ARCTIC
VOL. 35, NO. 3 (SEPTEMBER 1982) P. 349-357

Public Policy and Petroleum Development: The Alaska Case

WAYNE C. THOMAS[1] and MONICA E. THOMAS[2]

ABSTRACT. Present and potential petroleum development in Alaska is directly related to public-policy issues. The Prudhoe Bay oil discovery signaled the need for determination of a transportation route to market. Pipeline location became a function of political boundaries, with an all-American route preferred. Actual pipeline construction was dependent on settlement of land claims with Alaska's indigenous peoples and the development of environmental safeguards. However, implicit in the U.S. Congressional decision to build the pipeline was acceptance that expanded human activity would impinge on northern Alaska's pristine wilderness and that there was probable risk of environmental damage. Another major public-policy decision was to allow construction of a pipeline for Prudhoe Bay natural gas. The problem that remains is uncertain economics; thus no Alaskan construction has occurred to date. Public policy also was advanced in windfall-profit taxation, and towards exploration and development of new petroleum areas. Each policy has generated conflict between state and federal governments and private groups, but overall public-policy decisions and related judicial actions continue to favor a development stance. This is likely to persist as long as U.S. national attention is drawn to the uncertainty of foreign sources for petroleum.

Key words: Alaska, petroleum, public policy

RÉSUMÉ. Le développement actuel et futur de l'industrie pétrolifère en Alaska est directement relié à questions de politique publique. La découverte de pétrole à la baie Prudhoe a signalé le besoin d'une route pour la transport au marché. Le choix de l'emplacement des canalisations est maintenant déterminé en fonctions des frontières politiques, une route complètement américaine étant préférée. La construction actuelle de canalisations dépendait des réclamations que faisaient sur les terrains les peuples indigènes de l'Alaska, ainsi que de la mise en vigueur de sauvegardes visant le protection de l'environnement. Cependant, la décision du Congrès américain ayant trait à la construction du pipe-line acceptait le fait que la croissance dans l'activité humaine affecterait la nature vierge de l'Alaska et causerait sans doute quelque dommage à l'environnement. Une autre décision majeure de politique publique entraînait la construction d'un gazoduc pour le gaz naturel de la baie Prudhoe. Le problème qui se présente est celui de facteurs économiques incertains; il n'y a donc eu, à cet effet, aucune construction à date en Alaska. La politique publique fut aussi présentée lors d'une période d'imposition inattendue sur les profits, et visait l'exploration et le développement de nouveaux domaines pétrolifères. Chaque politique a causé quelque conflit entre les gouvernements fédéral et d'états et des groupes privés, mais les décisions en général et les actions judiciaires connexes continuent de favoriser un programme d'exploitation. Cette tendance se poursuivra pour aussi longtemps qu'il sera souligné aux Américains l'incertitude des marchés de pétrole étrangers.

Mots clés: Alaska, pétrole, politique publique

Traduit pour le journal par Maurice Guibord.

INTRODUCTION

In September 1969, the State of Alaska obtained $923 million from a petroleum lease sale located on the North Slope near Prudhoe Bay. The apparent interest in the sale by multinational oil companies and the size of the lease bonus payments were significant indicators that Alaska's petroleum industry was in a major expansion phase.

Oil and natural gas development in Alaska is a relatively new phenomenon. The first substantial commercial field was discovered in 1957 near Kenai and in conjunction with petrochemical developments provided the initial instance of a petroleum boom (Kresge *et al.*, 1977). When Alaska became a state in January 1959, it was permitted by the U.S. Congress under the Statehood Act (U.S. Public Law 85-508) to select from vacant unappropriated federal land within its borders an entitlement of over 40 million ha — 28% of the state's land base. In the early 1960s, state government selected a block of land bordering the Arctic Ocean and shortly thereafter several oil companies began test drilling. In February 1968, the Atlantic Richfield Oil Company struck commercial quantities of oil near Prudhoe Bay and after some additional exploration it became evident that a giant oil field had been discovered.

The objective of this paper is to investigate public policy as it relates to present and potential petroleum development in Alaska. This will involve an integration of economic, political, and technical factors in an analysis of the development process. An allied discussion of national legislation directly related to Alaskan petroleum activity will also be helpful. Given constraints on length and potential breadth of this topic, the paper will consider only major public-policy issues. More detailed individual accounts of specific issues will be noted in the references.

Public-policy issues surrounding petroleum development are magnified by the high value of the resource and its apparent abundance within Alaska. Taxation and royalty ownership of oil and natural gas fields by the state and federal governments will generate enormous revenues, at least through the year 2000. Recent estimates indicate that the State of Alaska will receive approximately $50 billion (in nominal dollars) between 1982 and 1998 just from its royalty share and production taxes on Prudhoe Bay oil (Alaska Department of Revenue, 1982a).

Oil and natural gas in Alaska are found both on and off shore. Proven reserves are located on the North Slope and near Kenai; however, apparently much is yet undiscovered

[1]Department of Economics, 317 O'Neill Resources Building, University of Alaska, Fairbanks, Alaska 99701, U.S.A.
[2]Department of Economics, 601A Gruening Building, University of Alaska, Fairbanks, Alaska 99701, U.S.A.

(Table 1). The initial size of Prudhoe Bay was estimated at 9.4 billion barrels and, after almost five years of production, this has fallen to approximately 7.3 billion barrels. Recent oil exploration has been directed to certain offshore areas; one discussed later is the Beaufort Sea just north of Prudhoe Bay. Onshore, the area with the apparent greatest potential for oil is located in the Arctic National Wildlife Refuge, currently being considered for exploration by the federal government. Oil exploration is continuing in proximity to the Prudhoe Bay oil field (Fig. 1).

PRUDHOE BAY AND THE OIL PIPELINE

With the discovery of Prudhoe Bay, a means to transport the crude oil to market became necessary. The Arctic Ocean adjacent to the North Slope remains ice-laden approximately 10 months per year. Sea transmission, the least expensive way to move oil, was judged not feasible at the point of discovery (Cicchetti, 1972). After some investigation, an overland pipeline was indicated to move oil 1286 km to an ice-free port in southern Alaska, thus facilitating low-cost ocean transportation to desired markets. The oil companies selected the sea route from southern Alaska in 1969 and created the Alyeska Pipeline Service Company to build and manage the pipeline (Lenzner, 1977).

TABLE 1. Oil and natural gas reserves of Alaska

	Oil (million bbl.)		Natural Gas (billion cu. ft.)	
Proven Reserves*				
Kenai	175		33 617	
North Slope				
Prudhoe Bay	7264		28 183	
Kuparuk	447		206	
TOTAL	7886		32 006	
Undiscovered Recoverable Reserves**	low	high	low	high
Onshore	2500	14 600	19 800	62 300
Offshore	4600	24 200	33 300	109 600
TOTAL	7100	38 800	53 100	171 900

*Oil or natural gas has been identified as extractable under current price/cost relationships and state of technology (source: Alaska Oil and Gas Conservation Commission, 1982).

**Oil or natural gas as yet undiscovered which is expected to be extractable under current price/cost relationships and state of technology. A possible exception to the technology assumption is oil or natural gas found under arctic sea ice (source: U.S. Department of Interior, 1981b). Higher undiscovered potentially recoverable oil and gas estimates are available but may not be constrained by the assumptions of current cost/price relationships and/or state of technology (e.g. National Petroleum Council, 1981).

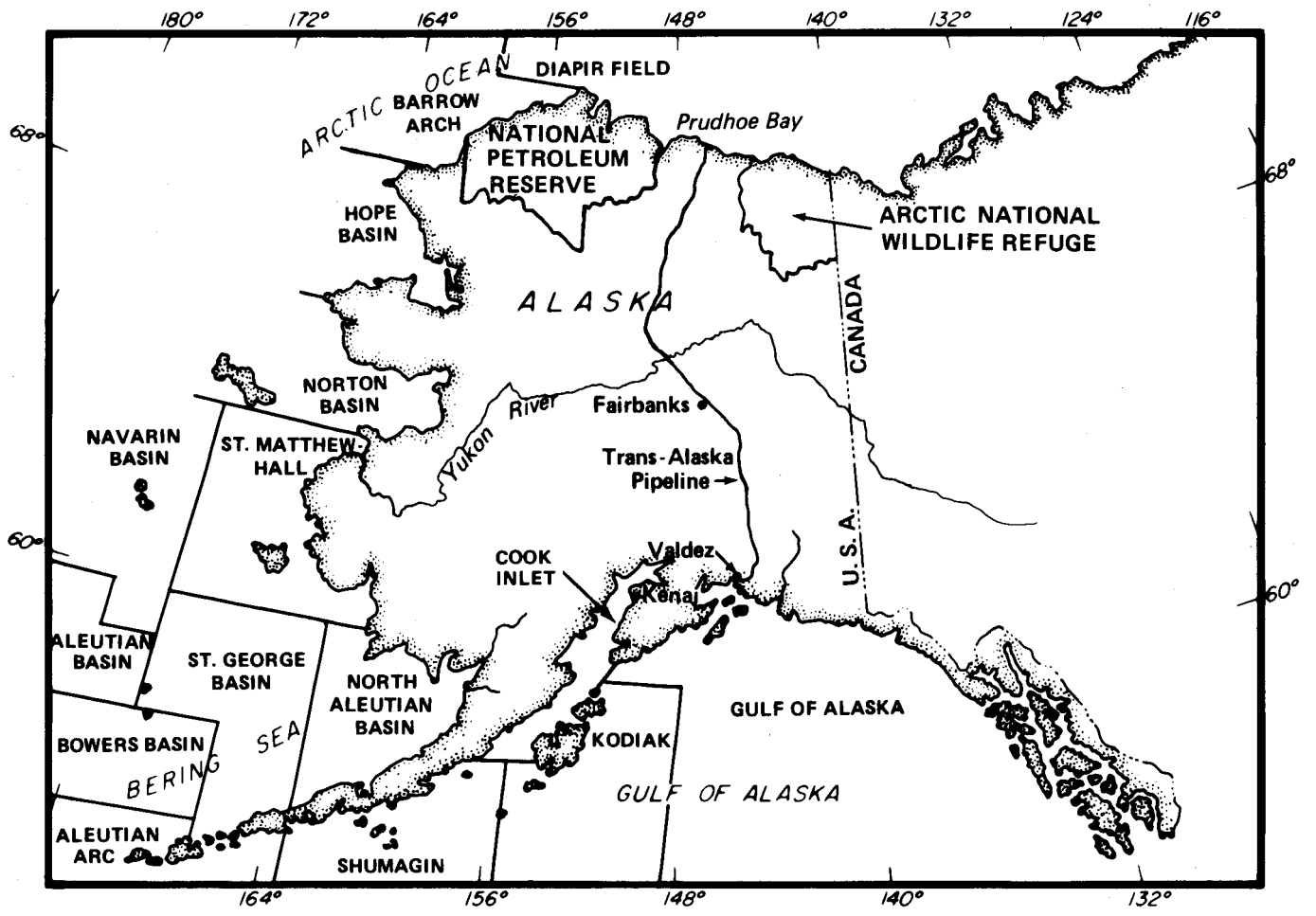

FIG. 1. Routing of Trans-Alaska Oil Pipeline, major petroleum areas and general location of OCS basins (in bold letters).

The route selected found disagreement in some quarters. The oil implicitly was destined for markets in other states in the United States. The oil shipped by supertankers from southern Alaska could efficiently reach California, but opponents of this plan suggested that the West Coast could not consume all the oil coming out of the Alaska pipeline.

Supertankers scheduled to move oil from Valdez, Alaska, the proposed pipeline terminus, could reach U.S. East Coast and Gulf Coast ports with surplus oil only by sailing around the tip of South America, because they would be too large for passage through the Panama Canal. The alternatives most commonly presented were movement of the oil only by supertankers from Alaska and either transshipment by pipeline from the West Coast eastward, or placement in smaller vessels for passage through the Panama Canal. Cicchetti (1972) argued that if the intended market for the oil was other parts of the United States, then the combination land/water route through southern Alaska to the West Coast was not the most profitable for the oil companies or the State of Alaska. An alternative all-land route through Canada was preferable. However, if the purpose was to sell the surplus oil to Japan, then the Trans-Alaska Oil Pipeline was the better economic decision.

An all-land route to midwestern and eastern markets was, of course, not selected. A major factor was unfavorable reaction by the oil companies toward additional government involvement (Canadian government and affected provinces) in the decision-making process associated with construction and operation of the pipeline. One potential problem was an estimated two-year delay in construction start-up (Cicchetti, 1972). A second issue was the political support given by the State of Alaska and others for building an all-American oil pipeline. Increasing isolationism in the United States, caused in part by the Arab oil boycott of October 1973, solidified support for the all-Alaska route. The Trans-Alaska Oil Pipeline Authorization Act (U.S. Public Law 93-153) passed the U.S. Congress in November 1973, after a very close vote in the U.S. Senate.

Two other factors were important to oil field development and pipeline construction: Native land claims and environmental concerns. When Alaska was purchased from Imperial Russia in 1867, land issues related to the indigenous Native peoples of Alaska became the responsibility of the United States government. The Organic Act of 1884 (U.S. Public Law, 48th Congress, Chapter 53) stated the desire for a Native land settlement sometime in the future. When the area around Prudhoe Bay was found to have great quantities of oil, land claims had not yet been settled. Since pipeline construction permits were required across federal lands, a claims settlement became paramount in allowing the construction phase to begin; this issue will be discussed later in the paper.

The second issue was that of environmental concern, particularly for the wilderness of northern Alaska. Many Native peoples have a "subsistence lifestyle" which depends in large measure on the harvesting of nearby wild game. Just east of Prudhoe Bay in the Arctic National Wildlife Refuge is the calving ground of one of the largest caribou herds in North America. With the exception of the few Native peoples that live, hunt, and fish in the northern interior and along the Arctic Coast, much of the area is pristine wilderness. The disturbance of this wilderness by oil-field development and pipeline activity was of major concern to environmental groups as well as Alaska Native peoples. Legal action was undertaken to prevent pipeline construction on the grounds that Native land claims had not been settled, severe environmental damage was possible and requirements for an environmental impact statement under the 1969 National Environmental Policy Act (U.S. Public Law 91-190) had not been met.

Plans for pipeline construction were in the formulation stage by 1969. Large movement of construction materials to the state occurred that year (Casavant *et al.*, 1979). The 122-cm diameter pipe was manufactured in Japan and began to arrive in Alaska in 1969. The period 1971-1972 saw a reduction in the flow of pipeline-related materials because of various legal battles over the construction project. Alyeska Pipeline Service Company continued, cooperated in, or was influenced by various engineering and environmental studies which, when construction was finally undertaken, provided for a number of changes in the original design.

Pipeline construction activities began in early 1974 with construction of a road parallel to the planned pipeline route, from the Yukon River to Prudhoe Bay. Actual pipeline construction began in 1975. During the next three years, a total of approximately $8 billion was invested in the Trans-Alaska Oil Pipeline; an additional $1.4 billion was invested in the terminal at Valdez. Oil-field development was also ongoing during this period and to the present. By early 1982, over 400 development wells were in place to supply the pipeline, and investment in field development exceeded $5.6 billion.

An area of major public-policy emphasis was impact on the northern ecosystem. Throughout the United States there was considerable interest in the wilderness environment of northern Alaska. The proposed pipeline was viewed by many as such a potential threat to this wilderness that its construction was not justified. Major issues included:

1. Disruption of the caribou and their range;
2. Permafrost disturbances;
3. Arctic construction as it related to caribou migration (and other fish and game animals) and permafrost;
4. Earthquake potential; and
5. Ocean-going tanker traffic with associated pollution problems (Cicchetti, 1972).

Studies were undertaken by many scientific groups to develop information concerning all the above points in order to find ways to overcome, where possible, associated environmental impacts in anticipation that approval

for pipeline construction would be forthcoming (e.g., Klein, 1979; McKendrick and Mitchell, 1978; U.S. Department of Interior, 1972). With pipeline construction approved, stringent environmental rules were placed on the pipeline company. This environmental protection was in large measures responsible for the increase in construction costs eight times over initial investment estimates (Lenzner, 1977).

The public-policy decision to allow pipeline construction was based on two premises: (1) the wilderness of northern Alaska would no longer be totally pristine; and (2) the risk of major environmental damage could not be reduced to a zero-probability level. A societal decision through the U.S. Congress was made to accept both wilderness impact and possible environmental damage because the value of the commodity was judged too great relative to the alternative of no production.

From the perspective of 1982, the pipeline has had few environmental problems since it began operation. A few minor leaks have occurred; all were cleaned up by the pipeline company under government supervision. Initial concern about impact on migrating animals seems to have lessened. Caribou appear to be coping with the pipeline and the accompanying haul road, but to what degree is controversial (Miller, 1980). North of the Yukon River, the pipeline appears to have brought little change to the wilderness environment. However, the haul road was recently opened to seasonal public traffic as far north as Dietrich. This action could have significant impact on certain wilderness areas of northern Alaska through increased human recreational and commercial activity.

ALASKA NATURAL GAS TRANSMISSION SYSTEM (ANGTS)

Competition for selection of the pipeline route highlighted the early phase of natural-gas activity associated with Prudhoe Bay. A large amount of natural gas (28 trillion ft^3) was found in conjunction with the oil. It was estimated that a natural-gas production rate of 2 billion $ft^3 \cdot day^{-1}$ could be maintained without causing substantial physical and economic damage to concurrent oil production. The production time horizon was estimated at 25 years. Three proposals were developed to transmit natural gas from Prudhoe Bay to major U.S. markets. Two were pipeline routes from Alaska into Canada and back into the United States. The first route went eastward through the Arctic National Wildlife Refuge into the Yukon and Northwest Territories and down the Mackenzie River system to southern markets. The second paralleled the Trans-Alaska Oil Pipeline route to Delta Junction and then followed the Alaska Highway into the Yukon Territory and on to southern destinations. The third followed the Trans-Alaska Oil Pipeline to near Valdez, where the natural gas was to be liquefied and moved by ocean vessels to the south (Thomas and Casavant, 1977).

In October 1976, the U.S. Congress passed the Alaska Natural Gas Transportation Act (U.S. Public Law 94-586), including a request for presidential advice on which route to select. In November 1977, Congress approved the selection of the Alaska Highway route (U.S. Public Law 95-158) as a means for moving Prudhoe Bay natural gas. This was done on the recommendation of President Carter, who believed that private financing would provide the necessary investment capital (Tussing and Barlow, 1979). The Canadian government also approved the route, which would carry natural gas through a 122-cm diameter pipeline to U.S. markets. However, the proposed pipeline has not yet been built, for reasons related to high initial capitalization, potential cost overruns, and technology. The two corporate partners are not large enough to raise the required initial investment capital of up to $43 billion, including $25 billion in Alaska. Private credit markets appear wary of the risks involved. Tussing and Barlow (1979) indicated that risk is associated with (1) the possibility that Alaskan natural gas may cost more than its market value; and (2) the possibility that unknown factors during construction and/or operation could raise the cost even further. The U.S. Congress did agree that a "rolled-in" pricing scheme instead of an "old" incremental pricing approach could be used for Prudhoe Bay gas (Tussing and Barlow, 1978). This allowed higher-priced Alaskan natural gas to be averaged into lower-priced gas from other sources, thereby improving its competitive position. Since approval of the route in 1977, the corporate partners have asked for more than just rolled-in prices. Additional requests include: (1) an all-events tariff which allows the cost of the project to be borne by the consumer even if the natural gas cannot be delivered; and (2) federal loan guarantees (Tussing and Barlow, 1979; Alaska Department of Revenue, 1979).

Technical problems have not been totally resolved either. Design difficulties appear more numerous than those related to placement of the oil pipeline. They include the inherent danger of placing a large high-pressure gas line next to the Trans-Alaska Oil Pipeline for the first 885 km.

A State of Alaska report indicates that, as the price of oil rises, the economics of Prudhoe Bay natural gas development tend to improve (Alaska Department of Revenue, 1979). However, large natural gas developments in Mexico and Canada could have adverse impacts on gas pipeline prospects (Tussing and Barlow, 1979). Decontrol of all U.S. natural-gas prices by 1985 could make alternative projects increasingly profitable and provide stiff competition to ANGTS.

In early 1981, the major Prudhoe Bay oil producers signed an agreement with Northwest Energy Company to provide 30% of the equity and arrange for 30% of the debt financing on ANGTS. The 1977 presidential decision and subsequent Congressional resolution specifically prohibited oil-producer ownership in the pipeline and an act of the U.S. Congress was required to alter that status.

In December 1981, a joint Congressional resolution (U.S. Public Law 97-93) approved President Reagan's recommendation of a waiver of law pursuant to the Alaska

Natural Gas Transportation Act of 1976. This resolution permitted (1) North Slope producers to hold an equity interest in the gas line project, (2) inclusion of the gas conditioning plant in the project, and (3) pre-commencement billing of U.S. consumers before the project is completed.

Certain Canadian portions of ANGTS are already under construction to facilitate movement of Canadian natural gas. The eventual construction of the Alaskan portion of ANGTS still remains highly uncertain. As of this writing, Northwest Energy Company has terminated most Alaskan employees and the State of Alaska is closing its gas pipeline surveillance office. The federal office is expected to close in October 1982.

MAJOR NATIONAL LEGISLATION

1971 Alaska Native Claims Settlement Act (U.S. Public Law 92-203) (ANCSA). Oil discoveries on the North Slope of Alaska in April 1967 were the major catalyst for legislation to resolve land claims by Alaska's indigenous people to the federal government. Federal and state government officials perceived that without the land claims settlement, legal actions initiated by Native peoples could delay, and possibly prevent, construction of the oil pipeline.

Settlement passed by the U.S. Congress allowed Alaska's Native peoples to select 17.8 million ha of unappropriated and unreserved federal lands (12% of the land in Alaska) and provided a cash settlement of $962.5 million, $500 million to be paid by the State of Alaska. It extinguished all future land claims within Alaska by Native people. Federal land to be crossed by the proposed pipeline corridor was placed in a reserved status before Native land selection could begin. The cash payment was in lieu of lost selection rights for patented state and private lands or reserved federal land. Specifically, the Native peoples of Alaska could not select the land associated with the Prudhoe Bay oil field because it had already been patented by state government.

1973 Trans-Alaskan Oil Pipeline Authorization Act (U.S. Public Law 93-153). The construction of the Trans-Alaska Oil Pipeline was delayed for two major reasons: Native land claims and environmental concerns. The first was solved with ANCSA. Environmental concerns were presented in a legal sense through various court actions. One approach was to prevent issuing of permits to build the line by indicating that an environmental impact statement (EIS) required under the 1969 National Environmental Policy Act (U.S. Public Law 91-190) was not complete. After the EIS was finished, a primary tactic was to attempt to discredit the effort in further court actions. The Pipeline Authorization Act as passed by Congress prevented further legal action by environmental and other interested groups unless instituted within 60 days of enactment. No such action occurred.

This legislation also affected marketing. It dictated that crude oil passing through the line could only be sold to customers in the United States. During early 1982, excluding in-state use of 50 000 barrels per day, an average 650 000 barrels per day of Alaskan oil were sold to U.S. markets on the West Coast. The remaining 900 000 barrels per day were sold to East and Gulf Coast markets (Alaska Department of Revenue, 1982b). This latter amount increases the average cost of crude oil transported from Prudhoe Bay, for reasons including the much greater distance involved and the bottleneck of the Panama Canal. The consequence is reduced wellhead value for the oil producers and the State of Alaska. (Wellhead value is determined by subtracting the marine transportation charges and oil pipeline tariff from the sale price at crude oil refinery.)

A marketing alternative is to allow the oil that is excess over West Coast needs to be sold to Japan. A like quantity of Mexican and/or Middle Eastern oil purchased by Japan could then be shipped directly to the U.S East or Gulf Coast. Politically, this would require permission of the U.S. Congress. It is uncertain whether the event will occur; however, recent American and Japanese government discussions have taken place. The major public-policy benefits from a United States perspective would be diplomatic, the sharing of a scarce resource with a political ally, and economic, reduction of the transportation costs for Alaskan oil with a concomitant increase in its taxable wellhead value.

1976 Alaska Natural Gas Transportation Act (U.S. Public Law 94-586). The legislation was the culmination of route selection efforts for moving Alaskan natural gas to southern U.S. markets. This act required the U.S. President to advise the U.S. Congress on which route was most feasible. After lengthy deliberations, a presidential decision was made in November 1977 to utilize the Alaska Highway route (U.S. Public Law 95-158). Congress, in passing the subsequent Natural Gas Policy Act (U.S. Public Law 95-621) in November 1978, suggested that the only federal subsidy should be the rolled-in pricing mechanism described earlier.

Tussing and Barlow (1979) indicated that Northwest Energy Company emphasized the risk-reduction aspects of the Alaska Highway pipeline route compared with the two alternative gas pipeline proposals. Further, it was implied that through risk reduction, private (non-government) financing could be obtained for the project. Even with passage of the waiver package (U.S. Public Law 97-93) in 1981, which transferred some project risk to the oil companies who own the natural gas, and to the consuming public, private-sector financing has not been secured. What appears to have occurred is that public-policy decisions have been made to build a pipeline, including entering into a treaty with Canada, while the economics of the situation tend to favor project cancellation. Moreover, the Alaska Natural Gas Transportation Act apparently mandates the Alaska Highway route, so consideration of alternate pipeline systems for Prudhoe Bay gas will require new Congressional action.

From a technical standpoint, there is a disagreement over the continued reinjection of natural gas and its effect on Prudhoe Bay oil production. Economides (1981) argues that gas reinjection must end around 1985 to prevent serious impact on production from Prudhoe Bay (Sadlerochit oilpool). Apparently, the major alternative view is that the reinjection process is not so time-sensitive that gas reinjection cannot continue past the mid-1980s. Alaska state law prohibits the flaring of natural gas at Prudhoe Bay (Alaska Statutes 40.01) so some form of transportation system eventually will be necessary to remove gas from the field if maximum oil production is to be obtained.

1980 Crude Oil Windfall Profit Tax (U.S. Public Law 96-223). In 1979 President Carter began to decontrol the price of domestically produced crude oil. As part of that decision, he requested that the U.S. Congress place a windfall profit tax on the added revenue which would accrue to the oil companies as a result of the deregulation. Congress passed the legislation in April 1980. The windfall profit tax is not a tax on profits but an excise tax on a portion of the incremental difference between a calculated base price and the market-determined price (McDonald, 1981). In the case of Prudhoe Bay oil (Sadlerochit oil pool), the base price is approximately $12.81 per barrel; in succeeding periods, this base price will be adjusted for inflation. The tax is 70% of the incremental difference between the base price and the wellhead price. In 1981, the monthly average wellhead price, unweighted, was $23.53. Estimated fiscal year 1981 distribution of wealth from the Prudhoe Bay field, less cost of field production, was 45% to the federal government, 33% to the State of Alaska, and 22% to the oil companies (Alaska Department of Revenue, 1982b).

On a national basis, including oil produced in all areas of the United States, the tax is estimated to provide the federal government $228 billion in additional revenue over an 11-year period (U.S. Congress, 1980). Tax receipts do not reflect payment from oil owned by state and local governments and American Indians, including the State of Alaska's ⅛ royalty share of Prudhoe Bay oil, because these groups were exempted in the legislation.

An interesting political division occurred during the formulation of the tax. The U.S. House of Representatives passed legislation to tax state-owned oil unless the revenue was used for public education. The U.S. Senate exempted state-owned oil under the legislation it passed. During free conference committee the U.S. Senate version won out.

The conflict that emerged between the two houses of the U.S. Congress reflects, to a large measure, the composition of each. The U.S. House of Representatives is apportioned by population, thereby largely representing the consuming states of the East Coast and Midwest. The U.S. Senate is geographically determined and represents, to a much greater degree, the western states where a large part of America's natural resources, and correspondingly few of its people, are located. The western states generally form a loose coalition to reduce the impact of "adverse" legislation directed at their resources. The passage of the Senate version of the windfall profit tax legislation is an example of this coalition's effectiveness and may be the forerunner of many more.

1980 Alaska National Interest Lands Conservation Act (U.S. Public Law 96-487). The U.S. Congress passed the Alaska Lands Act in December 1980. Almost 40 million ha of federal land were placed in national parks and monuments, forests, wildlife refuges, and recreation areas. The Act encouraged the development of an oil and gas leasing program on non-restricted federal lands in Alaska. The Act directed the U.S. Secretary of the Interior to carry out a study of all federal lands on the North Slope, excluding the National Petroleum Reserve in Alaska, which was covered by other legislation (U.S. Public Law 94-258). The purpose of the study was to assess the oil and gas resources of these lands, as well as wilderness needs and characteristics. The Secretary is to submit this study no later than eight years after the date of enactment of the Alaska Lands Act.

More significantly, the Secretary of the Interior was directed to provide a comprehensive inventory of the Arctic National Wildlife Refuge. Within two years of enactment, the Secretary must establish initial guidelines governing exploratory activities for the coastal plain portion of the refuge (Canning River to Aichilik River). However, production of oil and gas from the Arctic National Wildlife Refuge is prohibited, as is all commercial leasing activity, unless authorized by a further act of the U.S. Congress.

BEYOND PRUDHOE BAY

Petroleum development in Alaska gained momentum with Prudhoe Bay. A logical question to ask is "what happens next?" The original Prudhoe Bay field will begin to decline by 1987 (Tussing, 1981).

Exploratory drilling has occurred offshore and onshore near Prudhoe Bay for a number of years. Expectations have developed within many oil companies that the Beaufort Sea could be the next major oil field in America. Additionally, there are two major onshore reservoirs adjacent to the main Prudhoe Bay field, Kuparuk and Prudhoe Bay-Lisburne, and one major onshore reservoir to the east, Point Thomson.

In December 1979, a Beaufort Sea oil and gas lease sale was held in Fairbanks, Alaska (Alaska Department of Commerce and Economic Development, 1979). High bids on 70 tracts offered totaled $1 billion, to be divided nearly equally between the state and federal governments. One unique public-policy event occurred. Alaska selected 17 of its most promising tracts and sold them with no bonus payment but on the basis of percentage of net profit paid to the state. The high net-profit bid for one tract was 93%. If no oil is found on any of these tracts, the state has foregone the pre-drilling bonus payment. To date, initial explora-

tion activities appear highly promising. Artificial islands have been constructed and drilling operations are underway in several locations.

Expanded drilling in the Beaufort Sea was initially hampered by a series of legal actions filed by the North Slope Borough, two Native villages, and nine environmental groups. Their concern centered on two issues: (1) the sale should not include areas beyond a group of barrier islands because of major sea-ice problems; and (2) significant environmental damage may occur, particularly to sea life, if any part of the sale goes forth. Court injunctions preventing drilling were lifted on state and federal submerged lands in 1980 with further state court action possible.

There appears to be valid concern that seasonally moving sea ice, particularly seaward of the islands, could pose a serious threat to the drilling installations and associated feeder pipelines. Technology for drilling and related pipeline construction in severe sea-ice conditions is in the development stage (National Petroleum Council, 1981). Should technology fail, serious oil pollution of ocean waters under the ice is possible. The outcome could be severe localized damage of the marine environment and major losses in sea mammal populations (U.S. Department of the Interior, 1979a).

In 1976, the U.S. Department of the Interior was given management of the Naval Petroleum Reserve Number 4 and its name was changed to the National Petroleum Reserve in Alaska (NPR-A) (Fig. 1) (U.S. Public Law 94-258). Although test drilling had been carried out intermittently by the U.S. Navy for many years, mapping of sub-surface strata rather than oil exploration was emphasized. The Department of the Interior has changed the management approach, and conducted a 0.6 million-ha oil lease sale in January 1982. A disappointing $62 million was bid for 29 leases on 59 offered tracts; the Secretary of the Interior subsequently voided four leases because of low bid prices. A new lease sale totaling 1.5 million ha was conducted in late May 1982; only 12 out of 209 offered tracts were sold, for approximately $10 million. Apparently, there are numerous smaller oil fields scattered throughout the NPR-A which could become commercially viable with a pipeline extension from Prudhoe Bay (U.S. Department of the Interior, 1979b).

Another potential area is the Arctic National Wildlife Refuge. The size of deposits in the refuge, beyond estimates, is not known since no drilling has occurred to date. This is a highly promising geological area, particularly in comparison with the NPR-A. Oil per square mile could be nearly eight times greater if average values are considered (Mast *et al.*, 1980). Any development is controversial, however, due to significant wildlife conflicts. The 1980 Alaska Lands Act (U.S. Public Law 96-487) allowed for exploratory drilling but not production. Development in the refuge is likely to be slow.

Onshore petroleum activity in Alaska has increased awareness of the offshore potential. Politically, offshore activity is largely the responsibility of the federal government. It both manages the activity and retains all lease bonuses and royalties from oil and gas found off Alaska's coast on the outer continental shelf and slope (OCS) beyond the three-mile limit. A policy decision was made by the Reagan Administration to carry forward with some modification the Carter Administration's OCS leasing program (U.S. Department of Interior, 1981a). This program includes 16 areas through 1985. Alaska plans to coordinate adjacent state offshore lease sales (within the three-mile limit) with the federal OCS program. Substantial concern has been expressed regarding development of offshore oil fields near major salmon and king crab populations. Areas of particular concern are the massive red salmon fishery in Bristol Bay (Northern Aleutian Basin), where the planned April 1983 sale has been deleted, and the king crab fishery in Saint George Basin. To date, no substantial quantities of oil and gas have been reported in any major offshore drilling efforts on Alaska's OCS except for state submerged lands in the Beaufort Sea and Cook Inlet.

It is unlikely that another field the size of Prudhoe Bay will be discovered. This oilfield did provide the economic incentive to develop a transportation system to arctic Alaska and spurred both onshore and offshore exploration throughout Alaska. The outcome will likely be oil and natural-gas production from commercially viable smaller fields well into the next century.

CONCLUDING REMARKS

Native land claims settlement, the major Alaskan public-policy event of the 1970s, facilitated petroleum development in Alaska. Given this catalyst, the significant petroleum public-policy issues are the decisions to (1) explore, produce, and transport; (2) protect the environment; and (3) tax the production. These three policy goals can, if weighted differently, lead to alternative outcomes. If exploration and production are expanded, environmental protection becomes more difficult. If environmental protection is emphasized and its cost borne by the oil companies, cost of operation will increase, thus potentially reducing production and exploration. Increased taxation can reduce production and exploration and the level of accompanying environmental protection. All of the examples reflect public-policy decisions by government; in the case of Alaska, not just one government but two, federal and state. It is possible, even likely, that each government may differ in its weighing of these three policy issues. One observation seems rather safe, however; as long as U.S. national attention is drawn to the uncertainty of foreign sources of oil, decisions at any level of government to stop future petroleum activity in Alaska will be overturned. This type of uncertainty tends to increase social value of the resource, which in turn weighs strongly against environmental concerns which block development.

The oil pipeline continues to transport crude oil outside Alaska to other U.S. markets. A state public-policy deci-

sion to support the development of in-state processing of Prudhoe Bay oil and natural gas before transshipment would not necessarily run counter to national objectives. This topic has been widely discussed in Alaska and has led to construction and operation of a small refinery near Fairbanks which produces heating oil, diesel and jet fuel. World-scale processing operations at several locations in Alaska are also being discussed. The overriding factor in any petrochemical development is processing cost relative to market price, and Alaska tends to be a high-cost area. State government subsidization of the industry would likely facilitate development, but such an approach would create substantial public debate.

Finally, Prudhoe Bay has greatly influenced the economic position of the State of Alaska. It may make the state one of the wealthier governments in the world. One might hypothesize a growing disquiet between the state and federal governments over the transfer of large sums of money from American oil consumers to Alaska state government. Other oil-producing states in the U.S. will have similar problems. The outcome may be discriminatory tax laws passed against oil-producing states if the issue can be forced through the U.S. Congress. This, then, will become another area of conflict and controversy associated with Alaskan petroleum development.

ACKNOWLEDGEMENTS

The article is an outgrowth of a seminar given by W. Thomas at the Centre for Resource and Environmental Studies, The Australian National University, Canberra, in May 1980. Support for the Australian visit was provided by the Australian-American Educational Foundation, Canberra, and the Department of Agricultural Economics and Business Management, University of New England, Armidale, N.S.W. This research is a joint contribution from the School of Agriculture and Land Resources Management (AES journal paper J-151) and School of Management, University of Alaska, Fairbanks.

REFERENCES

ALASKA DEPARTMENT OF COMMERCE AND ECONOMIC DEVELOPMENT. 1979. The Alaska economy year end performance report. Volume 8. Juneau, Alaska: Division of Economic Enterprise. 32 p.

ALASKA DEPARTMENT OF REVENUE. 1979. Petroleum production revenue forecast. December. Anchorage, Alaska: Petroleum Revenue Division. 44 p.

———. 1982a. Petroleum production revenue forecast. March. Anchorage, Alaska: Petroleum Revenue Division. 46 p.

———. 1982b. Unpublished data. Anchorage, Alaska: Petroleum Revenue Division. [Available from Petroleum Revenue Division, 201 E. 9th Ave., Anchorage, AK 99501, U.S.A.]

ALASKA OIL AND GAS CONSERVATION COMMISSION. 1982. Unpublished data. [Available from the Commission, 3001 Porcupine Dr., Anchorage, AK 99501, U.S.A.]

ALASKA STATUTES (TERRITORIAL) 40.01. An act defining and prohibiting the waste of oil and gas in the territory of Alaska — March 15, 1955.

CASAVANT, K., THOMAS, W., WAANANAN, M. and LOGSDON, C. 1979. Alaska-Washington trade: waterborne commerce. Fairbanks, Alaska: Agricultural Experiment Station, University of Alaska. Bulletin 50. 90 p.

CICCHETTI, C. 1972. Alaska oil: alternative routes and markets. Washington, D.C.: Resources for the Future. 142 p.

ECONOMIDES, M. 1981. North Slope gas — a better approach? The Northern Engineer 13(2):4-8.

KLEIN, D. 1979. The Alaska oil pipeline in retrospect. Transactions, 44th North American Wildlife and Natural Resources Conference. 235-245.

KRESGE, D., MOREHOUSE, T. and ROGERS, G. 1977. Issues in Alaska Development. Seattle: University of Washington Press. 223 p.

LENZNER, T. 1977. The management, planning and construction of the trans-Alaska pipeline system. Anchorage, Alaska: Report to the Alaska Pipeline Commission by the Commission's Special Council. 598 p.

MAST, R., McMULLIN, R., BIRD, K. and BROSGE, W. 1980. Resource appraisal of undiscovered oil and gas resources in the William O. Douglas Arctic Wildlife Range. U.S. Department of the Interior, U.S. Geological Survey Open File Report 80-916. 28 p.

McDONALD, S. 1981. The incidence and effects of the crude oil windfall profit tax. Natural Resources Journal 21(2):331-339.

McKENDRICK, J. and MITCHELL, W. 1978. Fertilizing and seeding oil-damaged arctic tundra to effect vegetation recovery, Prudhoe Bay, Alaska. Arctic 31(3):296-304.

MILLER, D. 1980. Can caribou live with oil development? The Northern Line 2(4):1, 7, 8.

NATIONAL PETROLEUM COUNCIL. 1981. U.S arctic oil and gas. Washington, D.C. 284 p.

THOMAS, W. and CASAVANT, K. 1977. Alaska-Washington trade implications of proposed alternative national gas pipeline routes. Paper presented at Pacific Northwest Regional Economic Conference. 12 p. [Available from The Arctic Institute of North America, University of Calgary, Alberta, Canada T2N 1N4.]

TUSSING, A. 1981. The outlook for Alaska north slope crude oil production: 1981-2000. Anchorage, Alaska: Institute of Social and Economic Research, University of Alaska, R.S. No. 8. 8 p.

——— and BARLOW, C. 1978. An introduction to the gas industry and marketing and financing supplemental gas. Anchorage, Alaska: Institute of Social and Economic Research, University of Alaska. 297 p.

———. 1979. The Alaska highway gas pipeline: a look at the current impasse. Juneau, Alaska: Alaska Legislative Affairs Agency. 72 p.

U.S. CONGRESS. 1980. Conference report. Crude oil windfall profit tax act of 1980. Washington, D.C.: U.S. House of Representatives Report No. 96-817. 180 p.

U.S DEPARTMENT OF THE INTERIOR. 1972. Final Environmental Impact Statement, Proposed Trans-Alaska Pipeline. Vols. 1-6. Washington, D.C.: Bureau of Land Management. 2933 p.

———. 1979a. Final Environmental Impact Statement, Proposed Federal/State Lease Sale Beaufort Sea. Vols. 1-3. Washington, D.C.: Bureau of Land Management. 409 p. + unnumbered appendices.

———. 1979b. Final Report of the 105(b) Economic and Policy Analysis. Alternative overall procedures for the exploration, development, production, transportation and distribution of the petroleum resources of the National Petroleum Reserve in Alaska (NPRA). Washington, D.C.: Office of Minerals Policy and Research Analysis. 145 p.

———. 1981a. Draft supplement to final environmental statement, proposed five-year OSC oil and gas lease sale schedule January 1982-December 1985. Washington, D.C.: Bureau of Land Management. 122 p.

———. 1981b. Estimates of undiscovered recoverable resources of conventionally producible oil and gas in the United States, a summary. Washington, D.C.: U.S. Geological Survey Open File Report 81-192. 17 p.

U.S PUBLIC LAW, 48TH CONGRESS, CHAPTER 53. Alaska Organic Act — May 17, 1884.

U.S. PUBLIC LAW 85-508. Alaska Statehood Act — July 7, 1958.

U.S. PUBLIC LAW 91-190. National Environmental Policy Act — January 1, 1970.

U.S. PUBLIC LAW 92-203. Alaska Native Claims Settlement Act — December 18, 1971.

U.S. PUBLIC LAW 93-153. Trans-Alaska Oil Pipeline Authorization Act — November 16, 1973.

U.S. PUBLIC LAW 94-258. Naval Petroleum Reserves Production Act — April 5, 1976.

U.S. PUBLIC LAW 94-586. Alaska Natural Gas Transportation Act — October 22, 1976.

U.S. PUBLIC LAW 95-158. Joint resolution approving presidential decision on route of Alaska natural gas pipeline — November 8, 1977.

U.S. PUBLIC LAW 95-621. Natural Gas Policy Act — November 9, 1978.

U.S. PUBLIC LAW 96-223. Crude oil windfall profit tax — April 2, 1980.

U.S. PUBLIC LAW 96-487. Alaska National Interest Lands Conservation Act — December 2, 1980.

U.S. PUBLIC LAW 97-93. Joint resolution approving presidential recommendation on changes in Alaska Natural Gas Transportation Act of 1976 — December 15, 1981.