marketers point out that, for practical purposes, it costs them almost nothing to transport products from California. Were it not for these products, tankers bound north to pick up Alaskan crude would sail empty.

PUBLIC POLICY

As is the case with any publicly owned resource, the political environment has a far-reaching effect on the costs and benefits of petroleum development. Thus, despite the currently bright geologic and economic outlook, the future pace of Alaskan oil industry development is still a matter of conjecture.

Up to now, the laws and regulations affecting Alaska's oil industry have apparently been mutually beneficial to both the public and the industry. However, as oil investments and revenues have become more visible, public concern and controversy regarding the goals and effectiveness of oil resource management and taxation have increased.

Timing of lease offerings has arisen as one of the many questions facing Alaska in its resource management efforts. Like most such problems, its solution turns on a determination of the proper balance between present and future revenues. For instance, the discovery incentive clause of Alaska's oil law allows a reduction in individual lease royalty rates (from 12.5 per cent to 5 per cent) paid by those who find new fields. This provision sacrifices future royalty income in order to stimulate present exploration and to increase bonus bid receipts. When such provision is suspended, as it was in a

recent southern Cook Inlet lease offering, it represents a public policy judgment to the effect that a loss of bonus revenue and reduction in drilling activity is worth the probable gain to be realized in five or ten years, if and when oil is found.

Another manifestation of increased public concern over the oil resource is apparent in recent efforts to change the state's oil and gas taxation policy. Revision of this policy, and particularly the gross production tax, is the single most important issue facing Alaska in the development of its petroleum industry.

Enacted in 1955, two years before the discovery of the state's first commercial oil field, the "Oil and Gas Properties Production Tax" is imposed on the gross value at the wellhead of all oil and gas produced in Alaska. The tax is in addition to royalties that the firms may be required to pay the state under terms of their oil leases. While the production tax and royalty have an identical effect on the industry's revenues, the royalty rate is determined by a lease contract and may not be unilaterally increased by the state.

Payment of the severance tax exempts producers from a variety of other levies, including the Business License Tax and all state and local levies on producing properties and leases. Because of the difficulties in assessing oil and gas properties, it was reasoned that an *ad valorem* tax would be the easiest and most equitable tax to administer.

Originally set at 1 per cent, the tax was raised to 2 per cent during the 1967 special legislative session called as a result of the Tanana Valley flood. Proceeds of the additional 1 per cent levy are to be set aside, along with those from a special \$10 head tax, to form a disaster fund. Both the 1 per cent oil tax and the head tax will automatically lapse when the fund reaches \$7.5 million.

Considerable bipartisan support for a further increase in the production tax rate has been evident during the legislature's 1968 session. Proponents of increasing the public's share of oil revenues point out that the oil and gas belonging to the people of Alaska is being transferred to private firms for less than is being received in parallel situations in Canada. Industry officials and other advocates of the *status quo* maintain that the greater uncertainties and higher costs of Alaska petroleum development require a compensating incentive (in the form of a larger share of the gross revenues) if developers are to spend their dollars in the state. Referring to the state's already impressive oil revenues, they suggest that increasing the state's share at this time would be a clear case of "biting the hand that feeds."

While these arguments are still unresolved, it seems clear that more than just the level of taxation is involved in the decision to invest in Alaska or go elsewhere. While

TABLE 1.

The Tax - Profit Relation

Existing Tax Rate	Expected Tax Revenue From Existing Fields Through 1976 ^(A)	Expected Industry Rate of Return For Period 1957-1976 ^(B)	Estimated Present Net Worth of Alaskan Oil Fields ^(B)
2%	About \$30 Million	11 to 12%	\$765 Million

Each Percentage Point ^(C) of Increased Tax Would...

Increase State Revenues By	Reduce Expected Industry Rate Of Return By	Reduce Estimated Present Net Worth By
\$14 To \$16 Million	0.2 To 0.25%	About \$7 Million

Notes:
 A Actual estimated value; not discounted.
 B Calculated by net discounted cash flow method.
 C At tax rates above 15% these figures progressively lose accuracy due to the non-linear relationships involved.

taxes affect profit rates (as shown in Table 1 and Figure 6), it is the difference in expected profits, not taxes, that induces the investor to abandon one region for another. The region with the highest expected profit rate can anticipate capturing the largest share of future investments in oil exploration.

An economic analysis of profit rates in regions competing with Alaska for the oil industry's exploration investment could provide a basis for a public policy designed to maintain the highest level of petroleum investment consistent with maximum revenue to the state. Petroleum being a non-renewable resource, mistakes made today for lack of such analysis will be difficult, if not impossible to undo. If the tax rate is too low, the state loses revenues it need not forego. On the other hand, if the tax rate is too high, revenues over the long run will be reduced. Thus, the finding of an optimum level of taxation is of interest both to the industry and the state.

Additionally, the oil man's subjective evaluation of public and governmental attitudes appears to have an important bearing on the maximum tax rate he considers he "can live with." Because of this, benefits that would accrue to the state from a vigorous and sincere effort to bring about industry understanding of its position can not be underestimated. It is in the interests of the state to have a flourishing petroleum industry. Oil developers should have little to fear so long as they know the state is making a rational attempt to maximize its tax revenues over the long run.

Although the Institute is solely responsible for the completed publication, comments and opinions of the following persons were taken into consideration and their help is appreciated:

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 Hugh Gellert— Development Consultant
 Lum Lovely— Consulting Geologist
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 Joe Rudd— Attorney

FIGURE 6.

Net Discounted Cash Flow of Alaska's Oil Industry 1957-1976

