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OIL AND NATURAL GAS PIPELINE RIGHTS-OF-WAY

Part II

HEARINGS **BEFORE THE** **SUBCOMMITTEE ON PUBLIC LANDS** **OF THE** **COMMITTEE ON** **INTERIOR AND INSULAR AFFAIRS** **HOUSE OF REPRESENTATIVES** **NINETY-THIRD CONGRESS**

FIRST SESSION

ON

H.R. 9130

TO AMEND SECTION 28 OF THE MINERAL LEASING ACT OF 1920, AND TO AUTHORIZE A TRANS-ALASKA OIL AND GAS PIPELINE, AND FOR OTHER PURPOSES

HEARINGS HELD IN WASHINGTON, D.C.

MAY 17, 21, 22 AND 29; JUNE 7, 1973

Serial No. 93-12

Printed for the use of the
Committee on Interior and Insular Affairs



U.S. GOVERNMENT PRINTING OFFICE

57-439

WASHINGTON : 1973

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402 - Price \$3.45
Stock Number 5276-01932

441-23

71A-10-21-10M 3-11-19-21 JAN 19-10-30

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OIL AND NATURAL GAS PIPELINE RIGHTS-OF-WAY PART II

THURSDAY, MAY 17, 1973

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON PUBLIC LANDS
OF THE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Washington, D.C.

The subcommittee met, pursuant to notice, at 10:05 a.m., in room 1324, Longworth House Office Building, Hon. John Melcher (chairman) presiding.

Mr. MELCHER. The committee will come to order. We will continue with the hearings on H.R. 1893, H.R. 4651, and related bills.

We have a new bill assigned to the committee, H.R. 7851, to provide for a study of the availability of a route for a trans-Canadian oil pipeline to transmit petroleum from the North Slope of Alaska to the continental United States and for other purposes.

Without objection, I will make that bill a part of the record at this point.

Hearing no objection, so ordered.

[H.R. 7851 follows:]

[H.R. 7851, 93d Cong., 1st sess.]

A BILL To provide for a study of the availability of a route for a trans-Canada oil pipeline to transmit petroleum from the North Slope of Alaska to the continental United States, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. This Act may be cited as the "Arctic Oil and Natural Gas Act of 1973."

FINDINGS

SEC. 2. The Congress hereby finds that—

(a) Energy sources are in short supply and the Congress should act to hasten the recovery of underground petroleum reserves on the North Slope of Alaska;

(b) the principal alternative routes for constructing a transmission system for such recovery are a proposed trans-Alaska pipeline from the North Slope to Valdez and thence by oceangoing tanker to the West Coast of the United States, or a pipeline from the North Slope through northeastern Alaska and thence through Canada to the midwest area of the United States;

(c) the proposed trans-Alaska pipeline from the North Slope to Valdez has already been the subject of thorough and intensive study;

(d) the trans-Canada route for the pipeline should be thoroughly and objectively reviewed also, and diplomatic problems arising from the adoption of such a route should be identified and clarified; and

(e) a comparison of the studies of both routes should thoroughly consider and examine the environmental effects, economic costs, and national security aspects of both routes.

DECLARATION OF POLICY

SEC. 3. Because congressional action will be required before any delivery system for North Slope oil and natural gas can be constructed, the Congress hereby seeks to obtain sufficient information about the availability of an all-land trans-Alaska-Canada utility corridor to enable it to resolve a matter of national importance and to approve a delivery system for North Slope oil and natural gas which would best serve the overall national interest.

ASSESSMENT STUDY

SEC. 4. (a) The Comptroller General of the United States (hereafter in this Act referred to as the "Comptroller") is authorized and directed to conduct a thorough study of an overland pipeline route from the North Slope across northeastern Alaska and through Canada to the midwest section of the United States for recovering and delivering to the continental United States petroleum reserves located on the North Slope of Alaska. In addition, the Comptroller shall make an objective comparison study of the trans-Canada pipeline route with the trans-Alaska pipeline route, including marine transport to the continental United States.

(b) The Comptroller shall report his findings and conclusions, based on the studies authorized by this section, to the Congress, and shall file a final report, based on such study, with the Congress by January 1, 1974, or by the end of the one hundred and eighty-day period beginning on the date of enactment of this Act, whichever is later. In conducting the comparison study authorized by the last sentence of subsection (a), giving equal consideration to the environmental impact, economic cost, and national security aspects of the two principal alternative routes, the Comptroller shall—

(1) Identify and define those market areas in the continental United States that are expected to experience the greatest immediate and long-range demand for petroleum; and

(2) determine whether an Alaskan oil pipeline-oceangoing tanker system or an overland Canadian pipeline system is the better system of delivery for such North Slope petroleum in order to meet the demand for such petroleum.

(c) In conducting the studies authorized by this section the Comptroller shall enter into such contracts with the National Academy of Sciences, and such other persons, institutions, or agencies as may be necessary and appropriate to carry out the purposes of this Act.

(d) The Comptroller is authorized to secure from any department, agency, or instrumentality of the Federal Government any information he deems necessary to carry out his functions under this Act. Upon request of the Comptroller, the head of any Federal department, agency, or instrumentality is authorized (1) to furnish the Comptroller such information as may be necessary for carrying out his functions to the extent it is available to or procurable by such department, agency, or instrumentality and (2) to detail to temporary duty with the Comptroller, on a reimbursable basis, such personnel within his administrative jurisdiction as the Comptroller requests, each such detail to be without the loss of seniority, pay, or other employee status.

NEGOTIATIONS WITH CANADA

SEC. 5. The Secretary of the Interior, in conjunction with the Secretary of State, and such other Federal officials as may be appropriate, are authorized and directed to enter into negotiations with the Government of Canada to determine the feasibility and availability of a right-of-way across Canadian territory for the construction and operation of transmission facilities for the petroleum reserves on the North Slope of Alaska. The Secretary and such other Federal officials shall report the results of their negotiations to the Congress and to the Comptroller no later than November 1, 1973, or by the end of the four-month period beginning on the date of enactment of this Act, whichever is later.

FILING OF REPORTS

SEC. 6. All reports required by this Act to be filed with the Congress shall be filed with the Clerk of the House of Representatives and the Secretary of the Senate.

GRANTING OF RIGHTS-OF-WAY

SEC. 7. Notwithstanding any other law, rule of law, or any order or decision of any court, no order or rule of the Secretary of the Interior, or of any other Federal agency or officer of the United States, granting a right-of-way, easement, or special land use permit, respecting any Federal land, for the construction and operation of a pipeline for the transmission of petroleum from the North Slope in Alaska shall take effect until after January 1, 1974, or until after the end of the one hundred and eighty-day period beginning on the date of enactment of this Act, whichever is later. As soon as practicable after the end of the sixty-day period (excluding Saturdays, Sundays, holidays, and days on which either House is not in session) beginning on the day the Comptroller files his final report, the Secretary of the Interior shall, according to applicable provisions of law, upon application grant such rights-of-way or easements, and issue such special land use permits, with respect to any Federal land, as may be necessary to construct, operate, and maintain a petroleum transmission system along the route determined by the Comptroller, as a result of the study authorized and directed by section 4 of this Act, to be the better of the two principal alternative routes, unless the Congress, during such period adopts a concurrent resolution, according to the procedure specified in section 8, disapproving such route. If the Congress does adopt such a resolution within such sixty-day period, then the Secretary shall, according to applicable provisions of law, upon application, grant such easements or rights-of-way, and issue such special land use permits, with respect to any Federal land, as may be necessary to construct, operate, and maintain a petroleum transmission system along the other principal alternative route studied by the Comptroller under section 4 of this Act. All such rights-of-way, easements, or special land use permits, issued by the Secretary as provided in this section, may be granted or issued for such width as the Secretary of the Interior determines necessary and without regard to the provisions of section 28 of the Mineral Leasing Act of 1920 (30 U.S.C. 185).

CONGRESSIONAL ACTION ON PETROLEUM TRANSMISSION

SEC. 8. (a) This section is enacted by Congress—

(1) as an exercise of the rulemaking power of the Senate and the House of Representatives, respectively, and as such they are deemed a part of the rules of each House, respectively, but applicable only with respect to the procedure to be followed in that House in the case of resolutions described by this section; and they supersede other rules only to the extent that they are inconsistent therewith; and

(2) With full recognition of the constitutional right of either House to change the rules (so far as relating to the procedure of that House) at any time, in the same manner, and to the same extent as in the case of any other rule of that House.

(b) For the purpose of this Act, "resolution" means only a concurrent resolution, the matter after the resolving clause of which is as follows: "That the Congress disapproves the route for the development of a transmission method for the delivery of North Slope petroleum described as follows: _____", the blank space therein being appropriately filled; but does not include a concurrent resolution which specifies more than one plan.

(c) A resolution with respect to a petroleum transmission plan shall be referred to the Committee on Interior and Insular Affairs of the House of Representatives, or the Committee on Interior and Insular Affairs of the Senate, by the President of the Senate or the Speaker of the House of Representatives, as the case may be.

(d) If the committee to which a resolution with respect to a petroleum transmission plan has been referred has not reported it at the end of ten calendar days after its introduction, it is in order to move either to discharge the committee from further consideration of the resolution or to discharge the committee from further consideration of any other resolution with respect to the petroleum transmission plan which has been referred to the committee.

(e) A motion to discharge may be made only by an individual favoring the resolution, is highly privileged (except that it may not be made after the committee has reported a resolution with respect to the same plan), and debate thereon shall be limited to not more than one hour, to be divided equally

between those favoring and those opposing the resolution. An amendment to the motion is not in order, and it is not in order to move to reconsider the vote by which the motion is agreed to or disagreed to.

(f) If the motion to discharge is agreed to or disagreed to, the motion may not be renewed, nor may another motion to discharge the committee be made with respect to any other resolution with respect to the same plan.

(g) When the committee has reported, or has discharged from further consideration of, a resolution with respect to a petroleum transmission plan, it is at any time thereafter in order (even though a previous motion to the same effect has been disagreed to) to move to proceed to the consideration of the resolution. The motion is highly privileged and is not debatable. An amendment to the motion is not in order, and it is not in order to move to reconsider the vote by which the motion is agreed to or disagreed to.

(h) Debate on the resolution shall be limited to not more than ten hours, which shall be divided equally between those favoring and those opposing the resolution. A motion further to limit debate is not debatable. An amendment to, or motion to recommit, the resolution is not in order, and it is not in order to move to reconsider the vote by which the resolution is agreed to or disagreed to.

(i) Motions to postpone, made with respect to the discharge from committee, or the consideration of, a resolution with respect to a petroleum transmission plan, and motions to proceed to the consideration of other business, shall be decided without debate.

(j) Appeals from the decisions of the Chair relating to the application of the rules of the Senate or the House of Representatives, as the case may be, to the procedure relating to a resolution with respect to a petroleum transmission plan shall be decided without debate.

Mr. MELCHER. We have had a request from Carl E. Bagge, president of the National Coal Association, asking that the attached statement by Mr. Bagge be made a part of the record.

Hearing no objection, so ordered.

[The documents follow:]

STATEMENT BY CARL E. BAGGE, PRESIDENT, NATIONAL COAL
ASSOCIATION

My name is Carl E. Bagge. I am the president of the National Coal Association, which represents the major coal producing and coal sales companies of the nation. The coal industry welcomes the opportunity to present its views on the proposed removal of the 50-foot right-of-way restriction to permit the timely construction of the Alaskan pipeline.

The National Coal Association supports legislation which will permit the timely construction of the Alaskan pipeline. For the reasons set forth, we believe this to be in the national interest and consistent with the long-standing position of the National Coal Association that the fullest development of America's indigenous energy resources should be an urgent national priority.

This position might seem at odds with the mandate of the National Coal Association—to promote coal. However, we believe that careful analysis fully justifies our decision to support legislation to permit the transporting of domestic oil and natural gas across public lands. In addition to the indigenous resource argument cited above, this issue is vital to the coal industry because coal is the future feedstock for both oil and pipeline gas.

Our dependence on foreign energy is already growing at an alarming degree. During 1972 the U.S. imported more than 25% of its total national petroleum demand. Much of this total was in the form of residual fuel oil, a direct competitor of coal in the utility, industrial and commercial markets.

The impact of these imports has been devastating upon the coal industry. Coal has lost major markets along the East Coast to foreign residual oil and has, for all practical purposes, ceased to be a major competitive factor there. Now the impact of foreign oil is reaching inland and is threatening the very existence of large segments of the nation's coal industry.

Environmental standards have been the major cause of the acceleration in foreign oil imports. Stringent sulfur limitations have excluded coal from many of its traditional markets. In the absence of adequate pollution control technol-

ogy the only viable alternative has been oil—imported oil. Still more stringent import limitations scheduled to go into effect between now and 1975 will tend to accelerate the trend toward imported oil. Moreover, the uncertainty surrounding surface mining creates an additional impetus for increasing oil imports.

The cost of our increasing dependence on imported oil is considerable. From a balance of payments standpoint alone about \$4 billion went into foreign treasuries during 1972, a major threat to international monetary stability. More significant, however, was the decline in America's ability to expand its indigenous fuel capability to meet domestic demands. As domestic capability atrophied, the nation moved further along the road to foreign fuel dependence.

Our future energy situation will be more critical unless there is a major shift in national energy policy and a conscious decision to develop indigenous resources. Predictions by others indicate that imported oil may exceed 50% of our total oil consumption by 1985. Imported liquid natural gas from both North Africa and the Soviet Union is a distinct threat to the viability of our domestic energy base. The shift from Western Hemisphere oil sources to the Mid-East poses significant diplomatic and military questions. Finally, the magnitude of our balance of payments potential problems looms in catastrophic proportions. This could amount to more than \$30 billion by 1985.

The alternative is indigenous resource development. We must maximize our coal, oil, natural gas, and oil shale resources. We must, as a nation, commit ourselves to such development within the context of environmental quality.

Alaskan oil is one such indigenous resource. It is available, and although it will not, by itself, solve our long-term petroleum supply problem it nonetheless is a major new domestic reserve. Naturally, it is a competitor of coal and we must be prepared to meet it in the market place. It is domestic competition, however, and the alternative—more foreign oil—is a circumstance we believe is clearly not in the public interest.

Our basic concern here is the recent decision by the Circuit Court of Appeals for the District of Columbia which has blocked the timely development of an essential domestic energy resource. The thrust of that action clearly at odds with the best interests of energy consumers, the nation's fuel industries, their employees, and we believe, the nation at large.

The action of the court in this case is directly parallel to similar actions taken against the energy industries in recent years. For example, there is currently pending before the U.S. Supreme Court a lower court ruling which, if upheld, would prevent the construction and operation of coal fired power plants.

Combined with other events, such as the non-degradation suit now before the Supreme Court, the Alaskan oil pipeline decision could severely cripple America's indigenous energy resource base. As the members of this committee are well aware, such a series of events would place this country in a subservient role to foreign fuel suppliers, thereby subjecting the security of our energy supply to the whims of foreign nations, and the uncertainties of international politics.

In many respects, coal, oil, natural gas, uranium, oil shale, and water power are inextricably intertwined as part of the energy base upon which America must grow.

That is why we are here today in support of legislative efforts to permit the timely construction of the Alaskan pipeline.

For the record we have attached a statement by the associations representing America's major fuel interests. This statement sets forth the elements which we feel should be included in a unified energy program.

This was done because the associations involved recognized a mutual interest in indigenous resource development even though we must and should compete for our individual shares of America's energy market.

We agree with and urge passage of legislation which would allow the use of sufficient land to permit the construction, operation, and maintenance of new pipelines across federal lands. Such construction and operation should be within the context of proper environmental safeguards. We do not profess to be experts in what those safeguards should be, nor can we suggest to you what must be done to protect the environment in the instance of the pipeline under discussion. We do believe, however, that narrowly construed width restrictions do not justify forestalling the development of needed energy distribution systems.

Coal, like all other forms of energy which have the potential to be transported by pipeline must concern itself with the same safety and environmental

legislation, mainly that of recognizing that in most instances the 50-foot "right-of-way" is insufficient to cope with construction equipment and techniques for any pipeline of reasonable size.

The immediate question before this committee today is the construction of the trans-Alaskan oil pipeline. This is a matter which must be resolved expeditiously so that the vast oil reserves of the Prudhoe Bay area can be made available to American consumers.

The National Coal Association fully supports expeditious action on this particular problem as part of a national program for indigenous energy resource development and this committee and others involved in this all-important endeavor.

Attachment

TOWARD RESPONSIBLE ENERGY POLICIES

(A Joint Energy Policy Statement of the American Gas Association; American Petroleum Institute; Atomic Industrial Forum, Inc.; Edison Electric Institute; National Coal Association)

PREFACE

The United States is facing a critical energy problem. The supply of secure and environmentally-acceptable energy will not be adequate to meet prospective demand unless there is a change in the economic and political climate affecting the energy industries.

The few brief local interruptions of energy supplies in the past few years, and the restrictions on sales of natural gas now in effect in a number of states throughout the nation, are only a taste of what may lie ahead a few years from now.

Energy problems must be placed high on the list of our national priorities. Time is of the essence, since it often takes from five to ten years after a decision is made to develop new fuel sources or to construct electric generating facilities before additional energy supplies can be delivered to consumers. Unless prompt actions are taken, serious energy shortages will spread to all parts of the nation.

The attached joint energy statement, "Toward Responsible Energy Policies," has been prepared to alert the nation to the imminence of a major energy crisis and to recommend constructive actions to avert it. We present this statement with the hope that it will make a contribution towards these goals.

F. DONALD HART,
President, American Gas Association.
FRANK N. IKARD,
President, American Petroleum Institute.
CHARLES ROBBINS,
President, Atomic Industrial Forum, Inc.
W. DONHAM CRAWFORD,
President, Edison Electric Institute.
CARL E. BAGGE,
President, National Coal Association.

The United States is faced with a growing energy problem which has the potential of developing into a major national crisis. Public awareness of this is vital to its resolution.

The symptoms of difficulty first appeared in the 1960's, although they were largely obscured by an economic slowdown. It became increasingly apparent that we were living on our basic fuel reserves. Fuel additions were not matching fuel consumption, a warning that our energy economy was shifting from one of abundance to one of scarcity. The nation, and particularly the Eastern Seaboard, became more and more dependent upon imports of foreign oil. Natural gas service curtailments began to take place in scattered locations around the country.

Today, natural gas curtailments are becoming more widespread. Domestic oil production from presently proved reserves in the lower 48 states is at maximum levels and excess capacity has disappeared. Demands for low-sulfur fuel oil and low-sulfur coal cannot be met. The energy problem is continuing to worsen, to the point that the nation is on a collision course with a major energy shortage.

ENERGY—THE KEY TO PROGRESS

The history of the U.S. is one of unprecedented and unparalleled growth. No nation yet approaches the industrial strength of the U.S. No society in the history of the world has reached its level of prosperity.

Energy, readily available at reasonable cost, has been a major factor in this progress. A worldwide comparison of per capita energy consumption and real income points out the close correlation between the two. The higher a nation's per capita use of energy, the higher its per capita real income. Conversely, nations with low rates of energy consumption have low positions on the per-capita income scale. The reduction of poverty coupled with progress toward satisfying rising economic expectations throughout the world will require vast increases in the supply and utilization of energy.

Because of the long history of abundant energy at low cost in the U.S., the nation had come to believe that a limitless supply of cheap energy would always be available. One of the most alarming aspects of the current energy situation is that many Americans do not yet realize there is a problem. Even some of those who are aware that a problem exists do not understand its severity or its dangers. They are unaware of the possible impact of inadequate energy supplies upon their day-to-day activities and life styles.

THE EXPLOSIVE GROWTH IN DEMAND

The public demand for energy in the United States is expected to grow rapidly through the end of the century. Based on a 3.6 percent annual growth rate, a recent study by the U.S. Department of the Interior projects almost a tripling of energy consumption by the year 2000.

Although the share of total energy consumption supplied by each fuel may change, the actual amounts of each energy source which will be required to meet these demands will be far in excess of current levels.

THE NEED FOR ENERGY GROWTH

One way to conserve energy supplies would be to restrict the growth rate of energy use. This would reduce economic progress. We would fail to achieve our most pressing national goals, including full employment, alleviation of poverty, and protection of our national security. We would have to curtail efforts to clean up our environment, since additional energy will be required to secure needed environmental improvements to treat sewage, to recycle waste, and to remove sulfur from fuels. Little support can be given to the assumption that the nation will choose "no growth" in the energy sector of our economy during the rest of this century. Although every effort must be made to assure that our natural resources are used wisely, and for the benefit of all segments of our society, we must assume a growing energy requirement.

THE WISE USE OF ENERGY

An effective means of helping to meet the growing energy demands of the American people is to maximize the efficient utilization of energy in our society and minimize the waste of human and fuel resources. Insofar as practicable, we must strive toward maximum efficiency in the production, distribution and utilization of all forms of energy.

NO SHORTAGE OF RESOURCES

The U.S. has sufficient resources to meet its foreseeable energy needs. While the U.S. has become a "have not" nation in terms of usable commercial supplies of fuel, we are still a "have" nation in terms of available resources. Declining reserves of crude oil and natural gas reflect a low level of exploration and development relative to demand, not an exhaustion of these resources. Estimates by government and other informed specialists indicate that potential domestic resources of oil and gas could support substantially higher rates of production. Coal reserves are abundant, and represent a supply of at least several centuries at existing levels of consumption. Potential uranium supplies for nuclear power are more than adequate, assuming the timely development of breeder reactors. Synthetic oil and gas can be produced from coal. Looking to

the longer-run future, liquid fuels can be produced from oil shales and tar sands. There are huge reserves of these minerals in the Western States and Canada.

THE POSSIBILITIES OF SHORTAGE

A host of vesting problems, some of long standing and others of recent origin, have led to the current tenuous energy supply situation. High on the list are the delays and costs created by a lack of coordinated government policies. The many Federal departments and agencies which rule on energy matters have suffered from the lack of coherent policies to follow. Their decisions have been piecemeal and inconsistent, based upon narrow and short-run interpretations of conditions affecting particular fuels at a particular time. The results have been chaotic, and have discouraged the development of badly-needed energy resources.

The rapid introduction of stringent environmental standards has further constricted the nation's fuel supply. All existing energy sources have been affected. Oil from the huge Prudhoe Bay field in Alaska is still unavailable due to the long delay in approval of the trans-Alaska pipeline. This, in turn, is delaying the availability of new gas supplies from that area. Federal offshore leasing delays are affecting supplies of both oil and gas. In some states, bills have either been passed or are pending which seek to bar the search for petroleum off of their coasts, and make it difficult to find suitable sites for terminal facilities and refineries. Sulfur restrictions in major cities have curtailed usage of both domestic coal and fuel oil. In some states and in Congress, there are proposals to bar surface mining. Delays resulting from prolonged Federal regulatory procedures and court-ordered environmental evaluations of about 100 nuclear power facilities have slowed development of this important new energy source.

Government efforts to superimpose its direction as a substitute for market forces have exacerbated energy problems. As an example, regulation of natural gas prices at the wellhead by the Federal Power Commission, resulting in artificially low levels, acted to stimulate demand and discourage the search for new supplies. This imbalance led to a shortage of this clean-burning fuel, which could assist in reducing air pollution problems in major urban areas. Such government actions often overlook economic and technological interactions and lead to unexpected and undesirable effects.

Imports are playing and will continue to play a role in meeting the nation's fuel needs. It is inevitable that the U.S. will require larger oil and gas imports in the 1970's and nearly 1980's. However, attention must be given to the implications of rising energy imports and their impact upon the development of domestic supplies as well as upon national security. Most of the proved petroleum reserves of the world are located in the Eastern Hemisphere. Supplies of oil from some of these sources have been curtailed a number of times. Excessive reliance upon imported fuels would pose grave dangers to our economic health and national defense. In addition, with producing nations now banding together to demand higher prices and impose higher taxes, foreign oil is becoming more costly. Imported liquefied natural gas is now more expensive than domestic gas. The nation should also recognize that growing energy demand in the rest of the world will result in increasing competition for fuels in coming decades. Thus, looking to the future, foreign energy supplies are likely to be neither secure nor inexpensive. However, some of the risks inherent in fuel importation can be reduced by importing both oil and gas from a variety of sources.

Energy industries are also faced with huge capital requirements, and to an increasing extent must obtain these funds from financial markets rather than from internal sources. Adequate profitability is needed to attract the capital required for new facilities.

A long-range commitment to research and development in the energy field is needed. Government R&D programs should be closely coordinated with research efforts of the energy industries.

THE IMPORTANCE OF TIME

An all-out effort must be made to strengthen our energy economy. The time to make crucial decisions is now. Continued delay will permit minor shortages and inconveniences to develop into major shortages and serious disruptions.

This is because a common characteristic of all significant sources of energy is the long lead time involved in the planning, production, transportation and utilization. Delays can only add to the magnitude of our energy problems.

THE OBJECTIVES OF ENERGY POLICIES

There appear to be four main objectives of sound energy policies:

(1) *The development of an adequate supply of energy at reasonable prices, to permit our nation to enjoy continued economic progress and a high living standard.*

(2) *The achievement of relative self-sufficiency through the maximum development and utilization of domestic fuel resources to the extent justified by appropriate economic and national security considerations, supplemented by oil and gas imports as needed.*

(3) *The maintenance of a safe and healthy environment for both present and future generations.* High energy use has provided a high standard of living, but has also been partly responsible for adverse effects upon man's environment. These effects must be squarely faced and met in a balanced and responsible manner.

(4) *The attainment of maximum efficiency in the production, distribution and utilization of all forms of energy.*

There is no real conflict among these goals. By reshaping our energy policies to broaden the energy base, we can provide adequate and secure sources of reasonably-priced energy in harmony with environmental needs. Both nature and the marketplace can be served.

ELEMENTS OF RESPONSIBLE ENERGY POLICIES

The American Gas Association, the American Petroleum Institute, the Atomic Industrial Forum, the Edison Electric Institute and the National Coal Association, recommend the following basic policies in order to assure adequate supplies of secure and clean energy at reasonable prices:

(1) *Comprehensive energy policies must be formulated to bring about greater coordination and harmony between Federal, state, and local government agencies whose decisions affect energy industries. Government regulation of energy industries, to the extent that it is necessary, should be streamlined in order to adapt more rapidly to the changing needs and requirements of modern society.*

(2) *Energy policies should fully recognize the benefits of the free enterprise system and should be formulated within the context of sound business principles. Energy fuel prices should relate to actual demand and actual market conditions. Policies which stifle initiative in the development of any form of energy are contrary to the public interest.*

(3) *A balance must be struck between the need for environmental protection, and the need for economic development (including energy growth). National environmental policy should give consideration to the availability and cost of pollution control methods and the resulting impact upon energy prices. Costs must be balanced against the resulting social and environmental benefits.*

(4) *Incentives for energy development appropriate to the unique characteristics of fuels and minerals should be strengthened. An attractive economic climate must be developed which will elicit the massive amounts of venture capital needed to develop new supplies of energy fuels.*

(5) *National land use policies affecting both private and public lands, including the Outer Continental Shelf, should be coordinated with national energy policies. Energy production requires land use. Land use policies must recognize the non-renewable nature of fuel resources and the fact that they, unlike many other products, must be produced where found. Federal leasing regulations should permit optimum utilization of all energy resources in harmony with sound ecological principles. Multiple uses of land should be encouraged.*

(6) *Sound and stable import policies should be maintained in order to promote the development of indigenous fuel resources and technology to the extent justified by appropriate economic and national security considerations. While every effort must be made to meet environmental standards, the nation must also make every effort to minimize its dependence for energy upon those foreign sources which could pose problems of possible supply interruptions. In*

addition, unlimited fuel imports could represent a serious drain upon our balance of payments position. Import policies should be designed to allow the competitive use of overseas supplies of oil and gas in a manner that will supplement, but not supplant, domestic sources of supply. Such policies must recognize the special problems, such as environmental requirements, which may arise in particular industries or regions.

(7) *The long-range governmental commitment to research and development in the energy field must be strengthened, and existing cooperative industry/government efforts in research and development must be augmented. Parallel development of both fossil and nuclear fuels is essential if our nation is to meet short- and intermediate-term energy needs as well as longer-run needs. Balanced federal funding is needed to develop new technology which will permit the full utilization of our vast domestic fuel reserves. Primary responsibility for research and development should continue to rest with industry. Government's role should be concentrated mainly in the funding of longer-range programs which do not have an immediate impact, but which do have potential benefits for our nation's consumers of energy.*

High priority must be given to projects such as the development of breeder reactors and fusion technology. At the same time, the Federal Government should continue to share with industry the burden of constructing demonstration plants designed to remove sulfur oxides from the stack gases of coal and oil-fired power plants. In addition, more energetic government programs are needed to aid in the development of technology to convert coal to the more environmentally-acceptable gaseous and liquid forms and for utilizing it directly.

There must also be a more active program for conducting the essential research and development of pollution control technology. Government should insure that environmental goals and standards are set with due regard to existing technology and achievable improvements in the state of the art.

(8) *Health and safety regulations should be carefully designed and administered to minimize hazards to workers and the public and maximize operating efficiency.*

(9) *Wise and efficient utilization of all forms of energy should be promoted and encouraged. Economies in energy consumption can be achieved in homes, transportation, agriculture, business and industry, and government.*

(10) *Both industry and government must recognize their obligation to inform the public on energy matters. Public awareness of the energy situation is a major key to resolving the energy supply situation.*

THE CONSEQUENCES OF FAILURE

The responsibility to maintain a supply of energy which is adequate to meet the needs of our people must be shared by industry and government. It can be met if all segments of American society join together to formulate new energy policies which will remove existing roadblocks to progress.

One overriding need is to sweep away preconceived ideas concerning energy problems. It must be recognized that the era of energy abundance and cheap fuel has ended. Factors such as environmental costs, rising labor and equipment costs, and the need to attract venture capital, must be reflected in prices. The nation's fuel bill is going to go up. Recognition of these basic changes in the energy situation will contribute to a more responsible appraisal of the energy situation and a more realistic approach to the framing of new policies.

The consequences of failure, either by imprudent actions or inaction, are likely to be severe. The result could be energy shortages which could imperil the nation's economic well-being and cause substantial hardships to our citizens. If sound and timely decisions can be reached on energy policies, such a crisis need never arise.

Mr. MELCHER. We have here a letter from Mr. Spahr of Standard Oil Company. I had an additional letter from him and I assured him that this letter will be made a part of the official hearing record.

Without objection, I will make it a part of the record at this point.

[The document follows:]

THE STANDARD OIL Co.,
Cleveland, Ohio, May 4, 1973.

HON. JOHN MELCHER,
Chairman, Subcommittee on Public Lands, House Committee on Interior and
Insular Affairs, House of Representatives, Washington, D.C.

DEAR CHAIRMAN MELCHER: I want to thank you for the courtesy extended to me by you and your fellow members of the Subcommittee on Public Lands when I appeared before you on Wednesday, May 2.

Please do not hesitate to call upon me again whenever you feel that I may be able to be helpful to you as you consider the multitude of important matters that demand your attention.

It is with the intent to be helpful, or enlightening at least, that I now refer to a part of your conversation with some other members of your committee and/or staff that occurred just before you invited me to speak on May 2. I refer to your comment to the effect that the Secretary of the Interior had assured you that he intended to obtain reimbursement from the oil companies having interests in the Trans-Alaskan Pipeline for all of his department's costs already incurred and to be incurred as a consequence of developing the TAPS Environmental Impact Statement, providing design review, inspecting construction, and monitoring the operation of the pipeline.

I simply could not help overhearing this. I am concerned that silence on my part, under the circumstances, might be interpreted as agreement with the Secretary. This is not the case.

I feel very strongly that it is not right to expect the oil companies to accept such an open ended, unmeasured and unlimited burden. The situation in which we all find ourselves is a consequence of the recent enactment of a new law, The National Environmental Protection Act, which has been in an evolutionary period of interpretation. It seems to me that the oil companies are somewhat like pawns in a chess game, with no control over the eventual outcome or the length of the game. Also, it seems that the Interior Department, in carrying out its obligations under N.E.P.A., has been spending money in the general public interest as well as that of the oil companies.

In so far as inspection during construction and operation is concerned we have no way of controlling the conclusions as to manpower to be involved, or as to what is to be done. Further, it seems to me that such inspection is for the public interest, and not in all instances for that of the oil companies. The companies have the obligation of providing inspection of a quality and intensity necessary to assure themselves that they are fulfilling their obligation to provide a sound operating and safe facility.

We have been discussing these matters with representatives of the Department of the Interior in the hope of reaching an agreement as to the definition of the financial obligation that it would be appropriate for the oil companies to bear for Environmental Impact Statement preparation, design review and inspection during construction and operation of the pipeline.

I earnestly hope that you will consider our attitude a reasonable one.

If you would wish to make this letter a part of the record of the hearing I would have no objection.

Sincerely,

CHARLES E. SPARR

Mr. MELCHER. We have written to the various owners of Alyeska Pipeline Service Co. and we have received a reply from Mobil Oil, Amerada Hess, Atlantic Richfield, Phillips Petroleum, Union Oil Co. of California, and Exxon Co.

Without objection, those items will be made a part of the record at this point.

Hearing no objection, so ordered.

[The documents follow:]

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
U.S. HOUSE OF REPRESENTATIVES,
Washington, D.C., May 3, 1973.

Mr. _____

DEAR MR. _____: The House Public Lands Subcommittee, as you know, is holding hearings on rights-of-way legislation which has centered on the Alaska pipeline.

When Mr. Charles E. Spahr, Chairman and Chief Executive Officer of Standard Oil Company of Ohio, testified before the Subcommittee on May 2nd, I told him:

"The question will be raised repeatedly whether or not there is any assurance that if there is a (Alaska) pipeline built, that the crude will all come to the United States. We want your assurance that that is the full intention of your company."

Mr. Spahr told the Subcommittee that was the full intent of his company.

I am now directing this same question to the other six owners of Alaska Pipeline Service Company, which includes your firm.

I would appreciate a prompt reply since the hearing record is being held open to receive this information.

Sincerely,

JOHN MELCHER,
Chairman, Subcommittee on Public Lands.

MOBIL OIL CORP.,
New York, N.Y., May 10, 1973.

HON. JOHN MELCHER,
Chairman, Subcommittee on Public Lands, Committee on Interior and Insular Affairs, House of Representatives, Washington, D.C.

MY DEAR MR. MELCHER: In response to your letter of May 3, 1973, it is the intention of the Mobil Oil Corporation to utilize all of its anticipated Alaskan crude oil production in the United States. In this connection, we expect to refine this oil in our two West Coast refineries located at Ferndale, Washington, and Torrance, California.

We trust that the above adequately responds to your question.

Sincerely yours,

RICHARD F. TUCKER,
AMERADA HESS CORP.,
New York, N.Y., May 7, 1973.

HON. JOHN MELCHER,
Chairman, Subcommittee on Public Lands, Committee on Interior and Insular Affairs, House of Representatives, Washington, D.C.

DEAR SIR: This is to acknowledge your letter of May 3, 1973, and we wish to inform you that, if and when the Alaska pipeline is constructed, we expect to utilize the crude oil within the United States.

Very truly yours,

LEON HESS.

WASHINGTON, D.C., May 3, 1973.

HON. JOHN MELCHER,
Chairman, Subcommittee on Public Lands, Interior and Insular Affairs, House of Representatives, Washington, D.C.

DEAR MR. CHAIRMAN: In response to your letter of May 3 concerning Atlantic Richfield's attitude toward the sale of oil from the North Slope of Alaska to Japan, I think it is most appropriate to quote from testimony delivered that same day before the Senate Interior Committee.

In his testimony on behalf of Atlantic Richfield, Mr. Louis M. Ream, Executive Vice President, said:

"As to the assertion that the Alaskan route is being supported by oil companies because they want to sell a portion of their production to Japan, I can only repeat what my company has said for many years: We have absolutely no plans to sell North Slope oil abroad so long as there is a need for it in the United States. Our Cherry Point, Washington refinery represents, I believe, a concrete proof of our commitment. It was designed and built to process Alaskan crude for American customers."

Further, in an answer to a question from Senator McClure, Mr. Ream added that it would make absolutely no economic sense for our company to export North Slope oil to Japan when we can supply Japanese markets from fields in Indonesia. Alaskan oil will back out the Indonesian crude that would be needed on the West Coast, freeing it for sale in Japan without balance of payments loss to the U.S.

Since Mr. Ream goes into more detail on this subject on Page 5 of his prepared testimony and since Atlantic Richfield was unable to appear before your subcommittee in these hearings, I thought you might be interested in having a copy of Mr. Ream's testimony. Included is a map indicating the location of future synthetic fuel supplies in the mid-continent area as well as the gas and oil pipeline systems now serving the country.¹ An explanation of the potential future supply in the mid-continent appears on Page 4 of Mr. Ream's testimony.

I hope this material is of use to you. If we can be of any further assistance, please do not hesitate to call on us.

Sincerely,

PHIL D. HELMIG.

TESTIMONY OF LOUIS M. REAM, JR., EXECUTIVE VICE PRESIDENT,
ATLANTIC RICHFIELD CO.

Mister Chairman, I appreciate the opportunity to appear before this Committee today on a matter that becomes more important with the passage of each day. I trust my testimony will help clarify our Company's position and some of the misunderstandings and misinformation that have afflicted the debate over North Slope oil.

As you know, Atlantic Richfield made the initial discovery of oil in the Prudhoe Bay area in January of 1968, more than five years ago. Since that time, we have been striving to overcome the environmental, engineering and legal obstacles to delivering this commodity to the Lower 48. We are satisfied that we have achieved our aims in the first two instances, and by amending the 1920 Mineral Leasing Act to permit construction of the Trans-Alaskan Pipeline System (TAPS), the Congress can help us clear the last hurdle.

Before I address some of the more politically sensitive issues involved in the current discussion, I would like to deal briefly with the nature of the legislative relief required in this matter. First of all, let us recognize that some kind of right-of-way amendment is necessary, no matter what route is selected. Whether the line goes south or east from Prudhoe Bay, it must cross U.S. public lands. In doing so, it will require a right-of-way permit from the Secretary of the Interior that the courts have ruled he has no authority to grant under present law. Therefore, if we want the oil, we must amend the law.

The question is, how? I would like to reiterate what Atlantic Richfield's President, Mr. Bradshaw, told this Committee some weeks ago: The simplest remedy, it seems to us, is to confine the amendment to the right-of-way question only. While there seems no question that broader problems are involved with modernizing the Mineral Leasing Act, they will require time to study and when enacted will introduce new and as yet unlitigated issues. We believe that a simple bill permitting the Secretary of the Interior to issue special Land Use Permits, which he has been doing for many years, will solve the immediate problem raised by the court decision and reduce the possibility of time-consuming litigation.

Now, we are all aware that advocates of a Trans-Canadian pipeline system have been trying in the last several months to stop the Alaskan pipeline. They want to see North Slope oil diverted from the nearest, most accessible market—the West Coast—to bring it many hundred miles to the east, to supply a

¹ Map marked Map I has been placed in pocket attached to back cover.

market in which they have a greater interest. Those of us who have been involved in the Alaskan oil venture since the beginning are unanimous in feeling that this diversion would run counter to the national interest. In behalf of our argument we have repeatedly cited the reasons we believe a Trans-Alaskan pipeline is preferable:

- It has been carefully designed and engineered to meet the rigorous challenges of the Arctic topography.

- It is the most expeditious way to bring North Slope oil to market.

- It has adequate financing, all from the private sector.

- It will save the United States from \$5 billion to \$12.5 billion in foreign exchange over any alternative delivery system.

- It puts North Slope oil where it will do the most good in relation to the total U.S. energy picture.

Nevertheless, the proponents of a Canadian alternative persist in painting their proposal as an ideal and seemingly flawless one. The arguments, as we have also repeatedly shown, are deficient in several respects:

- The Canadian pipeline, as an engineering entity, does not even exist on paper.

- Its preliminary environmental work is far from complete.

- It still has all the regulatory and legal problems to clear, including the complex and lengthy one of native claims settlements.

- No one has yet come forward with a financial plan for the pipeline that takes into account questions of treaty requirements, taxes, equity ownership and rights to the oil transported.

- It will be almost twice as expensive.

- The Canadians themselves have shown only minimal interest in the line.

Many of the arguments supporting the trans-Canada route are based on a sense of regional competition—pitting one part of the country against another. But the energy crisis now facing us is a national, not a regional phenomenon. We need every barrel of American oil that we can produce and deliver domestically. Each dollar we save helps our balance of payments and strengthens the dollar that is spent in Chicago as well as the one spent in Los Angeles.

Tempting though it may be to focus on a regional need, such as that in the Midwest, and seek an expedient remedy, such as North Slope oil, we should ask ourselves whether this really serves our long-run interests. On one point alone—the U.S. Gross National Product—our studies with the Wharton Long Range Econometric Model indicate a cumulative loss to our economy of around \$19 billion (1973 dollars) through construction of a Canadian pipeline, with all its attendant costs of delay, flight of capital, etc. And this is predicated on the trans-Canada option delaying us only two years. The actual additional delay might run as long as five.

Let me deal for a moment with the very serious matter of a Midwest energy shortage. I think it is possible to demonstrate that the delays involved in building a trans-Canadian oil pipeline to answer Midwest needs will be counterproductive—not only to the total U.S. energy picture, but actually to the long-range requirements of the midcontinent area. There are three potential domestic energy resources, exclusive of initial North Slope oil, that can be used to alleviate Midwestern needs.

- (1) North Slope natural gas.

- (2) "Second-phase" North Slope crude oil—i.e., production that will result from renewed exploration in the area once oil is on stream to the Lower 48.

- (3) Synthetic hydrocarbons (tar sands, crude oil from coal, oil shale).

The first two of these resources depend entirely on construction of a delivery system for the 10 billion barrels of oil now known to exist under the North Slope. We cannot produce gas until oil production is started. To do so would result in a loss in recoverable oil reserves of as much as 20%. The gas, therefore, can be made available for the U.S. market much sooner with construction of the Trans-Alaskan pipeline. Atlantic Richfield Company is at present a participant with approximately 25 other companies (both U.S. and Canadian) in a study to determine the feasibility of bringing North Slope gas through Canada to the Midwest. This group is known as Gas Arctic Northwest Study Group.

Likewise, we cannot economically justify further exploration of the North Slope until we have some assurance we can get out oil we have already discovered and are ready to produce. If our expectations prove correct, new discoveries could provide a vast new resource that might then justify a trans-Canadian system to the Midwest.

The third element, synthetic hydrocarbons, holds perhaps the greatest promise for easing energy shortages, in the Midwest and elsewhere. By the mid-1980's we expect to have crude oil on stream from the Athabasca tar sands deposits in Alberta, Canada. These contain 200 billion to 300 billion barrels of potentially recoverable oil, the recovery of which has already been demonstrated. The Athabasca reserves could supply the petroleum needs of the Midwest at current rates of consumption for more than 100 years. Wyoming low-sulfur coal will soon be available. In every case, the Midwest is the natural marketplace. But I should point out that as long as the trans-Canadian pipeline is a serious subject of debate, plans to move this synthetic crude into the marketplace of the Midwest are measurably retarded.

Mister Chairman, I would like permission to place in the Record at this point our analysis of projected West Coast needs in the 1980's. (Appendix A.) The crude oil deficit on the West Coast in the early 1980's, when TAPS comes fully on stream, will be in the range of 2 million barrels a day, almost exactly the capacity of the pipeline. This gap in domestic production-vs.-demand is not as great as in PAD II, but here again our critics seem caught on a point of flawed logic. If the West Coast can absorb the entire North Slope production totally at the expense of foreign crude, and the producing companies can get it there for the least cost, most quickly, what national interests are served by delivering it to another market twice as far away five years later? There is no price benefit to the consumer, and the national energy situation is certainly not enhanced in the meantime. All interests would be better served by bringing the energy to market as soon as possible and finding better ways to meet Midwestern demands.

As to the assertion that the Alaskan route is being supported by oil companies because they want to sell a portion of their production to Japan, I can only repeat what my company has said for many years: We have absolutely no plans to sell North Slope oil abroad so long as there is a need for it in the United States. Our Cherry Point, Washington refinery represents, I believe, a concrete proof of our commitment. It was designed and built to process Alaskan crude for American customers.

Atlantic Richfield has recently undertaken studies to see how the greatest number of domestic markets can be assured of access to North Slope oil via the Trans-Alaskan pipeline. This will become increasingly important if further exploration and development produce substantial additional reserves in Alaska. Any surplus above PAD V (West Coast) needs must be transported to other domestic customers. One possibility is a pipeline system directly to Chicago from the West Coast. Another, tanker deliveries through the Panama Canal to Gulf and East Coast ports. A third proposal is a trans-Mexico pipeline from the Gulf of California to Texas.

Basically, the key arguments against the Trans-Canadian pipeline are delay and cost. A U.S. balance-of-payments loss of between \$2.5 billion and \$12.5 billion would be brought about through the Canadian option. Most of this would go to Middle Eastern nations whose dollar reserves are beginning to cause concern in western capitals. In addition, our studies indicate errors in calculation of pipeline costs have been made by proponents of the trans-Canadian system that result in gross underestimates. Recent testimony has placed the cost of the total trans-Canada MacKenzie Valley route at about \$3.5 billion, compared to about \$3.1 billion for the trans-Alaskan route. (Both figures in 1972 dollars.)

Our analysis indicates that the cost of the trans-Canadian line if built to the exacting environmental and engineering standards of the TAPS line would cost approximately \$5.6 billion. (Appendix B of my statement, which is attached, gives the justification for these adjustments.) Why this great disparity? Principally because advocates of the MacKenzie Valley route are quoting from a preliminary project report, which is not a precise accounting of engineering design, but merely a feasibility study.

The most crucial element in the equation of the trans-Canadian line, however, is financing. TAPS is a \$3.4 billion joint venture in which each of the seven owners will finance their individually owned undivided interests on their own credit capacity, which is considerable and adequate to do the job.

In contrast, a Canadian line may require twice as much capital, and the politically imposed requirement that Canadians own half of the venture presents a financing problem for which there is no present solution, inasmuch as Canadian companies do not have the necessary financial capacity to support

their share. To solve the many and complex financing problems and form a combination of participants would require many years, if indeed it could be accomplished at all.

In summary, Mister Chairman, the Congress should allow construction of the Trans-Alaskan pipeline to go forward as soon as possible because it provides the quickest and most effective access to the 10 billion barrels of proven oil reserves on the North Slope and to the natural gas associated with it.

It will, in short, get us on with the task we are in business to undertake: supplying domestic energy to the U.S. markets.

APPENDIX A.—WEST COAST HYDROCARBON LIQUID SUPPLY AND DEMAND—1980

Demand: 3.3 million barrels/day.

Supply: West Coast and So. Alaska production, 1.4 million B/D.

Other domestic, -0- B/D.

Imports 1.9 million B/D.

Supply/Demand Balance 3.3 million B/D.

Following the present expansion plan for the Trans-Alaskan Pipeline, its thru-put would not reach the yearly average rate of 1.9 or 2.0 million barrels/day until about the fifth year which would be in the early 1980's at which time the cumulative effect of demand growth of about 150M barrels/day/year on the West Coast would be more than sufficient to accommodate the North Slope oil.

The 3.3 million B/D total demand for 1980 is the same as projected by Secretary Morton. Critics of TAPS have rejected it for an earlier estimate of 3.0 million B/D by the National Petroleum Council and used by the Department of the Interior. The basis for this rejection is that the 3.3 million B/D estimate required a 5.4% annual growth rate between 1972 and 1980, higher than the 4.7% rate of the early and mid-1960's. The NPC estimate which is referred to was made some time ago as part of their initial appraisal of the U.S. energy situation. It is now out of date. On a national basis the growth in petroleum demand between 1970 and 1972 was 50% of the amount that NPC study projected for the entire period 1970 to 1975. It is evident that the growth projected by the NPC study was too low.

Specifically, with regard to the West Coast, domestic product demand grew 6.0% in 1972 and crude runs increased about the required 5.4%.

Further, EPA standards are increasing energy requirements, not decreasing them as claimed, and a shortage of natural gas is placing a heavier burden on oil as a substitute. If these recent trends are accounted for the demand could be as high as 3.6 million B/D in 1980.

APPENDIX B.—ANALYSIS OF MCKENZIE VALLEY PROJECT COST AND READINESS

Recent testimony regarding the cost and state of readiness of the McKenzie Valley Project contained many serious errors. First, the cost estimate of the pipeline segment from Prudhoe Bay to Edmonton was greatly understated at \$2.9 billion if the line is built to the same rigorous specifications being used for TAPS. The average direct cost per line mile in 1972\$ for TAPS is estimated to be \$2,245M for a 600M B/D capacity.

TAPS	
Distance (miles).....	789
Basic capacity (barrels per day).....	600,000
Cost (1972 dollars).....	\$2,710,000,000
Less cost other than direct line costs.....	\$940,000,000
Total.....	1,770,000,000
Average cost per mile (1972 dollars).....	\$2,245,000

Applying \$2,245M/mi. to the 1,738 miles of line from Prudhoe Bay to Edmonton results in a cost of \$3,901MM. Adding costs for pump stations, communication, etc. for a line capacity of 800 B/D would bring the cost to \$4,550MM. Increasing the capacity to 1800M B/D would increase the McKenzie Valley line cost, Prudhoe to Edmonton, to \$4,840MM. A TAPS capacity of 2,000M B/D would be \$3.1 billion in 1972\$.

Secondly, the Interprovincial/Lakehead mileage to Chicago is 1555 miles, not 1100 miles as stated in recent testimony. The cost for this segment would be \$483M/mile in 1972\$ for a total cost of \$756MM. Thus, the total cost of the Canadian route to deliver North Slope oil to the Chicago area would be \$5,596MM in 1972\$.

Why is there such a difference between the numbers put out by the McKenzie Valley project and our upgraded number? TAPS is a thoroughly evaluated engineering estimate, while McKenzie Valley is a feasibility study.

One major difference in concept is the interpretation of soil parameters to establish a burial criteria. TAPS allows differential settlement only within narrow limits, about one foot. McKenzie Valley equates burial to a total settlement concept of up to 3 feet. The concept difference leads to 20.7% of the line above ground for McKenzie Valley and 44.7% above the ground for TAPS. A one foot settlement criteria for McKenzie Valley would lead to 40.4% of the line above ground. This is significant because of the substantially higher cost to lay the pipe above ground.

A second major difference is in construction techniques. TAPS provides a construction work surface for the entire length of the line for ground surface protection. McKenzie Valley provides a temporary work pad for only 600 miles of the 1738 mile route. There are no highway systems available in the Yukon and upper Northwest Territories for logistics purposes. To our knowledge, to date Canada has issued only a tentative set of environmental guidelines for northern construction and more specifically directed to gas pipelines. Results of governmental investigations have not yet been collected and simulated into a formal set of environmental and technical stipulations.

Chapter 9 of the 1972 McKenzie Valley feasibility study lists several areas requiring further study. They indicate that all work has been directed to determine feasibility and appreciate that further research and development work remains to be done.

A partial list of further requirements is:

1. Terrain classification—Additional field work to verify and establish a satisfactory level of confidence in the air-photo interpretation technique.
2. Soil stability—Further field work to confirm basis of evaluation.
3. Environmental—Field work to fill in gaps in data determined largely by literature research.
4. Pipeline design—Field work to establish parameters of design such as soil coefficients of friction, soil modulus, and creep properties of permafrost.
5. Thermal predictions—Determination of more adequate soil properties and surface temperatures to increase the reliability of the mathematical model of heat conduction.
6. Seismicity—More complete data on seismic occurrences and location of fault areas.
7. Construction—Further refinement and investigation of summer techniques, hydrostatic testing, pipe coatings, logistics, and availability of men, equipment and material.
8. Communications—Further investigation of control mode: central automatic vs. conventional local control.
9. Operations and maintenance—Further investigation of pipeline safety from soil settlement, drainage basins, and oil spill-contingency plans.
10. Economics—Further in-depth studies and factual data in the areas of base costs and assumptions, regional and national economic impact, and methods of financing.¹

WASHINGTON, D.C., May 7, 1973.

Hon. JOHN MICHENER,

Chairman, Subcommittee on Public Lands, Committee on Interior and Insular Affairs, House of Representatives, Washington, D.C.

DEAR MR. CHAIRMAN: This is in reference to your letter of May 3, 1973, addressed to me, concerning the intention of Phillips Petroleum Company with regard to North Slope oil in the event that the Trans-Alaskan pipeline is built.

The fact is that if the Trans-Alaskan pipeline is built, it is the intention of Phillips Petroleum Company that its share of the crude oil produced will be sent to the United States. In view of the fact, however, that my position is solely one of providing legal counsel, I thought it appropriate that you have

¹ Identical statement was submitted for the record by Thornton F. Bradshaw, president.

this information from a duly authorized officer of the Company. This is to inform you that such a letter is in preparation and will be mailed to you within the next day or two.

With best wishes.

Sincerely,

MARTIN L. FRIEDMAN.

PHILLIPS PETROLEUM Co.,
Washington, D.C., May 7, 1973.

HON. JOHN MELCHER,
Chairman, Subcommittee on Public Lands, Committee on Interior and Insular Affairs, House of Representatives, Washington, D.C.

DEAR MR. MELCHER: In response to your question regarding the destination of Alaskan North Slope crude oil if the Trans Alaska pipeline is built from the North Slope to Valdez, it is the full intent of Phillips Petroleum Company that its share of the crude oil produced on the North Slope will come to the United States.

Very truly yours,

CARSTENS SLACK.

UNION OIL CO. OF CALIFORNIA,
Los Angeles, Calif., May 9, 1973.

HON. JOHN MELCHER,
Chairman, Subcommittee on Public Lands, Committee on Interior and Insular Affairs, House of Representatives, Washington, D.C.

DEAR MR. MELCHER: In your letter of May 3, you asked the intention of our Company with respect to utilization of Alaska North Slope crude oil.

This is to advise that our Company will have refining requirements on the West Coast of the United States for all of the production we can reasonably expect to develop on the North Slope and transport through our share of the Trans Alaska Pipeline.

Yours very truly,

JOHN M. HOPKINS.

EXXON Co., U.S.A.,
Houston, Tex., May 16, 1973.

HON. JOHN MELCHER,
Chairman, Subcommittee on Public Lands, House of Representatives, Washington, D.C.

DEAR MR. MELCHER: The following is in response to your letter of May 3, 1973, concerning Exxon Company, U.S.A.'s plans for the future disposition of North Slope crude.

It has been our intent since planning started for the Trans Alaska Pipeline System to use this System to move our North Slope oil to U. S. markets. As we presently see the U.S. energy situation, it appears there will be a ready market in the U. S. for all the crude that can be produced on the North Slope. It is certainly our present intent to use the System and our North Slope crude reserves to supply the U. S. market.

We appreciate the opportunity to make this statement.

Very truly yours,

M. A. WRIGHT.

Mr. MELCHER. This morning, the first witness we are going to hear from is our colleague on the committee, Congressman Vigorito from Pennsylvania, who is no stranger to any of us, and particularly close to myself. I am junior to Joe on two committees and have had the opportunity of working with him, not only here on the Interior Committee, but also House Agriculture Committee.

Joe, I have warm admiration for your work and I am sure that your statement today will be a welcome contribution to this hearing record.

**STATEMENT OF HON. JOSEPH P. VIGORITO, REPRESENTATIVE IN
CONGRESS FROM THE 24th DISTRICT OF PENNSYLVANIA**

Mr. VIGORITO. Thank you, Mr. Chairman.

I wish to thank you and the committee for this opportunity to speak out on the Alaskan pipeline. I want to state right from the beginning that I am very much in favor of immediate construction of the Alaskan pipeline. We don't have any time to waste. I am not going into our energy crisis. I think most of us realize the seriousness of the crisis, and actually, it is not a crisis, it is going to be a disaster, maybe even a catastrophe in the future, at the rate this country is going, as far as the energy question is concerned.

I believe that I speak with a little bit of authority on this subject since I spent a whole week up in Alaska in August 1971, from Prudhoe Bay in the north shore of Alaska, all the way down to Valdez on the southern coast of Alaska. I have seen all phases of it and I think that I have some answers.

I asked a lot of questions up there and I got answers to my questions. I would like to give that benefit to the committee. I hope we can get some legislation on this subject.

First, of course, the oil companies are ready to go. If they got the signal tomorrow, they could have this and in a matter of months the oil could start flowing. The maximum output of oil, they estimate, will be 2 million barrels a day, which isn't very much oil, considering the oil consumption of the country and of the world. But nevertheless, it is 2 million barrels a day, and it will end up on the west coast, primarily. I think that the pipeline should be constructed as soon as possible.

The oil companies spent and are spending millions of dollars a day on this while the project is at a standstill. They are investing in research in the subject at the University of Alaska. They have at the University a six or seven hundred foot replica of the pipeline with several stations on that pipeline to try to simulate exactly what is going to happen when the oil begins to flow. They are investigating different types of grass, and as I understand it, some of the grasses which will be used will be superior to the native grasses in Alaska on the right-of-way.

I believe that everyone is talking about the Canadian route as if that is all settled. I found out this morning that no application has even been submitted to any Canadian authorities. So, the quickest we could get oil through the Canadian route, assuming many factors in our favor, which I think would be a wrong assumption, would be anywhere from 5 to 10 years. We cannot wait 5 or 10 years to get the Canadian oil. We must act right now.

One of the objections on the Alaskan pipeline from the north to the south coast of Alaska is that it has to be trans-shipped to the west coast by tanker. We already bring into the United States 5 or 6 million barrels a day by tanker and how will the hazard be increased by the additional 2 million? I fail to see that.

This is only the United States importing oil at 5 or 6 million barrels a day. But worldwide there are hundreds of tankers at sea all of the time. You take Japan alone, a tanker has to land in a port in

Japan every 2 hours, 24 hours a day, 365 days a year. So an additional 1 million barrels from the southern coast of Alaska to the western coast of the Continental United States is not going to make any difference. That should be taken into consideration.

I believe the delay with construction has been to our advantage, because I mentioned a lot of research has gone into it. The size and strength of the pipeline, the grasses to be grown, the freezing and unfreezing of the tundra has been looked into, and every conceivable question answered.

So it is time, Mr. Chairman, that we act on this bill to get the Alaskan pipeline constructed. As a member of this committee, the Full Committee, I can state right now I am going to do everything I can to see we get the Alaskan pipeline underway as soon as possible.

With that, I would like to end.

Thank you again, Mr. Chairman. I would be willing to answer any questions.

Mr. MELCHER. Thank you, Joe.

Could I assume from your testimony that you would favor consideration of language by the subcommittee in the proposed bill to make a finding by Congress that the environmental impact question had been adequately studied, and that Congress had found it would not be adversely affected?

Mr. VIGORRO. Yes, I think it is safe to say that the environmental questions have been satisfactorily answered. As I see it, since Alaska is so huge, 500,000 square miles, give or take a few thousand miles, to me, putting a pipeline down there is like taking a black thread and laying it across a huge football field that is all black. You never notice the difference.

Mr. MELCHER. Thank you.

The gentleman from Guam.

Mr. WOX PAT. Thank you, Mr. Chairman.

I certainly want to join the chairman, of course, in welcoming our distinguished colleague on this committee.

Personally, I agree with your position with respect to the Alaskan pipeline, but there have been witnesses who have appeared before this committee earlier supporting, of course, the Canadian pipeline, with some justifiable reasons. Have you had an opportunity to discuss the Canadian proposal?

Mr. VIGORRO. I have done a little reading on it, and I fail to see, as of now, that the question is a Canadian route versus an Alaskan route. It is either the Alaskan route or nothing. The Canadian route, if it every comes to be, is 5 to 10 years away. The environmental problems that we have in Alaska will be more than doubled with a pipeline in Canada. It would be under a foreign jurisdiction. It would be 2 to 3 times as long, and so forth.

So from the environmental point of view, I just don't see any advantage whatsoever to a Canadian route.

If I may add to my statement, of course, a lot of Congressman and Senators from the Midwest part of the United States are in favor of the Canadian route because the gas and oil then would come down through the mid part of the United States where there is a shortage and will be more of a shortage in the future. However, that isn't valid either, since the oil from Alaska going to the west coast of the

United States will enable the other oil coming from the Middle East to go to the east coast and the gulf coast and into the midsection of the United States.

So I fail to see where that will be a problem.

Mr. WON PAT. You feel that the oil could be transported just as quickly from the west coast to this area?

Mr. VIGORITO. Yes.

Mr. WON PAT. I agree with your view that the reason for the support of the Canadian pipeline is the service to provide, in other words, the oil to these areas. But the point is that it would take so long to get these pipelines constructed.

Mr. VIGORITO. It would be 5 to 10 years away if everything goes according to plan for the Canadian route. A minimum of 5 years. Most testimony I have been able to read or evidence on the subject, says 10 years.

Mr. WON PAT. Thank you, Mr. Vigorito.

Thank you, Mr. Chairman.

Mr. MELCHER. The gentleman from Alaska.

Mr. YOUNG. Thank you, Mr. Chairman.

I speak in favor of the Trans-Alaskan pipeline like you have. You bring out some of the points, a restatement of the points made from the past. And by your statement, again they are correct. I think the big thing we are facing here is either the Alaskan pipeline now or none. We need the energy. We won't go into the energy problem. We need the energy, Alaska can provide the energy, and I hope the Committee can make the same trip you made and maybe they can get insight into some of the problems or solving the problems we view in Alaska concerning the Trans-Alaska pipeline.

I just want to compliment you on your ability to grasp the problem and see what can be done to help the United States.

Mr. VIGORITO. Thank you, Mr. Young. And if the committee goes to Alaska and you need a guide, I would be very willing to go back a second time.

Mr. MELCHER. Thank you very much, Joe. Your testimony was very much to the point.

Mr. VIGORITO. Thank you, Mr. Chairman.

Mr. MELCHER. There is no question where you stand. We appreciate it very much.

Now, as the committee members know, the staff well knows, we have held several days of hearings on these bills. We are now getting into a round of 3 days of hearings, today, and Monday and Tuesday of next week; 3 days of hearings. Principally, we will be hearing from witnesses who will represent the viewpoint of environmental groups.

We have allowed plenty of time for Government, Department of the Interior and Department of the Treasury and Department of State. We have allowed plenty of time for industry and witnesses representing oil companies. It will be my intention to allow plenty of time for environmental groups, environmental witnesses to present their viewpoints. We will, however, on individuals, look for some accommodation of the committee's time. We don't want to limit testimony and we want a very complete record.

We have coming up a number of individuals this morning, and we do have coming up a little bit later, a panel of three. I would hope to complete the five witnesses today. However, if we cannot—you will notice the last witness to appear today is Stewart Brandborg, executive director of the Wilderness Society. If it appears he cannot complete this testimony today, we will take him next week. Each of these 3 days, the witnesses that are coming from out of town, we will make a special point to make sure they are heard on the day that they come here, so they are not inconvenienced. If we can't complete the witness list, we will try to hold off the witnesses who reside here in Washington and even if necessary, pick them up on a subsequent day we have to set for additional hearing.

So with those remarks, we would be delighted to hear from Dr. Terris Moore, president emeritus, University of Alaska.

**STATEMENT OF DR. TERRIS MOORE, PRESIDENT EMERITUS,
UNIVERSITY OF ALASKA**

Dr. MOORE. I appreciate the opportunity to be here and I will make my remarks as brief as possible, because you do have many witnesses.

I want to start off by saying that I was very much impressed by the remarks of the distinguished Congressman from Pennsylvania. He has given my message for me, except I can add one or two minor points. I was, of course, very pleased to hear him point out the important work being done at the University of Alaska in studying the possible effect, probable effect, of the Alaskan pipeline on the local environment.

I can add a few words to that, and I am not going to read my testimony. Instead, I am going to point out three points. At the end of my testimony—I mention it first, because the Congressman mentioned it—

Mr. MELCHER. Dr. Moore, I heard your statement there. Without objection, Mr. Moore's full statement will be made a part of the record.

Hearing no objection, so ordered.

[Dr. Moore's statement follows:]

**STATEMENT OF TERRIS MOORE, PRESIDENT EMERITUS, UNIVERSITY OF ALASKA
ALASKA**

Mr. Chairman, and Members of the Subcommittee, I appreciate this opportunity to come before you and thank you for making it possible. I have come here entirely as an individual, at my own time and expense from Cambridge, Massachusetts (and Monson, Maine my permanent legal voting residence). I am completely retired on several partial pensions from different institutions, and represent neither the University, nor any gas, oil, or industrial companies, and am not aware of any conflicts of interest or bias which would affect the testimony I submit here.

I have known most Alaskan environments intimately for forty-three years and Canadian Arctic and sub-Arctic environments for twenty-seven. I was a member of exploratory mountaineering Alaska expeditions in 1930, 1931, and 1938; of Army environmental research expeditions and maneuvers in Alaska in 1942, 1953, 1959, and 1961. I served as President of the University of Alaska 1949-53; and intermittently since as a University research professor there. As pilot of my own light floatplane and skiplane I have made, over the years, eleven passages across Canada between northern New England and Alaska, necessarily (because of the "Cub" nature of my plane) stopping every few

hundred miles to refuel and overnight. In 1958 I flew this same light float-plane to the northern tip of Canada, Ellesmere Island, in support of the Canadian I.G.Y. scientific party there. For the National Geographic Society I made over 80 take-offs and landings with my skiplane on and around Mt. Kennedy to assist in the surveying and mapping of that mountain in 1965. At several different seasons of the year, I have flown myself as pilot, with frequent landings, over most of the proposed route of the Trans-Alaska Pipeline.

I have read the testimony of Governor Egan and Congressman Young of Alaska before this committee, and the speeches of Senator Stevens, and I concur in their contention (which I understand Senator Gravel also supports) that Alaska's North Slope oil should be brought into use as soon as possible, with every reasonable protection for the environment—realizing that some damage is inevitable—and that the proposed Trans-Alaska Pipeline is the most effective way to do this.

Mr. Chairman, in the enormously complex situation facing your Committee—the numerous bills filed and pipeline issues running into many states—I believe I may serve most usefully if I confine myself to three points only about Alaska's North Slope oil.

I. WHERE DO WE PREFER TO HAVE OUR OIL SPILLS?

Mr. Chairman, if I understand correctly, our domestic production of petroleum which in the past has always risen year to year from the drilling of new oil wells, has levelled off during the past three years, and the drilling of new wells has sharply declined during the past decade. If I have the figures correctly our production is now in the area of 12 million barrels per day (9½ million of crude oil, the balance in petroleum equivalents). But the problem is that our domestic demand, continuing to rise as in the past—not only from population increase, but also from the spreading of our affluence to much wider percentages of our people who formerly were below the poverty line but now have automobiles, better housing, refrigerators, color TV, air conditioning, etc.—has actually increased until it is now in the area of 16 million barrels per day. And there is one figure about which I believe there is no disagreement: that we now are having to import the difference, mostly from Middle East countries, about 3 million barrels a day of crude oil, and the balance in refined petroleum products. In short, there is no question that during the past three years we have become a "have-not" nation with regard to petroleum, and by an amount to which the 2 million barrel per day flow from the Trans-Alaska Pipeline would now (from its three year construction time) be ready to make a tremendous difference—had it not been blocked off.

There seems no question, moreover, but that the prospect is for a doubling of this petroleum deficiency gap toward the end of this decade. As to its actual size however, much will depend upon what is done, or not done in 1973, by the Congress in the way of legislation to clear the way for access by our consuming public to Alaska's North Slope oil.

Mr. Chairman, I should like at this point also to raise the question—what is the environmental effect, now, of Alaska's North Slope oil having been blocked off from use by the environmentalist litigation of the past three years. Pursuing this line of investigation, but more to the point because it deals with the future, what will be the environmental effect of continuing to block it off for yet another three years (the construction time) plus the additional years of Court challenges we are told the militant wing environmentalists are planning—unless the Congress acts in 1973 to give comprehensive clearance to the Alaska North Slope oil impasse?

If the Congress takes no action—which would now be tantamount to an outright decision to keep Alaska's North Slope oil locked up in order to prevent the inevitable minimal spillage along its thin transportation route across the vast uninhabited tundra to refineries on the West Coast and/or Chicago—then the deficiency will have to be supplied by tankers bringing over 2 million barrels per day more oil from the Middle East. And the inevitable spillage accompanying such a flow will, instead, occur in the Atlantic Ocean along our already heavily burdened Eastern seaboard. During recent months, because of the shortage of crude oil, of pipelines, and of refineries to supply the increased demand, we read that refineries are now both planned and under construction in Nova Scotia and Newfoundland, their feed stock of crude oil to come by tankers (often referred to as "rust buckets") from the Middle East and their output to go to the eastern consuming market.

Which is truly the more endangered environment. There already are some 28,500 tanker arrivals yearly now, we are told—that's about 78 a day—between Norfolk, Va. and Cape Cod alone. "Government researchers recently dipped their nets into the Atlantic Ocean hoping to collect marine sample, no come up with tar and polystyrene instead . . . 75 per cent of the time their nets were befouled by oil clumps so thick they extruded through the mesh "like spaghetti" . . . Dr. James N. Butler, a professor of chemistry at Harvard University, believes that the oil and tar slicks in this area have come from crude oil sludge . . . Sludge pumped overboard by tankers purging their tanks off Africa was carried by currents to the Bahamas, where the heaviest concentrations were discovered by NOAA last summer."

Mr. Chairman, my quote is from the *Sierra Club Bulletin*, (March 1973 page 19) And I ask, what sort of an environmental gain would this be in numbers of people already burdened by undesired pollution—to say nothing of the principle of protecting an environment for the environment's sake—to add yet another 2-million barrel a day rust bucket tanker fleet here? Also I would suggest that the reason the majority of Alaskans, as represented by their duly elected officials, are *not* objecting to the proposed pipeline but instead are asking for it, is not because they are indifferent to pollution—any more than you or I are indifferent to pollution. The point is that they know perfectly well as do I because of my 43 years of experience with the environment up there, how tiny is the percentage of that vast beautiful, clean northern environment which would in fact have to be sacrificed for the value in petroleum available there to provide human benefits.

II. THE \$40 BILLION TREASURE, \$120 BILLION IF YOU'RE AN OPTIMIST!

Environmentalists today insist that wilderness values cannot be measured in dollars. And indeed the pleasures of wilderness living and travel cannot. Only the most inappreciative would think of trying that approach. But I never hear today's children of affluence talk this way without being reminded of the—perhaps apocryphal—remark attributed to J.P. Morgan at the turn of the century. When someone asked him how much it cost to keep a yacht, he is supposed to have replied: "If you have to ask that question, you can't afford one!" My point here is simply that *somebody* has to pay for our pleasures (wilderness values or whatever); somebody has to be able to afford them.

J.P. Morgan was paying for his own pleasures, and affluent enough to be able airily to ignore the cost. But in the case of Alaska's North Slope oil, if we are to keep it locked up for a very tiny minority to enjoy pristine wilderness up there (and indeed for the most part only to think about it as pristine from afar), somebody—which means Alaskans, and about 200 million Americans elsewhere—will have to be able to afford it for them. And pay for it by having to buy 2 million barrels a day crude oil from Arab sheiks instead. Frankly, I suggest that this is altogether too high a price for everyone else to be asked to pay.

How do I come up with these multi-billion dollar figures? Quite simple arithmetic—though I'm sure our professional petroleum geologists and economists, if asked to, can adjust my figures and come up with some along this same approach which are professionally based. All I've done is read the literature, a wealth of which I realize is available to this committee, and note the 10 billion barrel proven reserves in the Prudhoe Bay petroleum district (the professional figure I believe is 9.6 billion), and that informed estimates indicate up to 30 billion may in fact become "proven reserves" when drilling is resumed. And for simplicity and also to be on the safe side I've ignored the natural gas there though it too is very large and valuable. To the petroleum figures only, I've simply applied the most recent price per barrel for crude oil being imported from the Middle East, as reported by trade sources. This figure is \$4.36 per barrel for Libyan crude oil landed at Baton Rouge, Louisiana (published in the *New York Times*, March 5, 1973, financial page together with several columns of discussion in trade sources about the new record high price). And I've also ignored the fact that the O.P.E.C.—the Organization of Petroleum Exporting Countries, which is now being called by some Harvard and M.I.T. economists "the world's biggest monopoly"—has since that date announced that they are meeting soon again to formulate their plans for raising their export prices yet higher, in order to "compensate" for the second drop of our dollar in the foreign exchange markets (a drop, incidentally, which some of their members helped bring about by abruptly dumping billions of dollars they had recently piled up from our new unprecedented oil imports).

Mr. Chairman, we may gain some idea of the vast economic importance of our subject when we note that this \$40 to \$120 billion value exceeds—by 4 times over—the \$10 to \$28 billion value of the nation's entire stock of monetary gold at Fort Knox! The value of the latter also is uncertain, depending upon whether one uses the old official price for gold, or the present European free market price, recently in the area of \$95 per ounce.

I suggest that this comparison is a fair and realistic way to look at Alaska's North Slope oil, for the reason that the petroleum not only carries within itself the potential for all the human uses to which it can be put, but also, for the foreseeable future, the petroleum automatically gets put to monetary use when brought out and fed into our refineries. For in our quite new international financial situation, its use will plug just that much of our soaring balance of payments deficit.

I have used the term "foreseeable" future because as a practical matter our "proven reserves" of petroleum are really all we have to buy time for our scientists and engineers until they can actually bring us into new sources of energy. I will not repeat the long list of these new, hoped for, sources of energy with which I am sure this committee is quite familiar—other than to note the fact that this Administration and the Congress are heavily committed to the Liquid Metal Fast Breeder Reactor project. Let us fervently hope that this and our other new sources of energy can be found and brought to practical use. My point is that the date for their arrival is probably the "unforeseeable" future, toward which in the meantime we must grope, depending upon petroleum.

III. THE NEW COLONIALISTS?

The March, 1973 issue of the *Sierra Club Bulletin* summarized the Alaska Pipeline situation as follows: "ALASKA PIPELINE STOPPED BY COURT DECISION . . . construction now will have to wait for Congressional amendment of existing statutes, because existing right-of-way limits are insufficient for modern pipeline facilities. The Court ignored environmental arguments in its decision. So even if Congress extends the right-of-way limitation, opponents of the pipeline will still be able to return for a ruling based on environmental issues. Consequently, pipeline construction will probably be delayed for years—if it happens at all. Speaking for the Sierra Club, Dr. Edgar Wayburn called the Court's decision 'a clear rebuff to the oil companies, which provides us all with a fresh opportunity to plan wisely for the great lands of Alaska, allowing for proper development while protecting its fragile environment.'"

But Mr. Chairman, Alaska's North Slope petroleum and the land beneath which it lies belongs to the State of Alaska and its people—not to the Federal Government, much less to the Sierra Club for that Club's tiny California leadership "to plan wisely for the great lands of Alaska allowing for proper development . . .". I suggest that the litigation under the National Environmental Policy Act has gotten out of hand, that when the Congress in its wisdom in 1969 enacted the NEPA legislation, it never had in mind any such extreme use to be made of the Act as this.

All that the State of Alaska and its people are asking in his House—if I understand Representative Young and Governor Egan correctly (and my testimony is offered to support their positions more than to advance my personal views)—is permission to run their petroleum by modern pipelines out to market over otherwise unused Federal land. Apparently a lease only, of the minimum width necessary to comply with the Secretary of the Interior's NEPA stipulations for the protection of the adjacent environment, would suffice. And I note that the simple legislation they seek would cover the requirements for both the Trans-Alaska pipeline and the Alaska portions of the various proposals for a Trans-Canada pipeline. From the enormous size of the national petroleum domestic energy gap opening up—seemingly of the order of five to ten million barrels per day of petroleum and petroleum equivalents between the middle nineteen-seventies and the middle eighties—not merely one, but two 48" pipelines can be deemed necessary. And 15 billion barrels only, of petroleum and petroleum equivalents, which we know certainly to be up there, can (simple arithmetic) supply the 4 million barrel per day flow of two such lines simultaneously for that ten year period, by which time hopefully new sources of energy may become available.

Mr. Chairman, for the Congress not to act in 1973 would seem, under the special circumstances emerging about NEPA in Alaska, to have the effect, indeed, of leaving the economic development of Alaska and its people, surpris-

ingly at the mercy of the Sierra Club's California leadership. Probably in compromise with the leadership of the other outside militant environmentalist groups, when they decide between them what, economically crippling, "environmental" lawsuits to bring, and which ones to relax.

Mr. Chairman, it seems we must actually take this seriously and ask, just exactly what sort of "development" does the Sierra Club's leadership have in mind for Alaska and its people—to replace the economic development which Alaskans themselves had in mind, but which was stopped cold beginning three years ago? Having joined the Sierra Club when I was an Instructor at the University of California at Los Angeles thirty-five years ago (it was an entirely different type small club of trail companions then), I think I can say with some confidence what in fact they now really have, consciously or unconsciously, in mind: no more economic development in Alaska than already exists. Do nothing which would increase the population further. Continue to keep Alaska one vast wilderness park. So when people from outside decide to come up for a summer vacation, there will be convenient facilities to take care of them at the jumping-off places for their wilderness outings—and at all costs no disturbance to the pristine nature of that wilderness, no matter how tiny a percentage of it might actually be affected. Draw the line; let the war with industry and local pocketbooks begin here. Make no compromises which can possibly be averted. I disagree: they forget that Alaska is now a State.

Mr. Chairman, the Sierra Club intentions unconsciously harbor the attitudes of forty years ago, when for a generation after the gold rush Alaska had in fact remained one vast little-changed wilderness with a population of but thirty-five thousand people of native stock most living pretty much in their original manner, with another thirty-five thousand whites in pleasant villages and towns. The Sierra Club leadership doesn't seem to realize—especially their young people who would not for a moment tolerate such an attitude anywhere else—how *colonialist* they are in their treatment of Alaska and Alaskans! Basically they have not accepted statehood for Alaska, and the change in attitude which this requires.

The reality is that with the coming of the jet air age, Alaska has modernized completely. Today there is a population of a third of a million people, with integration of the races a well-accepted way of life, and—to stress the point of relevance to this Hearing—Alaska's capacity to deal with its own economic and social development, pipelines, parks, and the rest, is fully up to the quality standards of the best of the other states. The University of Alaska for which our Legislature generously appropriated \$23.4 million this past session, has 10,000 students in all branches, and a highly qualified faculty numbering 587. Alaska has developed its own intellectual community quite capable of "planning wisely . . . allowing for proper development" while giving fair consideration to dissenting views.

To Sum Up. For three years now the project for bringing Alaska's North Slope petroleum out where it can be put to use, has been ricocheting around in legalistic trajectories between the Secretary, the environmentalists, and the Courts. Now for the first time, suddenly, the Congress has an opportunity to straighten out this matter. I suggest that its legislative action in 1973, can be the most important single step forward which can be taken by anyone, to solve the *foreseeable* future portion of our alarming energy crisis. Thank you, Mr. Chairman.

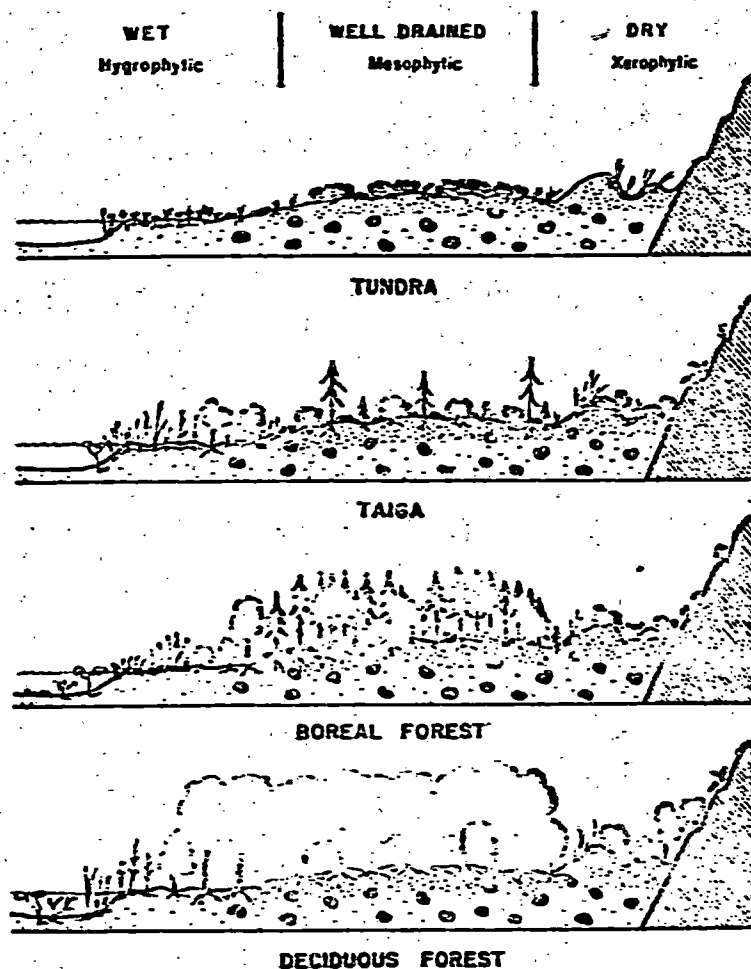
TUNDRA, TAIGA, BOREAL FOREST

FIG. 22. An outline of the typical vegetation of tundra, taiga (as defined in Chapter 5), boreal forest, and deciduous forest areas. The central portion, well drained upland, bears climax mesophytic vegetation, whereas the submerged or wet portion to the left holds aquatic and marsh (hygrophytic) vegetation, and the dunes and cliffs to the right support drought-resisting (xerophytic) vegetation.

From: GEOGRAPHY OF THE NORTHLANDS

Edited by G.H.T. Kimble and D. Good

American Geographical Society, New York 1955

Special Publication No. 32 (Page 87)

Library of Congress Catalog No. 55-7439

Dr. MOORE. The University of Alaska, now in the jet age, is not what it was 20 years ago when I was president. It is now a 10,000-student university, a faculty of 587, with branches all over the State and a distinguished faculty. The particular individual the Congressman mentioned, who is studying the pipeline effect, Dr. Peter Morrison, for example, has his doctor's degree in zoology from Harvard. Although the money is given, made available in part by one of the oil companies—an environmentalist attacked this fact—I don't think he is the least bit prejudiced by the fact of where the money comes from. I can state that it seems to me the study is being done as objectively as possible.

In this connection, as I mentioned in the beginning, I am not representing the University of Alaska or any group at all. I am here at my own time and expense in a position I believe to be completely objective. I have had 43 years of experience, on and off, with the Alaskan environment. In addition to heading the university and being research professor there at times, I was a member of the Canadian IGY program back in 1958; flew myself in my own plane to the top of Canada. I made 11 flights across Canada between New England and Alaska in a small cub type plane and inevitably became familiar with the environment.

I completely agree with Governor Egan, and Congressman Young, and Senator Stevens, and Senator Gravel in their views about the Alaskan pipeline, that the trans-Alaska pipeline should be brought into use as soon as possible, realizing that some damage is inevitable.

Now, I had two additional points to be made that perhaps have not been stressed before. I take the position that we need not one but even two pipelines trans-Alaska pipelines. At the same time that I say this, I would like to point out that I am a life member of the Sierra Club. I have my life membership card here. I have the highest regard for the individuals who run it and for many of their projects. For example, I favor the eastern wilderness bill, but I disagree with them as to the Alaska pipeline.

The crisis seems to me to have been stated in essence by the comments of the Libyan Government representative, according to the New York Times, Monday of this past week. He says that oil is going to be a weapon. I suggest we look to our defense. Oil is our defense perhaps in this conflict and they apparently have in mind—we have all read so much about it, and I only make this one particular point—the magnitude of the weapon.

The Alaska pipeline, 2 million barrels a day potential, this is about three-quarters of a billion barrels a year, and at the price we are now having to pay for the oil and may have to pay for it in the future, let's say in the area of \$4 to \$5 a barrel, this is something like three-fourth billion dollars a year in our future balance of trade. A more important matter even than the matter of balance of payments. I happen to have my doctor's degree from Harvard Business School. Although I have never pursued that aspect professionally, I kept closely in touch.

This is a weapon of defense. A defense weapon of very considerable magnitude, Mr. Chairman, I submit. And the project, I think, should be viewed in the light of the enormous magnitude of this defense weapon we have up there. If we take that deposit—the profes-

sional figure is 9.6 billion barrels, let's call it 10—and if it were to feed one pipeline, it would last about 20 years. If it were to feed to trans-Canada as well, it takes 3 years to build trans-Alaska and 5 to 10 to build the trans-Canada pipeline, if you take the figure of \$4 a barrel, certainly not an unreasonable one in view of the situation, there is the national treasury there of the order of between \$40 and \$120 billion. A defense, the defense.

When they speak of a weapon, the Arab states do not mean a war. I think they mean financial struggle. And this is the magnitude, it seems to me, of the subject we are discussing.

I have one other point to make, which, as I have been told, has not been made before, and that one is where do you prefer to have your oil spills? I read very briefly from the Sierra Club bulletin:

Government researchers recently dipped their nets into the Atlantic Ocean hoping to collect marine samples, only to come up with tar and polystyrene instead *** 75 percent of the net time their nets were befouled by oil clumps so thick they extruded the mesh like spaghetti.

My point is this: If you shut off the Alaska pipeline completely, the trans-Canada and trans-Alaska completely, Mr. Chairman, you have the effect then of putting the pollution of 2 million barrels a day pollution into the Atlantic Ocean, and there is inevitably going to be some, however you bring the oil out from the Middle East or Alaska North Slope. There is inevitably bound to be some spillage. Where do you prefer to have your inevitable, whatever it is, one-tenth of 1 percent of 2 million barrels, which one of the oceans, the Atlantic or Pacific, or up in the tundra where it is not going to bother anybody? I say, "anybody." I say it might bother a very tiny fraction of 1 percent of the population. But to add more burdens to the Atlantic or the Pacific unnecessarily, it seems to me is a mistake.

In the Pacific, as a trans-Alaska pipeline, of course, it will be said, "Well, it is going to go in the Pacific." But I point out, if the trans-Alaska pipeline is used, Valdez and Los Angeles and San Francisco, and Seattle, the ports between which the tankers would apply, are wholly under American control. If you shut off the Alaska pipeline, the trans-Canada pipeline completely, the rust-bucket tankers are going to bring the oil, the other end is uncontrolled where it comes from, and we will have more pollution than I submit, if the trans-Alaska pipeline is authorized to go through by appropriate legislation.

One final point, my third point, is the difference between the foreseeable future and the unforeseeable future. I suggest the unforeseeable future is the point at which our new sources of energy will hopefully become available to us. The liquid metal fast breeder reactor is one of the many new sources of energy which we are hoping will be brought in, but scientists tell us it is quite unforeseeable just when we really can count upon this new source of energy and other sources of energy coming in.

So I suggest in the foreseeable future is a period in which we are going to be still dependent upon petroleum. I wind up and say that for the foreseeable future, it seems to me that for 3 years now the project for bringing Alaska's North Slope petroleum out where it can be put to use, has been ricocheting around in legalistic trajectories between the Secretary, the environmentalists, and the courts.

Now for the first time, suddenly, the Congress has an opportunity to straighten out this matter. I suggest that its legislative action in 1973, can be the most important single step forward which can be taken by anyone, to solve the foreseeable future portion of our alarming energy crisis.

Thank you, Mr. Chairman.

Mr. MELCHER. Thank you very much, Mr. Moore.

I appreciate the fact that as the president emeritus of the University of Alaska, you would bring your firsthand knowledge and firsthand observations to the Committee for our consideration.

The gentleman from Guam.

Mr. WOX PAT. I don't have any questions.

Mr. MELCHER. The gentleman from Alaska.

Mr. YOUNG. Doctor, I would like to thank you for your presentation. Your former University of Alaska has been playing a role in the development of the economy for the last 20 years and is highly respected across the United States.

Your testimony I have read is well prepared, and there are some points in it, Mr. Chairman, I am sure the committee would be quite interested, especially concerning one of the recent bulletins published by the Sierra Club about the results of long delay.

I would just like to thank you for your testimony.

Dr. MOORE. One brief comment. I actually omitted one point here, in which I compared what seems to me the similarity of the struggle today over this with the struggle of statehood about 20 years ago. The "colonialist attitude," I don't think they realize it is, they are well intentioned people, the Sierra Club. They say, speaking for the Sierra Club, when they are stopping the pipeline, Dr. Wayburn called the court's decision

a clear rebuff to the oil companies, which provides us all with a fresh opportunity to plan wisely for the great lands of Alaska, allowing for proper development while protecting its fragile environment.

Again, I submit with the University of Alaska and the Alaska Legislature, the Representatives in Congress, and the two Senators, and Governor Egan, Alaska is quite capable now as are the other States of planning their economic development wisely.

Thank you very much, Mr. Chairman.

Mr. MELCHER. Thank you very much, Dr. Moore.

Our next witness this morning is Dr. Robert R. Curry, professor of Geology, University of Montana.

Dr. Curry, I am delighted to have you here. We have been asked by John Dienelt of the Wilderness Society, Environmental Defense Fund, to have the opportunity to introduce not only you, Dr. Curry, but the panel we are to hear from, Dr. Cicchetti, Dr. Freeman, and Mr. Stoel.

If there is no objection on the part of any of you, the committee will be delighted to accommodate Mr. Dienelt, and we will have all five of you approach the witness table, if you have no objection, and we will treat you as a panel of five.

**STATEMENT OF JOHN F. DIENELT, STAFF COUNSEL ON BEHALF OF
THE WILDERNESS SOCIETY, ENVIRONMENTAL DEFENSE FUND,
INC., AND FRIENDS OF THE EARTH**

Mr. DIENELT. My name is John Dienelt. I am staff counsel for the Environmental Defense Fund, Inc. I am also one of the attorneys who represent The Wilderness Society, the Environmental Defense Fund, Inc., and the Friends of the Earth in the litigation challenging the proposed Trans-Alaska pipeline. Four independent experts who have investigated various aspects of the TAPS proposal and the alternative all-land pipeline route through Canada are here today to testify. The plaintiffs in the TAPS litigation have relied upon the work and conclusions of these and other experts in formulating their position on development and transport of North Slope petroleum resources.

I have a prepared statement which deals in addition to describing the position of the plaintiffs in the litigation, with questions regarding the feasibility of the Canadian route, specifically the attitude of the Canadian Government, which is favorable, and the availability of information on the Canadian route which has not been consulted by the Department of the Interior, which would in our view expedite the process of consideration of that route.

I would like to submit that statement for the record, and at this time only summarize and emphasize the position of the three environmental groups whom I represent.

Mr. MELCHER. Mr. Dienelt, your testimony is before the committee members. It will be made a part of the record at this point, if there is no objection.

Without objection, so ordered.

[Mr. Dienelt's statement follows:]

**STATEMENT OF JOHN F. DIENELT ON BEHALF OF THE WILDERNESS SOCIETY,
ENVIRONMENTAL DEFENSE FUND, INC. AND FRIENDS OF THE EARTH**

I. INTRODUCTION

My name is John Dienelt. I am staff counsel for the Environmental Defense Fund, Inc. I am also one of the attorneys who represent The Wilderness Society, the Environmental Defense Fund, Inc. and the Friends of the Earth in the litigation challenging the proposed Trans-Alaska Pipeline. Four independent experts who have investigated various aspects of the TAPS proposal and the alternative all-land pipeline route through Canada are here today to testify. The plaintiffs in the TAPS litigation have relied upon the work and conclusions of these and other experts in formulating their position on development and transport of North Slope petroleum resources. The experts are Dr. Robert Curry, Professor of Environmental Geology at the University of Montana; Thomas Stoel, who is a former staff member of the President's Oil Import Quota Task Force in addition to being one of plaintiffs' attorneys in the litigation; Dr. Charles Cicchetti, Professor of Economics at the University of Wisconsin; and Dr. Myrick Freeman, Professor of Economics at Bowdoin College. We are pleased to honor the request of members of the Subcommittee that we present testimony on the several bills under consideration.

I will begin by stating the position of The Wilderness Society, Environmental Defense Fund, Inc. and Friends of the Earth on development and transport

tation of North Slope oil and gas and on the bills which are the subject of this hearing. In the course of the pipeline litigation, I have had occasion to study the public statements of the Canadian government on the acceptability of a pipeline through Canada and to explore the availability of information on proposed gas and oil pipelines from Canadian sources. I will, therefore, also discuss those subjects.

The experts will compare various aspects of the Trans-Alaska Pipeline and the Canadian alternative. Dr. Curry will focus on environmental considerations; Mr. Stoel will deal with national security issues; Dr. Cicchetti and Dr. Freeman will deal with economic and consumer questions.

One expert whose testimony we would like to present to the Committee is unavailable today. He is the distinguished marine biologist Dr. Richard Warner, Professor at the Memorial University of Newfoundland, who is at the present engaged in an extensive field research project off the coast of Florida. I have explained the situation in a letter to the Chairman requesting permission to submit his expert testimony for the record at a later date. That testimony will deal with the very significant oil pollution issues raised by the marine transport portion of the Trans-Alaska pipeline proposal.

II. THE POSITION OF THE WILDERNESS SOCIETY, ENVIRONMENTAL DEFENSE FUND, INC. AND FRIENDS OF THE EARTH

The Wilderness Society, Environmental Defense Fund, Inc., and Friends of the Earth are not opposed to well-planned development of North Slope oil and gas. But, we believe there is a better way than the Trans-Alaska Pipeline proposal to transport the petroleum resources of the North. Our examination of the alternatives, based on the available evidence, has led us to conclude that an all-land common corridor for oil and gas delivery, from the North Slope through Canada to the lower 48 states, would be superior to the Trans-Alaska plan. We draw support for this conclusion from the investigations conducted by the experts who will testify today, as well as investigations by other experts who submitted comments, which we collected, on the Department of the Interior's Impact Statement. We also call the Subcommittee's attention to the excellent analyses already submitted by Congressman Anderson and Congressman Aspin.

Regrettably, however, the Interior Department has not sought or developed the information on the Canadian route which is necessary for a fully informed choice among the alternatives in the national interest. The oil companies decided, in early 1969, to focus their efforts on an Alaskan pipeline route even though their own studies indicated that both the Alaskan and the Canadian routes were feasible. The Department of the Interior accepted this decision and concentrated its own efforts on study of the Alaskan proposal. Secretary Morton, in fact, frequently stated that his Department was essentially excluding the Canadian alternative from consideration because the oil companies did not want it. Thus, in April 1971, he stated flatly, "The scope of our work here is to deal with the applications on our desk." Hearings, Senate Committee on Interior and Insular Affairs, 92d Cong., 1st Sess., 454 (April 29, 1971). Although this passive approach was pointedly challenged in hearings before the Senate Interior and Insular Affairs Committee by Senator Gravel, the Secretary returned the next year with the same explanation of the Department's focus on the Alaskan route. Only 11 days before release of the final impact statement, the Secretary stated:

"We have no formal discussions going on with any element of the Canadian Government. The prime discussions have been between the Canadian Government and the applicants The only way [Canadian Government expressions of interest in all-land route] could change the plans is if a Canadian alternative was developed, and we had an application which we could consider of an alternative route through Canada. This could very well change the plans of the present applicants, but we have to remember that this is not a Government project." Hearings, Senate Committees on Public Works and Interior and Insular Affairs, 92d Cong., 2d Sess. 404-405 (March 9, 1972).

The result of the Department of the Interior's default of duty is that many pertinent questions regarding the Canadian common corridor alternative have not been answered adequately. The Administration and other supporters of the Trans-Alaska Pipeline ironically attempt to rely upon alleged uncertainties regarding the Canadian government's position and lack of information regard-

ing feasibility of oil and gas pipelines through Canada in asserting that TAPS is the only realistic means of transporting North Slope oil. But, as I discuss below, the alleged uncertainties can be resolved by discussions and negotiations with the Canadian government. And information to determine the technical and environmental details of the Canadian common corridor alternative, so that a detailed comparison with TAPS can be made, appears to be readily available. All that is necessary is to ask the Canadian government and the private industry consortiums who have investigated possible oil and gas pipelines for the studies and data they already have developed.

A proper evaluation of the Canadian route and adequate negotiations with the Canadian government can, in other words, take place in relatively short order. We strongly urge that Congress should authorize such a study, by an independent body. We further submit that Congress, at the end of such a study, should make the decision on transportation of North Slope oil. Consequently, we will support legislation which provides for a thorough Congressionally supervised study of the Canadian common corridor alternative and a comparison of that alternative with TAPS and which reserves for Congress the ultimate decision.

We also wish to emphasize, as strongly as we can, that such legislation is, in our view, the best and most expeditious means of both satisfying the objectives of the National Environmental Policy Act and bringing North Slope petroleum resources to the appropriate market as quickly as possible. With respect to NEPA, our primary purpose in the litigation has always been to insure that the objectives of that Act are fulfilled. We expect that a Congressionally supervised study would satisfy NEPA's objective of a thorough and unbiased evaluation of alternatives and would otherwise fulfill the spirit of the Act. If this expectation is fulfilled, we believe there will be no reason for further environmental litigation and delay. Moreover, if Congress makes the final decision, after having itself insured that NEPA's purposes have been met by a thorough and objective evaluation of the Canadian alternative, we believe there will be no legal basis for further environmental challenge since Congress will have expressly acted to vindicate the objectives of NEPA.

We believe that the process of adequate study by an independent body, consideration of that study, and decision by Congress can take place within one year. By contrast, if the controversy goes back to the courts, as a result of Congress' amending the width limitation of the Mineral Leasing Act of 1920 to permit the Interior Department to reach a decision, the litigation process will last at least a year. A victory by plaintiffs on their claim that NEPA's requirements have not been met could extend the court process for several years. In short, action by Congress to insure that the objectives of NEPA are met and to reach an informed decision on the alternative routes, which is not possible without an independent evaluation of them, is the quickest way to guarantee a start of construction of pipelines to deliver oil and gas from the North Slope.

III. THE ASSERTED LACK OF FEASIBILITY OF THE CANADIAN ALTERNATIVE

In a number of statements, Secretary Morton and other representatives of the Administration have insisted that the Canadian alternative oil pipeline is not feasible. They have asserted that it would take several years longer to develop because it has not been adequately studied and because of delays in securing Canadian government approval. They have also asserted that the Canadian alternative would be disadvantageous to the United States in any event because of onerous conditions which would be placed by the Canadian government upon approval of it. These assertions are largely undocumented speculation for, as I have pointed out, the Interior Department has not made a thorough examination of the alternatives. Statements of the Canadian government and the reported progress of study of Canadian oil and gas pipeline routes, in fact, strongly suggest that these assertions are baseless.

Before discussing these assertions in detail, however, I would like to stress one significant fact which bears on these, as well as other issues concerning the feasibility of the Canadian alternative, such as the possibility of environmental opposition to a Canadian pipeline or difficulty in resolution of Canadian Native Claims issues. That fact is that a gas pipeline will be built through Canada to the lower 48 states. That is the presumption of the Trans-Alaska sponsors, including Secretary Morton.

The consortium which plans to build the gas pipeline has indicated that it will file applications this year. From the U.S. end, we hear nothing but optimism regarding the progress of plans for that pipeline and cooperation between our government and Canada with respect to it. Let me, for example, quote Secretary Morton at his press conference of September 13, 1972. He said:

"[W]e are going to . . . work and stimulate and motivate a consortium to get together and put the money up to build a cold gas pipeline, which through Canada is the logical way for it to go." *Interior Department Transcript of Secretary Morton's Press Conference of September 13, 1972, at 33.*

No reason is apparent why the practical problems of implementation of a gas pipeline through Canada should be so simple and the practical problems of an oil pipeline through Canada so difficult. In fact, if the feasibility of an oil pipeline through Canada is evaluated in an objective manner, in an independent Congressionally-authorized study, we believe the conclusion will be that the optimistic expectations for a gas pipeline apply equally for the oil pipeline.

I will now turn to a more detailed consideration of the public record with respect to the feasibility of the Canadian alternative. First, and perhaps most important, is the question of the attitude of the Canadian government toward an oil pipeline through Canada. The Canadian government, on this point, has maintained a clear, consistent, and explicit attitude of encouraging construction of both an oil and a gas pipeline through Canada for the delivery of North Slope oil and gas to the lower 48 states. This position has been confirmed in official guidelines for pipeline development and by frequent statements of responsible government officials from July 1968 to the present. The understandable reasons for this attitude by the Canadian government are: (1) Canada's desire to open up its own Arctic oil and gas resources; and (2) insofar as an oil pipeline is concerned, Canada's desire, frequently expressed to our government, to avoid the serious environmental and economic damage to the coastal waters of British Columbia that would be caused by the marine leg of the Alaska pipeline proposal.

The Canadians expressed formal interest in a pipeline from the North Slope as early as a month after the discovery of oil in Prudhoe Bay. Statement by Minister Greene, *House of Commons Debate*, March 12, 1971, 4223.)

In March 1971, Joe Greene, then Minister of Energy, Mines and Resources, reiterated their interest.

I think we can assure the United States oil companies and the United States Government . . . that there will be no unnecessary roadblocks at the Canadian end and the Canadian governmental side. (*Id.* at 4226)

On February 3, 1972, Robert Howland, Chairman of the National Energy Board which would conduct hearings on approval of permits for a pipeline (addressing the government-sponsored Northern Pipeline Conference in Ottawa) confirmed:

The government is on record as being desirous of allowing pipelines under appropriate conditions to be constructed in the North The progress of research, both in the public as well as the private sector has been such that the government has indicated on several occasions its willingness to examine and discuss any proposals relating to the transport of Alaskan petroleum resources through Canada to market in the United States.

In March 1972, Minister of Energy, Mines and Resource MacDonald personally delivered a letter to Secretary Morton:

As has been stated publicly on several occasions, we expect to be in a position by the end of this year to be able to appraise any applications that might be received from companies wishing to build pipelines in the North.

The progress being made by industry is such that I would anticipate our being able to act early in 1973 to process expeditiously one or more applications to build an oil and/or a gas pipeline originating at Prudhoe Bay and traversing Canadian territory to southern markets.

On March 1, 1973, Jean Chretien, Minister of Indian Affairs and Northern Development, which would also pass on a pipeline proposal, stated in the House of Commons:

We as a government have said to the Americans many times that we oppose the shipping of oil along the British Columbia coast, and that we would prefer to have an oil line on the ground because there is much less danger of pollution with a pipeline than with a ship. (*Minutes of Proceedings and Evidence*

Before the Standing Committee on Indian Affairs and Northern Development, Issue No. 4, pp. 20-21, March 1, 1973.)

Finally, on March 18, 1973, Minister MacDonald in an interview on national television in Canada, said:

If the Americans came back and said to us look, we've had second thoughts on that trans-Alaska pipeline, we would like to take you up on your willingness to entertain an application about the oil line through the MacKenzie route, I think the interests of the west coast [of Canada] would dictate that the Government of Canada would enable that kind of application to go ahead.

This is a representative sampling. The only conclusion which can be drawn is that the Canadian government has done literally everything it can to promote a pipeline application short of making the firm promise in advance that it will approve an application regardless of the applicant's willingness to abide by conditions respecting the environment or other matters which the government considers necessary—a commitment that obviously neither a Canadian nor a United States government could ever make.

The affirmative attitude of the Canadian government is also reflected in statements on specific Canadian requirements for the pipeline. These conflict with assertions by spokesmen for the Administration and others who have urged that conditions which would be imposed, particularly regarding shares for Canadian throughput in the pipeline and financial participation in the venture, make the Canadian alternative impractical or undesirable.

The Administration has insisted, without ever identifying the basis for its contention, that the Canadian government will demand that 50% of the oil pipeline be reserved for shipment of oil from the Canadian Arctic rather than the North Slope. Quite to the contrary, then Minister of Energy, Mines and Resources Greene, in February 1971, indicated that Canada would be prepared to assure the same flow of North Slope oil across Canada that would flow across Alaska. He stated:

I can't believe that any serious concern would be expressed in the United States with the reliability of an agreement between our two countries under which Canada, for its part of the bargain, would undertake to insure the uninterrupted flow of Alaskan oil down a Canadian "land bridge" line equivalent in volume to any flow which could be put through the TAPS line. (Speech to Vancouver (B.C.) Men's Club, officially released by the Department of Energy, Mines and Resources.)

As the current Minister of Energy, Mines and Resources MacDonald recently noted, a willingness to make such a commitment makes sense from the Canadian perspective. (Television Interview, March 18, 1973). He pointed out that having the pipeline from the North Slope through Canada is in that country's long-term interest. There have not been sufficient oil reserves discovered in Canada to warrant a separate pipeline. The existence of a pipeline from the North Slope, however, would spur development of Canadian oil resources which could be ultimately transported without diminishing the shipment of North Slope oil, in a second pipeline or through the existing line if its capacity is expanded by the comparatively inexpensive looping process.

The Secretary of the Interior has also asserted that there would be insuperable difficulties in financing an oil pipeline because of conditions the Canadians would impose. The Canadians have stated, specifically with respect to the gas pipeline, that 51% Canadian ownership will be required. This does not, however, mean 51% of the total financing, as Secretary Morton erroneously claimed last year in testimony to the Joint Economic Committee, but 51% of the equity.

Traditionally, pipelines (and the proposed Trans-Alaska Pipeline is no exception) are built on the basis of approximately 20% equity and 80% debt. Therefore, the Canadians would be in the position of raising a minimum of slightly more than 10% of the total financing if the ownership condition were imposed on the oil pipeline as well. This does not appear to be a financial burden which could not be undertaken by private capital in Canada.

Moreover, Canada has never indicated that if the necessary capital is unavailable, it would refuse to approve a pipeline application which was based on a different financing arrangement. Rather, it seems certain that this, like shared throughput and many other questions is, at a minimum, a negotiable matter.

The point is, however, that this government and the Canadian government have never engaged in serious discussions of such issues, despite the repeated expressions of interest by the Canadian government. Indeed, the only meeting between Secretary Morton and Minister MacDonald was in March of 1972 after the impact statement was issued, when Minister MacDonald came here to apprise Secretary Morton formally of the progress of Canadian studies and to reemphasize the Canadian interest in the common corridor route. Long overdue negotiations, which would be required as part of the Congressionally-sponsored study, will result in specific answers that preclude the speculation and self-serving assertions on which the Secretary and others have thus far based their arguments and decision.

The question of delay in implementation of either alternative is another factor which obviously is important to a choice. As with other factors, the situation is uncertain because a careful analysis of the question has not been made. But, again, the current record strongly suggests that the difference in the time when the two alternatives could be placed into operation is certainly not three to five years, as the Administration has asserted. A more likely figure is two years or less.

Minister MacDonald estimated a two-year difference at a press conference after his meeting with Secretary Morton in March of last year. Since the Canadian government's favorable attitude is significant in determining the speed with which a pipeline can be approved and constructed, Minister MacDonald's estimate of only two years should not be dismissed lightly. Even that estimate, made a year ago, may be high today.

The time difference between the two alternatives was premised principally on the presumption that the construction on the Trans-Alaska Pipeline could commence immediately but that further study of the Canadian alternative was needed. Since Minister MacDonald's statement a year ago, the litigation on the Trans-Alaska Pipeline has prevented the start of construction. Of course, environmental issues remaining in the litigation, easily could delay construction for another year or more. In the meantime, the continuing progress of studies by Canadian government and industry, many of which are now complete and published, may narrow the gap further. Necessary information regarding a Canadian route has, in short, increasingly developed so that parity in terms of timing with the Alaskan route appears closer and closer.

On the basis of published reports from the Canadian government and private industry, in fact, it appears that more studies have been undertaken on the Canadian common corridor alternative than on the Trans-Alaska Pipeline. The total price tag of recent research efforts by the Canadian government, Canadian Gas Arctic Systems, Inc., which proposes to build the gas pipeline, and Mackenzie Valley Pipe Line Research, Ltd., which is studying the feasibility of an oil pipeline, exceeds \$50 million.

The Canadian government has conducted a comprehensive program of investigation of environmental, economic and other aspects of northern pipelines, commencing with the discovery of oil on the North Slope. Last year Minister MacDonald submitted to Secretary Morton a list of 30 current studies, the results and data from which he noted had neither been sought nor considered by the Interior Department in its discussion of the Canadian alternative in the Impact Statement. The Secretary later complained that some of the studies had not at the time been finalized or published.

With a year gone by, however, most of the studies are now complete. The current status of these efforts by the Canadian government was summarized by Minister of Indian Affairs and Northern Development, Jean Chretien, in *Minutes of Proceedings and Evidence of the Standing Committee on Indian Affairs and Northern Development*, Issue No. 4, March 1, 1973. According to Minister Chretien's oral remarks, his Department was allocated \$15 million for completion of "social and ecological studies in the north." (Id. 15-16)

At the conclusion of his remarks, Minister Chretien listed 51 different reports, all of which appear to be technical and environmental reports and most of which appear to have been published in 1972. He listed 55 other technical, environmental, social, and engineering reports, all but three of which are scheduled for completion by the end of this summer.

At the time the Impact Statement was released, Canadian Gas Arctic had recently published a five-volume study of the proposed gas pipeline. Neither the published study, nor data from it were considered in the Impact State-

ment. Since last year, plans for the gas pipeline also have progressed significantly. Route selection has been narrowed to two possibilities, a coastal and an inland route. The consortium, which has spent \$30 million in its studies, plans to submit applications this year.

Although oil and gas pipelines present certain different construction and other problems, a substantial part of Gas Arctic's studies pertain to common problems. This is particularly true since Canadian government guidelines for construction of pipelines require Canadian Arctic to demonstrate that its proposal is consistent with Canada's policy of confining pipelines within a common corridor and specifically that the route selected for the gas pipeline is also suitable for an oil pipeline.

Progress has also been made in the past year by Mackenzie Valley Pipe Line Research Limited, the consortium planning an oil pipeline along the Mackenzie River. Recently the company released a feasibility study which culminated more than \$7 million in research. The consortium's Arctic Oil Pipeline Study dealt with a specific 1,738-mile route from Prudhoe Bay inland to Edmonton. From there, the existing Interprovincial-Lakehead pipeline system could be expanded to carry oil to the Midwest and the Trans-Mountain Pipeline could be expanded to carry oil to the West Coast.

The study concluded that the Canadian route was economically and environmentally feasible. It described the various steps including obtaining approval from the Canadian government and continued planning, which would be necessary before construction could commence. And, the study projected a timetable for both completion of the approval and planning process and actual construction of the pipeline. Its informed estimate is that a total of four years—one and one-half to obtain approval, complete planning and make the arrangements for construction and two and one-half years for actual construction—is necessary before the pipeline could be put into operation. Recently, the Vice-President of MVPL testified before the Senate Interior and Insular Affairs Committee. In his testimony, he expressly confirmed the conclusions of that Report.

On the basis of that estimate, if a decision to pursue the Canadian alternative were not made until June of *next* year, after a thorough Congressionally-sponsored investigation, the pipeline could be in operation during 1978. By comparison, if environmental litigation and other legal delays prevented a construction start on TAPS until June of next year (an estimate of additional delay which is considerably less than could actually occur) TAPS would be in operation, according to Alyeska construction timetables, no more than one year earlier, in the latter half of 1977.

If Congress enacts a law requiring an objective evaluation of the Canadian common corridor alternative, there is nothing to prevent the oil companies from taking steps in Canada to insure that the process of approval can be accelerated even further. And there are sound reasons—those costs of delay which the Administration has stressed in advocating TAPS—for Congress to urge or require the oil companies to proceed on the Canadian front during the interval.

Finally, in addition to all the information which has become recently available in Canada, the development of a Canadian oil pipeline route would obviously be speeded by the experience which has been gained and the information which has been developed by government and industry in planning the Alaska route. Canadian Gas Arctic and Mackenzie Valley Pipe Line Research, it should be noted, have some of the same sponsoring members as Alyeska. It would not be surprising in light of the strong commitment of the oil industry to TAPS to hear the industry attempt to minimize the progress of study of a Canadian route. Regardless of what may be said regarding available studies, however, the stated conclusions of those studies strongly confirm the appropriateness of an independent evaluation of them at Congress' direction.

One further point regarding delay needs to be stressed. There is no apparent or documented reason why construction of oil and gas pipelines through Canada at approximately the same time, in contrast to relatively simultaneous construction of an oil pipeline in Alaska and a gas pipeline in Canada, should delay the progress of the gas pipeline. There appear, indeed, to be economies in having the construction confined to one area and there are obvious ways of planning so that construction crews will not interfere with one another. One

certain fact, however, is that Alaskan natural gas will not be available for the gas pipeline until sometime after Alaskan oil begins to flow. Thus, the delay in development of the Alaskan route because of the litigation and other legal matters could ultimately result in even more delay in delivery of North Slope natural gas than would prompt efforts to develop the Canadian route.

Two points emerge from a consideration of the public record regarding the attitude of the Canadian government and the level of information in Canada concerning oil and gas pipelines. First, it appears that the Canadian alternative is entirely feasible and does not involve the problems which the Interior Department and others have ascribed to it, without documented basis. Second, the willingness of the Canadian government to discuss these matters and the availability of information developed by the government and private industry make an independent study, as required by the Mondale bill, both meaningful and quite manageable within a time-frame that will not create unwarranted delay.

The same points may be made about confirming the superiority of the Canadian alternative of oil and gas pipelines within a common corridor on national security, economic and environmental grounds, to which the experts will not turn. The resolution of the dispute on those issues can and should be reached in a relatively brief period of study, of less than one year. The information is at hand to permit prompt completion of the necessary analysis, and the adoption of it as (or incorporation of it in) an Impact Statement. At that time, Congress will be in a position to make a decision, as it should, in the vital issue of transportation of North Slope petroleum resources.

Mr. MELCHER. Mr. Dienelt, you may proceed with any summary you wish. If it is agreeable with them, it is certainly agreeable with us, but I must point out you are testifying out of order. But we have no objection if they have no objection.

Mr. DIENELT. I will be very brief, Congressman.

Mr. MELCHER. Thank you.

Mr. DIENELT. The Wilderness Society, Environmental Defense Fund, Inc., and Friends of the Earth are not opposed to well-planned development of North Slope oil and gas. But we believe there is a better way than the Trans-Alaska pipeline proposal to transport the petroleum resources of the North. Our examination of the alternatives—and the experts here will discuss that in detail—based on the available evidence, has led us to conclude that an all-land common corridor for oil and gas delivery, from the North Slope through Canada to the lower 48 States would be superior to the Trans-Alaska plan.

Unfortunately, the Interior Department has not sought or developed the necessary information on the Canadian route to make the conclusion which we believe is correct a certainty and to permit a fully informed choice among the alternative means of delivering North Slope oil in the national interest.

That is the purpose of the legislation which we would support, which would provide for and require a thorough independent study of the Canadian alternative and comparison of that alternative with the Alaskan plan and would reserve for and require a decision by Congress at the end of that study.

We believe such a proper evaluation of the Canadian route can take place in relatively short order. We will support that kind of legislation.

One final point that we wish to emphasize, as strongly as we can, is that that kind of legislation is, in our view, the best and most expeditious means of both satisfying the objectives of the National Environmental Policy Act and bringing North Slope oil and gas to the appropriate market as quickly as possible.

With respect to NEPA, the primary purpose of the plaintiff in the litigation has always been to insure that the objectives of that Act have been fulfilled. In our view, they have not been. We expect a congressionally supervised study would satisfy NEPA's objective of a thorough and unbiased evaluation of alternatives and would otherwise fulfill the spirit of NEPA. If this expectation is fulfilled, we believe there will be no reason for further environmental litigation and delay. Moreover, if Congress makes the final decision, after having itself insured that NEPA's purposes have been met by a thorough and objective evaluation of the Canadian alternative, we believe there will be no legal basis for further environmental challenge since Congress will have expressly acted to vindicate the objective of NEPA.

We believe that the process of adequate study by an independent body, consideration of that study, and final decision by Congress can take place within 1 year. By contrast, if the controversy goes back to the courts, as the Administration supports, if it goes back to the courts, as a result of Congress amending the width limitation of the Mineral Leasing Act of 1920 to permit the Interior Department to reach a final decision, the litigation process will last at least a year. A victory by plaintiffs on their claim that NEPA's requirements have not been met in the litigation could extend the court process for several years.

In short, action by Congress to insure that the objectives of NEPA are met and to reach an informed decision on the alternative routes, which is not now possible and will not be without an independent evaluation of those routes, is the quickest way to guarantee a start of construction of pipelines to deliver oil and gas from the North Slope.

If there are no questions, the experts will take over.

Mr. MELCHER. There will be no questions until each of the panel members has had an opportunity to make their presentation.

Mr. YOUNG. Mr. Chairman, as each witness gives their testimony we cannot question them when they are finished with their testimony?

Mr. MELCHER. When we are having a panel here for purposes of utilizing time to better advantage, we will take the questioning of the panel as a group. We will allow plenty of time for questioning. I would advise each witness to keep in mind that probably for members of the committee, the questioning period is very necessary and most essential to us.

So keep your remarks brief. We will make sure each of your statements in its entirety will be a part of the record. I just want to remind you that we do want to question you as a group.

Dr. Curry.

**STATEMENT OF ROBERT R. CURRY, ASSOCIATE PROFESSOR,
ENVIRONMENTAL GEOLOGY, UNIVERSITY OF MONTANA**

Dr. CURRY. Thank you, Mr. Chairman. I am Robert Curry, an associate professor of environmental geology at the University of Montana. I hold advanced degrees in plant ecology and geology with a Ph. D. in geology and geophysics from the University of

California at Berkeley. Beginning in February 1969. I have been deeply involved with the scientific analysis of problems associated with Arctic Alaskan petroleum development. In the early spring of 1969, while employed as a professor at the University of California, I was engaged by the Department of the Interior, U.S. Geological Survey, to conduct a reconnaissance survey of the then-pending Alaska pipeline proposal and to help to formulate policy guidelines that might be used by the Department of Interior to assure minimization of environmental impacts for the Alaskan petroleum development. I was then serving as a scientific advisor to the U.S. Senate Public Works Committee on matters of environmental effects of off-shore petroleum development prompted by the Santa Barbara oil spill and was advising the President's science advisory staff on the same matter. Since I held a research hydrologist position with the geological survey and was employed part-time by them and since I had lived in Alaska and studied arctic landscape processes there while employed by the University of Alaska, I was asked to begin work for Interior in April of 1969 on route selection criteria for determining environmental impact of the various petroleum transshipment and roadway schemes then being proposed and effected by petroleum companies and the pipeline consortium.

I disagree completely with the premise we will either have an Alaska pipeline or no pipeline. I will present information today which will outline some of my arguments. I would like to summarize my prepared statement and ask the full statement be included in the record.

Mr. MELCHER. Without objection, Dr. Curry's full statement will be made a part of the record.

Hearing no objection, so ordered.

[The statement follows:]

STATEMENT OF ROBERT R. CURRY, ASSOCIATE PROFESSOR ENVIRONMENTAL
GEOLOGY, UNIVERSITY OF MONTANA, MISSOULA, MONTANA

I am Robert Curry, an Associate Professor of Environmental Geology at the University of Montana. I hold advanced degrees in plant ecology and geology with a Ph.D in geology and geophysics from the University of California at Berkeley. Beginning in February, 1969, I have been deeply involved with the scientific analysis of problems associated with Arctic Alaskan petroleum development. In the early spring of 1969, while employed as a professor at the University of California, I was engaged by the Department of the Interior, U.S. Geological Survey, to conduct a reconnaissance survey of the then-pending Alaska pipeline proposal and to help to formulate policy guidelines that might be used by the Department of Interior to assure minimization of environmental impacts for the Alaskan petroleum development. I was then serving as a scientific advisor to the U.S. Senate Public Works Committee on matters of environmental effects of offshore petroleum development prompted by the Santa Barbara oil spill and was advising the President's science advisory staff on the same matter. Since I held a research hydrologist position with the Geological Survey and was employed part-time by them and since I have lived in Alaska and studied arctic landscape processes there while employed by the University of Alaska, I was asked to begin work for Interior in April of 1969 on route selection criteria for determining environmental impact of the various petroleum transshipment and roadway schemes then being proposed and effected by petroleum companies and the pipeline consortium. This work included overflight and ground-visits to the Hinkle-Highway and the surveyed Trans-Alaska pipeline route, and preparation of an advisory report.

Following presentation of my findings and conclusions to Interior, I began a long and intense involvement with other scientists to bring the issues into the public realm. This contributed to the preliminary injunction and long litigation in *Wilderness Society vs Morton*, Civil No. 92-70. I have served in an advisory capacity in this litigation since the granting of the injunction and have prepared and digested many thousands of pages of documents on those aspects of the arctic pipelines within the areas of my expertise; namely arctic geomorphology, hydrology, and plant ecology. I have published professional papers in these fields, specializing particularly in those geologic processes that constitute hazards to human beings and their works such as river flooding, seismic hazards, permafrost considerations, slope stability, and similar natural events. Since 1961 I have visited and conducted field work on approximately 85% of the proposed Trans-Alaska pipeline route from Prudhoe to Valdez and have investigated representative portions of both the Alaskan and Canadian portions of several alternative MacKenzie Valley pipeline routes as far south as Edmonton, Alberta. I have also traveled extensively within Canada and had frequent discussions and assistance from Canadians to help me evaluate the basic data for their routes. At this time I wish to attempt to summarize an extremely large volume of factual information on the comparative terrestrial environmental impacts of the Alaskan and Canadian pipeline alternatives. These geologic and hydrologic data overwhelmingly favor MacKenzie Valley routes. Primary factors under consideration are seismic risk through pipeline failure associated with local ground accelerations and offsets, sea waves, slope failures, and glacier accelerations; flood and scour hazard associated with buried river crossings and glacier outburst floodways; foundation failure hazard associated with high ground-ice permafrost melting; and service and haul-road substrate destruction causing increased siltation in waterways and loss of permafrost and vegetative covers.

BASIC PHYSICAL ROUTE COMPARISONS

Some serious misinformation is still being used as the basis for comments and decisions regarding the environmental impacts of the two major pipeline routes (see for instance letter of Rogers C. B. Morton to "Senator", April 4, 1973). Although it is true that the Trans-Canada route is longer, it is not at all true that there is more unstable permafrost, more chances of slope failure, equal seismic risk, or equal hydrologic risk. Morton's letter to Congressmen of April 4 also illustrates some misconceptions about the hazard geology of the two routes, such as his ideas about design for earthquakes, permafrost, and river crossings that cause me to seriously doubt that he has the ability to grasp these technical matters sufficiently to assure his capability to attach adequate environmental and technical stipulations to any arctic pipeline permit, no matter where constructed. These factual and implied errors are so overwhelmingly incorrect that they must be thoroughly challenged in open scientific forum. The following analysis will cover some of the major points of terrestrial impact.

SEISMIC HAZARD

It is well-known that the Canadian alternatives offer less seismic risk than the Alaskan route but the degree of this difference is not fully appreciated. First, the magnitude of expected earthquakes was seriously underestimated for the longest mid-section of the Alaska Pipeline route (67° N. to Donnelly Dome) because earthquakes of several times larger energy release have occurred within 30 miles of the proposed pipeline within recent historical times. The very high risk seismic zone comprises over two-thirds of the Alaskan route while the lesser (6.0) highest risk zone for the Canadian route is less than 120 miles in length. About 450 to 500 miles of the Alaskan route are through areas with a conservatively-determined risk of 8.0 to 8.5 while but one-fourth that distance in Canada has but 1/30th or less expected ground movement. If we multiply length by risk factor, the longer Canadian line has but one/one-hundred-twentieth (1/120) the risk from ground acceleration that the Alaskan pipeline has over its full length. But ground acceleration is not the most dangerous seismic risk. Secretary Morton assures the Congressmen that "the environmental and technical stipulations that I will attach to the Alaska pipeline permit will assure that this pipeline is designed to withstand the largest earth-

quake that has ever been experienced in Alaska". I presume he means that the pipe will be designed to withstand ground accelerations of on the order of 1 g, or twice that of gravity. Although it is very doubtful that this can be done for all modes of operation of a pipeline under all temperatures throughout its lifetime; even if it could be done it would not accommodate the much larger fault offsets expectable only in southern Alaska. Periodic fault offsets of on the order of 3 feet are not at all unexpected along each of the many traces of the Denali fault system that the pipeline must cross in southern Alaska (J. H. Stout, et al, 1973, Geol. Soc. American Bull., v. 84, p. 939). This fault is apparently a major circum-Pacific fault bounding two plates of the earth's crust. Such faults have many traces and contain fault blocks that are wedged between large moving masses during offset. This causes local vertical ground displacements much greater than the regional fault displacements, as was observed in Alaska in 1964 when local movement of as much as 45 feet was observed (National Academy of Science, 1972, The Great Alaskan Earthquake-Seismology and Geodesy, p. 299). Many of these fault blocks remain undetected today and will not be discovered until pipeline excavations are conducted. This will lead to some considerable presently uncounted construction delays due to stipulated special construction modes to be required for crossing such fault-lines. Canada does not have this sort of faulting along any of the pipeline route. Nowhere have the pipeline companies or Department of the Interior demonstrated an ability to design pipelines operating at full capacity capable of withstanding 10 to 45 foot offsets and 1 g ground accelerations that are entirely probable along the Alaskan route.

Since the highest seismic area in Alaska coincides with the area of greatest tectonic (mountain-building) activity, the highest mountains and steepest slopes are found over the foci of the largest earthquakes. Thus, the highest ground accelerations are expected in the mountains near the sea leading to much greater landslide and seismic sea-wave hazard for the Alaskan route. Recent work by U.S. Geological Survey and others (Boore, D. M., 1972, Geological Society of America Abstracts with Programs, p. 454) has shown that previous estimates of ground accelerations to be expected near large-magnitude earthquakes were too low by factors of 5 to 10. This means that landslides, particularly landslides into the sea with associated giant sea waves up to hundreds of feet high as observed in southern Alaska, are virtually certain in the pipeline vicinity within its lifetime and many parts of the pipeline and associated structures would be very much more vulnerable to these hazards in southern Alaska than Canada.

The Alaskan route differs completely from the Canadian in its close association with active coastal-zone glaciers. These glaciers are subject to surges that may or may not be triggered by seismic activity. Some of the glaciers in the vicinity of the Alaskan pipeline are known to have surged in historic time and the route passes within the area over which the glaciers traverse.

Seismic sea waves, generated by submarine ground displacements such as that associated with the 1964 Alaskan earthquake, are a particular hazard to shore installations such as that at Valdez, the terminus of the pipeline. In narrow harbors, such as Valdez, these sea waves are particularly disastrous in that they generate waves that shoal in the confined waters and focus energy onshore; sending swash hundreds of feet above tidal range. These are associated with earthquakes, when the partly-full holding tanks and tankers at the terminus are vulnerable to rupture. No amount of protective berms around those tanks will prevent the oil from floating off on a sea wave surge.

STREAM HAZARDS

Secretary Morton was again given completely false information upon which to base his information that the stream-crossing hazards are equal or greater for the Canadian route. Quite the opposite is true. It is true that a MacKenzie Pipeline route would cross more water-courses, but those are generally different kinds of water courses than are crossed along the Alaskan route. First, the so-called 12 major rivers that must be crossed in Canada are not at all similar to those in Alaska. It is true that they are large rivers in terms of flood discharge volumes, but it does not follow that they are large in width or hazard. These large rivers would, for most preferable construction mode, be treated just as they are in Alaska—with an elevated suspended pipeline. It is not at all implausible that a full elevated suspended pipeline would be constructed

throughout the Canadian reach of the northern portion of the pipeline since that may be the least costly in terms of money and environmental damage and requires the least right-of-way (Barry Donnellan, 1972, An Evaluation of the Basic Soil Mechanics Decisions on the Trans-Alaska Pipeline Project; paper presented to the 139th Annual Meeting of the Am. Assoc. for Advan. of Science, Wash. D.C., Dec., 1972). Should attempts be made to lay pipe beneath these Canadian rivers, risks would still be less than for the general Alaskan case because of lesser Canadian bed scour, smaller gravel size, and lower stream gradients during flooding (R. R. Curry, 1972, Comments to the Hon. Rogers C. B. Morton on the Environmental Impact Statement for the Trans-Alaska Pipeline, 109 p. in Technical Comments, V. 1, Compiled by The Wilderness Society, et al, May, 1972). The Alaskan streams of intermediate and small size are generally wide and gravel-filled and flow on beds that become mobilized for many times the river's mean depths during floods. The critical Canadian rivers, on the other hand, flow on or near bedrock in narrower channels or contain mud and silt beds and have lesser scour hazard. Problems associated with burial of pipes in Alaskan streams are extreme and have not been adequately dealt with in the work of the Department of the Interior (with the exception of the U.S.G.S. paper not used in preparation of the Impact Statement: (Emmett, W. W., 1972, Hydraulic Geometry of some Alaskan streams south of the Yukon River, Open File Report, Water Res. Div., Alaska). Data presented by Emmett suggest that burial depths proposed for the Alaskan stream crossings are sometimes inadequate to accommodate the mobile river beds to be expected and that serious problems exist with many Alaskan crossings. In Canada, however, the generally greater distance between the pipeline route and high mountains means that fewer larger rivers will drain the majority of the regional runoff to the major MacKenzie watercourse. This means that the bulk of the tributary discharges can be crossed subaerially with advantage and that hazard is thus considerably reduced. The greater distance to the mountains, and the very different nature of the glacial history of part of the Canadian route, also accounts for the lesser depths of gravels encountered in many of the Canadian small streams. Thus, large rivers in Canada present no more hazard than they do in Alaska (the Yukon), except that in Alaska the seismic risk to suspended crossings is greater than in Canada. On the intermediate rivers risks are about comparable if pipe is to be buried, and on smaller rivers Canada affords safer crossings for the general case. Hazard to crossings for suspended pipelines for large rivers are very much less than to intermediate and small rivers with wide fluctuations in flow volumes and attempted pipe burial.

In Alaska, in addition, there is the compound problem of glacier dam bursts to be contended with along the sections of the route passing near and through the Alaskan range. This is not encountered along any of the Canadian route either in Alaska or Canada. These dam bursts, occasioned when lakes impounded behind glaciers force their way outward suddenly, add many times the expected discharges to small drainage channels with much scour and sediment movement. These occur in the highest seismic and landslide risk parts of the southern Alaskan route only.

PERMAFROST

While the Secretary is again technically correct when he states in this Congressional letter of April 4th that the Canadian pipeline would cross nearly twice as great a length of area underlain by permafrost (based on very inadequate data from Alaska and Canada), he has been seriously misled if he believes that the Canadian permafrost will create greater hazard. Depending upon the actual route chosen from Prudhoe Bay to the MacKenzie Corridor, permafrost hazard may be equal or less with the Canadian route. This is because the flanks of the Brooks Range are underlain by 'drier' permafrost than the Arctic Coastal Plain or interior Alaska permafrost area. These upland dry permafrost areas pose some hazard to concentrations of runoff but do not pose the thaw-instability problems that are by now well understood for the Alaskan route. The offshore alternative doubtless has some permafrost formed during the lower glacial-age sea level stands, but this does not probably extend to depths below 100 to 200 feet and such depths are found within several miles of shore along most of the route, particularly toward Canada. The MacKenzie River valley itself has less permafrost than might be expected

by comparison to Alaska since it is the locus of a north-flowing river carrying huge quantities of heat northward and thawing its near-shore areas. Careful location of the route along this corridor could minimize total length of high ground-ice permafrost for the Canadian route to make equal or less hazard than for the shorter Alaskan route. I estimate total length of the high ground ice soil for the trans-Canadian route as 380 to 400 miles compared with about 300 miles for the Alaskan route.

Another major permafrost consideration is that associated with haulage and service roads. All of the Alaskan pipeline must be built and serviced from roadways, which themselves constitute a serious threat to permafrost stability and thus to the pipeline. With the MacKenzie valley river corridor available for shipping pipe and service vehicles along a major portion of the route, new major roads paralleling the pipe need not be built. With a suspended pipeline, particularly carrying both gas and oil pipes, no roads need be built at all in permafrost areas, even to carry pipe from barge to construction sites. Long-term environmental damage will probably be greater in Alaska from roads than from the pipeline itself. Certainly the effects upon game, vegetation, and permafrost will be greater associated with the roads, and vehicle travel over them and the thawing, road construction, and greater gravel volumes required in Alaska, (not Canada as Morton was informed) will do greater damage to stream habitat and fisheries away from the immediate pipeline and road rights-of-way due to thermal erosion, stream course changes (particularly in Alaska where the pipeline route parallels many intermediate rivers rather than crossing them at right angles as in Canada), and necessity of hydraulic re-equilibration after gravel removals. Roadways cannot be reclaimed in the Arctic in lengths of time necessary to protect permafrost thaw effects, as has been amply demonstrated by Interior investigators (R. Sigafos, for instances) and many others.

This analysis has not considered any of the obvious comparative advantages of the Canadian versus Alaskan routes related to the hazards of the marine leg of the Alaskan route. Information on the marine hazard will be presented by my colleague Dr. Richard Warner in written statement. The long persistence of some toxic fractions in petroleum, particularly that from Prudhoe Bay, create a risk to the \$53 million Prince William Sound fisheries. There are many unknown factors in the evaluation of the marine hazard. These are particularly disquieting because the Department of the Interior has provided no stipulations for the marine route, nor for the numerous trans-continental routes that may then be used to carry petroleum to markets in the east and midwest from west coast tanker ports. The Alaskan route is 15 to 3 times as long between Prudhoe Bay and midwest markets as is the Canadian route, yet only one-third of the Alaskan route is protected by stipulations. If schemes to avoid the strictures of the Jones Act are applied as brought out by Congressman Les Aspin to this subcommittee on April 19 and refinement of Alaskan oil is considered for the Virgin Islands via a Central American pipeline, then the potential marine impact of the Alaskan Pipeline is orders of magnitude greater than previously stated by Interior.

SUMMARY

The major terrestrial advantages of the Canadian versus the Alaskan route are lesser Canadian seismic hazard by on the order of 100 times; lesser hazard associated with most probable-mode stream crossings; and route possibilities requiring less gravel, less stream destruction, less high-ground-ice permafrost crossing, and fewer miles of permanent roads. Coupled with the clear short-term and long-term economic advantages of the Canadian route assuming international cooperation, total absence of the marine leg and associated severe hazards to Canada and to a lesser extent the United States, and the security advantages of the inland route, there seems little reason to continue Alaskan Pipeline proposals except as a favor to energy company interests who would stand to make the greatest short-term profit from the Alaskan route.

Dr. CURRY. I wish to attempt to summarize an extremely large volume of factual information on the comparative terrestrial environmental impacts of the Alaskan and Canadian pipeline alternatives. These geologic and hydrologic data overwhelmingly favor Mackenzie Valley routes. Primary factors under consideration are

seismic risk through pipeline failure associated with local ground accelerations and offsets, sea waves, slope failures, and glacier accelerations; flood and scour hazard associated with buried river crossings and glacier outburst floodways; foundation failure hazard associated with high ground-ice permafrost melting; and service and haul-road substrate destruction causing increased siltation in waterways and loss of permafrost and vegetative covers.

Some serious misinformation is still being used as the basis for comments and decisions regarding the environmental impacts of the two major pipeline routes, as for instance in Secretary Morton's letter to Congressmen of April 4 of this year. Although it is true that the trans-Canada route is longer, it is not at all true that there is more unstable permafrost, more chances of slope failure, equal seismic risk, or equal hydrologic risk. Morton's letter to Congressmen of April 4 also illustrates some misconceptions about the hazard geology of the two routes, such as his ideas about design for earthquakes, permafrost, and river crossings that cause me to seriously doubt that he has the ability to grasp these technical matters sufficiently to assure his capability to attach adequate environmental and technical stipulations to any arctic pipeline permit, no matter where constructed. These factual and implied errors are so overwhelmingly incorrect that they must be thoroughly challenged in open scientific forum. The following analysis will cover some of the major points of terrestrial impact. I will not attempt to cover them all.

Let's begin with seismic hazard. It is well known that the Canadian alternatives offer less seismic risk than the Alaskan route but the degree of this difference is not fully appreciated. First, the magnitude of expected earthquakes was seriously underestimated for the longest midsection of the Alaska pipeline route—67° N. to Donnelly Dome—because earthquakes of several times larger energy release have occurred within 30 miles of the proposed pipeline within recent historical times. The very high risk seismic zone comprises over two-thirds of the Alaskan route while the lesser—6.0—highest risk zone for the Canadian route is less than 120 miles in length. About 450 to 500 miles of the Alaskan route are through areas with a conservatively determined risk of 8.0 to 8.5 while but one-fourth that distance in Canada has but one-thirtieth or less expected ground movement. If we multiply length by risk factor, the longer Canadian line has but one-hundred-twentieth the risk from ground acceleration that the Alaskan pipeline has over its full length. But ground acceleration is not the most dangerous seismic risk. Secretary Morton assures the Congressmen that, "The environmental and technical stipulations that I will attach to the Alaska pipeline permit will assure that this pipeline is designed to withstand the largest earthquake that has ever been experienced in Alaska?" I presume, as a scientist, he means that the pipe will be designed to withstand ground accelerations of on the order of 1 g. or twice that of gravity. Although it is very doubtful that this can be done for all modes of operation of a pipeline under all temperatures throughout its lifetime; even if it could be done it would not accommodate the much larger fault offsets expectable only in southern Alaska. Periodic fault offsets of on the order of 3 feet are not at all unexpected

along each of the many traces of the Denali fault system. I give references in my prepared statement to the papers.

This fault is apparently a major circumpacific fault bounding two plates of the earth's crust. Such faults have many traces and contain fault blocks that are wedged between large moving masses during offset. This causes local vertical ground displacements much greater than the regional fault displacements, as was observed in Alaska in 1964 when local movement of as much as 45 feet was observed. Many of these fault blocks remain undetected today and will not be discovered until pipeline excavations are conducted. This will lead to some considerable presently uncounted construction delays due to stipulated special construction modes to be required for crossing such faultlines. Canada does not have this sort of faulting along any of the pipeline route. Nowhere have the pipeline companies or Department of the Interior demonstrated an ability to design pipeline operating at full capacity capable of withstanding 10 to 45 foot offsets and 1 g ground accelerations that are entirely probable along the Alaskan route.

We are not talking about possibilities, we are talking about definite probability within the lifetime of the pipeline.

I go on in my prepared statement to talk about landslides, giant sea waves, and glaciers which are larger for the Alaska route. I want to talk now about one of the other major hazards, and that is the hazard of stream crossings.

Secretary Morton was again given completely false information upon which to base his information that the stream-crossing hazards are equal or greater for the Canadian route. Quite the opposite is true. It is true that a Mackenzie pipeline route would cross more watercourses, but those are generally different kinds of watercourses than are crossed along the Alaskan route. First, the so-called 12 major rivers that must be crossed in Canada are not at all similar to those in Alaska. It is true that they are large rivers in terms of flood discharge volumes, but it does not follow that they are large in width or hazard. These large rivers would, for most preferable construction mode, be treated just as they are in Alaska—with an elevated suspended pipeline. It is not at all implausible that a full elevated suspended pipeline would be constructed throughout the Canadian reach of the northern portion of the pipeline since that may be the least costly in terms of money and environmental damage and requires the least right-of-way. As a matter of fact, it requires no increase in rights-of-way over existing legislation. Should attempts be made to lay pipe beneath these Canadian rivers, risks would still be less than for the general Alaskan case because of lesser Canadian bed scour, smaller gravel size, and lower stream gradients during flooding. Problems associated with burial of pipes in Alaskan streams are extreme and have not been adequately dealt with in the work of the Department of the Interior—with the exception of the USGS paper not used in preparation of the impact statement. Data presented by Emmett suggest that burial depths proposed for the Alaskan stream crossings are sometimes inadequate to accommodate the mobile river beds to be expected and that serious problems exist with many Alaskan crossings. In Canada we do not find the same kind of hazard.

In Alaska, in addition, there is the compound problem of glacier dam bursts to be contended with along the sections of the route passing near and through the Alaskan range. This is not encountered along any of the Canadian route either in Alaska or Canada. These dam bursts, occasioned when lakes impounded behind glaciers force their way outward suddenly, add many times the expected discharges to small drainage channels with much scour and sediment movement. These occur in the highest seismic and landslide risk parts of the southern Alaskan route only.

Lastly, I want to talk about permafrost. While the Secretary is again technically correct when he states in this congressional letter of April 4 that the Canadian pipeline would cross nearly twice as great a length of area underlain by permafrost—based on very inadequate data from Alaska and Canada—he has been seriously misled if he believes that the Canadian permafrost will create greater hazard. Depending upon the actual route chosen from Prudhoe Bay to the Mackenzie Corridor, permafrost hazard may be equal or less with the Canadian route. This is because the flanks of the Brooks Range are underlain by "drier" permafrost than the Arctic Coastal Plain or interior Alaska permafrost areas. These upland dry permafrost areas pose some hazard to concentrations of runoff but do not pose the thaw-instability problems that are by now well understood for the Alaskan route. The offshore alternative doubtless has some permafrost formed during the lower glacial-age sea level stands, but this does not probably extend to depths below 100 to 200 feet and such depths are found within several miles of shore along most of the route, particularly toward Canada. The Mackenzie River Valley itself has less permafrost than might be expected by comparison to Alaska since it is the locus of a north-flowing river carrying huge quantities of heat northward and thawing its near-shore areas. Careful location of the route along this corridor could minimize total length of high ground-ice permafrost for the Canadian route to make equal or less hazard than for the shorter Alaskan route. I estimate total length of the high ground ice soil for the Trans-Canadian route as 360-400 miles compared with about 300 miles for the Alaskan route.

Another major permafrost consideration is that associated with haulage and service roads. All of the Alaskan pipeline must be built and serviced from roadways, which themselves constitute a serious threat to permafrost stability and thus to the pipeline. With the Mackenzie Valley river corridor available for shipping pipe and service vehicles along a major portion of the route, new major roads paralleling the pipe, need not be built. With a suspended pipeline, particularly carrying both gas and oil pipes, no roads need be built at all in permafrost areas, even to carry pipe from barge to construction sites. Long-term environmental damage will probably be greater in Alaska from roads than from the pipeline itself. Certainly the effects upon game, vegetation, and permafrost will be greater associated with roads, and vehicle travel over them and the thawing, road construction, and greater gravel volumes required in Alaska—not Canada as Morton was informed—will do greater damage to stream habitat and fisheries away from the immediate pipeline and road rights-of-way due to thermal erosion, stream course

changes—particularly in Alaska where the pipeline route parallels many intermediate rivers rather than crossing them at right angles as in Canada—and necessity of hydraulic re-equilibration after gravel removals. Roadways cannot be reclaimed in the Arctic in lengths of times necessary to protect permafrost thaw effects.

In conclusion, yet me remind you that this environmental analysis—and it will be the only environmental analysis this panel presents—has not considered any of the obvious comparative advantages of the Canadian versus Alaskan routes related to the hazards of the marine leg of the Alaskan route. Information on the marine hazard will be presented by my colleague Dr. Richard Warner in written statement. The long persistence of some toxic fractions in petroleum, particularly that from Prudhoe Bay, create a risk to the \$53 million Prince William Sound fisheries. There are many unknown factors in the evaluation of the marine hazard. These are particularly disquieting because the Department of the Interior has provided no stipulations for the marine route, nor for the numerous transcontinental routes that may then be used to carry petroleum to markets in the East and Midwest from west coast tanker ports. The Alaskan route is 1.5 to 3 times as long between Prudhoe Bay and Midwest markets as is the Canadian route, yet only one-third of the Alaskan route is protected by stipulations. If schemes to avoid the strictures of the Jones Act are applied as brought out by Congressman Lee Aspin to this subcommittee on April 19, and refinement of Alaskan oil is considered for the Virgin Islands via a Central American pipeline, then the potential marine impact of the Alaskan pipeline is orders of magnitude greater than previously stated by Interior.

In summary, the major terrestrial advantages of the Canadian versus the Alaskan route are lesser Canadian seismic hazard by on the order of 100 times; lesser hazard associated with most probable-mode stream crossings; and route possibilities requiring less gravel, less stream destruction, less high-ground-ice permafrost crossing, and fewer miles of permanent roads. Coupled with the clear short-term and long-term economic advantages of the Canadian route assuming international cooperation, total absence of the marine leg and associated severe hazards to Canada and to a lesser extent the United States, and the security advantages of the inland route, there seems little reason to continue Alaskan pipeline proposals except as a favor to energy company interests who would stand to make the greatest short-term profit from the Alaskan route.

Mr. MELCHER. Thank you. Next will be Dr. Charles Cicchetti.

Mr. SAYLOR. Dr. Curry, I don't want to take anything away from your statement. I am not going to ask you any questions. I have news for you. I have read your statement in less than one-third of the time that it took you to read it. Now, if you expect this committee and your panel expects this committee to get the benefit of some questions that are in the minds of the members here, I would advise you, your statement is already in the record. That goes for all of the rest of you. I know you have come a long distance and you worked hard on your paper, but it is there and all you did was reread it.

Mr. MELCHER. Dr. Cicchetti.

**STATEMENT OF CHARLES CICHETTI, DEPARTMENT OF
ECONOMICS, UNIVERSITY OF WISCONSIN**

Dr. CICHETTI. With that in mind, let me summarize my statement very briefly.

Mr. MELCHER. Without objection, Dr. Cicchetti's statement will be made a part of the record at this point.

Hearing none, so ordered.

[Dr. Cicchetti's statement with attachment follows:]

STATEMENT OF DR. CHARLES J. CICHETTI, UNIVERSITY OF WISCONSIN

My name is Dr. Charles J. Cicchetti, I reside at 1930 Regent Street, Madison, Wisconsin. I am a Visiting Associate Professor of Economics and Environmental Studies at the University of Wisconsin, Madison.

Prior to my present position I was a Research Associate at Resources for the Future in the Natural Environments Program. While in that program I spent nearly two years studying the economic and environmental aspects of the proposed Trans Alaska Pipeline and several alternative overland pipeline routes through Canada. I have written a book entitled: *Alaskan Oil: Alternative Routes and Markets* (Johns Hopkins Press for Resources for the Future, 1973), several articles on these issues and I co-authored public statements with Dr. John V. Krutilla on both the Draft and Final Environmental Impact Statements of the U.S. Department of Interior on the proposed Trans Alaska Pipeline.

In my analysis I concluded that the Trans Alaska Pipeline was environmentally and economically inferior to either a Mackenzie Valley Pipeline or an Alaskan Highway pipeline. Both routes would avoid the most serious seismic and avalanche areas of southern Alaska and the marine pollution associated with tanker traffic and terminal facilities. Both routes would deliver oil to the midwest and east coast rather than the west coast. These non oil producing states east of the Rockies are presently in greatest need of oil and the price of oil is higher there than any other place in the world. Additionally, most concede that a natural gas pipeline will be constructed in the future and that there are substantial economic and environmental savings, if both a crude oil pipeline and natural gas pipeline are built in the same corridor. Since natural gas is most needed in the mid continent markets and an all land system is the only economically feasible alternative, these advantages only add to the desirability of an all land transportation system across Alaska and Canada. Canada has not only expressed a strong interest in such a joint oil and natural gas transportation system, the Honorable Donald MacDonald has even offered to supply the United States with oil during any planning and construction periods, thus greatly reducing the often stated early delivery advantage of TAPS.

While the midwest and east coast of the United States need the entire throughput of a Trans Alaska-Canada Pipeline now, the west coast of the United States would be oversupplied with oil for a considerable length of time. My analysis showed this excess supply would last between 5 and 15 years depending upon the oil import quota system used on the west coast, if TAPS is built. Excess supply during our present energy crisis is mind boggling. Several intricate plans to deal with this situation were uncovered during my research. These included: (1) selling the oil to Japan in exchange for additional imports on the east coast with the exporting company reaping super normal profits by avoiding the Mandatory Oil Import Quota Restrictions, (2) shipping oil to the Virgin Islands via new Central American pipeline in non U.S. built owned and operated tankers, thus avoiding the Jones Act and (3) backing out present imports to the west coast with the affected company being compensated by being granted import quota tickets on the east coast.

The conclusion of my analysis was that the environmentally and economically superior route would cross Alaska and Canada and bring oil to the midwest and east coast. On the other hand by taking advantage of the market

restrictions imposed by the Mandatory Oil Import Quota Program the decision was made to develop the Trans Alaska Pipeline thus reaping the greatest possible profits by sacrificing the interests of all the other concerned parties. The state of Alaska responded by imposing a minimum well head price of \$2.65 per barrel for the purpose of collecting taxes and to protect itself from the expected losses that would be generated from the oil companies intricate international marketing schemes.

A. SOME RECENT CONFUSION IN THE ECONOMIC COMPARISONS OF TAP AND ALL LAND SYSTEMS ACROSS CANADA

Recently there has been considerable attention given to my economic analysis and I'd like to review that for this committee. In my analysis of the Trans Alaska Pipeline I compared its economic value with that of the Trans Canadian Pipeline. I considered two different cases. One in which the price of oil in each part of the country would be based upon world prices; that is the Middle East price (including taxes) plus transportation costs would be the price in all parts of the United States. The second case that I considered was based upon an assumption that the domestic pattern of prices and costs that presently exists will continue in the future in the United States.

Proponents of TAP have focused on the first approach. If foreign oil is the price setter then east coast, gulf coast and west coast prices would be equal and prices in the midwest would be the highest in the nation about 25¢ to 30¢ per barrel greater than all other regions.

Most estimates of the cost of TAP and the cost of TCP put the two systems within about 10¢ to 20¢ of one another even when delays of two years for TCP are considered. When the lowest estimates of TAP's cost per barrel are compared with the highest estimates of TCP's cost per barrel the difference will be approximately equal or less than the higher price of foreign crude oil in the midwest. TAP proponents, therefore, incorrectly conclude that the two routes are economically equivalent and if delays for TCP are greater than two years TAP is superior to TCP. The first thing wrong with such a biased comparison is that it assumes all high estimates of the cost of TCP are accurate at the same time all low estimates of the cost of TAP are accurate. Second, it ignores any economic savings from constructing a natural gas and perhaps a second oil pipeline in the same corridor. Third, it ignores the admission of oil companies, findings of the Department of Interior, my own findings and recent substantiating information that shows the west coast will not need large quantities of the North Slope oil that would flow through TAP. On the other hand the midwest and east coast needs that Alaskan oil now. Over time the shortage in the midwest and on the east coast will become even greater. Since excess west coast supplies will either increase cost or further increase the inequity in relative prices in different regions of the country, ignoring these regional supply and demand imbalances incorrectly biases the comparison heavily in favor of TAP.

If these qualifying factors are not convincing enough in and of themselves let me remind you that this is the case that TAP pipeline proponents find most useful to use to promote their decision to push TAP. If present price patterns in the United States continue the case in favor of a Canadian route is unbeatable. First, it should be pointed out that given the characteristics of North Slope Crude it is better suited for refineries that produce a greater mix of light and heavy refinery products as are found in the midwest and on the east coast. At the time I completed my analysis very light crude oils were priced at about 30¢ per barrel greater in the midwest and 60¢ per barrel greater on the east coast than similar crudes on the west coast, North Slope quality oil was priced at about 64¢ more per barrel in the midwest and 90¢ more per barrel on the east coast than similar crude oil on the west coast.

The theory put forward by Mr. Simon of the Treasury Department, the Standard Oil Company (Ohio) and Governor Egan of the state of Alaska is that these price differences will disappear in the future given the president's new oil policy. The first question that should be directed to these gentlemen is whether they think west coast prices are to rise to east coast levels (a price increase of about 30%) or should east coast consumers, contrary to all oil company advertising, expect a price decline to west coast levels (a price decrease of about 25%). They will probably answer such a question by stating the period of cheap foreign oil has passed and repeat industry claims that at

the present time some foreign oil is being delivered to the United States at prices higher than domestic oil prices.

If this is their collective response a second question must be asked. At the present time the Japanese are paying more than \$1.50 less per barrel of oil with qualities similar to North Slope crude (see Appendix A for a recent comparison of lighter crudes). The Japanese are being supplied with low cost Middle East oil, while the largest oil producing and consuming country, the United States, has higher domestic prices and many government and industry spokesmen soon predict we will be paying more for imported crude oil than these high domestic prices. I suggest we learn a lesson from the Japanese and start requiring our oil companies to bargain with producing countries for lower prices and stop the foolish practice of having our domestic oil companies serve as tax collectors for producing nations by ending the foreign tax credit on royalty and severance.

I stated earlier that the prices that existed at the time that I undertook my analysis were such that the midwest price was about 65¢ (and the east coast 90¢) more per barrel than the west coast for oil similar in quality to North Slope oil. In the few weeks since the President's energy message prices have been changing in this nation. They are not changing in the direction predicted by Mr. Simon, Mr. Egan or SOHIO, however. Instead as the recent issues of the *Oil and Gas Journal*, week after week (especially the April 30 edition), point out prices in the east of the Rockies market have been increasing by between 25¢ and 50¢ per barrel, while west coast prices did not show any movements until this past week, when a 25¢ per barrel increase was announced. This means that relative prices have either not changed or have increased to the detriment of midwest and east coast consumers, who now may be paying as much as 90¢ per barrel more in the midwest and \$1.15 per barrel more on the east coast.

West coast oversupply and lower prices make the selection of TAP over TCP a very poor choice for midwest and east coast consumers. Finally, I would like to comment on a related aspect that has been raised by my critics, who have recently questioned my own objectivity for using a 50-50 mix of domestic and foreign crude oil in the midwest and a 17-83 mix on the west coast. For those who take the time to read my book, they will realize that it was not my biases that were behind these different percentages. Instead, the more than 15 years of bias in national policy that resulted in much higher prices for midwest and east coast oil was the bias that was being computed. The bias that these percentages were reflecting was similar to that the New England Governor's and recently the Governor of my own state, Wisconsin, were opposed to when they challenged the use of a different import quota system east of the Rockies than on the West coast. The bias that prevented the development of Canadian tarsands and which placed a limit on other Canadian oil coming into the midwest is another type of bias, that these calculations were meant to reflect.

When the new data are examined it seems that the economic case against TAP is greater than ever. The final fall back of TAP's proponents may be that prices don't matter, it is resource costs that are the key. This would only be true for those who do not think that vastly different prices and security of supply of oil in different parts of the country do not matter. I do not think this Congress should be so callous and narrow minded.

B. THE PRESIDENT'S ENERGY MESSAGE

Last month the President issued executive proclamation 3279, which ended direct quantity controls. This change has an important impact on the selection of the optimal transportation system for Alaskan oil. By ending direct quantity controls the financial advantage of the import for export sale of oil to Japan and the Virgin Islands—Central American Pipeline plans are virtually eliminated. (Note some avoidance of the import license fee may still be possible.) As a result all three measures of comparison: economic, environmental and oil company profits now point to the Trans Canadian routes as superior to the Alaskan-tanker system.

New information on a second factor has recently come to light. It is related to regional supply-demand imbalance in the future in the United States. The President proposed a speedy increase in oil leasing in off shore areas. Two of these areas, the Gulf of Alaska and California, if developed will only com-

pound the present regional imbalances in domestic oil supply and demand. In addition oil production in the areas of Western South America and South East Asia would benefit the west coast. A recent study prepared by the State Resource Agency of California indicates that even without any North Slope or Gulf of Alaska oil, PADV, the west coast, could be "essentially independent from unstable foreign supplies through 1985."

By following a proposal similar to the president's, the report concluded California production would exceed two million barrels per day by 1985. The mid-west and east coast on the other hand have no alternative but to become heavily dependent on these same so-called "unstable foreign supplies" unless Alaskan and Canadian oil and gas are brought into these regions in increasing quantities.

It is important to consider other aspects of the President's energy message. In it were two major proposals, western coal and oil shale, for domestic energy self-sufficiency. Both are located in the Rocky Mountain region of the nation. Technology to convert these resources either to oil or gas has been given some priority. However, a very important limitation on these developments is the availability of sufficient quantities of water. It is simply impossible to expect a full development of such resources without Canadian-U.S. cooperation.

The need for a North American Energy Policy has never been greater. The economic and environmental benefits to the U.S. and Canada will be maximized only by cooperating and engaging in long run planning. Developing tar-sands in Alberta, locating electric plants on the Great Lakes, developing western coal and oil shale are very much interrelated to one another as well as to Arctic oil and gas development. There is probably no better way to scuttle a North American energy policy before it even begins than to allow a single private concern like the cash flow of two U.S. and one British oil company to dominate such a major international and domestic decision. Quite simply Canada cannot be expected to be ignored on the initial Arctic oil transportation system decision and then be expected to cooperate on future energy developments.

C. SOME PROPOSALS TO PLUG THE LOOPHOLES

Two weeks ago I made a series of proposals to your Senate counterparts. I repeat them here today. They are aimed at my critics, who will say that present conditions have changed oil company plans and that my analysis is based upon out moded calculations. I think they should be answered by recommending the following 10 point program, which I think should be amended to any legislation which makes it possible to build the Trans Alaska Pipeline. If my previous findings are still correct the reaction to these proposals will be hostile, if I am now wrong most of these proposals will be unimportant.

I. No oil can be exported from Alaska to a foreign country as long as import restrictions of any type are imposed in other parts of the nation.

II. If any oil is exported royalty and severance taxes must be treated as expenses and not credited against federal corporate income taxes.

III. If oil imports are increased on the east coast or in the midwest because TAP backs them out of PADV, then these should either be charged the new license fee or be sold to the highest bidder with revenues going to the federal treasury and not used to bring windfalls to oil companies.

IV. In order to control both the safety requirements and mode of operations of the necessary tankers moving oil out of Alaska only U.S. built owned and operated tankers should be permitted even if foreign ports are the ultimate destination.

V. Full agreements concerning routes and operations along Canada's west coast and Puget Sound should be resolved before TAP is begun.

VI. In order to protect the state of Alaska from various international marketing schemes a minimum posted price for the purposes of calculating royalty and severance tax should be set, thus ending the oil companies attempt to use the courts to overturn Alaska's new legislation.

VII. Final marketing destinations for all Alaskan oil should be made available to Congress and the economic and environmental impact of such flows of oil should be compared to alternative transportation systems.

VIII. Plans for a natural gas pipeline must be documented before TAP is built so Congress can guarantee each system is compatible with maximizing collective welfare and having a minimum impact on the environment.

IX. Resale of the pipeline to future oil consortiums for the purpose of reducing taxes in the future should be declared illegal.

X. A committee of Congress should hold an inquiry to determine the present position of the Canadian government concerning various natural gas and oil transportation systems.

This controversy has shown us the great importance of the National Environmental Policy Act. By requiring full public disclosure of the decision making process we have determined that a very narrow private interest has sought to sacrifice the Alaskan environment, oil consumers, taxpayers of the state of Alaska and the nation, the U.S. Maritime industry and doubtless others. The important juncture we find ourselves in today is whether we shall let this narrow private interest to proceed unfettered by a broader national concern for the greatest number of citizens of both Canada and the United States. I urge this Congress to assert its authority in these matters and to reject the apparent decision of the executive branch to make its decision purely on the basis of oil company demands. Thank you.

APPENDIX A.—Recent Japanese versus New York prices

Fob price Abu Dhabi Crude (Mar. 19, 1973, OGJ) equal:				
To Japan				\$2.38
Less markup over other Japanese imports (it is also typical for discounts on fob to Japan)				12.3
Total				2.26
Tanker rate range 0.27¢ to 43.5¢ per barrel.				
Landed prices:				
	High	Low		
\$2.26	\$2.38	\$2.26	\$2.38	
.43	.43	.27	.27	
\$2.69	\$2.81	\$2.53	\$2.65	
New York 32° API price				\$4.13
Plus price increase spring 1973				.25
New York Price at present				4.38
Current New York and Tokyo price differences:				
	\$4.38	\$4.38		
	-2.81	-2.53		
(Low)	1.57	(High)	1.85	

THE TRANS ALASKA PIPELINE: A BENEFIT COST ANALYSIS OF ALTERNATIVES (By Charles J. Cicchetti, Working Paper 10, University of Wisconsin-Madison; Institute for Environmental Studies, January 1973)

This paper is based upon research conducted at Resources for the Future. Its current form has been supported by the Institute for Environmental Studies at the University of Wisconsin and the Public Interest Economics Center, Washington, D.C. It was presented at the annual meeting of the American Association for the Advancement of Science, Washington, D.C., in December 1972.

I. INTRODUCTION AND PROBLEM

From the vantage point of 1972 we can identify two unrelated developments in the latter part of the previous decade, which are now intertwined into one of the nation's most significant environmental preservation and energy development controversies. In the period of 1968 to 1970, successful exploratory efforts resulted in the discovery of a major oil field on the North Slope of Alaska. By the end of 1970, the American Petroleum Institute estimated the proved reserves in this Prudhoe Bay field to be approximately 9.6 billion barrels. A field of such size makes this discovery one of the single most important in the history of the domestic crude oil industry.

At about the same time that oil explorations were being undertaken in Alaska, the Congress of the United States enacted the National Environmental Policy Act of 1969 (NEPA, PL 91-190). One of the requirements of this Act is that agencies of the federal government undertaking actions that might have an impact on the environment, must file an Environmental Impact Statement (frequently called a 102(C) statement). This requirement includes agencies issuing permits to private developers as in the Alaskan oil case. In these statements the agencies must analyze and quantify the expected impact of the proposed action on the environment. Furthermore, when irreversible deleterious impacts on the environment are found, a consideration of alternatives, including but not restricted to nondevelopment, must also be undertaken by the agency. The consideration of alternatives has been interpreted to include both an environmental and economic comparison of alternative actions. This present paper will concentrate on the economic comparison of the Trans Alaska Pipeline and its principal alternatives. Initially, the Department of Interior did not file the required Environmental Impact Statement and subsequently the claim was made that the statement was inadequate, in part because it did not consider the alternatives to the proposed pipeline. Environmentalists used these facts to delay the construction of the pipeline. The principal but not the only concerns of environmentalists were and continue to be related to the following factors:

- (1) The impact of production and the proposed pipeline on the ecology of the North Slope, particularly the caribou herds which inhabit it.
- (2) The possibility of pipeline leaks and/or breaks caused either by (a) melting permafrost, (b) seismic activity or (c) avalanches.
- (3) The physical disruption of the nation's largest remaining wilderness and the impact of construction and operation of the pipeline on this wilderness and the many rivers and streams crossed by the pipeline.
- (4) The impact of "normal" tanker loading operations in Prince William Sound at the Port City of Valdez and West Coast ports.
- (5) The prospects of possible tanker accidents caused either by (a) collisions, (b) earthquakes, or (c) tidal waves.

As stated above this paper will concentrate on an economic comparison of alternatives. However, a short digression to define the alternatives and to describe their different environmental impacts will be undertaken first.

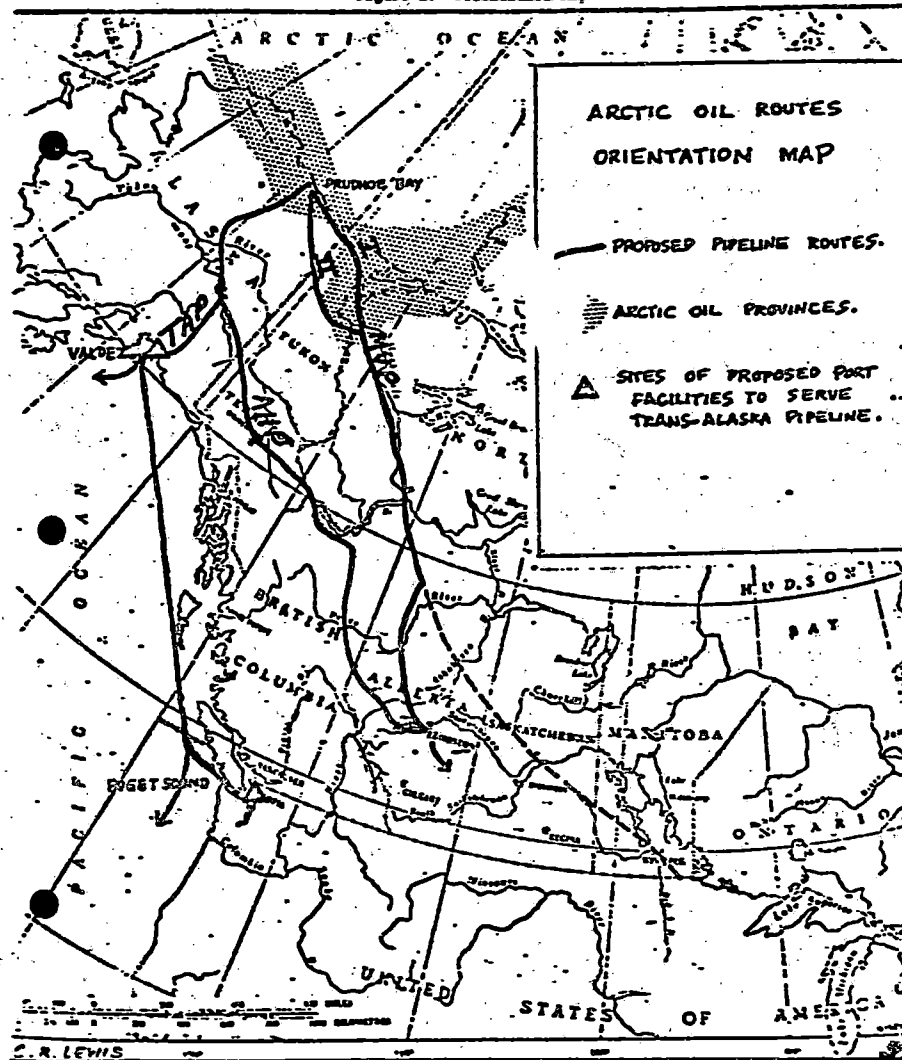
II. AN ENVIRONMENTAL COMPARISON

This paper will consider the economic effect of three alternative policy options. The proposed Trans Alaska Pipeline and tanker system (TAPS) and two all land Trans Canadian Pipelines (TCP) are the alternatives that will be considered in this analysis. The environmental effects of each have been analyzed by various public and private agencies including the Department of Interior in response to the initial legal action taken by environmentalists.

The route, which is currently proposed by the consortium of oil companies,¹ would move in a north-south direction across Alaska crossing two major mountain ranges and in its southern half would cross the most seismically active region in North America. The pipeline would terminate in the port city of Valdez where storage and terminal facilities will be constructed to ship the North Slope oil to final markets. In Figure 1 this route is labeled TAP. A second alternative would be to construct a pipeline from the North Slope to the Canadian city of Edmonton following the natural corridor of the Mackenzie River. This route is labeled MVP in Figure 1. There are two routes which have been proposed for the Mackenzie Valley. These are labeled I and II in Figure 1. Finally, a third alternative would follow the TAP route to the Alaskan city of Fairbanks and follow the man-made corridor of the Alaska Highway and, in some portions, previous pipeline routes to the Canadian City of Edmonton. This route is labeled AHP in Figure 1. The all-land pipeline alternatives will not stop in Edmonton. However, pipelines already connect Edmonton with the Pacific Northwest and the U.S. Midwest. Therefore, the new environmental impact would be minimal.

Footnotes at end of article.

Figure 1. Orientation Map



The Department of Interior undertook an environmental comparison and concluded that: "No single generalized route appears to be superior in all (environmental) respects to any other."² However, the department concluded that TAP was superior to the Trans Alaska Canada routes only from the standpoint of its impact on the abiotic or nonliving environment and it pointed out this advantage was also lost, if a natural gas pipeline were to be considered as part of the Arctic development plan. Second, it concluded that from the standpoint of the impact on the overall biotic environment, MVP-I was superior. Third, the Department of Interior concluded that from the standpoint of the unavoidable impact upon "socioeconomic systems, . . . recreation, aesthetic, wilderness, communities, and native culture and substance," the MVP-I route was superior. Fourth, the department concluded that routes MVP-II and AHP would probably have the least impact on the marine environment. From the standpoint of risk, or threatened environmental impact, the Department of Interior concluded that both of the Trans Alaska Canada routes were superior to TAP for both the terrestrial and marine environment.³ Since TAP is environmentally inferior, in the next sections of this paper we will examine its economic advantages to determine the social tradeoffs that are necessary to select the optimal route.

Footnotes at end of article.

III. ECONOMIC ANALYSIS

The controversy surrounding the Trans Alaska Pipeline (TAP) has not been restricted to environmental matters. The reason for this is that, as in most development projects which will have admitted environmental consequences, the proponents of such projects point to their economic advantages. Implicit in such arguments is the supposition that various economic benefits, if sufficiently large, can be used to justify the deleterious effects on the environment.⁴

The first step in assessing the economic benefit of the Trans Alaska Pipeline (TAP) is to determine the cost of constructing and operating this oil transportation system. Capital investments represent opportunities foregone in several time periods. Therefore, a second determinant of the project's cost is the rate of time preference. Presently, there is some agreement among economists and government officials that this rate is currently 10%.⁵ However, since benefits and cost comparisons are generally very sensitive to the value of the discount rate which is selected, I will use rates of 8 and 12 percent to bracket the discount rate and therefore test the sensitivity of the conclusions to this important parameter.

The present value of the costs of a pipeline depends on the rate of utilization of the system; that is, the time stream or scheduling of throughput. This means that the analysis also depends on several interdependent factors: (1) the project's life or time horizon, (2) the total oil which is transported by the project, and (3) the amount of oil that is produced in any given year. In the present analysis two production schedules are examined; these are shown in Table 9 (page 31).

There have been many estimates of the construction costs for the Trans Alaska Pipeline system, and at the present time there is still no single estimate that is agreed to by industry or government sources; to say nothing of the estimates one might expect from environmentalists. Therefore, the strategy which will be adopted is to use various capital costs from \$1.75 billion to \$2.5 billion in current 1971 U.S. dollars in a simulation model, that will show the sensitivity of the results to variations in this parameter.⁶

The total transportation costs of the proposed Trans Alaska Pipeline (which equal average capital costs + operating costs) and the tanker operations to Los Angeles are shown in Table 1 for each throughput, discount rate and capital cost case. These estimates are based upon tanker costs of \$.35 per barrel and the pipeline and terminal operating costs of \$.13 per barrel.

TABLE 1.—TOTAL COST PER BARREL TO LOS ANGELES FROM THE NORTH SLOPE VIA AMERICAN FLAG SHIPS AND THE TRANS-ALASKA PIPELINE

Capital costs (in billions of 1971 dollars).....	\$1.75	\$2.00	\$2.25	\$2.50
Alaska throughput (dollars per barrel)				
Discount rates:				
8 percent.....	0.819	0.868	0.916	0.965
10 percent.....	.913	.975	1.037	1.099
12 percent.....	1.024	1.102	1.179	1.257
Accelerated throughput				
8 percent.....	0.763	0.813	0.864	0.914
10 percent.....	.832	.882	.932	.982
12 percent.....	.909	.971	1.032	1.093

The Cost of the Mackenzie Valley Pipelines (MVP)

Any interested party who attempts to keep track of the various public estimates of the cost of a Trans Canadian pipeline will probably have a difficult time of it. Estimates of construction costs ranging from one billion to seven billion may be found by reviewing the public statements and writings of various oil companies and public officials in both Canada and the United States.⁷

It should be noted that all Trans Canadian pipeline routes avoid most of the necessary expenditures for terminal and marine facilities that are included in the TAP estimates above. Using the same costs per mile as TAP the capital costs of crude oil pipeline from the North Slope to Edmonton down the Mackenzie Valley range between \$2.0 billion and \$2.75 billion in 1971 U.S. dollars.⁸

Additionally, it is often presumed that a Canadian route may take two additional years before it would begin operation. This can be accounted for by further discounting of the proposed throughputs. It should be noted that for the discount rates considered, a two-year construction delay followed by an accelerated throughput schedule for a Canadian pipeline would just offset (actually it saves about \$.01 per barrel) any gain in the present value of costs per barrel that the slower production schedule (implicit in the Alyeska rate of throughput) starting two years earlier would have.

The second component of costs per barrel is the operating cost per barrel of crude oil, which has been estimated by the three major North Slope companies for the North Slope-Edmonton-Chicago system operating at 2 million barrels per day (730 million barrels per year) to be approximately \$.30 per barrel⁹ (\$216,900,000 per year). This operating cost may be broken down into costs of \$.174, \$.126 and \$.065 per barrel for the North Slope to Edmonton, Edmonton to Chicago, and Edmonton to Puget Sound respectively.

The capital cost estimates per barrel for the Edmonton to Chicago leg depend upon the assumption that is made about the costs of looping or using existing excess capacity on the Interprovincial pipeline and may be as small as \$.1 million.¹⁰ On the other hand, frequently cited figures for a Canadian pipeline to Chicago are 3.0 to 3.5 billion dollars, thus implying estimates nearly ten times greater or \$1 billion for this route. In order to bracket the above estimates and some earlier industry estimates,¹¹ Capital cost of \$.6 billion, \$.8 billion, and \$1.0 billion will be analyzed for the Edmonton to Chicago leg.¹² Finally, one can add the total per barrel operating and capital cost estimates for the North Slope to Edmonton and Edmonton to Chicago segments, and determine the total North Slope to Chicago transportation cost estimates per barrel, which are shown in Table 2.

It is useful to compare the per barrel transportation cost estimates shown in Table 2 for the Mackenzie Valley crude oil pipeline (MVP) and similar per barrel cost estimates for the Trans Alaska pipeline and tankers to the Los Angeles market (TAP), which are shown in Table 1. A comparison of these tables indicates that the accelerated throughput schedule without delay for MVP has lower costs per barrel than TAP estimates using the Alyeska schedules for comparable cases.¹³ Furthermore, it should be noted that the range of estimates for the Alyeska schedule in both tables begin at about \$.80 per barrel and increase to about \$1.26 per barrel for TAP and \$1.46 per barrel for MVP. Accordingly, this cost comparison is inconclusive at best.

Benefit Cost and Financial Analysis of the Trans Alaska and Trans Canadian Pipelines

Methodology:

Production and transportation costs, as described above, are not the only variables which must be considered in order to evaluate the economic merits of the proposed pipeline systems. For example, by analyzing the price at which the oil is sold, as well as the system's costs, several additional "decision-making" parameters can be determined. These are:

Tide Water Price per barrel—Market Price per barrel—Tanker Costs per barrel.

Wellhead Price per barrel—Tidewater Price per barrel—Pipeline Costs per barrel.

Wellhead Value or net revenue per barrel—Wellhead Price per barrel—Production and gathering costs.

The last two factors are especially important for determining the "financial" desirability of the proposed system. First, the State of Alaska will collect revenues of approximately 20% of the "wellhead price." Second, the net revenue per barrel represents the return on the initial investment of more than a billion dollars for the oil companies in exploration and lease purchases before corporate income taxes are imposed.¹⁴

While returns to the State of Alaska and the oil companies are important economic considerations, they are excluded from the benefit-cost calculus, since they represent monetary transfers between two sets of individuals in the same society. That is, the profits or taxes that are received from producing and selling oil from the North Slope of Alaska represent monetary exchanges between

Footnotes at end of article.

TABLE 2.--TOTAL COST PER BARREL FROM THE NORTH SLOPE VIA A MACKENZIE VALLEY CRUDE OIL PIPELINE TO EDMONTON AND THEN TO CHICAGO (MVP)
[Production schedule in dollars per barrel]

Capital costs to Edmonton in 1971 US\$...	\$2.00 (billion)			\$2.25 (billion)			\$2.50 (billion)			\$2.75 (billion)		
Capital costs Edmonton to Chicago (billions)	\$0.6	\$0.8	\$1.0	\$0.6	\$0.8	\$1.0	\$0.6	\$0.8	\$1.0	\$0.6	\$0.8	\$1.0
Alyeska throughput (percent):												
8	0.804	0.843	0.882	0.852	0.891	0.930	0.901	0.940	0.979	0.950	0.988	1.027
10	.943	.993	1.042	1.005	1.055	1.104	1.067	1.117	1.170	1.129	1.179	1.228
12	1.103	1.170	1.232	1.185	1.248	1.310	1.263	1.326	1.388	1.341	1.403	1.465
Accelerated throughput (percent):												
8	.720	.759	.785	.761	.793	.825	.801	.833	.866	.841	.874	.906
10	.822	.862	.903	.872	.913	.953	.923	.963	1.003	.973	1.013	1.053
12	.938	.987	1.036	.999	1.050	1.097	1.061	1.116	1.159	1.122	1.171	1.220
Accelerated throughput with 2-year delay (percent):												
8	.798	.823	.867	.837	.875	.913	.885	.922	.960	.932	.969	1.007
10	.932	.981	1.029	.993	1.041	1.090	1.053	1.102	1.151	1.114	1.163	1.211
12	1.100	1.162	1.223	1.177	1.240	1.300	1.254	1.316	1.377	1.331	1.393	1.454

the consumers of oil and its producers, and unless a society values a dollar received by an oil company stockholder or the state treasury differently from a dollar kept by an oil consumer, or vice versa, then *real* economic benefits and costs are generally not created by such transfer payments. Instead, economists utilize the criteria of economic efficiency. One method of calculating the economic efficiency benefits of producing and transporting oil on the North Slope of Alaska is to determine the costs of an alternative means of supplying oil to the same market. To clarify this approach, net benefits can be defined by equation (1):¹⁵

$$(1) \quad b = (B_{NS}^i - C_{NS}^i) - (B_A^i - C_A^i) - \bar{X}$$

where:

b = Net benefits of the proposed production and transportation of oil from the North Slope

B_{NS}^i = Gross benefits of oil which is produced on the North Slope, when it is utilized by consumers in market i .

C_{NS}^i = Real cost of producing and transporting North Slope oil to consumers in market i .

B_A^i = Gross benefits of an alternative source of oil in market i .

C_A^i = Real cost of producing and transporting an alternative source or oil to market i .

$\bar{X}$ = A row vector of other considerations, including environmental costs whether quantifiable or not in dollar terms, as well as other real economic benefits and costs, such as national security considerations, etc.

If both alternatives serve the same market (i) and the quality of substitute crude oils are similar, then consumers would be indifferent between the two alternative sources of oil. That is, the gross benefits of either source of supply are identical, $B_{NS}^i = B_A^i$. Furthermore, if we assume:

(1) that there are no economically superior (i.e., lower costs) North Slope (NS) to i transportation alternatives, (2) that market i is the highest valued final destination for North Slope crude, and (3) $\bar{X}^i$ is assumed to be zero, then the net benefits of the North Slope oil would reduce to equation (2):

$$(2) \quad b' = C_A - C_{NS}$$

Equivalently, the ratio of the costs of the best alternative to the costs of the proposed development project can be used to determine the conventional benefit-cost ratio of the development project, when the three assumptions stated above hold. This is shown by equation (3). A further test must be performed before development is approved, namely, the gross benefit of the oil (or value in consumption) must also exceed the costs. This is shown in equation (4):

$$(3) \quad B/C = \frac{\text{Cost of alternative oil}}{\text{Cost of North Slope oil}}$$

$$(4) \quad \text{Subject to: } B_{NS} = B_A \geq C_{NS}$$

The most probable alternative foreign source of supply to the West Coast markets of the United States if the Trans Alaska pipeline is not built is the Persian Gulf. Further, it is not likely that domestic oil from presently developed West Coast sources of supply will meet *all* the growing West Coast demand in the future.¹⁶ This conclusion is subject to the following assumptions: (1) the Trans Mountain pipeline from Edmonton to Puget Sound is not expanded, (2) District V (West Coast) prices remain at their current levels, and (3) there is no appreciable change in inter-district flows of oil in the United States.

Using the above framework a computational benefit-cost model can be developed. Presently, the following additional assumptions will be made, the first two of which will be relaxed below.

(1) The quantity of oil demanded at the present price in year t will equal the present supply plus the proposed throughput of the Trans Alaska pipeline in year t .

(2) Foreign oil, rather than higher cost domestic oil, would be the source of supply for the West Coast if TAP is not built, as is presently the case.

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(3) The average cost of producing and transporting a barrel of oil is equal to the marginal cost of a barrel of oil in each producing area; that is, supply functions for crude oil are perfectly elastic in certain ranges.

The calculation of the real cost of a foreign alternative to TAP on the West Coast, using a specific reference crude, Iranian Light 34°API, has been explained at great length elsewhere.¹⁷ Two costs can be used for the year 1975 in Los Angeles. They are \$2.01 per barrel based upon improved tanker methodology and presently contracted price agreements and \$2.49 per barrel based upon a more "conservative" set of assumptions. Due to its inland location the costs of this foreign oil delivered to Chicago are about 25¢ per barrel higher.

In order to calculate the state tax revenue and the net revenues of the oil companies, some additional information is necessary. Table 10 (page 32) shows the prices of crude oil in various world markets. When available the prices are shown for oil similar in quality to the oil that has reportedly been found on the North Slope.¹⁸ Moreover, in some instances the sulfur content of the crude oil is given. Sulfur content is important in determining price because of current anti-air-pollution laws, and the fact that additional costs are borne by refiners when sulfur is present.

The wellhead price can be determined by subtracting from the price of oil in each domestic market, the transportation costs of TAP in each throughput, discount rate, and capital cost case. Tax (royalty plus severance) receipts in Alaska are equal to approximately 20% of this wellhead price. Furthermore, if the average production and gathering cost of \$2.45 per barrel plus the tax paid to the State of Alaska are subtracted from the wellhead price, the net revenue before corporate income tax can be determined.

TAP is clearly inferior to MVP from the standpoint of wellhead prices and therefore state taxes and corporate profits. If identical production schedules are compared, the system cost differences are relatively small. Since the costs of transporting foreign crude inland to the Midwest exceed these differences, the Midwest market represented by Chicago is an economically more efficient alternative than selecting a coastal market for Alaskan crude, which can be supplied by foreign overseas imports more cheaply. Given the either/or situation, the benefit-cost ratios shown in Table 3 mean that MVP is economically superior to TAP. Therefore, under these circumstances, selecting TAP over MVP generates negative net social benefits, since it is an economically inferior alternative. If environmental advantages of MVP are also considered, this conclusion is strengthened. Before making such conclusions, several additional benefit-cost adjustments must be made and the apparent irrationality of the decision to forego greater profits made by the oil companies must be examined further. These will now be considered in turn below.

Domestic and Foreign Oil as a Source of Supply

Up to this point it was assumed that the most likely alternative source of supply for North Slope crude oil in District V, the West Coast of the United States, was the importation of overseas foreign oil. In the states east of the Rockies it may be less likely to expect that this will be case at least in the short run for the following reasons. First, domestic production in these regions is more than six times the total consumption on the West Coast. Second, some production in the districts I to IV is restricted by state demand prorationing laws, which hold back production from some of the more efficient wells and fields in order to maximize oil production over time and maintain a price sufficiently high to encourage and reward exploratory drilling. Third, a larger proportion of domestic production on the West Coast is based upon secondary recovery techniques. Therefore, the probability of increased production from secondary recovery is relatively greater in the eastern regions of the United States. Fourth, both the West Coast and East Coast have the prospect of additional offshore discoveries and expansion of domestic sources. Fifth, the present import restrictions on the West Coast protect domestic producers at an

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TABLE 3.—SUMMARY COMPARISON OF TRANS-ALASKA PIPELINES TO LOS ANGELES AND MACKENZIE VALLEY PIPELINE TO CHICAGO USING A 10-PERCENT DISCOUNT RATE

Throughput schedule	Total system costs per barrel (dollars per barrel)		Wellhead price per barrel (dollars per barrel)		Present value of taxes ¹ (billions of 1971 dollars)		Present value of profits ² before corporate income tax (billions of 1971 dollars)		Conservative case benefit cost ratio	
	Low	High	Low	High	Low	High	Low	High	Low	High
Trans-Alaska pipelines:										
Alyeska.....	\$0.91	\$1.10	\$2.07	\$2.26	\$1.7	\$1.8	\$5.7	\$6.3	2.05	2.46
Accelerated.....	.83	.98	2.19	2.34	2.2	2.3	7.5	8.1	2.29	2.71
Mackenzie Valley pipeline:										
Alyeska.....	.94	1.23	2.58	2.87	2.1	2.3	7.4	8.3	2.03	2.64
Accelerated.....	.82	1.05	2.76	2.99	2.8	3.0	9.8	10.7	2.36	3.03
Accelerated after a 2-year delay.....	.93	1.21	2.60	2.88	2.1	2.4	7.6	8.4	2.05	2.67

¹ Present value of taxes are calculated by multiplying the wellhead price by 20 percent and the resultant per barrel tax by the appropriate present value of throughput.

² Present value of profits are determined by subtracting royalty severance taxes, and production costs from the wellhead price and then multiplying by the appropriate present value of throughput.

historical price and then permit foreign oil to be imported to meet the difference between the quantity of domestic plus Canadian oil supplied and domestic quantity demanded at this price.

On the other hand imports in Districts I to IV are based upon a percentage of domestic production. Accordingly, if present import quota regulations are maintained, the probability of cheaper foreign oil increasing in the west as a percentage of domestic supply is far greater than in the east, if North Slope oil is not produced. That is, present institutional rigidities will create a greater incentive for domestic producers east of the Rockies to produce any shortage in supply than their West Coast counterparts. The relative quantities produced in each section of the country are particularly important, since production east of the Rockies is more than six times greater than West Coast production. Therefore, small percentage increases in supply from various incentives such as increasing prices, new technology, more favorable tax treatment will have a far greater absolute increase in oil supplied for markets east of the Rockies.

Two conclusions should be drawn from the above discussion. First, foreign oil tends to be far less costly in both real and monetary terms than the marginal barrel of oil produced in the eastern part of the United States. Therefore, if the alternative to North Slope oil is more likely (Pa) to be a domestic source than a foreign source (Pf) then the average cost of the alternative to North Slope will be greater in both monetary and real terms in the Midwest and East Coast when compared to the West Coast. Second, the market is far greater in terms of its actual size and its growth in demand; therefore, both markets will probably find their dependence on foreign oil increasing over time. Therefore, from a national security standpoint, the full throughput of either crude oil pipeline will displace foreign crude. The difference between alternatives is that in the eastern part of the United States, due to different institutional rigidities, North Slope crude is more likely to back out higher cost domestic crude as well. Therefore, the assumption of relatively low cost foreign sources of supply being used as a substitute for North Slope crude oil in Chicago may not be as appropriate as making that same assumption in the case of Los Angeles. One way to account for this distinction is to estimate the probability of using domestic or foreign sources of supply in each market. The

Footnotes at end of article.

average costs of domestic and foreign sources of supply can then be combined to form a weighted average alternative cost, as follows:

(5)

$$\bar{C}_{DF}^i = P_d^i C_D^i + P_f^i C_F^i$$

where:

$\bar{C}_{DF}^i$ = Weighted average cost of alternative source of supply in market j from domestic (D) and foreign (F) sources of supply.

$P_D^i = 1 - P_f^i$ = The probability of domestic sources being used as a substitute in market j .

P_f^i = The probability of foreign sources being used as a substitute in market j .

C_D^i = Average cost of domestic crude in market j .

C_F^i = Average cost of foreign crude in market j .

$$P_f^i = \frac{2 \text{ billion barrels per day}}{(10 \text{ billion barrels per day} + 2 \text{ billion barrels per day})} = \frac{1}{6}$$

$$P_d^i = 1 - P_f^i = \frac{5}{6}$$

An additional adjustment that might be made is to relax the assumption of equal benefits to consumers of crude oil from different sources of supply. The viability of domestic and foreign production restrictions east of the Rockies will certainly be affected differently if North Slope crude rather than foreign crude is used as a source of supplying Midwest demand in the future. An additional measure of benefits is the fact that oil consumers in different markets value products made from crude oil differently. For example, gasoline is a major product of refineries on the West Coast. Gasoline is light and the lighter the crudes the easier (that is, least costly) it is to derive gasoline from crude oil. In the Midwest a greater mix of products is demanded by consumers. One of the main reasons for this is that home heating fuels (which are relatively heavy products) are highly valued in the Midwest, but not on the West Coast. Since North Slope crude is a relatively heavy crude, its value to refiners and consumers is greater in the Midwest due to greater product mix than on the West Coast. Since lighter crudes can be substituted more readily on the West Coast and since the entire world market is potentially available for import, this relative advantage of a Midwest final market for crude is important. One method of measuring this relative importance is to note that most crudes east of the Rockies are adjusted \$.02 per degree of API specific gravity difference, while on the West Coast the penalty for heavy crudes is about \$.06 or \$.07, or about three times greater. In this section the importance of these exceptions will be analyzed to determine their effect on the benefit-cost ratios, state taxes and the profitability of each Arctic transportation system.

The first step is to estimate the probabilities of using foreign or domestic sources of supply in each market. The greater the domestic production in a region of the United States, the probability of foreign oil as an alternative source of supply is less likely. Therefore, I will assume for simplicity that weights (P_d and P_f) may be assigned on the percent that the full North Slope throughput would be to the approximate present domestic production plus that full throughput level of production. Therefore, in Districts I to IV, I will use the following weights:¹⁸

Since such an adjustment for any possible savings over possible domestic alternatives was not made on the calculations performed above for the West Coast, if a Trans Alaskan pipeline is selected a similar set of weights

$$(P_d^i \text{ and } P_f^i)$$

can be determined. Using the same formula as the east of the Rockies, these probabilities will be approximately equal, since the expected TAP throughput approximately equals present "domestic" production in District V, therefore:

$$P_f^i = \frac{2 \text{ billion barrels per day}}{(2 \text{ billion barrels per day} + 2 \text{ billion barrels per day})} = \frac{1}{2}$$

$$P_d^i = 1 - P_f^i = \frac{1}{2}$$

Footnotes at end of article.

To calculate relative domestic costs there is insufficient information available. One simple method to approximate relative cost differences is to use relative price difference as a proxy. Prices of domestic crude oil are available at the producing source. Specific adjustments to account for qualitative differences in domestic crudes such as specific gravity and sulfur content are also available. The prices at the wellhead of these domestic crudes are net of transportation costs to specific markets. Since such transportation costs are real economic costs, it is appropriate to calculate the cost of these reference crudes in specific consuming markets, such as Los Angeles, Chicago and New York. Prices in the latter two markets are determined by adding the transportation costs of crude oil from the East Texas-Southern Louisiana Gulf region to the price of crude oil in this Gulf region. Producing areas which sell crude on the Gulf Coast are priced at a lower amount of their wellhead to reflect the cost of transporting this crude to the Gulf.¹⁹ Relative price differences between the west coast and east of the Rockies market will also reflect the relative cost of refining crudes for different product mixes. Since these differences are also important to consider in assessing real economic benefits, this is an additional reason to use relative price difference. Finally, domestic market restrictions for crude oil make it likely that domestic producers will, in the absence of a large low-cost domestic source of supply, produce crude oil at a high marginal cost. If prices are expected to increase if North Slope oil is not supplied to a particular U.S. market, then higher marginal cost oil will be produced than is presently the case. Therefore, it is appropriate to use the present price as a measure of the average cost of additional domestic sources of supply (and also assume in this range that the average domestic cost equals the present marginal cost).

Using the above weights and present prices and assuming a system of "swaps" is developed so that effectively half the crude from the North Slope displaces higher cost domestic and foreign crudes in Chicago and New York, a weighted average cost of alternative similar to that shown in equation (5) above can be determined as follows:

	Per barrel	
	Midwest	East coast
Present marginal domestic cost (assume marginal = average).....	\$3.81	\$4.06
Persian Gulf (conservative).....	2.75	2.50
Weighted average (5/6 and 1/6).....	3.63	3.80
Average cost of alternative source of supply east of the Rockies.....		\$3.715

A similar adjustment for the Los Angeles market using a mixed domestic and foreign alternative source of supply can be calculated as follows:

$$\frac{1}{2} (\$3.17) + \frac{1}{2} (\$2.50) = \$2.835$$

These estimates of \$3.715 and \$2.835 per barrel can be compared with the per barrel benefit estimates of \$2.74 and \$2.49 for the east of the Rockies and West Coast markets respectively. These later values were used in Table 3 above and are based upon a long-run view that foreign crude was the only alternative source of supply.

In the computations presented below, several additional parameters are reviewed. First, it has been pointed out the North Slope oil is medium in sulfur content. However, the domestic crudes that supply the Midwest market are generally lower in sulfur content than domestic crudes on the West Coast.²⁰ To adjust for this difference, crude prices might be reduced east of the Rockies. An \$.11 per barrel difference exists between the posted wellhead of West Texas sour and West Texas Intermediate Sweet.²¹ This difference is used below to account for sulfur content differences. A second possible adjustment is that North Slope oil may be lighter than 26.9° API, in which case the penalty charged against it may be too severe for the West Coast relative to the Midwest. This adjustment may reduce relative prices by an additional \$.05 to \$.10 per barrel. To account for both factors, the various benefit estimates will be reduced by \$.18 per barrel. This combined adjustment is identified below as the "Alaska Price Adjustment Factor."

Footnotes at end of article.

It should be noted that the adjustment for sulfur content and specific gravity penalties reduces the reference price in the Midwest to \$3.63 per barrel. However, it is important to note that this adjustment may be in the wrong direction, since early analysis of North Slope crude indicated it scored particularly high using a Hydrocracking refining technique, which is now being installed in the Midwest.²² Using that finding, a reference price of \$3.13 per barrel would be in order. As a final point on prices (in the opposite direction) the Department of Interior used a maximum price of \$3.50 per barrel for reference purposes in the Midwest.²³ However, this has recently been increased to \$3.60 per barrel²⁴ and the East Coast price has always been consistent with those higher prices used in the analysis above. Therefore, the case labeled "Alyeska Adjustment" can also be interpreted as the new Department of Interior maximum Midwest price case,²⁵ and the Midwest price without adjustment is high or low depending upon future conditions but it certainly falls in the most likely range of \$3.63 to \$3.93 per barrel for the Chicago market.

Much discussion in this controversy has dealt with the environmental advantages of the Alaskan Highway Route (AHP). Thus far we have not considered its economic benefits and costs. This route is longer than the Mackenzie Valley route (MVP). Walter Parker²⁶ therefore estimated it would cost about \$409 million more in 1971 \$. This difference needs to be taken into account. In doing so below, the operating costs of this longer route have also been increased proportionately.

The last factor, which will be considered in the analysis below, tests the sensitivity of the results of an assumption that the real costs of the Canadian alternatives have been underestimated. This could be due to uncertain and inaccurate cost data or to possible new taxes or other real costs imposed by Canada. Guaranteed capacity for Canadian oil is sometimes mentioned as a possibility. Such decisions might result in U.S. consumers of oil paying higher costs or taxes to the Canadian government and thus represent a real cost. All such adjustments would be in the same direction, that is, cost would increase; therefore, the sensitivity of the results to an appreciation in all costs of 10 percent and 20 percent will be examined below.²⁷

In Table 4 the benefit-cost ratios are shown adjusted for the above factors. Only at the highest capital cost per barrel, as are found in the ANP case (Alaska Highway with capital costs of about \$4 billion), with a two-year delay and 20% cost appreciation (making capital cost equal to about \$5 billion) do the benefit-cost ratios that are calculated using a mixed domestic and foreign alternative fall to levels as low as the results for TAP at the lower end of the spectrum of capital cost and the Alyeska production schedule. If costs have not been understated, the Trans Canadian pipeline alternatives always have greater or equal benefit-cost ratios than the Trans Alaska pipeline alternative in all but one case.

Footnotes at end of article.

TABLE 4.—BENEFIT-COST RATIOS (CONSERVATIVE PRICES) FOR TRANS CANADIAN ALTERNATIVES TO CHICAGO AND TRANS ALASKA PIPELINE TO LOS ANGELES AT A 10 PERCENT DISCOUNT RATE

	Mackenzie Valley Route MVP				Alaska Highway Route AHP			
Capital costs to Chicago in billions of 1971 dollars.....	2.8	3.55	2.8	3.55	3.2	3.95	3.2	3.95
Appreciation in estimated cost	Accelerated throughput		Accelerated after a 2-year delay		Accelerated throughput		Accelerated after a 2-year delay	
Foreign alternative source of supply (percent):								
0.....	2.89	2.46	2.54	2.14	2.59	2.24	2.27	1.95
10.....	2.62	2.23	2.31	1.95	2.36	2.04	2.07	1.77
20.....	2.41	2.05	2.12	1.78	2.16	1.87	1.89	1.62
Domestic and foreign source of supply (percent): ¹								
0.....	4.18	3.56	3.68	3.11	3.75	3.24	3.29	2.82
10.....	3.83	3.26	3.37	2.85	3.44	2.98	3.02	2.59
20.....	3.54	3.01	3.12	2.62	3.18	2.75	2.78	2.39
Domestic and foreign with Alyeska price adjustment factor (percent):								
0.....	3.94	3.35	3.46	2.92	3.53	3.05	3.11	2.66
10.....	3.61	3.08	3.18	2.68	3.24	2.80	2.84	2.44
20.....	3.34	2.84	2.94	2.48	3.00	2.59	2.62	2.25
Trans Alaska Route TAP								
Capital cost to Valdez in billions of 1971 dollars.....	2.0		2.5		2.0		2.5	
	Accelerated throughput				Alyeska throughput			
Foreign alternative source of supply.....	2.55		2.29		2.31		2.05	
Domestic and foreign source of supply.....								

¹ Similar benefit-cost ratios for New York can also be calculated. For without the cost appreciation case, the following ratios would result: 3.55, 3.02, 3.11, 2.62, 3.18, 2.74, 2.78, and 2.38. Note that the 3.55 for New York is based upon the same assumptions as the 4.18 for Chicago. If the benefit-cost ratios for an Alyeska schedule are important, they are approximately equal to the accelerated after a 2-year delay ratios shown in this table.

That one exception occurs when the lowest of TAP's capital cost estimates is compared with the highest capital cost estimate for AHP.

In Table 5 an index is presented which is easier to use for comparison purposes. It is the net benefit estimate based on average capital cost for the three main routes: the Mackenzie Valley (MVP), Alaska Highway (AHP), and Trans Alaska (TAP). The first conclusion that one must draw from this comparison is that in all cases, including AHP, with a two-year delay and 20% increase in costs, the net benefits exceed, and in some cases by a factor of about two-thirds, similar estimates for the average TAP computations which are presented. A second significant difference revealed by this table is the greater net benefits of about one-half a billion dollars in present value in 1971 of a Mackenzie Valley Route (MVP) compared to the more southerly Alaska Highway route (AHP). The difference is the amount that any environmental advantages attributed to AHP would have to equal or exceed (in the sense of a discounted time stream of environmental cost differences), in order for AHP to be preferred over MVP.

While the previous two tables show that the social value or net benefits of each Canadian alternative exceed comparable TAP estimates, it is important to note the fact that the state's revenue and oil company profits will generally not be affected by the adjustments to real costs and benefits which were made when domestic alternative sources of supply were included in the analysis. Therefore, whether or not "real" benefits are adjusted to reflect these differences will not affect the "financial" desirability of each alternative.²⁸

The conclusions to be drawn are quite clearcut. First, the present value of benefits to the nation if TAP is built are considerable. They equal about \$3 to \$8 billion. Accordingly, foregoing production due to environmental damage must equal or exceed this amount. However, since an environmental comparison led us to conclude that two all-land routes through Canada were superior

Footnotes at end of article.

environmentally, we undertook an economic evaluation of them as well. That economic analysis revealed the fact that these Canadian alternatives are very likely to be far superior from the standpoint of net benefits (B/C ratios), tax revenue for Alaska and oil producers' profits. The question that must, therefore, be asked is: Why was the TAP alternative chosen over the TCP alternative? I will now attempt to address that question in the final section by analyzing the various U.S. and world markets for petroleum.

TABLE 5.—NET BENEFIT ESTIMATES FOR THE THREE PRINCIPAL PIPELINE ALTERNATIVES USING A 10 PERCENT DISCOUNT RATE AND AVERAGE CAPITAL COSTS

	Mackenzie Valley MVP		Alaska Highway AHP		Trans-Alaska TAP	
	Accelerated	Accelerated after 2-year delay	Accelerated	Accelerated after 2-year delay	Accelerated	Alyeska
Case I:						
Average capital costs in 1971 dollars and prices	\$3.2 billion		\$3.6 billion		\$2.25 billion	
Per barrel net social benefits in dollars per barrel	\$2.53	\$2.40	\$2.43	\$2.29	\$1.66	\$1.55
Present value of net social benefits in billions of 1971 dollars	12.6	9.9	12.1	9.5	8.3	6.3
Undiscounted net social benefits (assuming 15 billion barrels are produced) in billions of 1971 dollars	38.0	36.0	35.5	34.2	24.9	23.3
Case II.—Operating and capital costs of Trans-Alaska alternatives increase by 20 percent:						
Average capital costs in 1971 dollars and prices	\$3.9 billion		\$4.3 billion		\$2.25 billion	
Per barrel net social benefits in dollars per barrel	2.34	2.18	2.23	2.05	1.66	1.55
Present value of net social benefits in 1971 dollars	11.6	9.0	11.1	8.5	8.3	6.3
Undiscounted net social benefits (assuming 15 billion barrels are produced) in billions of 1971 dollars	35.1	32.7	33.5	30.8	24.9	23.3

IV. SUPPLY AND DEMAND IMBALANCES: SOME INSTITUTIONAL AND ECONOMIC CONSIDERATIONS

One assumption maintained up to this point was that the quantity of oil supplied to any of the U.S. markets would be matched by the demand at the present price level. An important part of this analysis will be the determination of the benefits and costs, profitability and tax generating effect of several plans that have been discussed to deal with any supply and demand imbalances. Finally, throughout this section the analysis will be directed at the question raised above concerning the decision on the part of the oil companies and State of Alaska to build an inferior transportation route from the standpoint of profits and tax revenues.

For the quantity of oil demanded and supplied to be in equilibrium at the present prices in each domestic market, changes in demand and supply must be offsetting. Accordingly, implicit in the discussion thus far has been a assumption that the increased supply of North Slope oil to District V would be just offset by some combination of factors such as (1) growth in demand, (2) decline in domestic production in District V, and (3) changing institutional arrangements for foreign imports.

The results of the Trans Alaska Pipeline analysis are particularly sensitive to such assumptions, since District V is given separate treatment under the present Mandatory Oil Import Quota Program. Additionally, the growth in demand in District V has been below the national average in recent years, although depressed economic conditions on the West Coast may be the cause. Furthermore, West Coast oil consumption is much lower than east of the Rockies. Therefore, any excess in the quantity of oil supplied is likely to have an important effect on profits, tax revenues, and economic efficiency.

Footnotes at end of article.

In recent years the growth in demand for oil in Districts I to IV has been about five (5) percent per year. If such a rate of growth in demand continues, by 1975 the increase in demand would be 3.4 million barrels per day (MMb/d), which is far in excess of even the greatest production schedule (2.0 MMb/d) now contemplated for Arctic oil. Even if domestic production east of the Rockies were to grow by as much as 2% per year, then by 1975 (at present prices) excess demand would be 2 million barrels per day. This increased demand east of the Rockies could be met by North Slope oil, if the accelerated throughput, no delay Trans Canadian pipeline were to be constructed immediately. Therefore, it does not appear likely that an excess supply problem in the case of Trans Canadian alternatives would occur. Indeed, the Midwest and East Coast of the U.S. are likely to face severe shortages and, therefore, an increasing pressure on price is likely.

Several important conclusions can be drawn from these facts. Using recent rates of growth in demand (2.5%) and supply (1.3%) in District V, if the entire throughput of TAP were brought to the West Coast of the United States, it is likely that there will be an excess quantity of oil supplied into the 1990s. On the other hand, the oil deficit Midwest and East Coast would be confronted with an immediate shortage of oil by 1975. Since this is the earliest possible time that the full throughput could conceivably be made available to the markets east of the Rockies, this relative importance of a Trans Canadian Pipeline is significant.

First, consider the effect of oversupply for the West Coast on the benefit estimates, which were described above using a static economic analysis. Since District V may be oversupplied with oil for perhaps 15 or more years, the corresponding estimates of benefits, taxes and profits, which were based upon an assumption of no excess supply, have been consistently overstated. The appropriate adjustment for these calculations depends upon: (1) the rates of growth in demand and supply of oil on the West Coast, and (2) the type of restrictions that might be placed on foreign oil in the future. The present value of benefit estimates, which were based upon demand being sufficient to absorb the full TAP throughput, might be overestimated by as much as 75%.²⁹ Accordingly, when dynamic conditions are taken into account the estimate of the social value of a barrel of North Slope oil would increase significantly for the Canadian alternatives relative to the TAP alternative. This adjustment further minimizes the margin of error that might exist in the benefit-cost calculations made above.

Additionally the net profit and tax revenue estimates, which were discussed above for TAPS are very significantly overstated. Furthermore, since the estimates of comparable parameters for the Canadian alternatives are not likely to be sensitive to dynamic supply and demand conditions (at least not in the downward direction), the conclusions reached previously concerning the superiority of the Canadian alternatives relative to TAP from the standpoint of profits and tax revenues are greatly reinforced.

Nonprice Methods for Dealing with Excess Supply

In the preceding section the likelihood of sizable amounts of excess supply of oil in District V was discussed. We will now analyze two proposals which deal with this excess supply by transporting the oil to markets other than the West Coast of the United States. Such decision parameters as oil company profits, state tax receipts, and economic efficiency will be examined. It should be emphasized that there isn't any need to develop such secondary markets for North Slope oil, if a TCP alternative is selected, since the Midwest and East Coast will need all the additional oil by 1975.

The President of Alyeska has estimated that oversupply in the 500,000 barrel per day range is likely into 1980. He called this oversupply "Panama" oil, and suggested that either it might be shipped eastward through Central America or westward for sale to Japan.³⁰ In this section both alternatives will be considered. Special emphasis will be given to (1) an Import for Export proposal, (2) the implications of the Jones Act, and (3) the special treatment afforded the Virgin Islands as a refining center.

Prior to considering these alternatives, it must be pointed out that at the present time, all oil transported between two U.S. ports must be carried in U.S. flagships. Furthermore, an explicit prohibition against a foreign port serv-

²⁹Footnotes at end of article.

ing as a break in the chain exists.³¹ In selecting alternative marine transportation systems for dealing with the excess supply of oil on the West Coast, these restrictions of the so-called "Jones Act" are a major consideration.

The Sale of North Slope Oil to Japan

The sale of North Slope oil to Japan has been discussed by several oil company executives. Each has suggested a different basis for such an arrangement. Rollin Eckis³² has suggested that Japan may be willing to pay a premium for a relatively secure non-Middle East alternative, since he points out that Japan has a very rapidly growing demand for oil and at the same time more than 80% of its supply comes from the Middle East. A very different proposal for marketing North Slope oil in Japan came from John M. Houchin, President of Phillips Petroleum, who proposed a two-tier pricing system.³³ This alternative was labeled an "Import for Export" program, since it urged the approval of a plan by the President in which every barrel of oil that was exported should be replaced by an additional right to import oil by the exporting company. Since the U.S. would be producing an amount of oil equivalent to the increase in imports it was averred that national security and balance of payment effects would be mutually offsetting and therefore negligible.

Another oil company executive who discussed the Japanese market for North Slope oil was Mr. E.L. Patton, President of Alyeska, who indicated that as much as 100,000 barrels per day may be sold to Japan in 1980.³⁴ If Cook Inlet production, which is both closer and presently being used to supply natural gas to Tokyo, is displaced (backed out) in District V markets by North Slope oil, the total Alaskan oil going to Japan in 1980 may well exceed 300,000 barrels per day.

Estimates of the tanker costs for a Valdez to Japan marine transportation system in non-U.S. flagships are shown to be approximately \$.20 to \$.34 per barrel. In 1970 the average price of crude oil in Japan was about \$1.83 per barrel. This price might be expected to increase to slightly more than \$2.00 by 1975.³⁵ Therefore, North Slope oil transported via a Trans Alaska Pipeline to Japan is worth approximately \$1.15 per barrel less at the wellhead than if it were sold in Los Angeles in 1975 at the current domestic price of \$3.17 per barrel.

Marketing oil in Japan would yield a before-tax profit of approximately \$.95 per barrel.³⁶ If the same barrel of oil were sold in Los Angeles, the profit before taxes is approximately \$2.00 per barrel, if oversupply does not cause prices to fall. However, a combination of: (1) falling West Coast prices, (2) appreciating world prices, and (3) possible Japanese willingness to pay a national security premium, might make up these differences.

From a United States social benefit standpoint, this alternative would be inferior to both the MVP and AHP. Furthermore, if the environmental damages in the Arctic and the real costs in the oil deficit Midwest and East Coast areas from an increased foreign dependence are taken into account, the size of the net social costs of this Japanese alternative increases significantly.

These conclusions apply more or less equally to society, the treasury of the State of Alaska and the oil companies, when oil is sold to Japan, without any offsetting compensation. However, such a conclusion would not hold for all parties concerned about the optimal pipeline route selection, if an "import for export" plan as described above was approved. Under such a plan foreign oil would be imported to the East Coast outside the Mandatory Oil Import Quota Program to compensate the company which exported the Alaskan oil. This would mean a windfall profit of approximately \$1.75 per barrel (using a price of oil of approximately \$1.06 per barrel (26 to 26.9° API) and the cost of an imported barrel of about \$2.30 per barrel).

In Table 6 these results are used to estimate the effect on profitability. If the net profits before taxes from selling North Slope oil in Japan (about \$.95 per barrel), the savings in taxes paid to the State of Alaska (about \$.23 per barrel, based upon 20% of the wellhead price difference between selling oil in Japan at \$2.00 or Los Angeles at \$3.17 per barrel), and the economic profit (\$.175) from using foreign oil on the East Coast are summed, the net revenue or value to the oil companies amounts to nearly \$3.00 per barrel (\$2.93 = .95 + .23 + \$.175) for each barrel of North Slope oil, which is marketed in this manner. Accordingly, while the oil companies would find these profits approximately \$1 per barrel higher under this arrangement, the State of Alaska

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would receive less than one-half as much per barrel in royalty and severance taxes. Furthermore, the social costs of producing a single barrel of oil for U.S. consumers would equal the sum of: (1) the cost of imported foreign oil (approximately \$2.30), and (2) the cost of supplying Japan (approximately \$1.05). While national security and benefits from trade may also be present, this estimate of the costs of a barrel of oil exceeds all previous North Slope estimates by approximately \$2.00 per barrel.²⁷

TABLE 6.—NET REVENUE EFFECTS OF AN IMPORT FOR EXPORT PROGRAM

	Per barrel	
	Los Angeles	Japan
Posted prices.....	\$3.17	\$2.00
Approximate production costs for North Slope oil.....	.25	.25
Approximate pipeline costs.....	.60	.60
Approximate tanker costs.....	.35	.20
Before tax net revenue.....	1.97	.95
Excess of domestic price over foreign costs on the East coast of the United States.....		1.75
Savings in taxes to the State of Alaska from a wellhead price difference of \$1.17 per barrel.....		.23
Per barrel equivalent net revenue.....	1.97	2.93
Difference.....		.96

The importance of this "import for export" program in the analysis is due to the fact that this is the first case that was considered in which all three measures of value: social benefits, tax revenues, and oil company profits did not result in the same ranking of alternatives. I will return to this point below, but first the other part of the "Panama" oil case will be analyzed.

Sale of North Slope Oil on the East Coast of the United States

While the movement of Alaskan oil to Japan would presently be permitted in non-U.S. flagships, oil transported to the U.S. East Coast from Alaska is not permitted in foreign tankers. There are two methods that might circumvent this restriction. First, oil shipped to Central America, piped across to a Caribbean port, and shipped to the eastern part of the United States, may fall outside the restrictions of the Jones Act, since two foreign ports and a foreign pipeline would be involved.

A second exception to the Jones Act is more likely. It would occur if North Slope oil was transported via a Central American pipeline or around Cape Horn to the Virgin Islands. It could then be refined and sent to markets in the eastern part of the United States. Lending additional credence to this alternative is the fact that Amerada Hess Corporation is reported to have expanded its refinery complex in the Virgin Islands to 450,000 barrels per day in order to process an expected large quantity of North Slope oil for marketing in the U.S.²⁸

The Virgin Islands represent something of an anomaly in the manner in which oil restrictions are applied. First, the Virgin Islands are exempt from the restrictions of the Jones Act. Second, foreign oil may be imported into the Virgin Islands for refining. However, the amount of oil that is permitted into the U.S. is restricted under the present Mandatory Oil Import Quota Program.

Presently, no appreciable amount of domestic oil has been sent to the Virgin Islands to be refined and then sent back to the U.S. mainland for consumption. Therefore, there are no precedents for an alternative which would ship Alaskan oil to the Virgin Islands and simultaneously circumvent the Jones Act and the Mandatory Oil Import Quota Program. However, unlike the "import for export" program which was discussed above, the proponents of this alternative would probably have to be enjoined to stop their plans, rather than to have to seek executive approval as in the case of the former alternative.

From both an economic and a financial standpoint, several calculations can be made to analyze these "Virgin Island-Panama" alternatives. These calculations are shown in Table 7. The following general conclusions can be made. First, a Central American pipeline would probably be a more efficient expenditure of resources, both social and private, than a similar Cape Horn alternative, which would cost about \$.44 (foreign flag) to \$.92 (U.S. flag) more per barrel. Second, abstracting from any benefits to the nation from having goods shipped in domestic bottoms, the cost differentials between foreign and domes-

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tic tankers indicate that foreign flagships are more efficient. However, a conclusion based solely on cost differences must be carefully interpreted, since the Congress of the United States as the elected representatives of society, has judged the encouragement of the domestic merchant marine to be very important as indicated by the enactment of the Jones Act.

Putting such questions aside, the average costs for North Slope oil shipped directly to New York in U.S. flagships are estimated to be approximately \$1.95 (per barrel) and \$2.62 (per barrel) for the Central American pipeline and Cape Horn alternatives, respectively. These cost estimates are well in excess of the range of total cost estimates for a direct Trans Canadian pipeline extended to New York of \$1.32 to \$1.71 per barrel as estimated above at a 10% discount rate.²³ Therefore, these extra costs in transportation represent real losses of resources for the nation, if this roundabout method of supplying the East Coast of the U.S. is selected to deal with the excess supply of oil on the West Coast. Furthermore, the difference between the costs of supplying the Midwest through New York (an even more roundabout plan), and a direct T.C.P., are approximately \$.94 to \$1.61 per barrel, when the average cost of the 10% discount rate cost cases of a direct pipeline to the Midwest of \$1.26 per barrel is used as a basis for comparison.

TABLE 7.—NORTH SLOPE OIL TO THE EAST COAST BY TANKER FROM VALDEZ
(Dollars per barrel)

	Valdez-Central America-Virgin Islands	Valdez-Cape Horn-Virgin Islands	Valdez-Central America-New York	Valdez-Cape Horn-New York
Approximate costs:				
(1) Production.....	\$0.25	\$0.25	\$0.25	\$0.25
(2) Pipeline (TAP).....	.60	.60	.60	.60
(3) Tanker costs ¹				
(a) Foreign flag.....	.54	.98	1.41	1.88
(b) U.S. flag.....	1.95	1.87	.95	1.77
(4) Central American Pipeline.....	.25		.25	
Total cost:				
(a) Foreign flag.....	1.64	1.53	2.54	2.73
(b) U.S. flag.....	2.05	2.72	1.95	2.62
Approximate Present Prices (28-28.9° API):				
New York price.....	4.06	4.06	4.06	4.06
World price.....	2.01	2.01	2.01	2.01
Net revenue before taxes:				
(a) New York price:				
(1) Foreign flag.....	2.42	2.23	2.52	2.33
(2) U.S. flag.....	2.01	1.34	1.21	1.44
(b) World price:				
(1) Foreign flag.....	.37	.18	1.47	1.28
(2) U.S. flag.....	1.04	1.71	.06	.61

¹ This estimate is the least likely transportation costs for this case given the most probable interpretation of the Jones Act.

² Tanker costs are based upon a straight averaging of the range shown in table 8 for each case. An educated guestimate is used for an additional 10 cents for handling in the Virgin Island scenarios.

TABLE 8.—APPROXIMATE TANKER TARIFFS

	Foreign flag		U.S. flag
	Long run	Short run	
Persian Gulf to Los Angeles.....	\$0.44	\$1.71	
Valdez to Japan.....	.30	.34	
Valdez to Los Angeles.....	.11	.19	\$0.35
Valdez to Panama to New York ¹ (pipeline across Panama).....	1.32	1.53	\$0.65 to \$1.06 ²
Valdez to New York around Cape Horn ³	.66	1.11	1.32 to 2.22 ³
Seattle to Los Angeles.....			15

¹ Terminal and pipeline costs must be added. Assume 25 cents for construction and operating costs; therefore, estimates of 57 and 78 cents will be used.

² Assume U.S. Flags would cost twice as much per barrel for operating and construction costs.

³ Perhaps 10 cents per barrel should be added to these estimates, if the oil is first brought to the Virgin Islands.

SOURCE.—Based upon rates utilized by the Cabinet Task Force and a simplified linear approximation, "The Oil Import Question."

If the crude oil is shipped to the Virgin Islands for refining, additional transportation costs would be expected. However, by diverting oil to the Virgin Islands, the prospects of lower cost foreign tankers are greater in this case. Additionally, the expected savings in resources from using foreign tankers would more than compensate for the additional distance and handling costs required.

Using the estimates shown in Table 7, this savings would range from \$.41 to \$.89 per barrel for the Central American and Cape Horn routes respectively. Therefore, the socially uneconomic decision of diverting oil to the Virgin Islands would probably be selected, if the restrictions of the Jones Act could only be circumvented by this action.

All of these plans will only be acceptable to the oil companies if the domestic price rather than the world price is expected on the East Coast. At the same time, in the Virgin Island examples, if the world price was used to determine wellhead prices in Alaska, the higher costs (even in the foreign flag-ship case) would result in royalty and severance taxes to the State of Alaska of only about \$.10 per barrel. This is about \$.35 per barrel less than the expected royalty and severance tax, if that same oil were sold in California at the current price. Should the oil after refining then be permitted to enter the East Coast market outside the import quota system, this saving in taxes would represent additional profits to the oil companies with no accompanying loss in revenue. The State of Alaska could protect itself from both of the preceding marketing plans by passing a law similar to those used by Middle East countries, which use a posted price for calculating taxes regardless of where the oil is marketed and therefore it is net back. Such decisions are transfers between oil companies and the state and indicate an equity issue but will not affect economic efficiency.

One case is particularly interesting to consider. In that case oil is transported: (1) to the Virgin Islands, (2) in foreign tankers (outside the Jones Act), (3) through Central America, (4) sold at the world price, and (5) then refined and sent to the East Coast in addition to the import quota levels. Under such a scenario, the profits before taxes are \$2.42 per barrel, with the additional tax savings of about \$.35 per barrel: equivalent oil company profits are about \$2.77 per barrel. At the same time, state taxes would be their lowest per barrel and the additional social costs of this plan are about \$.13 to \$.32 per barrel greater than the average direct Canadian pipeline transportation systems.¹⁰

In summary, marketing North Slope oil in either Japan or on the East Coast of the United States is likely to be profitable. However, in most cases Alaska's taxes and net benefits will be lower than the estimates calculated above, when it was assumed that North Slope oil would be sold on the West Coast of the United States at the current price. Accordingly, the values used for these parameters when they were compared for the TAP, MVP and AHP alternatives should be adjusted downward in the case of TAP, thus increasing further the relative advantages of a direct North Slope to Midwest transportation system even if it was further delayed.

Finally, without quantifying the environmental savings expected for a Canadian route, and possible economic savings if a joint gas pipeline is built in Canada, it can be concluded that national and state interests require the development of the economically superior and more urgently needed Trans Canadian pipeline even with delays up to 5 years when such factors are considered as: (1) West Coast oversupply and the various plans for dealing with it, and (2) higher economic benefits per barrel in the Midwest and East Coast compared to the West Coast. Contrary to this conclusion is the position of the oil companies, who it seems intend to do business as usual and to utilize existing, often irrational industry regulations to increase profits at the expense of oil consumers, taxpayers, the State of Alaska, the U.S. Maritime Industry and doubtless others. Accordingly, the issue represented in this current controversy and discussed above is more than a question of relative economic or environmental superiority. It is in compact form: which interest, oil profits or national well-being, will dominate major decisions of this nature?

TABLE 9.—PROJECTED PRODUCTION THROUGHPUT SCHEDULE¹

Year	Alaska	Accelerated barrels/day
1975	350,000	2,000,000
1976	800,000	2,000,000
1977	1,200,000	2,000,000
1978	1,400,000	2,800,000
1980-2000	2,600,000	2,000,000
2001		

¹ See Table IV-1, Alaska Pipeline Report prepared for the USDI by Tussing, A.R., Roger, G.W., Fischer, V., Margaret R. and Erickson, G., of the Institute of Social, Economic and Government Research, University of Alaska, 1971, p. 72. Note: R. Nehring, "Future Developments of Arctic Oil and Gas: An Analysis of the Economic Implications of the Possibilities and Alternatives," U.S. Dept. of the Interior, Office of Economic Analysis, May 10, 1972, reports a more rapid 3-year buildup has been described by Alyeska. Under this schedule the first three years would average 0.6, 1.2, and 1.6 billion barrels per day respectively. This schedule falls between the two used in the remainder of this monograph and will therefore not be referred to below, since it is bracketed by the schedules utilized.

Notes.—Implied total over 25 years times 365 days per year equals approximately 16.7 and 18.3 billion barrels respectively for the Alyeska and accelerated cases.

TABLE 10.—1971 CRUDE OIL PRICES IN VARIOUS MARKETS

Market	Quality	Price per barrel	Source
New York	26-26.9° API	\$4.06	Louisiana South plus gathering costs of 14 cents and transportation of 45 cents.
Los Angeles	26-26.9° API California sulfur range 1 to 2 percent.	3.17	Signal Hill plus gathering and transportation costs of 5 cents.
Chicago	26-26.9° API	3.81	Louisiana South plus gathering costs of 9 cents and transportation of 25 cents.
South Louisiana (well-head)	25-26.9° API (less than 0.5 percent sulfur).	3.47	Platt's crude oil summary, Aug. 25, 1971.
Tokyo	Average of all crudes imported.	1.83	Platt's Aug. 19, 1971.
Canada (eastern)	Average of all crudes imported.	1.93	Platt's for Apr. 1, 1971, listings.
Venezuela		2.08	Do.
West Germany	Average of all imports.	3.03	Platt's as of May 1971.
United Kingdom	do.	2.74	Platt's as of June 1971.
Australia	do.	1.53	Do.

All prices are based upon data published in recent editions of Platt's Oilgram Price Service, with U.S. prices based upon Crude Oil Supplement of Aug. 25, 1971, vol. 49, No. 164-B. Costs are based upon the Cabinet Task Force, op. cit., for Chicago and New York and the State of Alaska, op. cit., and Tussing et al., op. cit., for Los Angeles.

FOOTNOTES

¹ This consortium is named the Alyeska Pipeline Service Company and is owned by Amerada Hess Corporation, ARCO Pipeline Company, BP Pipe Line Corporation, Humble Pipe Line Company, Mobil Pipe Line Company, Phillips Petroleum Company and Union Oil Company of California. The acknowledged major ownership is in the control of three parent companies which have found the most North Slope oil: Atlantic Richfield Company (ARCO), British Petroleum Company Limited (BP) (its U.S.-owned subsidiary is BP Oil Corporation, which was merged with the Standard Oil Company (Ohio) on January 1, 1970), and the Standard Oil Company of New Jersey (Humble).

² U.S. Department of Interior, *Final Environmental Statement* . . . , vol. 1, p. 320.

³ U.S. Department of Interior, *Final Environmental Impact Statement* . . . , vol. 1, Washington: National Technical Information Service, 1972, pp. 320-2.

⁴ Testimony of J. V. Krutilla and C. J. Cicchetti, *In the Matter of: Pacific Northwest Power Company and Washington Public Power Supply System, Projects Nos. 2243/2273*, before the Federal Power Commission. See also Krutilla, J. V., and Cicchetti, C. J., "Evaluating Benefits of Environmental Resources with Special Application to the Hells Canyon," *Natural Resources Journal*, Vol. 12, No. 1, January 1972.

⁵ Eckstein, O. and Harberger, A., "Economic Analysis of Public Investment Decisions: Interest Rate Policy and Discount Analysis," *Joint Economic Committee* (Washington: USGPO, 1968). Seagraves, J. A., "More on the Social Rate of Discount," *Quarterly Journal of Economics*, vol. LXXXIV, No. 3, Aug. 1970. Water Resources Council, *Proposed Principles and Schedules for Planning Water and Related Land Resources, Federal Register*, Dec. 21, 1971, Vol. 36, No. 245, Part II, pp. 24144-84, and Office of Management and Budget, *Circular A-94*, Discount Rates to be Used in Evaluating Time Distributed Costs and Benefits."

⁶ The most recent estimate utilized by the Department of Interior placed the 1973 construction costs at \$2.3 billion, converting this back to 1971 for comparability using a 10% discount rate implies a 1971 capital cost estimate of \$2.3 billion, which is within the range utilized in this analysis. See Nehring, R., "Future Developments of Arctic Oil

FOOTNOTES—Continued

and Gas: Analysis of the Implications of the Possibilities and Alternatives," U.S. Department of Interior, Office of Economic Analysis, May 10, 1972.

²For a more detailed discussion of the reasons for this confusion, see Cicchetti, C. J., *Alaskan Oil: An Economic and Environmental Analysis of Alternative Routes and Markets*, Baltimore: Johns Hopkins Press, forthcoming December 1972.

³Note that in a recent Department of Interior Analysis, Nehring uses a total system cost of \$5.3 billion in 1974 \$, converting this to 1971 \$ at a 10% discount rate makes his total cost estimate to Chicago \$4.0 billion, and splitting this at 66% for the North Slope to Edmonton segment results in his comparable estimate being equal to \$2.63 billion in 1971 \$. Further, each capital cost case for TCP I and TCP IV is increased below by 10% and 20% for additional sensitivity.

⁴Source: Atlantic-Richfield Company, memorandum re Trans Canada Alternative Route submission to U.S. Department of Interior, Sept. 10, 1971, Appendix B, entitled: "Transcontinental Pipeline Project, Transportation of Alaskan Crude Oil, Atlantic, BP, Humble, December 31, 1968, Prudhoe Bay to Chicago Pipeline."

⁵See the *Oil and Gas Journal*, Oct. 18, 1971, "Interprovincial Adds a Quarter Million Horsepower."

⁶See the Atlantic-Richfield memorandum re Trans Canada Alternate Route submitted to the Secretary of the Interior, Sept. 1971.

⁷Note converting the estimate made by Nehring into 1971 \$ in the manner described in footnote 15 shows his estimate to be slightly higher for this segment, namely \$1.35 billion. Note, however, that while his total capital costs in 1971 \$ are about \$2.25 billion greater (\$3.98 billion minus \$3.75 billion) than the high case shown in Table 3, it is well below the capital cost case of \$4.5 billion, which is used below when the results in Table 5 are further tested for sensitivity and adjusted upward by 10% and 20%. See Nehring, R., "Future Developments of Arctic Oil and Gas: An Analysis of the Economic Implications of the Possibilities and Alternatives," Office of Economic Analysis, Department of Interior, May 10, 1972. He estimates the costs in 1974 to be \$5.3 billion which equal \$3.98 billion in 1971 dollars at a 10% discount rate.

⁸Comparable is meant to mean, in this discussion and elsewhere in the text, high-cost cases are considered with each other, medium with medium and low with low. Note in Table 5 below, some of these cost comparisons are presented jointly.

⁹In the analysis below the before corporate income tax calculations will be utilized, since the special tax provisions of the crude oil industry make it nearly impossible to estimate the after tax return. Furthermore, as recently as 1968, when the oil depletion analysis was set at 27.5 percent rather than the present 22 percent, the major oil-producing companies in the U.S. paid an average corporate income tax of only 7.1 percent.

¹⁰For a more detailed discussion of approach, see: Steiner, Peter O., "The Role of Alternative Cost in Project Design and Selection," *Quarterly Journal of Economics*, 79:421-2, 1965.

¹¹In a recent paper by Richard Nehring of the Office of Economic Analysis, U.S. Department of Interior, the possibility of increased imports from Ecuador, Peru and Indonesia, as well as from domestic sources is discussed. If locational savings from these foreign sources are used to increase the taxes collected by such countries, such alternatives would not affect the benefit-cost calculations, which I base upon a Persian Gulf alternative. However, if some real savings are possible then I have systematically biased my calculations in favor of the proposed pipeline development. See: Nehring, R., "Future Developments of Arctic Oil and Gas," *op.cit.*

¹²See Cicchetti, C. J., *Alaskan Oil* . . . , *op.cit.*

¹³These weights slightly exceed the present regulatory limit of $\frac{1}{6}$ of domestic crude production utilized to determine the amount of foreign crude imports in Districts I to IV. The $\frac{1}{6}$ therefore biases the benefit estimate downwards slightly, given present institutional constraints.

¹⁴For a discussion of the Gulf Coast basis of pricing east of the Rockies, see page C-14 of the U.S. Department of Interior, *Economic and Security Analysis of the Trans Alaska Pipeline*, vol. I (Washington, D.C., National Technical Information Service, December 1971). For an interpretation of this basis as it relates to the present controversy, see public "Comments by Charles J. Cicchetti and John V. Krutilla on the Final Environmental Impact Statement for the Proposed Trans Alaska Pipeline" and the "Complementary Analysis of the Economic and Security Aspects of the Trans Alaska Pipeline," submitted to the Department of Interior May 5, 1972.

¹⁵I owe a consideration of these differences to personal correspondence dated September 30, 1971, with Mr. E. L. Patton, President of Alyeska Service Company.

¹⁶Platt's Oilgram Price Service, Crude Oil Supplement of August 25, 1971, vol. 49, No. 164-B.

¹⁷Rosellus, R. R. and Steffens, J. H., "North Slope Oils Score High with Hydroprocessing," *Oil and Gas Journal*, May 17, 1971.

¹⁸Timenes, N., Appendix C, vol. I, "An Analysis of Transportation Alternatives," *An Analysis of the Economic and Security* . . . , *op.cit.*

¹⁹Vogele, W., "Comments on Trans Alaska Pipeline and Alternatives" submitted by the *Environmental Defense Fund*, and Cicchetti-Krutilla "memo to the Undersecretary," U.S. Department of Interior, May 8, 1972.

²⁰For a complete discussion of the prices used for reference purposes in each market by various analysts, see "Comments by Charles J. Cicchetti and John V. Krutilla on the Final Environmental Impact Statement for the Proposed Trans Alaska Pipeline . . ." submitted to the Department of Interior, May 5, 1972.

²¹Parker, W., *A Comparison of Prudhoe Oil Costs Via Valdez or Via a Mid-Canada Pipeline*, *op.cit.*

²²These adjustments would amount to higher costs or taxes paid to the Canadian government of approximately \$.10 to \$.25 per barrel.

²³The \$.18 per barrel adjustment for possible lighter North Slope crudes and sulfur content differences would have a small percentage effect on the wellhead prices and therefore the taxes and profits. However, since this adjustment is both uncertain and perhaps an overestimate of any adjustment of this kind, it will not be used.

FOOTNOTES—Continued

² This assumes that the full throughput of the TAP is oversupplied for 15 years and the discount rate is 10%, thus reducing the present value of benefits to approximately 24% of those which were utilized above. While this might be an outside estimate many of the cases considered in Table VII-1 would imply that the benefits which were used for TAP would fall to between 24% and 50% of those values, which were used previously for TAP.

³ See Corrigan, R., "Resources Report/Japan May Get Some Alaskan Oil; Foreign Flag Shipping of Exports is Likely," *The National Journal*, July 31, 1971.

⁴ See United States Code §61 *et seq.* (1961), Common Name, "The Jones Act."

⁵ Mr. Eckis is an executive with Atlantic-Richfield Company and a former president of Richfield Oil before its merger with Atlantic Refining Company. He discussed the Japanese market in his paper, *Alaska Oil in Domestic and World Markets*, which appeared in *Change in Alaska*, ed. by George W. Rodgers, College, Alaska, University of Alaska Press, 1970.

⁶ *Oil Import Controls*, Hearings before the Subcommittee on Mines and Minerals, House Interior and Insular Affairs Committee, March-April 1970. It should be noted that, at the present time, Phillips is not a holder of major proved-up reserves on the North Slope. However, it does have reserves in Cook Inlet which is both closer to Japan and more likely to be backed out of District V by North Slope oil.

⁷ This interview, as well as others with U.S. and Japanese government officials is reported by Richard Corrigan, "Resources/Japan May Get Some Alaskan Oil; Foreign Flag Shipping of Exports is Likely," *National Journal*, July 31, 1971.

⁸ The \$1.83 per barrel is based upon averages for the first quarter of 1970 found in the May 10, 1971, issue of Platt's *Oilgram Price Service*.

⁹ This is calculated by subtracting production costs (\$.25), transportation costs for a pipeline (\$.60) and tanker (\$.20) from a price of \$2.00 per barrel.

¹⁰ It should be noted further that, if the imported oil is produced by the same company that exports Alaskan oil, the royalties paid to the producing country may be credited against U.S. corporate income taxes. Such a tax advantage has not been included in the analysis of benefits and costs, since it is a transfer payment. However, it will affect profitability and must therefore be included when private decisions are analyzed. This is especially true when the company producing North Slope oil will also be the producer of foreign oil that will enter under an "import for export" program.

¹¹ See Corrigan, R., "Resources Report . . ." *op.cit.*

¹² Note the values shown above for transporting oil to Chicago must be increased by two factors to determine these costs: \$.25 per barrel production costs and \$.25 per barrel for transportation between Chicago and New York.

¹³ This is based upon an average total cost on the East Coast of a TCP alternative of \$1.51 per barrel compared to \$1.64 per barrel for a Central American system and \$1.83 per barrel for a Cape Horn system. If the Midwest is the principal North Slope market, these extra costs would be approximately \$.63 and \$.82 respectively.

Dr. CICHETTI. I am a visiting Associate Professor of Economics and Environmental Studies at the University of Wisconsin.

I would like to speak about four things.

First, I would like to review some of my previous findings.

Second, I would like to review some of the recent comments and uses of my testimony, my previous testimony and my analysis, by various spokesmen for government and oil company officials.

Third, I would like to say a little bit about the President's energy message and what it says about the pipeline development issues. Finally, I proposed in my testimony some proposals to plug some of the loopholes I think will still exist if this committee makes it possible to go ahead with the Alaskan pipeline, and I would like the committee to consider those loopholes, although I won't go into them today.

I started my analysis pretty much based upon the notion that environmentally the Trans-Canadian pipeline, whether the Mackenzie Valley pipeline or Alaska Highway pipeline, would be environmentally superior, was environmentally superior to the Trans-Alaska pipeline. That was based upon testimony of public witnesses and I think confirmed quite clearly by the Interior Department's own environmental impact statement, which could only find the Alaska pipeline superior because it was shorter.

And when you add it in, as the Interior Department mentioned in one section, the fact a gas pipeline would also have to be built, the environmental savings of shortness of length, by having an oil and gas pipeline in the same corridor, tilted every factor that Interior

Department considered environmentally in favor of the Canadian pipeline, whether it be Mackenzie Valley or the Alaska Highway.

So that is where I began.

I did an economic analysis, and in the analysis I compared several factors. When I looked at the cost of the two, I found using company estimates that when they were put on the same basis in terms of interest rate, group schedules, and what have you, that the difference in the cost of winding a pipeline through Canada and the cost of bringing that same oil to Los Angeles, was no more than 10 or 20 cents. When one added delays and looked at some of the cost estimates that were made, again the difference was around 25 cents to 30 cents per barrel difference in cost of transporting the system. True, the Canadian route would be longer and therefore more costly to construct. There wouldn't be any need to construct tankers, terminal and storage facilities in Valdez. When these costs are added in, that brings the two routes almost in line with one another, from a cost standpoint.

The next thing I did in my analysis, where would Los Angeles get its oil if it didn't get it from Alaska, and where would Chicago get its oil if not from Alaska? I looked at two cases. The first case I looked at, let's suppose if Alaskan oil wasn't delivered to either of those two markets, they would use foreign oil. The second case I said, let's look at the prices in these different markets and let's assume prices reflect domestic cost. Let's see what the difference would be if we assume the present system of domestic prices keeps hold in the Midwest and on the west coast, and let's see what that says about the two routes.

I found out if we looked at the price of foreign oil that the difference in the cost of foreign oil either in the Midwest or on the west coast was between 25 and 30 cents a barrel. That is about what the difference is in the cost of the two systems. So one would say economically there is little difference between the two, if in fact there was a 2-year delay for a Canadian route, and if you had that foreign oil as the alternative source of supply and price setter and price-determining factor in all of U.S. markets.

Mr. Simon, who is with the Treasury Department, Governor Egan of Alaska, and Standard Oil Co. of Ohio have taken that case in my analysis and based most of their recent testimony on that assumption. They have assumed that because of the President changing the quota system, prices in all parts of the country are going to be based upon prices delivered from the Middle East.

That doesn't bear up with the fact, when you look right now at the price for oil. The quality that is found in Alaska is 65 cents a barrel higher in the Midwest, and 90 cents a barrel higher on the east coast than it is on the west coast.

I think the question of anybody who says the Middle East is going to be the price determining factor that has to be asked those witnesses is what do they think is going to happen. Do they think the west coast prices are going to rise to the east coast prices, or do they think east coast prices are going to fall? I think most of them are going to say they don't know, they expect the historic pattern to keep hold. Do they think foreign oil is going to get so expensive that all prices have to go up?

I think if you look at some of the information available, and I have included in my testimony, you find, a couple of surprising

facts. One is, right now the Japanese are paying between \$1 and \$2 less per barrel of oil than the United States is paying on the east coast and in the midwest.

There is very little reason why that should be the case. But it is the case, and I think that is relevant for members of this committee. Because, over a period of years, with different quota policies, different oil policies, oil consumers east of the Rocky Mountains have been forced to pay much higher prices for crude oil, have been forced to deal with problems of uncertainties in supply and in securities of supply, and I think that is the issue involved in the whole case.

Finally, I should say recently there have been price changes domestically. For the last month, prices east of the Rocky Mountains have been rising between 25 and 50 cents per barrel. It wasn't until last week there was finally a price increase on the West Coast, 25 cents per barrel price increase. The relative prices I talked about and used in my analysis—and if you use relative prices and not foreign costs—you clearly come up with a major economic advantage for a Canadian pipeline, even if it is delayed, 5, 6, 7 years. It is still better to go with the Canadian pipeline if you take into account those higher prices east of the Rocky Mountains and the shortage of oil east of the Rocky Mountains.

You find out that the relative prices that I use in my analysis have sustained, but they have changed even more in favor of the Canadian route, because the price increases east of the Rockies have been even greater than the price increase announced last week on the west coast.

In conclusion, I guess I would say that it is incorrect to assume that foreign oil will be the only factor to consider in whether or not the Canadian pipeline or the Alaska pipeline is economically superior. Because if you think the relative price difference that exists now in the Midwest and the east coast is either going to stay the same or get worse, as recent evidence indicates, you are going to have to deal with midwest Congressmen and east coast Congressmen and their constituents who are going to say they are paying as much as a dollar more for a barrel of oil than oil priced on the west coast. You are going to have to deal with the fact the west coast is going to have excess supply because recent studies of California showed under the President's Emergency Message, California could be producing 2 million barrels a day by 1985. You add in another 2 million barrels from Alaska, you say from southern Alaska, you find there is going to be at least a million barrels of oil more than the west coast needs. Where is it going to go? To Japan, the Virgin Islands? It is going to be transported in some roundabout scheme at higher cost to the east coast and the Midwest?

It seems to me these are the questions that have to be confronted by this committee and this Congress. I don't think it is right to turn this consideration back to the Interior Department, because I think their own economic analysis was biased from the start and all of their comments have been made on that document, the basis of that bias.

Thank you.

Mr. MELCHER. Thank you, Dr. Cicchetti.
 [Following the hearings a further statement was received from Dr. Cicchetti.]
 [The statement follows:]

ADDITIONAL STATEMENT OF CHARLES J. CICCETTI

On June 15, 1973 Secretary Morton filed a statement with this subcommittee entitled: "An Analysis of Alaskan Oil Alternative Routes and Markets." The book referred to is one that I recently authored. I would like to take this opportunity to respond briefly to several of the comments made in Secretary Morton's filing.

1. By using a 3 percent rate of inflation when I used a 10 percent rate of inflation Secretary Morton makes my calculations appear to be heavily biased against the Trans Alaska Pipeline. Actually, by using a rate that exceeds even the present high rate of price inflation (10% versus about 6.5%) I have biased my calculations against the Trans Canadian Pipeline in order to temper my conclusions, which show the Trans Canadian route to be far superior economically.

2. Although Secretary Morton criticizes me for not having updated data he is guilty of the same oversight in his regional oil supply and demand analysis. He estimates that supply in district V, the west coast, will decline by 2 percent per year. This is in marked contrast with a recent study prepared by the state of California that indicates the state of California could be completely self sufficient through 1985 by expanding its offshore oil drilling and more than doubling its production. Since the President has directed Secretary Morton to encourage this offshore development along with offshore oil in the Gulf of Alaska, which would only further add to the west coast over supply of oil, it is surprising that the Secretary actually forecasts a decline in west coast (district V) production. Bringing oil to this oversupplied area of the nation when the midwest and east coast face shortages and rising prices is in my view an extremely callous decision for an administrator, who is supposed to represent the interests of all regions of the nation.

3. Secretary Morton has criticized my investment cost data as being out of date. He suggests that TAPS would cost about \$3.62 billion in 1973 and TCPS would cost about \$6.435 billion in 1973. He points out that I used investment costs of \$2.5 billion and \$3.75 billion in 1971 for TAPS and TCPS respectively. His statement is true. However, as my manuscript points out I did not stop here. First, I added \$400 million for possible higher cost Alaska Highway route. Second, I added the higher costs of a two year delay for TCPS increasing my cost estimates by 21%. Finally, I added an additional 20% to the costs of TCPS to reflect greater uncertainty and to make my economic comparison as conservative as possible. When these adjustments are made and all costs are put in 1973 dollars using the 10% inflation that I utilized (not the 3% suggested by Secretary Morton) my investment costs became \$3.02 billion for TAPS and \$6.03 billion for TCPS. While these are still somewhat lower than Mr. Morton's figures it should be noted that the spread between the two alternative investments is greater in my figures. Accordingly, I have been more heavily biased against TCPS than I would have been if I used Mr. Morton's most recent figures.

4. When my most extreme calculations (in terms of biasedness against TCPS) are presented I conclude that TCPS may cost about 20¢ more per barrel than TAPS. This difference is about equal to that presented by Mr. Morton. The Secretary and all recent critics of my analysis have pointed out that this difference is about equal to the 25¢ per barrel additional transportation costs from the Gulf coast to the midwest. Since the President has ended the oil import quota program each of these critics from industry and government have isolated my world price analysis and conclude that TAPS will not be greater than or at least equal to TCPS economically. For this conclusion freeing up imports must result in a drop in the relative price of oil in the midwest compared to the west coast. If it were to fall from the 65¢ per barrel difference, which was the amount crude oil of comparable quality to Alaskan oil in Chicago exceeded similar oil in Los Angeles, to the 25¢ per barrel trans-

port cost difference of foreign crude the two systems would be economically equal. I pointed this out in my analysis and I stick to that conclusion. However, it has been sometime since the President's energy message, which ended the oil import restrictions. Relative prices have changed but not in the direction favoring TAPS. Contrary to economic logic, which says increasing supply of lower cost oil should cause a price decline, prices have increased since foreign oil has been permitted to enter the U.S. market without quantity restrictions. There have been two rounds of such price increases in the midwest, gulf coast and east coast markets. These have resulted in a price increase of about 70¢ to 75¢ per barrel. At the same time west coast prices have risen only 25¢ per barrel.

In other words the relative price difference that I used of 65¢ per barrel is no longer accurate. However, this difference has not been reduced to the 25¢ difference implied by Mr. Morton and other recent critics. Instead it has increased to \$1.10 to \$1.15 per barrel. The TCPS is now more than ever more economically viable than TAPS. Adding to this the midwest and east coast shortage I cannot even speculate as to the possible motives of the Secretary in sticking to his decision to promote TAPS at the expense of the far superior TCPS.

ACTION POPPING ON U.S. OIL PRICE FRONT

Crude price increases maintained their strong drive across many U.S. producing areas last week.

Although a second round appeared to be faltering in the Permian basin, the Ferriday area of Mississippi and northeastern Louisiana drew its second increase in a move by Ashland Oil Purchasing Co. to match higher levels on the Gulf Coast. Combined effect of the two moves by Ashland is a 53¢/bbl jump.

Charter International Oil Co. added another 15¢ to its postings effective Apr. 17 on 25,800 b/d of sour crude and 4,200 of intermediate in West Texas and Southeast New Mexico, boosting prices to \$3.85 and \$3.96, respectively. The company had posted the prevailing 25¢ increase—to \$3.70 for sour and \$3.81 for intermediate—effective Apr. 11.

Charter thus became the third company to pay 40¢ above the level of previous postings in the basin Sun Oil Co. earlier announced a combined increase of 40¢ to a new top of \$3.96 for West Texas intermediate to match a price negotiated by Apco Oil Co. in Fisher and Kent counties (OGJ, Apr. 23, p. 32).

Other buyers, including some of the biggest in the Permian basin, were sticking with increases of 25¢ in retroactive price moves announced after the Charter, Sun, and Apco hikes were disclosed.

West Texas-New Mexico sweet crude brings a maximum of \$3.93/bbl in all new postings announced so far.

Ashland's second increase boosts 45,000 b/d of line-connected Ferriday crude 25¢ to a new top of \$4 effective Apr. 19. Its first increase of 28¢ to \$3.75 went into effect last month, also made to match Gulf Coast postings.

Permian basin. Four of the biggest buyers in the Permian basin—Mobil Oil Corp., Exxon Co. U.S.A., Gulf Oil Co. U.S., and Texaco Inc.—joined the round of 25¢ increases. Their action, combined with earlier moves by other major buyers, brings virtually all of the basin's crude output under higher postings.

Mobil moved effective Apr. 1 on 89,000 b/d of sour, 133,000 of intermediate, and 10,000 of sweet.

Exxon posted its increase effective the same date on 105,000 b/d of sour, 2,900 of intermediate, and 7,300 of sweet. The company's increase on intermediate is 30¢ to match postings by other companies. Its previous price was 5¢ under other postings.

Gulf's price jump, effective Apr. 18, affects 111,500 b/d of sour, 30,000 of intermediate, and 20,500 of sweet crude. Its price for intermediate is \$3.86, because it had been paying 5¢ more than other companies in earlier postings.

Texaco made its increase effective Apr. 19 on 64,000 b/d of sour, 80,500 of intermediate, and 7,000 of sweet.

In other postings for the basin, increases of 25¢ were announced by Sohio Petroleum Co. effective Apr. 15, Atlantic Richfield Co. effective Apr. 18, and Chevron Oil Co. effective Apr. 19.

Other areas. Elsewhere, buyers posted higher prices in areas ranging from the Gulf Coast to Illinois and the Rocky Mountains. Most lists are up 25¢.

Shell Oil Co. and Texaco, among the largest buyers on the Gulf Coast, announced 25¢ increases on more than 765,000 b/d in the region.

Shell's move, effective Apr. 23, made its new top price \$4 for 376,400 b/d on the Texas-Louisiana coast, \$4.01 for 8,755 b/d on the Louisiana coast and \$3.95 for 6,300 b/d in Southwest Texas and the upper Texas Gulf Coast. Texaco posted the increase to \$4 effective Apr. 19 on 374,000 b/d in South Louisiana and made similar jumps in Illinois to \$3.85 and in North Texas to \$3.81 effective Apr. 1.

Sun boosted its prices 25¢ to \$3.85 on 15,000 b/d in East Texas field and to \$4 on 60,000 b/d on the Texas-Louisiana Gulf Coast effective Apr. 16. The action breached the \$4 mark for Texas coastal Grade A crude. The company's new price for this type of crude is \$4.16/bbl for 29° gravity and above in West Beaumont, Esperson, Orange, and Spindletop fields.

Gulf moved up 25¢ to \$4 on 16,200 b/d of Texas Gulf Coast crude, to \$3.80 on 6,500 b/d in Northeast Texas, and to \$2.94 on 23,500 b/d in Baxter field, Miss.

Exxon posted 25¢ matching increases on 4,300 b/d in West Central Texas, 28,500 b/d in East Texas field, and 22,300 b/d in other fields of East Texas. Its purchases of 8,600 b/d of heavy crude in Elk Basin field of Wyoming and Montana drew a 30¢ boost to \$3.80, while 7,100 b/d in Loudon field, Ill., went up 20¢ to \$3.85. All are effective Apr. 1.

Amoco Production Co. went up 25¢ on 32,000 b/d in East Texas field and also moved on 13,000 b/d of other crude in the East Texas area.

Other 25¢ increases in East Texas field include General American Pipe Line Co., 17,800 b/d; La Gloria Oil & Gas Co., 15,000; Scurlock Oil Co., 12,000; and Permian Corp. Permian also boosted its postings 25¢ in the upper Texas Gulf Coast, on 20,000 b/d in West Central Texas, and on 22,000 b/d in North Texas.

American Petrofina Co. of Texas jumped its postings 25¢ in Northeast Texas.

Marathon Oil Co. went up 30¢ in the Rockies effective Apr. 17, making its new top prices \$3.44 for 45,000 b/d of Wyoming heavy crude and \$3.80 for 5,200 b/d of Elk Basin heavy. The company also added 25¢ to its East Texas field posting, affecting 2,300 b/d.

Sohio announced an increase in its postings effective Apr. 1 on a total of 11,850 b/d in three states. About 10,000 b/d of crude in Tinsley field, Miss., got a 25¢ boost to \$3.63, while 400 b/d of Magnolia-Smackover crude jumped 42¢ to \$3.67 and 1,100 b/d of Stephens and North Stephens crude moved 37¢ to \$3.57 in Arkansas.

Sohio also increased its flat posting for 350 b/d of Ohio crude 25¢ to \$3.67.

U.S. CRUDE PRICES MOVE ANOTHER 20 TO 45 CENTS

A second round of crude-price increases took a firm grip on producing areas in the Four Corners, Kansas, Oklahoma, Texas, and Louisiana last week in a flurry of moves by buyers to protect supply sources.

The latest second-round bonuses and postings added 25-45¢/bbl to about 1,284,600 b/d of production in the regions. Most jumps were in the 30-35¢ range. There were no changes in gravity differentials.

Combined with earlier second-round price hikes and contract purchases (OGJ, May 28, p. 35), the latest action brings about 1,317,600 b/d under prices higher than prevailing first-round postings. Independents and majors alike joined the second-round action that pushed top prices to \$3.91 on the Four Corners, \$4.20 in Kansas, \$4.30 in Oklahoma, \$4.28 in the Permian basin, and \$4.51 on the Gulf Coast.

A breakout of the latest price moves shows that 1,036,900 b/d is being bought through new postings and at least 247,700 b/d through bonuses.

Majors. Six major companies announced second-round price moves on a total of 931,700 b/d last week. Other big firms were studying similar action.

Price hikes of 20-45¢ were unveiled by Shell Oil Co., Sun Oil Co., Phillips Petroleum Co., Continental Oil Co., Skelly Oil Co., and Cities Service Oil Co.

Shell's new posting, effective June 6, covers 395,200 b/d in the Four Corners, Oklahoma, and Texas.

Oklahoma crude jumped 45¢ to a new top of \$4.30 for 1,500 b/d of sweet and \$4.13 for 10,000 b/d of sour. Price hikes of 35¢ pushed the company's top price in the Four Corners to \$3.91 for 16,500 b/d; in East Texas field, \$4.20, 14,500 b/d; Bryans Mill (Tex.) debutanized condensate, \$4.09, 8,100 b/d; Frost Carbon-dale North Carbon-dale (Tex.), \$3.90, 2,600 b/d; West Texas-New Mexico sour, \$4.05, 272,000 b/d; intermediate, \$4.16, 47,000 b/d; and sweet, \$4.28, 23,000 b/d.

Sun's action, involving a total of 335,000 b/d, boosted its postings effective June 1. Top prices moved up 35¢ to \$4.35 on the Texas-Louisiana Gulf Coast to \$4.51 for coastal Grade A crude, to \$4.22 for South Texas heavy, to \$4.20 in East

Texas and Conroe fields, and to \$3.95 in Clay Creek field, Tex. South Texas light rose 30¢ to \$4.24, and West Texas intermediate jumped 20¢ to \$4.16.

Sun also moved up 45¢/bbl to \$4.30 for Oklahoma sweet and to \$4.25 for Delhi, La., crude.

The company also is offering contracts with several price options to its suppliers in Oklahoma and certain parts of Texas.

Phillips began paying a 30¢ bonus for 8,300 b/d in Kansas and 9,000 b/d in Burbank field, Osage County, Okla., making its top price in both areas \$4.15. A 35¢ bonus brought 37,600 b/d of West Texas intermediate to a new top of \$4.16.

Continental added a 35¢ bonus to its prices on 42,600 b/d of Oklahoma sweet and a 30¢ bonus on 8,000 of Kansas crude, making its top prices in both states \$4.20/bbl.

Skelly's price hit a similar top with a 35¢ bonus effective June 1 on 30,000 b/d in Kansas and 20,000 b/d in Oklahoma. Cities matched this move on 16,500 b/d in Kansas and 29,500 b/d in Oklahoma.

Independents. Along with the majors, 10 independents announced price boosts on 352,900 b/d in Kansas, Oklahoma, and West Texas. Other independents were reported to be paying prices above prevailing second-round postings, but these reports couldn't be pinned down immediately.

Higher prices were announced by Koch Oil Co., Permian Corp., National Cooperative Refinery Association (NCRA), CRA Inc., American Petrofina Co. of Texas, Clark Oil & Refining Co., OKC Corp., Bigheart Pipe Line Corp., Vickers Petroleum Co., and Osage Oil Transportation Inc.

Koch jumped its postings 35¢ to new highs of \$4.20 for sweet crude and \$4.08 for sour. The company buys 120,000 b/d in Oklahoma and 35,000 b/d in Kansas.

Permian posted a 36¢ increase to \$4.16 for West Texas-New Mexico intermediate and a 35¢ boost to \$4.28 for West Texas-New Mexico sweet in a move effective June 1. The company buys about 120,000 b/d in the Permian basin. Its posting for West Texas-New Mexico sour remains unchanged at \$3.70.

Permian also is paying a 30¢ bonus on about 10,000 b/d it buys in Kansas, making its top price there \$4.15.

NCRA added a similar bonus on 19,000 b/d in Kansas, and CRA followed suit on 10,200 b/d in Kansas and 5,000 b/d in Oklahoma. These prices jumped to \$4.15.

American Petrofina issued a new posting calling for a 30¢ hike effective June 1 on 1,500 b/d in Kansas. Its top price hit \$4.15.

Clark is paying a 30¢ bonus in Kansas, basing its price at this amount above the arithmetic average of three postings by other companies.

OKC's 25¢ bonus in Oklahoma is based on a flat 10¢ bonus plus payment of trucking charges which, in some cases, range up to 15¢/bbl. The company doesn't post in the area.

Bigheart posted a 45¢ boost to a new top of \$4.30 effective June 1 for 20,000 b/d of Oklahoma sweet, and Vickers moved up 35¢ in postings that call for a top price of \$4.20 for 1,200 of Kansas crude and \$4.08 for 9,000 b/d of Oklahoma sour.

Osage started paying a 45¢ bonus on 2,000 b/d of Oklahoma sweet, making its new top \$4.30.

Erroneous report. Meanwhile, a Journal check disclosed that a reported deal for sale of Louisiana crude at \$5.50/bbl is highly questionable.

Reports in the daily press credited the sale to John Mecom, Sr., Houston, in a deal with American Grain & Cattle Corp., San Antonio. Under the reported trade, Mecom was to sell the output from holdings in Lake Washington field to the farm cooperative at a field price that could accumulate to \$350 million.

Mecom also was credited with plans to repurchase the 51% interest in the field, which he earlier had sold to Signal Oil & Gas Co.

Signal, however, says it owns controlling interest in the properties and is negotiating for sale of its 80% interest to Crown Central Petroleum Corp. The sale would be made through a Signal limited partnership whose production amounts to about 18,000 b/d of oil and 109 MMcf of gas (OGJ, Apr. 30, p. 106).

Negotiations with Crown Central, Signal told the Journal, are continuing.

Mecom was unavailable for comment—as was Harold Nelson, named in daily press as president of American Grain & Cattle. The latter firm has no telephone listing in San Antonio.

Mr. MELCHER. Dr. Freeman.

**STATEMENT OF A. MYRICK FREEMAN, III, VISITING PROFESSOR
OF ECONOMICS, UNIVERSITY OF WISCONSIN**

Dr. FREEMAN. My name is Myrick Freeman. I have a doctorate in economics and am presently a visiting associate professor of economics at the University of Wisconsin. My areas of specialty include resource and environmental economics, benefit-cost analysis, and international economic theory.

I have a longer statement which I would like to have submitted to the record and will only briefly outline a couple of my major points

Mr. MELCHER. Without objection, so ordered.

[Dr. Freeman's statement follows:]

STATEMENT OF A. MYRICK FREEMAN III, PH. D., ASSOCIATE PROFESSOR OF ECONOMICS, BOWDOIN COLLEGE, BRUNSWICK, MAINE, AND VISITING ASSOCIATE PROFESSOR OF ECONOMICS, UNIVERSITY OF WISCONSIN-MADISON

My name is Myrick Freeman. I am on the faculty in economics at Bowdoin College in Maine, and hold a visiting appointment in economics at the University of Wisconsin-Madison. My training and research work have been in the fields of benefit-cost analysis, the economic analysis of public investments, resource and environmental economics, and international economic theory.

A year ago I reviewed the final *Environmental Impact Statement* and the *Economic and Security Analysis* of the Trans-Alaska Pipeline, and prepared extensive comments for submission to the Department of Interior. Since most of the points I want to make today are discussed in greater detail in those comments, I am submitting this *Evaluation* for inclusion in the record.

NEPA AND THE PIPELINE IMPACT STATEMENT

I would first like to emphasize the important and valuable role that the National Environmental Policy Act has played in the Alaskan Pipeline issue. NEPA requires that all agencies develop procedures "which will insure that presently unquantified environmental amenities and values be given appropriate consideration in decision-making along with economic and technical considerations." To that end, the Act requires that agencies prepare detailed statements on the environmental impacts of major actions, that they use "a systematic interdisciplinary approach which will insure the integrated use of the natural and social sciences," and that all relevant alternatives to the proposed action be considered and evaluated.

NEPA has been invaluable in the TAPS case because it has required the Secretary of Interior to make public the data and analyses supporting his decision to issue the pipeline permits, and has allowed scientists, environmentalists, economists, and others to scrutinize the data and the decision. The data and information contained in the *Impact Statement* have made a substantial contribution to public debate on this issue. The *Impact Statement* is the most important single source of information on the proposed pipeline and its likely environmental and economic effects. Yet serious questions have been raised about the *Impact Statement*, and there has been sharp criticism of the Secretary's decision. Why is this so? Why can different people read the same record, look at the same data, yet arrive at quite different conclusions? There are two basic reasons for this. The first has to do with the adequacy and accuracy of the data presented, and in particular the consideration of alternatives; the second concerns the analyses and evaluation of the data—particularly the weighing of non-commensurables.

In both the the record of public commentary on the *Impact Statement* and in testimony before this Committee, serious questions have been raised about the accuracy of the data used by the Department of Interior in the analysis of the TAPS alternative. Examples include Professor Curry's testimony concerning seismic factors, and Professor Cicchetti's and Mr. Stoel's analyses of the

supply-demand data for PAD V. I will not dwell on this point because there is a more important inadequacy in the *Impact Statement*. The *Impact Statement* is inadequate in its consideration of alternatives to TAPS. Specifically the most glaring weakness is the absence of data and analysis concerning common corridor through Canada for both oil and natural gas pipelines. It is now clear that the real choice we face is between TAPS plus a separate gas pipeline through Canada on the one hand and a joint oil and gas pipeline through a common corridor in Canada on the other. Yet the *Impact Statement* is of no help in comparing these alternatives. We can not accept the Secretary of Interior's choice of TAPS if the document on which the choice is supposedly based is silent concerning the major alternative.

Concerning the second reason for disagreeing on conclusions, that is analysis and evaluation, there are several instances where the Department of Interior has departed from accepted economic and scientific reasoning and analytical procedures and reached conclusions which simply can not be supported by the data they use. This is the case with respect to the Department's analyses of the costs of delaying North Slope development, national security, balance of payments impacts, and job creation. These points are detailed and documented in my *Evaluation* which is appended for the record, and I will return to them shortly.

In addition to instances where faulty reasoning is used, people may reach different conclusions due to honest and reasonable differences in the subjective weights or valuations they use in comparing various kinds of noncommensurable environmental and economic benefits and costs. It is essential for good decision making on major issues such as North Slope oil that study and data gathering continue until there is agreement on the facts and logical and analytical conclusions. There may still be disagreement on the subjective valuations; but even here proper analysis can help by focusing attention on the critical issues. NEPA requires that an integrated analytical framework be developed and utilized for just this purpose. The *Impact Statement* does not provide such a framework. In my *Evaluation*, I devoted considerable attention to developing such a framework and applying it to both environmental and economic factors.

My analysis was based primarily on data from the *Impact Statement*, yet I reached quite different conclusions, namely: that a weighing of all environmental factors together favored development of a Canadian corridor over TAPS and that a weighing of economic and security factors also tended to favor the Canadian corridor.

ENVIRONMENTAL FACTORS

One step in the application of an integrated analytical framework is the summarization of data on environmental damages and risks. Ideally one would want to single index or measure of environmental harm for each alternative. But in reality there are many forms of non-commensurable environmental damages. The principal environmental hazards of an arctic pipeline are related to the wilderness character of the territory to be traversed, the fragile nature of the ecological systems, and the uncertainties and risks associated with constructing and operating a pipeline carrying hot oil across permafrost and through earthquake zones. Of further concern has been the threat of oil pollution associated with tanker and terminal operations and possible disasters of the Torrey Canyon variety.

The Alaskan and Canadian routes are quite different in the kinds of environmental damages and risk associated with them. In attempting to rank the two routes on the basis of environmental harm, one must weight the greater overland distance of the Canadian route and the disruption associated with it against the hazards of marine transportation and the risks of earthquake damage accompanying TAPS. The Department of Interior's own analysis reflects these difficulties. The *Impact Statement* concluded that, "No single generalized route appears to be superior in all (environmental) respects to any other." However in all but one of six categories of environmental harm, the *Impact Statement* ranked the Canadian alternative above Taps. The issue reduces to how important is the one category favoring TAPS relative to the five categories favoring the Canadian route?

In my *Evaluation* I developed indexes of environmental damage based on data in the *Impact Statement*. Although these indexes were not definitive, they clearly showed that the effects of marine oil pollution from tanker operations

and the threat of earthquake damage to the pipeline were the critical factors affecting the relative ranking of TAPS and the Canadian route on the basis of environmental risk. Since the Canadian route had no tanker phase and did not traverse a seismic zone, it was strongly preferred on these two factors. And as a consequence, one had to place a very low weight on these factors or be willing to say that marine oil pollution and earthquake hazards were unimportant elements of environmental damage in order to justify a judgment that TAP was preferred to the Canadian route on environmental grounds.

It should be pointed out that this conclusion did not take into account the possibility of gas pipeline along the Canadian route. When that possibility is considered environmental factors even more strongly favor the Canadian route for a common corridor.

ECONOMIC FACTORS

My economic analysis of the two alternatives focused on five elements: the net economic benefits or resource savings, differences in national security, the economic costs of delay, impacts on the balance of international payments, and job creation.

Economic Benefits

The net economic benefit or resource cost saving is the difference between the resource cost of delivering Mid-East oil to a particular market and the cost of delivering an equal amount of Alaskan oil to the same point. For both routes, the cost of delivering Alaskan oil is substantially below the cost of the imported oil it would replace indicating substantial economic benefits from development. The relevant question is which alternative has the higher net economic benefit for society. Although the cost of delivering Alaskan oil to the Mid-West is greater than the cost to the West Coast, the cost of the imported alternative is higher in the Mid-West, too. And although there is great uncertainty in the data, on the basis of the figures provided in the *Impact Statement*, the net economic benefits of the alternatives are approximately equal, with a possible slight preference going to the Canadian route. I might add that my colleague, Professor Charles Cicchetti has made a long and careful study of this issue. And on the basis of independent data and a more careful analysis than is possible with the data in the *Impact Statement*, he has concluded that the Canadian route is definitely superior to TAPS on economic grounds.

There are two points to be made concerning this conclusion. The first is that there has been no adequate analysis of the economics of a common corridor for oil and gas. It seems likely that the cost of the oil pipeline would be reduced if the oil and gas lines could be built through the same corridor. If this is so, the economic superiority of the Canadian route would be well established. As I said before a major shortcoming of the *Impact Statement* is that it did not provide either an economic or environmental analysis of this alternative.

The second point concerns the possibility that the Canadians would require that part of the capacity of the line be reserved for Canadian oil. This would in no way alter the economic benefits per barrel of oil delivered to the U.S. If the full capacity of the pipeline cannot be used for Alaskan oil, the relevant question becomes: should additional capacity be planned and built along the same corridor? The answer is probably "yes". It seems likely that further exploration on both the Canadian and Alaskan North Slope will justify a second oil pipeline eventually. But the present plan for TAPS does not call for full use of pipeline capacity until the 8th year of operation. Thus in the years before 1982-83 there would be room in the pipeline for Canadian production. And if Canadian production and throughput turned out to be substantial, a second parallel line could be installed to handle the full production of both Alaskan and Canadian fields with no serious diminution of planned deliveries to the U.S. If it is true as I believe that both economic and environmental factors favor placing the gas and first oil pipelines in a common Canadian corridor, they will probably favor placing the second oil line through the same corridor. This routing would avoid the greater environmental risks of TAPS. There are likely to be further cost economies in construction. The Mid West market would be able to absorb the throughput of the second line. And there is the possibility of routing some of the throughput to the Pacific Northwest if necessary via the Intermountain Pipeline.

National Security

Turning to the national security arguments, there are two aspects of national security relevant to the pipeline issue, the timing of delivery, and the region receiving the additional supply. Here I will only comment on the latter. For any given marketing region, the danger and cost attributable to a disruption of foreign supply is directly related to that region's dependence on imports, in other words to imports as a percentage of total consumption. The relative dependence of the East Coast and Mid-West on non-Canadian imports is far higher than for the West Coast. Thus regional considerations of national security suggest higher national security benefits for the Canadian alternative.

Costs of Delay

One thing which has become clear from recent public comments is that a major concern of members of Congress is the possible economic costs to the nation of delaying the delivery of North Slope oil to the lower 48. At least some members of Congress appear to be disposed to accept an argument that the delivery of oil would be substantially delayed if a decision were made now to build a Canadian route, and that the costs of such a delay would be substantial and would outweigh any possible economic and environmental advantages the Canadian route might have. In evaluating such an argument, we must consider three separate sets of factors: the cost of delay, the length of delay, and the benefits of delay.

1. How big are the costs of delay in economic terms? This is a matter of interest rates, discounting of future values, and what economists call time preference. Both the magnitude and significance of these costs have been greatly exaggerated in the *Impact Statement* and by pipeline advocates, and there are compensating benefits which must be weighted against these costs. As is discussed in my *Evaluation*, the *Impact Statement* uses an illogical technique and indefensible assumptions in calculating the costs of delaying of oil.

The true costs of delay depend on the net economic benefits of North Slope oil now and in the future. The cost of delay is the cost of postponing the receipt or realization of the net economic benefit of a barrel of North Slope oil. The net economic benefit at any point in time equals the cost of the foreign alternative less the cost of North Slope oil delivered to the same point. Other things equal, if the price of Mid East oil increases by 50¢, the net economic benefit of North Slope oil increases by 50¢. If we postpone the extraction of one barrel of oil for one year, for whatever reason, and during that interval the price of Mid East oil rises by 50¢, say from \$3.00 to \$3.50, the net economic benefit of producing that oil also increases by 50¢, for example from \$1.00 to \$1.50. In that hypothetical example, we will have experienced a 50% appreciation in the value of our oil asset by postponing its extraction.

Other things equal the more rapidly the price of foreign oil increases, the lower the cost of delay, and the more likely that delay will be actually economically advantageous. Another way of putting this is to say that if the price of foreign oil is expected to rise rapidly in the future, it is economical to use relatively more of it now and in the near term future while its price is still low relative to the more distant future, and to use our own North Slope oil later. The significant conclusion is that those who predict rapidly rising world oil prices, and use this to argue for the most rapid possible development of the North Slope have their logic backwards. Oil in the ground is an asset, and it should be treated as such. Decisions about when to utilize that asset should take that into account.

2. How long would the delay be? Here there is great uncertainty. Until good faith discussions are entered into with the Canadian Government, we can only speculate on the possible time span for reaching an agreement. Litigation of the NEPA issues could substantially delay, if not block the TAPS route. And Congress itself could take steps which would substantially reduce the likelihood of lengthy delay by initiating studies of the Canadian alternative now.

3. What are the economic and environmental advantages, if any, of the Canadian alternative, and how big are these advantages? We have offered a substantial body of testimony and background information which support our contention that the advantages of the Canadian alternative are substantial. If the Canadian route is advantageous economically, this benefit must be weighed against the costs of a possible delay associated with it. When we consider the

apparent advantage a joint oil-gas corridor in Canada, it seems likely that the costs of delay will be outweighed by the benefits. Despite the recent short term energy problems and crisis atmosphere, the real danger is in making a hasty and unwise decision to push ahead with TAPS now.

It should also be borne in mind that just as the benefits of exploiting Alaska oil will largely accrue to oil companies in the form of profits, the costs of delay are largely the costs of deferred receipt of those profits. Let me add, however, that I am sympathetic to the plights of the State of Alaska and the Alaskan natives, for they share in these costs through delayed receipt of royalties. I suggest that if the State and the native groups are likely to experience serious fiscal problems due to a delay, it is both equitable and to our advantage to work out some form of fiscal relief.

Balance of Payments

The impact of the development of Alaskan oil on the U.S. balance of international payments is an important but often misunderstood point. Public discussion of the issues has often been confused by the failure to make an important distinction. There are two quite different questions: first, what is the balance of payments impact of the substitution of low cost Alaskan oil for higher cost imported oil?; and second, what difference does it make to the balance of payments whether Alaskan oil is shipped through TAPS or through Canada? The first question bears on the issue of whether or not Alaskan oil should be developed at all. But it is not directly relevant to the real question before Congress—namely which route?

Both TAPS and the Canadian route would reduce imports of foreign oil by two million barrels per day. Either route would have the same gross and net effect on expenditures to foreign oil producers—and therefore on our balance of payments. There are some difficult problems in estimating what this impact would be. But since the impacts are the same as between the two routes, that information plays no role in the choice of which route.

The dominant consideration in comparing the two routes is the nature of the arrangement for financing the construction of the Canadian route. To illustrate what is involved let us consider two extreme hypothetical alternatives.

Suppose the Canadian pipelines were entirely financed by U.S. capital. This would show up as a long term capital outflow during the construction period followed by a return flow of recouped investment, interest, and profits over the life of the project. Over the lifetime of the pipeline, the return flow would substantially exceed the original investment and the net effect on the U.S. balance of payments would be positive.

Alternatively if the pipeline were financed entirely by Canadian or other foreign capital, then the pipeline costs for the Canadian portion of the line would represent a direct dollar outflow. But if the Canadian line were financed as a joint venture, for example with a majority of the equity capital coming from Canada but a majority of the debt capital being U.S., the balance of payments outflow would be reduced as the U.S. share in the investment increased.

How big are these outflows likely to be? It is possible to provide some very crude estimates of the likely first round outflows. The *Impact Statement* estimates that shipment by a Canadian route would cost approximately \$1.20 per barrel. If the line is built entirely with Canadian capital, the first round outflow would be \$876 million per year. If the line were built with 50% U.S. capital, the direct outflow would be \$438 million per year. Furthermore, to put these figures in perspective the total dollar outflow for imports of goods and services is likely to be over \$100 billion per year by 1980, and may be over \$150 billion per year by 1985. Thus the net dollar outflow attributable to building the Canadian route rather than TAPS will be a small fraction of 1% of the total volume of U.S. expenditures abroad. It should not be a major factor in the choice of routes.

It also must be pointed out that whenever dollar payments to another country are increased, the transaction triggers other economic forces which lead to offsetting increases in dollar receipts from these countries. Thus the first round dollar outflows, whether large or small, will be partially offset by induced dollar return flows. And furthermore, to the extent that the payments are not fully offset, a smoothly functioning international payments system can accommodate whatever adjustments are necessary, for example by a change in the value of the floating Canadian dollar.

Job Creation

Finally I want to speak out strongly against the notion that we need TAPS to provide jobs, or that jobs can be considered a benefit of TAPS. It has been suggested in the *Impact Statement* and elsewhere that the jobs created in constructing TAPS or in building and operating the ships for the marine leg of the TAPS route are in some sense a benefit to the nation. To argue this position is to turn economic logic on its head. Any reference to job creation as a justification for building TAPS has the whole problem backwards.

The real economic problem facing the U.S. is finding sufficient resources, that is labor and capital, to do all of the things that society wants and needs to have done. The real problem is scarcity. Any demand for labor, for example to build TAPS, takes resources which could be used elsewhere. Labor use is a cost, not a benefit.

CONCLUSION

Congress faces an important decision reflecting conflicts between environmental and economic values and between narrow short run private and broad long run public interests. Congress has an historic opportunity to utilize the best available scientific, technical, and economic information in making this decision. Much important work has already been done in compiling, organizing, and analyzing this information. But there are still major gaps and serious uncertainties.

On both environmental and economic grounds, the scales are already tipped toward the Canadian route. Despite this the Department of Interior persists in advocating TAPS, in distorting and misrepresenting the results of its own analysis, and in refusing to enter into good faith discussions with the Canadian government. It would be desirable, particularly in the face of this rigidity on the part of Interior, and what must be a massive private lobbying effort on behalf of the oil industry, to obtain more information, the bulk of which already appears to have been amassed by Canadian sources, on the economic and environmental aspects of the joint oil-gas corridor in Canada. There should also be serious discussions with the Canadian government concerning environmental conditions, financing arrangements, and their own likely needs for oil delivery capacity during the next 10-12 years.

Now that the pipeline issue appears to have come to Congress for its ultimate resolution, Congress has a unique opportunity to complete the important work begun in the *Impact Statement*. It can assure that no final decision is made until the most relevant alternatives, especially the common corridor through Canada, are given thorough, searching and unbiased analysis. In the spirit of NEPA, congress can require that it be presented with adequate information on the relevant alternatives, and that this information be presented in a framework which facilitates comparison, and identifies the crucial tradeoffs.

The striking thing about the recent discussion is how little factual information is available on the real issues which have emerged—the common corridor oil-gas system and the possibility of two oil pipelines, and how much of the discussion is based on speculation about outcomes and consequences. The need for information and study is clear. And it appears that the responsibility lies with Congress to see that these studies are carried out.

Dr. FREEMAN. Mr. Chairman, last year I conducted a lengthy analysis of the environmental impact statement and the economic and security analysis that was issued by the Department of the Interior. Most of the points I make in my testimony are based on that more lengthy analysis, and I would ask that that be included in the record as a supplementary part of my testimony.

Mr. MELCHER. Without objection, Dr. Freeman's analysis will be made a part of the record at this point.

Hearing no objection, so ordered.

[Dr. Freeman's analysis referred to above follows:]

AN EVALUATION OF THE FINAL ENVIRONMENTAL IMPACT STATEMENT ON THE PROPOSED TRANS-ALASKA PIPELINE AND AN ANALYSIS OF THE ECONOMIC AND SECURITY ASPECTS OF THE TRANS-ALASKA PIPELINE

(By A. Myrick Freeman, III, Department of Economics, Bowdoin College, Brunswick, Maine)

BIOGRAPHICAL INFORMATION

I am Associate Professor of Economics and Chairman of the Department of Economics at Bowdoin College. I was awarded an A.B. degree by Cornell University, and M.A. and Ph.D. degrees by the University of Washington, all in economics. My areas of research and publication are the economics of resource utilization; environmental quality and management; and international economics. I have published a book and more than twenty articles in these areas in such journals as *Science*, *American Economic Review*, *Quarterly Journal of Economics*, *Natural Resources Journal*, and *Water Resources Research*. I have also prepared study papers for the Joint Economic Committee of the Congress; testified on environmental policy before committees of the Congress and the legislature of the State of Maine; and served as a consultant to the Department of Health, Education, and Welfare and the New England Economic Research Foundation.

I. INTRODUCTION

The National Environmental Policy Act requires that all agencies of the federal government develop methods and procedures "which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decision-making along with economic and technical considerations,"¹ and that they shall "utilize a systematic interdisciplinary approach which will insure the integrated use of the natural and social sciences . . . in decision-making which may have an impact on man's environment."² The Act further requires that agencies prepare detailed statements on the environmental impacts of major federal actions.

If the purpose of the law is to be achieved, environmental impact statements and their supporting economic analyses must be designed to facilitate a "systematic, interdisciplinary approach" and "the integrated use of the natural and social sciences and the environmental design arts." The documents under review do not meet this requirement.³ They fail in four crucial respects.

1. The environmental impact data are not presented in a manner so as to facilitate the systematic analysis of various alternatives, including alternative routes, alternative dates for the development of a particular route, and the alternative of nondevelopment.

2. The documents do not integrate environmental, technical, and economic information as required by the law. There are virtually no references to the economic findings in the six volumes of *Environmental Analysis*; nor is there any discussion or reference to the environmental findings in the three volumes of *Economic Analysis*.

3. The *Economic Analysis*, itself, is inadequate, incomplete, and in some places, just plain wrong. The findings summarized in Volume I of *Economic Analysis* raise assumptions to the status of conclusions, and in at least one crucial instance present findings which are quite inconsistent with the supporting data.

4. The discussion of relevant alternatives is incomplete because the implications of development of a gas pipeline which will be built through Canada to transport North Slope gas are not incorporated into comparison of the alternative Alaskan and Canadian oil transport systems.

¹ National Environmental Policy Act of 1969, Title I, Section 102(B).

² *Ibid.*, Section 102(A).

³ These documents are: Department of Interior, *The Final Environmental Impact Statement on the Proposed Trans Alaska Pipeline*, Washington, March 1972, hereafter referred to as *Environmental Analysis*; and Department of Interior, *An Analysis of the Economic and Security Aspects of the Trans Alaska Pipeline*, Washington, March 1972, hereafter referred to as *Economic Analysis*.

In this evaluation, I will first present a critical review of the three volumes of *Economic Analysis*. I will then turn to the question of how environmental impact data on alternatives can be presented in a systematic way and how this information can be integrated with economic data in a manner which makes clear to the decision maker the implications of his choice from among the alternatives.

For the most part, in the sections that follow, I rely on data used by the Department of the Interior in its analysis. This is both a strength and a weakness of my evaluation. It is a strength in that it permits me to demonstrate that the authors of the documents have not made adequate use of their own information. But it is a weakness in that I have foregone the opportunity (with one or two exceptions where the data deficiencies were most glaring) to examine critically their data and methods. This evaluation, then, is primarily a two-pronged effort to determine, first, whether the conclusions and findings contained in these documents are adequately supported by the data employed and, second, to determine what can be learned by combining existing analytical techniques and conceptual frameworks with that data.

II. THE ECONOMIC ANALYSIS

This section deals with four major issues: the resource savings or net economic benefits stemming from development of North Slope oil; the economic costs of delaying or postponing development either to obtain more information or to arrange for an alternative route; the national security implications of a decision not to develop North Slope oil; and the analysis of the balance of payments effects of development. In each of these areas the Department of Interior's analysis as reported in the *Economic Analysis* is either shallow and incomplete, conceptually faulty, or erroneous. Hence, conclusions based on that analysis could result in serious mistakes and harm to the economy and/or the environment.

A. Resource Saving

The concept of resource saving or benefit is fundamental to any analysis of policy alternatives with respect to the development of North Slope oil. The issue posed by the application for a permit for the pipeline is: are the economic benefits associated with development of the oil field sufficiently large to justify incurring the environmental risks and unavoidable damages which are identified in *Environmental Analysis*? In other words, are the economic benefits that would be foregone by not developing the North Slope oil too big a price to pay for preserving the Alaskan environment? Either way the question is asked, we must attempt to measure net economic benefits of development.

Not only is the concept of economic benefits fundamental to the question of development vs. preservation, but it enters into any consideration of alternative transportation modes and alternative routes for bringing North Slope oil to its point of use, as well. Just as the environmental damages may be different for different routes, so may the net economic benefits depend on the route chosen. The question of whether to develop the oil, thus, cannot be separated from the question of what route should be used.

Equation 1 defines net benefits. (1) $N = B - C$ where N is net benefits, B is the benefit or the value of the oil produced, and C is the resource cost of producing the oil, all in dollars. Net benefits must be calculated for each of the possible alternative routes. If N is negative for all routes, then it is clear that the North Slope oil should not be developed. If net benefits are negative for all but one of the routes, then we must attempt, for the route with positive benefits, to compare the benefits with the environmental damages associated with that route. If the net benefits are positive for several of the alternatives evaluated, the analysis will be more complex.⁴ If there are two routes with positive net benefits, one of which has higher benefits but also higher environmental damages, then the decision must involve an assessment of environmental damages vs. economic benefits. But if one route has the same or higher net benefits and lower environmental damages, it is clearly preferable.

Let us now review the analysis of net benefits as reported in Appendix H and Appendix K-3 of *Economic Analysis*. That analysis assumes that, if North Slope oil is delivered to the West Coast, it will displace equal quantities

⁴ These issues are discussed more fully in Section IV below.

of imports from the Middle East to that market, and that the oil will be sold without changing the market price. Hence the gross benefit (B) of North Slope oil is the savings in resources otherwise spent for imported oil. This resource savings is the resource cost of obtaining an equal quantity of oil from the next cheapest alternative, i.e. Middle East imports.⁵ Call this C_A . Then the net benefit or real resource savings of delivering North Slope oil via TAP is given by equation (2):

$$(2) N_{TAP} = C_A - C_{TAP}$$

where C_{TAP} is the resource cost of developing North Slope oil and delivering it via TAP to the West Coast.

The impact statement provides three different estimates of the net benefits of developing TAP. These are summarized in Table II-1. All the estimates are based on the same cost of alternative, i.e., the \$2.80 figure provided by the Council of Economic Advisors (See Appendix K-3). The differences in estimates of net benefits are attributable to different assumptions with respect to costs of production and transportation. The range of estimates of net benefits is from \$1.45 per barrel to \$1.70 per barrel.

TABLE II-1.—NET BENEFITS OF TAPS—AS ESTIMATED IN ECONOMIC ANALYSIS

Cost of alternative supply (C_A).....	\$2.80	\$2.80	\$2.80
Cost of Taps oil (C_{TAP}):			
Production.....	\$0.23-0.26	\$0.30	\$0.30
Gathering.....		\$0.30	\$0.30
Pipeline.....	\$0.66-0.80	\$0.05	\$0.05
Tanker.....	\$0.21-0.24	\$0.30	\$0.30
Total costs.....	\$1.10-1.30	\$1.25	\$1.35
Net benefits (N).....	\$1.50-1.70	\$1.55	\$1.45

¹ Economic Analysis, p. K-3-4.

² Economic Analysis, app. K-2.

³ Economic Analysis, p. H-2.

Since these estimates are a basic part of the economic analysis of TAP, they deserve serious scrutiny. But such scrutiny is made difficult by lack of references in *Economic Analysis* to the sources of key pieces of data. There are three questions to be raised about these estimates.

(1) *Tanker costs*.—The Council of Economic Advisors uses a range of \$0.21-0.24 per barrel, but does not provide a source (Appendix K-3, p. 4). Appendix K-2 provides a review of a number of independent estimates of tanker transportation costs, and presents a best estimate of \$0.30 per barrel (Appendix K-2, p. 7). This would reduce the upper end of the range of possible benefits from \$1.70 per barrel to something closer to \$1.60 per barrel.

If the Council's estimate of \$0.21-0.24 per barrel is based on foreign flag costs, this is invalid, since the Jones Act will require shipment in higher-cost U.S. flag vessels. These higher tanker rates represent a real resource cost to the U.S. and must be included in any economic analysis attempting to measure real resource savings.

(2) *The cost of alternatives*.—Appendix K-3 estimates the resource cost of Middle East oil delivered to Los Angeles in 1975 to be \$2.80 per barrel. This figure is contained in a letter from Chairman McCracken of the Council of Economic Advisors dated August 6, 1971. The source for this figure is not reported. Cicchetti provides a carefully documented estimate of the resource cost which, at \$2.01 per barrel in 1975, is considerably lower than Dr. McCracken's.⁶ His estimate is based on the most recent agreements with OPEC countries regarding increases in taxes or royalties between now and 1975. Furthermore Cicchetti takes account of the fact that posted prices for foreign

⁵ The alternative cost concept of benefits is described in Otto Eckstein, *Water Resource Development*, Harvard University Press, 1958, pp. 52-53; in Water Resources Council, *Proposed Standards for Planning Water and Land Resources*, Section III-B, and Peter O. Steiner "The Role of Alternative Cost in Project Design and Selection," *Quarterly Journal of Economics*, pp. 417-430.

⁶ Charles J. Cicchetti, *Arctic Oil: Economic and Environmental Analysis of Alternative Transportation Systems*, Review Draft, dated December 15, 1971. See Pages III-21 to III-23.

crudes are used to determine taxes (which he indicates have been about 50 percent of the posted price historically) but that posted and actual prices differ substantially. Cicchetti's low estimate also reflects projected decreases in tanker costs over this period. His figure probably should be interpreted as a lower-bound estimate of the true value. On the other hand the Council's figure of \$2.80 is almost certainly too high, since it appears to be based incorrectly upon the higher posted prices rather than actual prices.

Since the analysis of net benefits is very sensitive to the projected cost of imported oil, and since there is uncertainty on this point, I will present calculations based on Cicchetti's estimated of \$2.01 per barrels (labelled as Lower Estimate) as well as upon a figure of \$2.40 per barrel. The latter figure "splits the difference between Cicchetti and the Council of Economic Advisors, and can be used to determine the sensitivity of any conclusions to changes in this controversial parameter."

(3) *Production and Gathering Costs.*—The Council of Economic Advisors has used a figure of \$0.23–0.26 per barrel for production costs, again without indicating its source (Appendix K-3, p. 4). The Department of Interior does not attempt an independent estimate of these costs but reviews existing studies and picks out a middle or "best estimate value of \$0.30 from the range of estimates (Appendix K-1, p. 10). To this the Department adds \$0.05 per barrel for a gathering charge, for a total of \$0.35 (Appendix H, p. 2). The effect of using the Council's figure is to increase the calculated net benefits of TAP. I will use Department of Interior's estimate of \$0.35 below. The sensitivity of our conclusions to this assumption can be tested by reference to the alternative calculations of benefits based on a cost of alternative of \$2.40 since this figure raises calculated net benefits about four times as much as would using the lower production cost figure.

Table II-2 shows the effects of taking these adjustments into account. In the first column, the cost of alternative supply (CA) is Cicchetti's lower estimate of \$2.01 per barrel. The \$2.40 per barrel is used in the second column. The costs of TAP oil are based on figures which lie within the range of estimates shown in Table II-1 and discussed above. In addition, pipeline cost has been set at \$0.70 per barrel since the Department of Interior, itself, has suggested the lower \$0.60 figure is out-of-date (Appendix H, p. 1).

As the first column of Table II-2 shows, the effect of these adjustments (and principally the adjustment to costs of alternative supplies) is to reduce the net benefits by 50–60 percent. The estimate of benefits in the first column

TABLE II-2—NET BENEFITS OF TAPS—REVISED DATA

	Low estimate	Middle estimate
Cost of alternative supply (CA).....	2.01	2.40
Cost of TAPS oil (CTAPS):		
Production and gathering.....	.35	.35
Pipeline.....	.70	.70
Tanker.....	.30	.30
Total.....	1.35	1.35
Net benefits (N).....	.66	1.05

is thus reduced to \$0.66 per barrel. In the second column the estimated benefits are \$1.05 per barrel, a figure 25–30 percent below the figures presented by the Council of Economic Advisors. Estimates of the total savings and the present value of resource savings must be reduced correspondingly. (See Appendix H, p. 3 and Finding IV-1). At an annual production rate of 2 million barrels per day (BPD), then the net economic benefits are between \$180–\$770 million per year.

It was suggested above that a complete economic analysis would require making comparable evaluations of alternative routes and transportation modes.

As will be noted later, calculations of real resource cost savings, the cost of delay, and balance of payments impact are sensitive to the assumed cost of imported oil. But the economic comparison of TAP and the Canadian alternative Mackenzie Valley Pipeline (MVPL) is not affected by our assumptions.

No such comparable evaluation is presented in the impact statement.⁸ Net economic benefits for alternative routes can be calculated and compared using the framework described above. Table II-3 provides estimates of the net benefits of the Mackenzie Valley Pipeline calculated in this manner. The cost estimates for this alternative come from the impact statement (See Appendix H, p. 2). Since the MVPL would deliver oil to the Chicago market, the relevant alternative for calculating C_A is the cost of delivering Middle East oil to the same market. Although the routes are different, the costs of delivering this oil to New York are the same as for Los Angeles delivery. To this figure must be added a \$0.25 per barrel pipeline charge to Chicago (see Appendix K-2, p. 7). As above, we use a resource cost of the alternative supply to Chicago of \$2.26 per barrel as a lower estimate with an alternative middle estimate of \$2.65 per barrel.

As Table II-3 shows, net benefits are \$0.71 per barrel, or \$1.10 per barrel under the alternative assumptions. This compares with \$0.66 per barrel or \$1.05 per barrel for TAP. This difference is net benefits, although not significant given the range of possible error in the pipeline cost estimates, is independent of the assumptions about the cost of imported oil. It demonstrates by appropriate economic analysis that the TAP route and the MVPL alternative stand on roughly equal footing in purely economic terms.

TABLE II-3.—NET BENEFITS OF MVPL¹

	Lower estimate	Middle estimate
Cost of alternative supply (C_A).....	2.01	2.4
Delivered to New York.....	2.01	2.40
Pipeline to Chicago.....	.25	.25
Total.....	2.26	2.65
Cost of MVPL (CMVPL):		
Production and gathering.....	.35	.35
Pipeline.....	1.20	1.20
Total.....	1.55	1.55
Net benefits (N).....	.71	1.10

¹ Economic Analysis, app. C, p. 19; app. H, p. 2.

There is, however, one serious qualification that must be entered here. Throughout the impact statement, there appear statements to the effect that in the early years of the TAP life, TAP would create an excess supply of oil on the West Coast.⁹ The existence of such an excess supply means that additional resource costs must be incurred to transport the excess oil to alternative markets. The effect will be to reduce the net benefits per barrel of TAP. This problem needs more careful and explicit treatment than it has been given in *Economic Analysis*.

Two further points should be made. First, the medium value supply and demand forecasts for District V that are provided in Appendix L-3 (p. 17), when combined with the TAP production schedule shown in Appendix E (p. 16) do not show any excess supply arising with the addition of TAP. This is inconsistent with the repeated mention of the likelihood of excess supply and the need to export TAP oil during the early years of the pipeline life. In this respect *Economic Analysis* is internally inconsistent and contradictory. Inconsistencies such as this point out the need for further and more careful analysis.

Second, Finding III (which states that delivery of oil to the West Coast is the objective of public policy) is unwarranted. This statement simply assumes

⁸ Appendix C provides a comparison of TAP with a Mackenzie Valley Pipeline (MVPL) which utilizes the "net back" concept. Since net back is based on market prices at the point of delivery, it is a better indicator of profitability to the companies than it is of net economic benefits. The costs of alternatives do not enter into the calculation of net back. Rather, differences in net back arise because of differences in market price; and these price differentials are the result of historical accident and market imperfection.

⁹ Finding VI-4; see also Appendix C, pp. 14; 23-24; Appendix D, p. 4; Appendix F, pp. 20-22; Appendix N-5, p. 5.

that objective thereby raising an assumption to the status of a conclusion. Analysis to show that public policy should establish the objective of delivery of North Slope oil to the West Coast is never provided. In fact the likelihood of excess supply on the West Coast with TAP is somewhat inconsistent with this finding. All told, the proper use of the data provided by the Department of Interior suggests that on economic terms we should be indifferent as between delivering oil to the West Coast or the Midwest, or should actually prefer the latter alternative.

To summarize the findings of this section:

- (1) The *Economic Analysis* statement has used the proper conceptual framework for estimating the resource savings or net benefits of TAP.
- (2) Three undocumented pieces of data were used in these estimates. The net effect appears to be to bias upwards the estimate of net benefits by at least 50 percent (from \$1.05 to \$1.60) and perhaps by more than 100 percent (from \$0.66 to \$1.60).
 - a. Production in gathering costs used by the Council of Economic Advisors in its calculations of net benefits are \$0.09 to 0.12 per barrel lower than those provided elsewhere in *Economic Analysis*.
 - b. Tanker costs appear to be overstated.
 - c. The costs of alternative supplies is \$0.79 per barrel higher than a well-documented estimate from another source.
- (3) The statement does not calculate the net benefits of the Mackenzie Valley pipeline alternative for comparative purposes. When this is done in an appropriate manner, the data reveals a slight preference for the Canadian alternative, about \$0.95 per barrel. But this is well within the likely margin of error of estimates.
- (4) The economic analysis statement is inconsistent in its treatment of the possibility of excess supply of oil in District V. Furthermore, there is no analysis of the effect of excess supply on the estimates of the net benefits of TAP. Although this problem is not analyzed here, the effect would be to reduce the net benefits of TAP and tend to increase the relative net benefits for MVPL.

B. The Costs of Delay

The economic comparison of TAP and MVPL presented above abstracted from one relevant factor: possible differences in the timing of production. Any benefit received today is more valuable today than a benefit to be received a year from now. In other words, one is willing to pay more today to receive a benefit immediately than to receive a guaranteed right to an equal sized benefit one year from now. The present value of a stream of benefits is smaller, other things equal, the farther in the future the starting date for receiving the stream of benefits. And if circumstances cause a delay in the commencement of this stream of benefits, the cost of that delay is the reduction in the present value of the stream of benefits.

The cost of delay factor can enter into the economic analysis in two ways. First, if TAP were approved now, it is estimated that oil delivery would begin in 1975; but if it is decided to use the MVPL route, delivery of oil may be delayed by two to three years,¹⁰ because of such factors as the need for additional design and planning of the route and negotiation with the Canadian Government. This difference in time patterns can affect the economic comparisons of TAP and MVPL. Alternatively, if it were decided to defer approval of TAP for one or more years, for example to gather more information, this postponement would entail a reduction in the present value of the stream of benefits from TAP. Hence, in either case, it is important that we analyze carefully the costs of delay.

The Statement of Findings in *Economic Analysis* includes the following statement: "A year's delay of delivery of north slope oil forfeits the possible resource cost saving of \$1.50 to \$1.70 per barrel or \$1.1-1.25 billion in resource costs" (Finding IV, 2). This statement is faulty in three respects. First, the Department of Interior has used an erroneous technique for calculating the total cost of one year's delay. And the effect of this error is to overstate the cost of the delay by almost a factor of two. Second, the estimate is based on a resource costs savings per barrel which I have shown to be too high by between 50 and 100 percent. And third, the statement ignores certain important benefits associated with delay which, although not easily measured in dol-

¹⁰ In the *Economic Analysis*, General Lincoln estimates a three-year delay (Appendix X-3, p. 3).

lar terms, are nevertheless real and relevant to decision-makers. I will discuss each of these points in turn.

Table II-4 is useful in considering the method of calculating the cost of one year's delay. The first line of Table II-4 shows the time pattern of production for each year, assuming that TAP is shortly approved and the first oil throughput is in 1973. See *Economic Analysis*, Appendix E, p. 16. The second and third lines show the same pattern with a one-year delay and the amount by which the total annual supply of oil is reduced in each year because of this delay. Note that although the TAP capacity is two million barrels per day, the highest shortfall in any one year is only 0.4 million barrels per day, in 1976.

TABLE II-4.—TIME PATTERNS OF LOST PRODUCTION DUE TO DELAY

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
I. TAPS production: Annual average ¹	0.3	0.7	1.0	1.2	1.3	1.5	1.7	1.9	2.0	2.0	2.0	2.0	2.0
II. TAPS production:													
1 yr delay.....	0	.3	.7	1.0	1.2	1.3	1.5	1.7	1.9	2.0	2.0	2.0	2.0
Production lost.....	.3	.4	.3	.2	.1	.2	.2	.2	.1	0	0	0	0
III. TAPS production:													
3 yr delay.....	0	0	0	.3	.7	1.0	1.2	1.3	1.5	1.7	1.9	2.0	2.0
Production lost.....	.3	.7	1.0	.9	.6	.5	.5	.6	.5	.3	.1	0	0
IV. TAPS production:													
3 yr delay accelerated output ²	0	0	0	.3	.7	1.1	1.4	1.7	1.9	2.0	2.0	2.0	2.0
Production lost.....	.3	.7	1.0	.9	.6	.4	.3	.2	0	0	0	0	0

¹ From "Economic Analysis," p. E-16.

² Million barrels per day.

³ Calculated to "catch up" with original TAPS by 1981.

The method of calculating the total cost of a one-year delay consists of three steps: first, calculating the short-fall for each year by multiplying the per-day rate given in the table by 365; second, calculating the dollar value of the resource cost associated with that year by multiplying by the resource cost savings per barrel; and third, calculating the present value as of 1973 (the start of production) of that loss. Equation 4 summarizes this.

(4)

$$\text{Cost} = \frac{(0.3 \times 365 \times \$1.50)}{(1+i)} + \frac{(0.4 \times 365 \times \$1.50)}{(1+i)^2} + \dots + \frac{(0.1 \times 365 \times \$1.50)}{(1+i)^9}$$

where cost is in billions of dollars as of the beginning of 1973. This equation makes use of the Council of Economic Advisors' figure of \$1.50 per barrel resource cost savings. One further adjustment must be taken into account. The loss of throughput at the beginning of the pipeline's life is not lost forever. It is made up at the end of the project life, which the *Economic Analysis* assumes to be 25 years. The cost given by equation (4) should be reduced by a factor representing the present value of an additional 730 million barrels of oil delivered after the year 2000. At a discount rate of 10 percent, this factor reduces the costs of delay by about 9 percent.

Table II-5 shows the results of calculations based on equation (4), assuming first a resource saving of \$1.50 per barrel, then \$0.66 and \$1.05 per barrel as calculated in the previous section. A discount rate of 10 percent was used, but other calculations showed that the results are not sensitive to the choice of discount rates between 5 and 10 percent.

TABLE II-5.—COST OF 1-YEAR DELAY IN TAPS PRODUCTION

(in billions of dollars)

	At resource cost saving of—		
	\$1.50 per barrel	\$0.66 per barrel	\$1.05 per barrel
Present value at 10 percent.....	\$2.627	\$1.112	\$1.431

As Table II-4 shows, by using a proper methodology for the Department's own data, the cost of delay is only 55 to 60 percent of the figure given in *Economic Analysis*. And using a more appropriate resource costs savings figure, the true cost is between 25 and 40 percent of that stated in *Economic Analysis*.

This raised the question of how the Department of Interior arrived at its figure on cost of delay. The only way to arrive at this figure is by performing the calculations according to equation (4) with a discount rate of 0 and by ignoring the adjustment for regained production at the end of the project life. In other words, the \$1.1-1.25 billion figure is an undiscounted sum of a stream of future costs. But if the stream is summed without discounting, it is contradictory to apply a discount factor to the regained production at the end of project life. If the costs and later gains are both calculated at a 0 discount rate, the net cost of delay is zero. In sum, the Department of Interior appears to have used a zero discount rate for the costs of delay, and in infinite discount rate for the later benefits of delay. This is very bad economics.

One of the alternatives to developing TAP now or at some later date is to develop the MVPL alternative. Since such a decision would result in a delay in the flow of North Slope oil to the American market, it is important to know the magnitude of the cost associated with that delay. Table II-6 presents the results of calculations, based on equation (4) and Table II-4, under alternative assumptions for four different variables. They are as follows:

(1) *Resource savings per barrel*.—All calculations are presented for the alternatives of \$0.65 per barrel and \$1.05 per barrel resource savings for TAP. The effect of the higher figure is to raise the costs of delay proportionately.

(2) *Three-year vs. two-year delay*.—Calculations are presented on the alternative assumptions that MVPL comes on line in 1978, with a three-year delay compared to TAP, and with only a two-year delay. The longer the delay, the higher the costs of delay.

(3) *Accelerated production*.—Calculations are presented under the alternative assumptions of no change in the shape of the production schedule and where it is assumed that the production schedule for MVPL, although delayed in starting, is accelerated.

(4) *Net advantage of MVPL*.—The costs of delay are sensitive to the relative economic advantages of MVPL vs. TAP. The calculations presented in section II-A, based on Department of Interior data, suggest that MVPL may have greater net economic benefits per barrel, perhaps \$0.05 per barrel. If this is the case, the costs of delay are reduced since, although we wait longer to get the benefits of oil, we wind up getting greater benefits. I have shown calculations based on a zero advantage and with the alternative \$0.05 and \$0.10 per barrel net advantage for MVPL reflecting, perhaps, the effect of excess supply on the West Coast. The figure with the minus sign in the right-hand column demonstrates that under some plausible conditions, delay costs nothing and in fact leads to a net gain.

Under the least favorable assumptions, Table II-6 shows that the costs of delaying in order to take advantage of an MVPL route may be as high as \$1.3 billion in present value terms. Of course, these costs must be weighed against whatever possible benefits might be associated with an MVPL route over the TAP route. But considering the likelihood that accelerated production will be possible reduces the estimated costs by 25-30 percent. If the delay is only two years, the cost is further reduced. And under the more favorable combinations of resource cost saving and economic advantage of MVPL, costs drop to under \$300 million. Finally, it should be noted that if TAP created excess supply on the West Coast between 1975 and 1985, the costs of delay would be reduced still further. This is because the adjustments necessary to accommodate the excess supply reduce the net benefits of TAP and increase the relative economic advantage of MVPL.

TABLE B-5.—COSTS OF DELAYING FOR THE MVP1 ROUTE
[In billions of dollars]

	Net resource, 0	Cost saving for MVP1, \$/BBL per barrel	Advantage, \$/BBL per barrel
I. Based on resource saving of \$1.65 per barrel for TAPS: ¹			
A. 3-yr delay:	\$2.827	\$2.614	\$2.461
No acceleration.....	.671	.475	.281
Accelerated production.....			
B. 2-yr delay:	.577	.375	.175
No acceleration.....	.416	.292	— .012
Accelerated production.....			
II. Based on resource saving of \$1.05 per barrel for TAPS: ²			
A. 3-yr delay:	1.325	1.133	.950
No acceleration.....	1.068	.873	.629
Accelerated production.....			
B. 2-yr delay:	.918	.717	.516
No acceleration.....	.652	.453	.233
Accelerated production.....			

¹ See table B-2.

² An economic gain.

The wide range of estimates provided in this Table suggest that if the possible costs of delay are to be an important factor in the ultimate decision (and the Summary of Findings in *Economic Analysis* supports this possibility), then far more research and analysis is required to narrow this range of uncertainty and provide a more accurate estimate of these costs. The analysis provided by the Department of Interior obviously does not provide this necessary data.

A final point to be considered is the positive benefits of delay *per se*. The *Environmental Analysis* contains numerous admissions that present knowledge is inadequate in many areas to fully predict or evaluate possible environmental damages.¹¹ One benefit of delay is the opportunity to carry out research and conduct studies designed to fill the more crucial information gaps. As information is collected, we should find that our greater knowledge enables us to make wiser decisions about whether to develop North Slope oil, and if so, how. The second benefit is the preservation of options or alternatives. A decision to develop is, for all intents and purposes, irreversible. But a decision to forego development or postpone development can be reversed at a later date. For example, delaying a development decision preserves the option to decide permanently against development if new information shows that the environmental damages would be unacceptable, or to leave the field undeveloped until a later date when the value of the oil might be much higher. Thus, if the real resource cost of imported oil is rising rapidly, economic calculations may favor using as much imported oil now while it is relatively cheap, and substituting North Slope oil later. This option is preferred whenever the expected percentage rate of price increase of imported oil exceeds the social rate of discount (opportunity cost of capital), used in project analysis.

C. National Security

The Department of the Interior's analysis of the national security aspects of North Slope oil development is inadequate in at least three respects: its treatment of the security implications of delivery of oil to different regions; its analysis of the timing of development and delivery of new supplies; and its investigation of alternative ways of achieving equivalent improvements in national security.

(1) General Lincoln of the Office of Emergency Preparedness writes, "Unless 500,000 B/D can be provided from the north slope, imports from eastern hemisphere sources will increase to about one-third of demand in District V by 1975 and 46 percent by 1980. This is unacceptable in terms of national security."¹² No justification is offered for the underlined assertion. Common sense tells us that if two million barrels per day of North Slope oil are delivered to District V to reduce its dependence on foreign oil, that oil cannot be delivered somewhere else, for example, to Chicago. The Department of Interior data show that unless 2 million barrels per day can be provided to Chicago

¹¹ See especially Vol. V, pp. 8-10.

¹² *Economic Analysis*, Appendix X-2, p. 1, emphasis added.

from the North Slope, the east coast (District I) will find its dependence on non-Canadian foreign oil increased from 75 percent to 92 percent.¹³ If 45 percent is unacceptable for District V, 93 percent surely must be unacceptable for District I. This *reductio ad absurdum* should make the point that the implications of delivery of oil to different geographic regions requires more analysis than has been given it by General Lincoln.

The Department of Interior has attempted to provide a national security rationale for delivering North Slope oil to the West Coast. Appendix D of the *Economic Analysis* states that because District V (West Coast) has the smallest of the three deficits (compared with Districts I and II), North Slope oil would have the greatest relative impact on that district.¹⁴ But this line of reasoning also will not stand close scrutiny.

The objective of introducing national security considerations is to minimize the disruption to industry and to the economy which would accompany the loss of all or a substantial portion of the supply of imported oil. Consider two hypothetical situations. In the first, three regions of a country have the same relative dependence on foreign sources of oil, let us say for example, 30 percent. If foreign supplies are cut off, the three regions must each adjust to the same degree by some combination of increased domestic supply and reduced consumption. In the alternative case, suppose two of the regions were self-sufficient while the third was totally dependent on foreign oil. If foreign supplies are lost, in addition to the adjustments described above, arrangements must be made to transfer oil from the other two regions to the third region. This adds to the cost of adjustment to a loss of foreign supply, and may take a considerable period of time to accomplish (for example, if pipelines must be constructed). This, in fact, is the situation which the Department of Interior and the Office of Emergency Preparedness advocate placing us in.

According to Table C-1¹⁵ the delivery of North Slope oil to District V will result in the following pattern of relative dependency on non-Canadian foreign oil in 1980: District I—93 percent; District II—1 percent; District V—0 percent.

The alternative pattern of relative dependency with North Slope oil going to Chicago is as follows: District I—75 percent; District II—1 percent; District V—51 percent.

If other things were equal, it would appear preferable, on national security grounds, to use the North Slope oil to ease the relative dependence of the East Coast on non-Canadian imported oil. That is, unless one were prepared to argue that the economy and industry of the East Coast is significantly less essential for the national security than the industry and economy of the West Coast.

(2) The second national security question is the matter of the timing of additional supplies of oil. The *Economic Analysis* argues that, from a national security point of view, it is important to get North Slope oil to the lower 48 states as soon as possible: the Alaskan pipeline will deliver oil three years sooner than the MVPL alternative; hence, early completion of the Alaskan pipeline must be considered an important national security objective. This question is very closely related to the economic costs of delay, discussed above, since the results are sensitive to the expected time-pattern of production. Recall that it is not expected that TAP will be operative until 1975. And, as Table II-4 shows, production would start at a low level (about 3 million barrels per day) in 1975, reaching full capacity (2 million barrels per day) in 1983.

The relevant question is, by how much will TAP actually reduce our dependence on non-Canadian imports when we take into consideration the phased production schedule described above? This question is answered in Table II-7. This table is based on data from *Economic Analysis* (Appendix C, p. 12). The first column of the table shows the projected dependence of the U.S. on non-Canadian imports for each year from 1974 to 1985. This is based on the middle projection of Table C-1. The second column shows the percentage of that dependence which would be supplied by TAP beginning in 1975. The third column shows the differential impact of the two alternatives on foreign dependence.

¹³ *Economic Analysis*, Appendix C, p. 12.

¹⁴ *Economic Analysis*, Appendix D, p. 4.

¹⁵ *Economic Analysis*, Appendix C, p. 12.

The major impact of delay would be felt in an increased dependence during the three years 1976-78. In these years TAP would supply 12-15 percentage points more of the total U.S. dependence than would MVPL coming on line at a later date. In all other years the difference between the two alternatives is minor—six percentage points or less.

TABLE II-7.—IMPACT OF NORTH SLOPE OIL ON U.S. DEPENDENCE ON NON-CANADIAN IMPORTS

Year	Dependence without North Slope ¹ (million barrels per day)	Percentage supplied by TAPS ² (percent)	Percentage supplied by MVPL ² (percent)	Difference (percent)
1974	4,290	0	0	0
1975	4,000	6	0	6
1976	3,790	12	0	12
1977	6,730	15	0	15
1978	7,810	15	4	11
1979	9,070	14	8	6
1980	10,530	14	9	5
1981	12,240	14	10	4
1982	13,220	13	9	4
1983	15,510	12	9	3
1984	19,180	10	9	1
1985	22,270	9	9	0

¹ "Economic Analysis," p. C-12, and interpolated with assumed constant growth rate—middle projection.
² Production schedule taken from table II-4 above.

How serious is this difference? Since the Department of Interior has not taken the trouble to determine the size of this differential in dependence, it is in no position to assess its significance. The significance of this differential depends on two sets of factors—whether or not the time of highest differential coincides with the period of highest risk (i.e. highest probability of major stoppage of Middle East imports), and the costs of adjusting to or compensating for a major disruption during this period, if it should occur. There is no analysis presented in *Economic Analysis* of the first factor; hence, no evaluation is possible. This second factor is discussed below.

(3) The third national security question is concerned with means of supplying additional oil to compensate for any short-term threat to security because of delayed delivery of North Slope oil. The *Economic Analysis* again does not properly address this problem. To compare TAP and MVPL adequately in terms of their national security implications, the relevant question is "what steps can be taken to provide the additional security equivalent to that which would be provided by TAP?" In other words, one must identify the marginal or incremental benefits that TAP provides for national security, and compare this with the incremental or marginal costs of providing equivalent protection by other means. These are manageable and answerable questions. But they are not answered by the *Economic Analysis*.

The Cabinet Task Force on Oil Import Control has, by contrast, studied alternative means for meeting the national security objectives of obtaining secure oil, with specific reference to the costs.¹⁶ More significantly, it appears that the national security aspects of the timing of North Slope oil delivery may be an unimportant question. The Canadian Government has offered to supply the U.S. with additional Canadian (secure) oil during the time when North Slope oil deliveries are delayed because of study and development of MVPL.¹⁷ As shown in Table II-4, this would require additional Canadian imports of 0.3 million barrels per day in 1975, 0.7 million barrels per day in 1976, 1.0 million barrels per day in 1977, and decreasing amounts thereafter. The cost of obtaining an increment to national security equivalent to that provided by TAP would be the added resource cost, if any, of Canadian imports relative to importing equivalent quantities of Mideast oil.

¹⁶ Cabinet Task Force on Oil Import Control, *The Oil Import Question*, Washington, 1970.

¹⁷ Statement of The Honorable Donald S. Macdonald, Minister of Energy, Mines, and Resources, in the Canadian House of Commons, April 9, 1972.

D. Balance of Payments

There are two questions regarding the analysis of the balance of payments in *Economic Analysis*. The first is: "What has really been measured?" The second is: "Has this been measured accurately or reasonably?"

The *Economic Analysis* predicts that, after taking into account the effects of reduced foreign exchange earnings on our exports to oil exporting countries, there will be a net reduction in foreign spending of the U.S. of between \$470 to \$680 million dollars per year as of 1980 because of development of TAP. This is repeatedly referred to as a balance of payments benefit.¹⁸ After dividing these figures by the annual throughput of 730 million barrels per year, a balance of payments benefit per barrel of \$0.65 to \$0.94 is calculated. But this is not a benefit which can be added to or compared with other benefits and costs (such as the resource cost savings) of TAP, but only an estimate of the impact of the pipeline on the U.S. balance of payments accounts under certain assumptions. What has been measured is a change in the net international monetary flows associated with the reduction in the flows of international currency to foreigners to pay for our imports of oil. In contrast, economic benefits are the savings in the expenditure of real resources associated with obtaining a given supply of oil. To the extent that changes in monetary flows reflect changes in the real resource cost of obtaining oil, this has already been measured and counted as a benefit in the real resource cost savings counted above. To add this \$0.64 to \$0.93 per barrel figure calculated above to these real resource cost savings would, thus, involve counting the same benefit twice.

Two qualifications must, however, be made. First, a measurement of the balance payment impact of the development of North Slope oil is or could be very useful in its own right. Such an impact measure could be used to predict the possible need for corrective balance of payments policies—for example, exchange rate changes. In more general terms, such an impact measure might be used to predict the direction and size of a possible change in the terms of trade needed to keep a balance of payments in equilibrium, other things being equal. Second, the above discussion should not be construed as claiming that balance of payment benefits do not exist. They do; but they cannot be identified and measured by the technique used in *Economic Analysis*.

Models of the relationship between international trade and economic growth show that any economic change which augments the supply of resources for a country can have effects on trade patterns, the balance of payments, the terms of trade, and welfare. These welfare effects, if positive, would be benefits. The development of North Slope oil can be construed as an example of anti-trade biased growth in factor supplies.¹⁹ Other things equal, when anti-trade biased growth occurs, the equilibrium net barter terms of trade shift in favor of the country experiencing the growth.²⁰ When the terms of trade improve, a nation finds that it needs to expend less of its own resources in the production of export goods in order to maintain a given level of imports. This reduction in the relative cost of imported goods raises real incomes in that country and can be counted as a benefit separate from the direct benefits associated with real resource cost savings. However, defining and measuring these indirect terms of trade benefits poses some very difficult conceptual and empirical problems which have not yet been satisfactorily solved.

Granted that *Economic Analysis* has measured a balance of payment impact rather than a benefit, there remains the question of whether it has measured this impact correctly. Models of international trade show that the impact of a given change in purchases of foreign oil will depend on the marginal propensities to import with respect to income levels in the two countries. People in the oil exporting country experience a decrease in their income levels as exports decline, and respond in part by decreasing their imports. Similarly, in the oil importing country, substitution of low-cost domestic oil raises real income levels. People respond by spending part of the increase in their real incomes on imported goods. The empirical models used in the impact study bear no relationship to the theoretical models described here. Lacking data on marginal propensities to import out of income, *Economic Analysis* falls back on

¹⁸ *Economic Analysis*, Appendix F, pp. 2, 3, 14, 21.

¹⁹ For further explanation, see my *International Trade: An Introduction to Method and Theory*. New York: Harper & Row, 1971, Chapter 12.

²⁰ The balance of payments impact measured by the Department of Interior could be used to predict the magnitude of the change in net barter terms of trade.

the assumption that average propensities and marginal propensities are equal (Appendix F, p. 3). But the *Economic Analysis* also fails to produce data on the average propensities to import out of income. Rather, it uses an import ratio which is simply the proportion of each country's imports which came from the United States. One is left with the feeling that this technique is better than drawing numbers out of a hat, but with no idea of whether this feeling is justified in fact.

The *Economic Analysis* has, in addition, ignored the dollar outflow associated with profits earned by British Petroleum, one of the participating companies. These profits will be substantial.

E. Allocating the "Unallocated Balance"

Appendix H of the *Economic Analysis*, in discussing the "size and distribution of costs and returns," appears to ignore or endeavor to obfuscate a simple economic reality. For here, the authors of the analysis have forgotten or rejected one of the more important words in the economist's vocabulary—"profits." Instead, the phrase "unallocated balance" is euphemistically employed.

The data from Appendix H, Table VIII-1 of *Economic Analysis* are reproduced here in slightly rearranged form.

TABLE II-S.—Costs and profits of TAPS

Revenues to oil companies: Delivered price—Los Angeles	\$3. 31
Expenses of oil companies:	
Production	.30
Lease bonus	.33
Royalty	.46
Gathering charge	.05
Pipeline charge	.70
Tanker charge	.30
Total	2.14
Profit	1.17

This Table shows the per barrel revenues and expenses of the oil companies which are associated with delivering North Slope oil to the West Coast market. To quote *Economic Analysis*, "The 'unallocated' balance is the difference between the price and the total of all other itemized charges." (Appendix H, p. 3). To put the proper name on it, this is profit. Now there is nothing wrong with profits, *per se*; but any analysis which goes on for seven pages discussing the size and distribution of costs and returns, and only once mentions profits, is seriously distorting the reality of the situation.

It is a widely held value in this country that when the government commits resources to a particular action, by spending money, by permitting publicly-owned land to be used, or permitting the environment to be placed at risk, the objective should be to gain benefits for the populace as a whole, rather than for any small special interest group. To put it differently, we, as a society, are not indifferent as to the way the costs and benefits of government actions are distributed among ourselves. As a society, we articulate a preference for public projects and programs which distribute benefits widely rather than narrowly, and which tend to favor middle- and low-income groups rather than the more affluent in the society. The question of the distribution of benefits and costs of public programs has thus been a legitimate concern of economists for a long time.²¹ It is, accordingly, appropriate, if not obligatory, that the distribution of costs and benefits associated with building TAP be considered as part of the economic analysis of the project. The analysis carried out in Appendix H of *Economic Analysis* is not adequate in this regard.

The one thing that can be said for this analysis is that it correctly identifies who will not benefit from TAP: "However, . . . analysis . . . suggests that the mechanisms of the oil import quota system would keep supply and demand in

²¹ For recent writings on this subject, see my "Project Design and Evaluation with Multiple Objectives" in U.S. Congress, Joint Economic Committee, Subcommittee on Economy in Government, *The Analysis and Evaluation of Public Expenditures: The PFB System, A Compendium of Papers*, Washington, 1969, pp. 565-578, and references therein.

balance at current price, so that prices would not fall and there would be no consumer saving" (Appendix H, p. 3). Rather, the benefit accrues as an "unallocated balance" or profit to the oil companies. Furthermore, this discussion fails to point out that favorable tax treatment of oil earnings reduces the federal income tax liability of most oil companies to well under 10 percent of net income. So it appears that companies will get to keep a very large portion of the "unallocated balance." But in a most curious paragraph, the authors of this analysis attempt to soften the blow to the consumer.

Thus, the consumer would benefit not from lower prices, but rather from indirect effects. Principal among these will be the security of supply, as reflected in reduced dependence on imports from the western [sic] hemisphere. Also important would be the secondary effect of the resource cost saving, as that money rediffuses through the economy rather than being lost to foreign interests. Other indirect effects could be a deferral of upward pressure on crude oil prices, due to the substantial influence of the relatively low-cost Alaskan oil. Some benefit might possibly be derived from increased domestic exploration activity which could result from the improved cash-flow and capital situation of the oil companies. (Appendix H, p. 4).

The real security argument has been discussed above. The incremental benefit to security of supply is likely to be quite small. And the price tag to consumers is very high. The Cabinet Task Force estimated the costs to consumers for the national security purchased by the Import Quota Program was about \$5 billion per year.²² The statement about money rediffusing through the economy is really the archaic and offensive notion of "trickle-down" benefits in disguise. To put it more baldly, the document suggests that, when the stockholders spend their dividends, this may provide some useful employment for members of the lower classes. But in an economy at or close to full employment, expenditures by any one group do not create benefits, but simply divert resources from one use to another. If consumers were provided the benefits in the form of lower prices, or the government captured the benefits through taxes, spending would similarly diffuse through the economy. We can no more identify benefits associated with that process than we can when stockholders spend their dividends. But we can judge which of these distributions of the benefits of TAP is to be preferred on grounds of equity or fairness.

F. "Benefits" From Construction of Tankers

Finding VI, 3 of the *Economic Analysis* asserts that "[c]onstruction of 33 new tankers required in the United States shipyards will generate substantial employment and income to those shipyards". This statement is reminiscent of Frederick Bastiat's "Petition of the Candle Makers".²³ To imply that the employment of substantial amounts of labor in constructing new ships to carry oil is in some sense beneficial is to turn the economic world on its head. That labor has already been counted as a cost, and rightly so, in calculating the costs of transporting North Slope oil via TAP and the tanker route. And that calculation recognized the economic reality that, were it not for the construction of the tankers, the labor involved could be put to use producing something else of value.

III. SYSTEMATIC ANALYSIS OF ENVIRONMENTAL FACTORS

In this section, I will present a framework for bringing together information on a number of diverse and non-commensurable environmental effects in order to compare alternatives on environmental grounds. I will argue that this framework can assist the decisionmaker in comparing alternatives and will, in fact, compel him to gather and present data in an appropriate form and to think systematically about his choices. The *Environmental Analysis* does not make adequate use of such a framework.

²² Cabinet Task Force on Oil Import Control, *The Oil Import Question*, Washington, 1970.

²³ Reprinted in Paul A. Samuelson, ed. *Readings in Economics*, 6th ed. Bastiat was a nineteenth century French journalist who effectively satirized the protectionist sentiments of the day in a fictional petition to require that all windows in Paris be boarded up or curtained to block out that cheap, foreign source of illumination, the sun. Increased employment of candle makers, and thus, prosperity for the nation, would result.

A. A Framework

Environmental policy presents an excellent example of the difficulties of decision making and choice where non-commensurable effects are present. The two primary alternative pipeline routes (TAP and MVPL) can be compared in terms of a number of different environmental impacts and characteristics; but because these impacts or characteristics are as unlike as apples and oranges, they cannot simply be added together to obtain a single measure of the overall environmental impact of the project. Problems of non-commensurability arise, at least potentially, whenever two things that we might want to compare are measured in different dimensions or different units.

Non-commensurability is an almost universal characteristic. It is instructive to reflect on the ways by which non-commensurability problems are solved when they arise. Consider the problem posed by two piles, one of apples and one of oranges. We have measures of the magnitudes of these unlike objects but these measures are in non-commensurate units, i.e., numbers representing the counts of the different objects in the two piles. Commensurability can be achieved only by defining a common measurement dimension, and then establishing some rule or system of weights for converting the non-commensurable units into the common dimension of measurement. For example, if weight in pounds is the common dimension, the method of converting counts of apples and oranges into the common dimension involves measuring the weights of the two piles. In the broadest sense, this is the establishment of values. This is made more clear by considering another common dimension, i.e., money value, where the method of converting to the common measure involves prices or values. Apples and oranges are made commensurate by adding their money values, as represented by their prices.

The important thing to note in this discussion is the distinction between measurement, which can take place in non-commensurate units, and valuation, which involves use of weights, prices, and the like, in converting non-commensurable measures into commensurable ones.

One of the difficulties faced by the authors of *Environmental Analysis* is that there is no set of weights or values which can be used to convert non-commensurate measures of different kinds of environmental impacts (for example, to the marine or terrestrial environment) into a single measure of environmental hazard. Thus, for example, *Environmental Analysis* concludes that, "no single generalized route appears to be superior in all respects to any other." (Vol. I, p. 320). Without a system of weights for making commensurate the different aspects of alternative routes, no definitive statement can be made about the choice among alternatives. But the lack of a readily accepted system of valuation or weighing should not cause the end of systematic inquiry and comparison of alternatives, as it apparently did in the *Environmental Analysis*.

There are two ways in which a more systematic analysis may be able to sharpen our understanding of the problem of commensurability.²⁴ Both these approaches can be illustrated through the use of the example outlined in Table III-1 which presents a list of five alternative projects. Assume that our task is to choose the project with the least environmental damage. Further, assume, for simplicity, that there are only two identifiable adverse environmental effects of these projects. To make the example more concrete, we will assume that adverse characteristic A is the unavoidable disruption of the Arctic terrain, and that it can be measured by the number of miles of the route traversing permafrost zones. We will further assume that adverse characteristic B is the threatened damage to the environment associated with pipeline ruptures caused by earthquakes, and that the characteristic can be measured by the probability that an earthquake of given magnitude will occur during some specified time period. No way is provided for combining the measures of these two characteristics into a single measure of overall environmental impact for

²⁴These approaches are described and evaluated in the context of the analysis of public investment projects with multiple objectives in my, "Project Design and Evaluation With Multiple Objectives," in the U.S. Congress, Joint Economic Committee, Subcommittee on Economy in Government, *The Analysis and Evaluation of Public Expenditures: The PPB System, A Compendium of Papers*, Washington 1969, pp. 565-578.

each project. However, presentation of the available information in this tableau can help us think more systematically about the choice problems involved.

A study of the table shows that we do not need a comprehensive measure of environmental impact to rule out one of the five projects as definitely inferior. Project (2) should always be chosen over Project (1) since it involves less of both characteristic A and characteristic B. In technical terms, Project (1) is dominated by Project (2) in any rational ranking of the five projects. Nevertheless, a difficult choice problem still remains among the other four projects. In moving from Project (2) to Project (5), a reduction in the amount of characteristic B (seismic risk) can only be achieved at the cost of more of adverse characteristic A (unavoidable terrain disruption).

TABLE III-1.—HYPOTHETICAL PROJECTS WITH NONCOMMENSURABLE ENVIRONMENTAL CHARACTERISTICS

Project No.	Adverse characteristic A	Adverse characteristic B
1	550A	.5B
2	500A	.4B
3	600A	.3B
4	750A	.2B
5	1000A	.1B

The two approaches to the problem of commensurability can now be discussed in detail in this context. For the first, we will assume that the above information has been presented to the responsible decision-maker. We further assume that, on the basis of this information, he chooses Project (3). His choice reveals something about his relative assessment of or valuation of characteristics A and B. To put it differently, his choice reveals the implied weights attached to these two characteristics in an implicit judgment of overall environmental hazard. If Project (3) is chosen, we must conclude that, in the decision-maker's judgment, Project (3) has the lowest overall environmental hazard.

We can approach the problem of identifying the implicit weights in two ways. First, assume that the decision maker started by comparing Projects (2) and (3). He would note that if he chose (3), he could achieve a reduction of 0.1 in characteristic B by permitting a 100 unit increase in characteristic A. In choosing (3), he showed his willingness to accept this price. In comparing Projects (3) and (4), he would see that the price of another 0.1 reduction in B is an increase of 150 units in A. The decision-maker revealed that he was not willing to pay a price this high. Therefore, the implied weight, relative value, or tradeoff (W) between characteristic A and B lies somewhere between:

$$\frac{100}{0.1} \text{ and } \frac{150}{0.1} \text{ or } 1,000 \leq W \leq 1,500$$

Alternatively, if the decision-maker first looked at Project (4), he would see that he could gain a reduction in adverse characteristic A of 150 by accepting or paying a 0.1 increase in adverse characteristic B. By choosing Project (3) he revealed his willingness to pay this price. But he was not willing to accept another increase in B in order to get only a 100 unit further reduction in A. (i.e., he preferred project (3) over Project (2)). The calculation of implied weight between A and B is the same as above.

In this example we have been interpreting the implications of a decision which has already been made. In the Alaskan pipeline case, the decision has not yet been made. How does our example help the decision maker? It helps him by showing him a way to check the implications of alternative choices for reasonableness. In other words, the decision maker can always ask the following question: "If I choose Project X, what does this imply about the relative weight I place on environmental risk A, and is this implied weight really reasonable?" I will present an example of the application of this approach to the pipeline case below.

Now, let us turn to the second approach to the problem of commensurability. If the values or weights to be attached to different characteristics are known or can be approximated, an index of overall environmental impact can be calculated. The project with the lowest index should then be chosen. In this approach we ask the decision maker to calculate hypothetical or trial environmental impact indices, using different sets of weights. Some of these weights may appear to be reasonable, while other weights may be acknowledged as extreme values. By looking at the ranking of alternative projects, calculated with different weighting functions, the analyst can determine which of the relative weights or values seem to be most critical in calculating the environmental impact. He may find, for example, that the ranking of projects does not change (i.e., the same project always comes out on top) over wide ranges of weights for certain of the characteristics. This may lead him to focus attention upon characteristics in the environmental index which show the greatest sensitivity to different weights and to gather more information on them to determine the weight he should give them.

Suppose that a weight or price of 1250 were placed on characteristic B in Table III-1. Note that this lies within the range that we assume was revealed by the decision maker's preference for Project (3). We can calculate an overall environmental hazard index for each project by multiplying characteristic B times its weight (1250) and adding this to characteristic A. The results are shown in Table III-2. Project (3) has the lowest index of environmental hazard, and would be preferred, given this weight.

Examination of the table and some additional calculations can also give the analyst a better feel for the dimensions of his choice problem. For example, the ranking of Projects (2) through (5) is sensitive to a relative weight given to characteristic B. If B is given a weight of 2000 rather than 1250, Project (4) is indicated as the preferred project. It takes a weight of more than 2500 to reductions in characteristic B in order to make Project (5) (which is most favorable in terms of that characteristic) the preferred project. But in every calculation, Project (1) stands at the bottom of the list. In other words, its bottom ranking is insensitive to the weight chosen. Hence, we do not need to know the precise value of these weights in order to have the common sense to reject Project (1) from further consideration.

TABLE III-2—ENVIRONMENTAL HAZARD INDICES

[Weight for B is 1,250]

Project No.	A	B	Total
1	550	625	1,175
2	500	500	1,000
3	600	375	975
4	750	250	1,000
5	1,000	125	1,125

B. Analysis by Miles of Route.

The approach discussed above may be applied to alternative transportation and route combinations for North Slope oil. In Volumes I and V of *Environmental Analysis*, six alternative routes are selected for comparison and evaluation. Three, including the TAP to Valdez, move south or southwestward across Alaska to ports where the oil is transferred to tankers for transshipment to the West Coast. The other three take various corridors through parts of Alaska and Canada to Edmonton, Alberta to connect with existing pipelines to Chicago and Seattle. Summary information on these six routes is displayed in *Environmental Analysis*,²⁵ and is reproduced in slightly different form in Table III-3. The Table shows, for each route, the number of miles in continuous permafrost, miles in discontinuous permafrost zones, and miles outside of any permafrost zone. The sum of these figures is the total pipeline length. In addition, if the pipeline passes through the seismic zone, the length in this zone is indicated in the fourth column. The length of the tanker route also is indicated. Finally, the last two columns indicate the number of stream crossings and mountain crossings along the route.

²⁵ See Vol. V, Table 1a, pp. 234-235.

TABLE III-3.—CHARACTERISTICS OF ALTERNATIVE TRANSPORTATION ROUTES¹

Route.....	Miles outside of permafrost M	Miles in continuous permafrost CO	Miles in discon- tinuous permafrost CO	Miles in seismic zone (Richter >6) Q	Miles of tanker route T	Number of stream crossings S	Number mountain crossings X
Prudhoe Bay to Bering Sea plus tanker.....	0	499	350	0	3,400	9	1
Prudhoe Bay to Redoubt Bay plus tanker.....	60	230	500	260	2,400	50	2
Prudhoe Bay to Valdez plus tanker.....	20	230	540	260	2,250	60	3
Prudhoe Bay to Edmon- ton (coastal).....	460	305	890	0	0	22	0
Prudhoe Bay to Edmon- ton (inland).....	500	315	890	0	0	15	2
Prudhoe Bay- Big Delta- Edmonton.....	325	230	1,310	120	0	80	2

Source: "Environmental Analysis," vol. V, table 1A, pp. 234-235.

It is assumed that the number of miles travelled through a seismic zone can be used as a measure of this adverse environmental characteristic. It is similarly assumed, for the other characteristics, that the environmental hazard is proportional to the number of miles traversed under these conditions. This assumption is obviously reasonable for some kinds of environmental damage. Unavoidable disruption of terrain, for example, will depend upon the nature of the terrain traversed, and, other things equal, is proportional to the miles of pipeline in that terrain zone. The probability of an oil spill resulting from collision or storm damage *at sea* appears directly proportional to the miles of tanker route. On the other hand, the extent of water pollution resulting from oil handling in port and the dangers of accidental spillage due to collision in close waters are independent of the distance between ports. In short, although miles are not a perfect measure of environmental hazard, they may be a useful simplification to demonstrate the technique.

For each of the six routes, an index of environmental hazard which is the sum of the number of miles in each class for that route, weighted by that class' or zone's relative degree of hazardousness, is calculated. Equation (5) shows the calculation.

$$(5) \quad E_i = a_1 M_i + a_2 C_i + a_3 D_i + a_4 Q_i + a_5 T_i$$

where E is the environmental risk of a project. Taking a mile of pipeline outside a permafrost zone as our standard of reference, a weight of 1 may be applied to this figure (M). In other words a_1 is equal to 1. Miles of pipeline through continuous or discontinuous permafrost are more hazardous to the environment, and hence the weights attached to them (a_2 , a_3) should be greater than 1. And the weight attached to continuous permafrost should not be smaller than the weight attached to discontinuous permafrost miles. Pipeline miles through a seismic zone are already counted in M_i , C_i , or D_i as appropriate. But seismic risk adds to the environmental damages associated with M_i , C_i , or D_i . Hence, Q_i should take values equal to or greater than zero depending upon the relative seriousness with which seismic risks are taken. Finally, tanker miles are substituted for overland miles. If marine transport of oil is deemed more hazardous per mile than regular overland miles, then a_5 should have a weight greater than 1. But if the hazards associated with marine transport are less than transporting oil over an equivalent distance by land pipeline, then a_5 should have values less than 1. The information on reasonable values for the five weights is summarized here:

$a_1 = 1$ —establishes a scale; set arbitrarily at 1 for simplicity.

$a_2, a_3 > 1$

$a_4 > 0$

$a_5 > 0$

It should be noted that this calculation does not take advantage of the information on number of stream crossings or mountain crossings. If instead of mountain crossings, data on miles of mountainous zones were presented, this would be treated in the same way as miles in seismic zones. Similarly, rather than numbers of stream crossings, miles of pipeline parallel to or within a certain distance of streams could be used for comparisons. Lacking data on these alternative forms, the information on mountain and stream crossings is not used below.²⁶

I first calculated E for the six alternative routes, assuming that all overland and tanker transit miles had equal weights and with no additional weight given to seismic hazards. In other words, all weights were assumed equal to 1 except a_1 , which was set to zero. The relative rankings and scores were as follows: Prudhoe Bay—Edmonton (coastal) 1,655; Prudhoe Bay—Edmonton (inland) 1,705; Prudhoe Bay—Big Delta—Edmonton, 1,865; Prudhoe Bay—Valdez—Tanker, 3,040; Prudhoe Bay—Redoubt Bay—Tanker, 3,190; Prudhoe Bay—Bering Sea—Tanker, 4,150.

This shows that with these weights, the three Canadian routes were all preferred to any of the Alaskan routes. Furthermore, differences between the Canadian alternatives were small relative to the difference between all Canadian alternatives compared with all Alaskan alternatives.

Inspection of Table III-3 and additional calculations show that the relative ranking of the three Canadian alternatives is quite insensitive to the weights chosen. A similar finding is true when the three Alaskan routes are compared among themselves. Therefore, all further comparisons will be limited to those between one Alaskan route, i.e., to Valdez, and one Canadian route, the Edmonton inland route.²⁷

The next step is to explore the sensitivity of the relative standing of these two routes to changes in the weights given to the two permafrost zones and seismic zone, in all cases holding the weight for tanker miles constant at 1. The results are insensitive to increases in the weights given to permafrost zones up to the level where continuous permafrost is rated 5 and discontinuous permafrost is rated 3. For example, where:

$$a_2 = 5$$

$$a_3 = 3$$

$$a_4 = 0$$

$$\text{TAP} = 5,040$$

$$\text{MVPL} = 4,745$$

If the weight for discontinuous permafrost zone is increased to 5, the balance shifts, and TAP is preferred:

$$\text{TAP} = 6,120$$

$$\text{MVPL} = 6,525$$

However, when weight is given to the seismic risks associated with TAP, the ranking reverses, and MVPL is still preferred, even at these extremely high rates placed on permafrost. Thus, a first tentative conclusion would be—differences between the two routes in their permafrost distances do not affect the relative standings of the two projects significantly except at the extreme; and any advantage given to TAP is offset by placing non-zero weights on the seismic risk associated with TAP.²⁸

²⁶ One of the virtues of this framework is that it can help to show some kinds of data which can be readily obtained and which can assist the decision-maker in ranking alternatives.

²⁷ The inland route was chosen over the coastal route because the *Environmental Analysis* suggests that it is preferable. See Vol. I, p. 251.

²⁸ The discussion of the relative effects of discontinuous vs. continuous permafrost may be somewhat beside the point in view of the following comment in *Environmental Analysis*: "there is a difference of about 2x in land length between the trans-Alaska routes and the trans-Alaska-Canada routes . . . In this case the greater length of the Canadian route is offset by the greater terrain disruption that would be involved in crossing at least 1 more mountain range in any trans-Alaska route and the occurrence along the routes of known areas of high ice content permafrost" (See Note 1d to Table 1b, p. 289, Vol. V). While this is probably a subjective assessment with only an implicit weighting lying behind it, it shows other ways in which project characteristics can be identified and defined (e.g. miles in ice rich permafrost) for purposes of comparison. The point is that this should be an explicit and open process rather than being implicitly stated and buried in footnotes.

Inspection of Table III-3 and sample calculations show that the relative standings of the two projects are most sensitive to the weight given to tanker transport miles, since this variable is the largest one in the TAP score. If tanker miles are deemed more hazardous to the environment than ordinary land pipeline miles (and this is the informed opinion of many experts), the balance is shifted so far toward the Canadian route that further calculations are not necessary. But if tanker miles are deemed less hazardous than ordinary land miles—perhaps in part to compensate for the fact that part of the real hazard with marine transportation involves unavoidable and threatened spills in and around harbors and transfer points and is not proportional to length of sea route, then, under some conditions, TAP appears to be preferred to the Canadian route. In order to reach this conclusion, the weight placed on tanker miles must be reduced to about 0.5, seismic effects must be given near zero weight, and higher weights must be placed on continuous and discontinuous permafrost zones. For example, one calculation showed the following:

$$\begin{aligned}a_2 &= 2 \\a_3 &= 2 \\a_4 &= 0 \\a_5 &= 0.5\end{aligned}$$

TAP—2,685

MVPL—2,910

However, when the seismic risk is acknowledged, the result is:

$$\begin{aligned}a_2 &= 2 \\a_3 &= 2 \\a_4 &= 1 \\a_5 &= 0.5\end{aligned}$$

TAP—2,945

MVPL—2,910

To summarize, this experimentation with different weights for calculating an index of environmental hazard has shown that the crucial variable is the relative degree of hazard of tanker miles in comparison with overland miles, and that, in order to support a choice of TAP over MVPL, tanker transport must be viewed as considerably less damaging (actually or potentially) to the environment. More importantly, it has shown the feasibility of assigning weights on a trial basis to learn more about the sensitivity to different weighting assumptions. Although the necessary data are not readily available in *Environmental Analysis*, weights could be assigned on different bases and alternative indices calculated. For example, each overland route could be divided into short (e.g. five-mile) segments and scored in terms of the relative hazard caused by a pipeline. The environmental index would be the total scores summed over all segments.

C. Display of Ordinal Rankings

Environmental Analysis ranks the six proposed routes on an ordinal basis for each of 25 different environmental impact categories.²⁹ With so many characteristics and so many projects explained, it is difficult to perceive any patterns from this table. However, when two of the three Alaskan routes are disregarded, along with the Canadian route via Big Delta, and it is recognized that two of the Canadian routes are so similar that presentations of data in this form are not likely to enable valid distinctions to be made, more succinct presentation of the data are possible. Specifically if the comparison is limited to the TAP route to Valdez and the inland MVPL route, a clearer picture of their relative standing emerges.

In the following table, I have replaced the letter A, B, C, D, etc., with a plus sign to indicate that the alternative poses less hazard in that category, a minus sign to indicate greater hazard and zero to indicate a tie. All rankings are taken directly from *Environmental Analysis*.³⁰ Table III-4 shows that, of the 25 characteristics rated ordinally, the two routes tie on seven, MVPL is preferred on 13, and TAP is preferred on 5. This does not, itself, establish a case for choosing one route over the other. It is possible that those characteristics on which the Alaskan route is preferred are highly important and significant characteristics, while those characteristics on which the MVPL is pre-

²⁹ See Volume V, Table 1b, pp. 238-240.
³⁰ *Ibid.*

ferred may be relatively insignificant. But this is a possibility which can be explored and analyzed: it need not remain a matter of speculation.

TABLE III-4

Impact	TAP	MVPL
Terrestrial:		
1. Terrain disruption-pipeline	0	0
2. Terrain disruption-terminal	+	+
3. Construction materials	+	+
4. Induced terrain disruption	+	+
5. Surface and groundwater	+	+
6. Air quality	+	+
7. Vegetation habitat disruption	+	+
8. Fisheries	+	+
9. Wildlife, including birds	+	+
10. Physical space commitment	+	+
11. Recreation/aesthetics	+	+
12. Wilderness	+	+
13. Communities	+	+
14. Native culture and subsistence	+	+
15. Seismic risk-pipeline	+	+
16. Seismic risk-terminal	+	+
17. Permafrost degradation	+	+
18. Slope failure	0	0
19. Flooding risk	0	0
Marine:		
20. Terminal port waters	-	+
21. Destination port waters	-	+
22. Fisheries	-	+
23. Wildlife, including birds	-	+
24. Tanker casualties	-	+
25. Oil transfer operations	-	+
Total (-)	13	5
Total (+)	5	13
Total (0)	7	7

For example, six of the thirteen items in which MVPL is preferred refer to marine threats. If the Alaskan route actually is chosen, this means that marine environmental hazards, while recognized, are not considered to be important or serious in comparison with the five characteristics on which the Alaskan route is preferred—for example, construction materials, air quality and vegetation and habitat disruption. Similarly, MVPL is preferred in terms of impact on communities, native culture and subsistence, and seismic risk. To choose the Alaskan route in the face of these ordinal preferences again implies a low weight being given to these impact.

This is not to argue that these low weights may be invalid. Rather, it is meant only to show that a systematic presentation of the data can reveal what kinds of weighting patterns are necessary to justify particular choices.

The *Environmental Analysis* similarly provides a verbal comparison of the six routes in terms of six classes of environmental damages (Vol. I, pp. 320-321). Table III-5 summarizes this ordinal ranking information. Because of the large number of alternatives, a pattern may not be immediately apparent. However, if the comparison is limited to only one Alaskan and one Canadian corridor, a rather strong picture emerges. As is shown in Table III-6, the MVPL is preferred in terms of five of the six environmental characteristics. In the face of this information, if TAP is chosen, this will imply some combination of the following: an extremely large relative advantage in terms of the one characteristic favoring TAP—terrestrial abiotic unavoidable impacts—and/or a very high importance attached to this characteristic in comparison with threatened terrestrial and marine effects, and unavoidable marine and socio-economic effects. Once again, systematic presentation of available information can be useful in revealing the kinds of assumptions necessary to justify a particular course of action.

D. The Relevant Choice

The analysis so far has accepted the framework established in the *Environmental Analysis*, namely that the choice is between the following two alternatives:

TABLE III-5—ORIGINAL RANKING OF 6 ROUTES BASED ON IMPACT STATEMENT SUMMARY

	Prudhoe Bay to—					
	Bering Seaport	Redoubt Bay	Valdez	Edmonton (coast)	Edmonton (inland)	Edmonton (Big Delta)
Unavoidable impacts:						
A. Terrestrial abiotic.....	1	3	2	4	4	4
B. Terrestrial biotic overall.....	1	6	14	2	13	14
C. Socioeconomic.....	1	3	5	2	3	6
D. Marine.....	4	4	6	2	1	1
Threatened impacts:						
A. Terrestrial.....	3	5	6	1	1	2
B. Marine.....	5	4	5	1	1	1

* The verbal description is not sufficient to establish an unambiguous ranking.

Source: "Impact Statement," vol. I, pp. 320-322.

TABLE III-6—ORIGINAL COMPARISON OF TAPS AND MVPL

	TAPS	MVPL
Unavoidable impacts:		
A. Terrestrial abiotic.....	1	2
B. Terrestrial biotic overall.....	2	1
C. Socioeconomic.....	2	1
D. Marine.....	2	1
Threatened impacts:		
A. Terrestrial.....	2	1
B. Marine.....	2	1

Source: See table III-5.

An oil line from Prudhoe Bay to Valdez with tanker transport; or an oil line from Prudhoe Bay to Edmonton

In fact, however, *Environmental Analysis* repeatedly acknowledges that if North Slope oil is developed, there will be a pipeline built along one of the Canadian corridors to transport natural gas to the Midwest market. Yet this acknowledged fact is not systematically brought into the analysis. It should be because it has a significant effect on our perception of the alternatives, as well as our relative ranking of alternatives. Once it is acknowledged that a gas line through Canada is a virtual certainty, the choice we face becomes:

An Alaskan corridor for oil plus a separate Canadian corridor for gas, or a single corridor through Canada for both oil and gas.

Since the *Environmental Analysis* does not contain relevant environmental information for this alternative, I have not attempted to analyze it in terms of either of the models for choice presented in this Section. However, I will introduce these alternatives in the following section.

E. Summary

In this section I have proposed and illustrated a framework for analyzing environmental data in a systematic way. Since I am not an ecologist or natural scientist, I have not felt qualified to evaluate the accuracy of the data provided in *Environmental Analysis*. A natural scientist could evaluate and refine that data and discuss plausible ranges for some of the parameters that are involved in these models. He might be able to provide better parameters and better information as inputs. But as an economist I am qualified to discuss problems of choice and to describe the present state of the art in presenting information and evaluating alternative allocations of resources.

The strongest point that I can make is that there are frameworks for more systematic analysis of non-commensurate environmental data. These methodologies can often be surprisingly revealing in the sense that a systematic presentation of the information may reveal patterns which are confused or obscured by verbal presentations. Although these techniques are available, the Department of Interior has not adequately employed them.

IV. INTEGRATING ENVIRONMENTAL AND ECONOMIC CONSIDERATIONS

In the last section I discussed the problem of evaluating the total environmental impact of projects when the different kinds of impacts associated with the projects were non-commensurable. I showed how decisions or choices among alternatives implied the values or weights which could be used to make the different impacts commensurable. I also showed how trial weights could be used to test the sensitivity of the rankings of alternatives to different weighting forms, and how the systematic presentation of data on different types of impacts could reveal what kinds of weights had to be assumed in order to justify a particular decision or ranking of alternatives.

That section, of course, focused only upon environmental factors. Other factors involved in the decision might justify selection of an alternative, even though it was not the most desirable from the environmental perspective. The conceptual framework outlined and utilized, however, can also be applied to the problem of integrating non-commensurate environmental and economic considerations. Some of the possible impacts of the alternatives can be measured in dollar terms, while others can only be measured in some non-commensurate dimensions. In this section I will bring together the identifiable economic and environmental aspects of the several alternatives which are being or should be considered. It must be counted as a serious shortcoming of *Environmental Analysis* and *Economic Analysis* that they make no attempt to "utilize a systematic interdisciplinary approach which will insure the integrated use of the natural and social sciences." NEPA, Sec.102(A) I do not claim that what follows represents the kind of comprehensive analysis that I believe should be used. Such an analysis would require the time and talents of experts from a number of fields. What follows does, however, represent a demonstration that such systematic interdisciplinary analysis is possible, as well as essential if wise decisions are to be made about our use of the Alaskan environment.

A. The Alternatives

The first step in such a systematic analysis is to identify the relevant alternatives. This has not been done adequately in either *Environmental Analysis* or *Economic Analysis*. Although the former reviewed a number of alternative transportation and route alternatives, it did not correctly identify the full range of alternative choices.

In what follows I assume that two basic corridor alternatives dominate all others, both in terms of economics and environmental considerations. These are the Prudhoe Bay-Valdez-Tanker route and the inland Mackenzie Valley to Edmonton route. Concentration on these two appears to be justified after examining the results of Section III.

Although the *Environmental Analysis* devotes considerable space to the evaluation of alternative routes, its analysis of the implications of a possible gas pipeline is inadequate. When it is recognized that there will be strong economic pressures to permit a gas pipeline from the North Slope through the Mackenzie Valley corridor, it becomes apparent that decision makers face a choice from among five alternatives. These are:

(1) Do nothing. This is the preservation alternative. It is a reversible decision in that it can be revised in the light of new information or future developments. It is virtually indistinguishable from a decision to defer a choice for one, two, three years, while attempting to develop more information to better evaluate the possible consequences of development.

(2) TAP but no gas pipeline. By including virtually no environmental or economic analysis of the possible gas pipeline, the Department of Interior has implicitly analyzed this alternative.

(3) MVPL but no gas. Again, by failing to present environmental and economic information on the gas pipeline, the Department of Interior has basically concentrated upon this alternative.

(4) TAP for oil plus MVPL for gas. The Department of Interior has admitted, in effect, that adoption of alternative (2) is, in fact, a decision for alternative (4), although it has not included this alternative explicitly in its analysis.

(5) MVPL for oil and gas. Similarly, choice of alternative (3) actually results in this alternative. For this reason, it must also be explicitly considered.

For logical completeness, two other alternatives can be identified. Both would have a gas pipeline along the Prudhoe Bay-Valdez corridor, with an oil pipeline either to Valdez or along the Mackenzie Valley corridor to Edmonton. These are not included because it seems likely that either would be dominated by one or more of the five alternatives explicitly considered.²¹

B. The Framework

Ideally, we would like to be able to calculate, for each alternative, an overall welfare index in which the known measures of the different and non-commensurate economic and environmental impacts would be made commensurate by some appropriate set of weights or values. In addition to requiring us to define and measure accurately such things as national security, and various environmental impacts, this approach would require us to be able essentially to attach price tags to each of these so that they could be made commensurate with other dollar values, such as true balance of payment benefits and real resource savings. Such a prescription is beyond the present state of the art. But the inability to combine the disparate impacts into a single welfare measure does not and should not prevent efforts to come close to that goal by analyzing all the available measures of environmental and economic impacts together. In this section we will fill in a tableau of economic and environmental impacts. The tableau is Table IV-1 below. In it, each alternative has one column, and each environmental and economic factor for which we have information is allotted one row. The cells of the table will be filled with the available information. Where possible, we shall then determine ordinal rankings of the five alternatives in terms of each of the impacts or rows. The next seven sections describe each of the rows of the tableau. In the final section, we use the tableau to make comparisons among alternatives.

C. Real Resource Cost Savings

The real resource costs savings are as defined in Section II-A. The results of these calculations are shown the first row of Table IV-1. If there is no development, there are no economic benefits; the resource savings are zero. With TAP alone being developed, our calculations for Table II-2 showed a low estimate of net benefits of \$.66 per barrel and a middle estimate of \$1.05 per barrel. Assuming production begins in 1975 and rises to the capacity of two million barrels per day by 1983, and that the pipeline life is 25 years, the present value of this stream of benefits is \$3.21 billion for the low estimate and \$1.10 billion for the middle estimate. The low estimate is shown in Table IV-1). Alternatively, if MVPL is developed Table II-3 shows a low estimate of net benefits of \$.71 per barrel and a middle estimate of \$1.10/bbl. Taking into account a possible three-year delay, but recognizing \$.05 per barrel additional benefits, the present value as of 1975 for this benefit stream is \$2.57 billion for the low estimate and \$3.84 billion for the middle estimate. (See Table II-6 for the cost of delay.)

²¹ See, for example, the *Economic Analysis* assertion that a gas pipeline to Valdez, which would require liquefied natural gas transport is unlikely. (Appendix C, p. 221.)

TABLE IV-1.—TABLEAU OF ECONOMIC AND ENVIRONMENTAL CONSIDERATIONS

	Alternatives				
	Do nothing (1)	TAP, no gas (2)	MVPL, no gas (3)	TAP plus MVPL gas (4)	MVPL gas and oil ^a (5)
Economics:					
1. Real resource cost savings (economic benefits) ¹	0(5) ¹	\$3.21 billion (37) ¹	\$2.57 billion (47) ¹	More than \$3.21 billion (27) ¹	More than \$2.59 billion and possibly more than No. 4 (17).
2. National security:					
(a) Place of delivery of oil	0(5)	West Coast (4)	Midwest (2)	West Coast (3)	Midwest (1)
(b) Time of delivery of oil	0(5)	Begin 1976 (2)	Begin 1978 (4)	Begin 1976 (1)	Begin 1978 (3)
3. Balance of payments	0(5)	+ (27) ²	+ (4)	+ + (17)	+ + (27) ²
4. Royalty to Alaska	0(5)	\$2.24 billion (37) ¹	\$1.88 billion (47) ¹	More than \$2.24 billion (17)	More than \$1.88 and possibly more than No. 4 (27).
5. Option value	+ (1)	— (2) ³	— (2) ³	— (2) ³	— (2) ³
6. By miles (see table III 3) ⁴	M 0(1)	20(2)	460(3)	480(4)	600(5)
	C 0 (1)	230(2)	305(3)	535(5)	467(4)
	D 0(1)	640(2)	890(3)	1,530(6)	1,138(47)
	Q 0(1) ⁵	260(4)	0(1)	260(4)	0(1)
	T 0(1) ⁵	2,250(4)	0(1)	2,250(4)	0(1)
7. Ordinal rankings: ⁶					
(a) Inevitable:					
Terrestrial abiotic	0(1)	— (2)	— (3)	— (5)	— (4)
Terrestrial biotic	0(1)	— (4)	— (2)	— (3)	— (3)
Econoeconomic	0(1)	— (4)	— (2)	— (5)	— (2)
Marine	0(1)	— (4)	0(1)	— (4)	0(1)
(b) Threatened:					
Terrestrial	0(1)	— (4)	— (2)	— (5)	— (2)
Marine	0(1)	— (4)	0(1)	— (4)	0(1)

¹ Present value of stream until year 2000, at 10 percent benefit of \$0.66/bbl based on cost of alternative of \$2.01/bbl. See table II 2. If the cost of alternative is \$2.40/bbl, benefit is \$1.05/bbl and the present value of resource cost savings is \$3.10 billion.

² Ordinal ranking of the 5 alternatives on the basis of this characteristic. A "—" signifies a tie. A "?" signifies uncertainty.

³ Adjusted for 3-year delay and \$0.05/bbl greater benefit. See table II 6. If the cost of alternative \$2.40/bbl, the present value of resource cost savings is \$3.84 billion.

⁴ Present value of stream until year 2000, at 10 percent. Royalty of \$0.46/bbl. See "Economic Analysis," p. H 2.

⁵ Adjusted for 3-year delay, \$0.08/bbl greater royalty due to higher well head price for Midwest delivery (approximately 20 percent × \$0.40).

⁶ See vol. I, pp. 320-322.

At this point the relative ranking of alternative (2) above (3) seems to be established. But this is by no means certain, and if factors which are inadequately treated in the *Economic Analysis* are given due consideration, it is quite possible that this ranking would be reversed. The two most important considerations are the extent and nature of delay associated with MVPL, and the disposition of the excess supply on the West Coast if TAP is built. The most conservative assumptions regarding MVPL has been employed for the former. Any lessening of the delay or accelerated production after 1978 would reduce the disadvantage of MVPL. (See Table II-6). More important, the potential excess supply in PAD District V will be disposed of in one of two ways, either of which will substantially reduce the calculated resource cost savings for TAP. Either throughput will be slower leaving excess capacity in the pipeline, an unlikely circumstance, or the oil will be sold in other places incurring either a higher resource cost for shipping, a lower gross benefit where it is sold, or both. This is a crucial area in the comparative analysis of the alternatives, and it requires far more study.

Since the *Impact Statement* did not include an economic analysis of the gas pipe line, either alone or in combination with oil, the last two columns cannot be filled in with certainty. However, if it is assumed that the Mackenzie Valley gas pipeline is economically feasible, i.e., has positive net benefits per barrel, then a range of the possible values for columns 4 and 5 can be established. For TAP plus MVPL-gas, the total benefit would be the TAP benefit (\$2.1 billion to \$3.10 billion) plus MVPL-gas benefits. Similar logic applies to column 5 in comparison with column 3. And, further, if there are costs savings associated with building the oil and gas lines together, and if these savings more than outweigh the costs of delaying MVPL oil (about \$.64 billion for three years), then the benefit for column 5 may exceed that of column 4. This ranking is possible but not established.

We can now see how the ordinal rankings of the five alternatives have been arrived at. Preservation is lowest in terms of economic benefits; the MVPL without gas may be second lowest because of delay in receiving the benefits. But this is only established under assumptions which are very unfavorable to MVPL and possibly unrealistic. The relative ranking of the two combined oil-gas alternatives is also uncertain as indicated by the question marks.

D. National Security

There are two non-commensurate dimensions to the national security analysis. These were both discussed in Section II-C above. The first concerns the place of delivery of oil, the second the implications of delayed delivery. It was argued above that national security is better served by delivering oil to the Midwest rather than the West Coast. Hence the Two Mackenzie Valley alternatives are ranked highest. Further, it is assumed that the addition of a gas supply from the North Slope will result in some marginal fuel substitution and slight reduction in dependence on imported oil. The two TAP alternatives are ranked 3 and 4, because if it is assumed that the regional factor is more significant than the incremental gas supply.

Careful analysis may make it possible to attach dollar price tags to this dimension of national security. Conceptually, the benefit of delivering oil to the Midwest rather than the West Coast is equal to the additional cost of adjusting to a loss of two million barrels per day of imported oil when TAP oil is being delivered to the West Coast and, as a consequence, the East Coast dependency ratio is raised.

A TAP project, with or without gas, would begin deliveries to the West Coast in 1975, thus decreasing our dependence on foreign oil (at the margin) two or three years earlier than would be the case with the Canadian alternative. For this reason, the two TAP alternatives rank higher than the MVPL routes. And similarly, TAP plus MVPL gas route rates higher than TAP with no gas, because it is assumed that the gas supply has a marginal positive impact on national security. It should be noted however that this potential benefit is overstated unless the projected excess supply to PAD District V is taken into account.

Again, it is conceptually possible to place dollar price tags on this dimension of national security benefits. Following the framework outlined in Table II-7, we would calculate the difference that delay in delivery of North Slope oil makes in our dependence on Non-Canadian imports. We could then identify

alternative schemes for making up that difference, and calculate their cost. Avoiding that cost is the national security benefit of having North Slope oil available three years earlier. As was discussed in Section II these costs may not be substantial, considering the Canadian offer to provide additional imports during any period of delay associated with choosing MVPL.

E. The Balance of Payments

As discussed in Section II, if an economic change, such as the substitution of domestic oil for imported oil, has a favorable impact on the balance of payments, the equilibrium net barter terms of trade will shift in favor of the country in which the change occurs and the resulting increase in real incomes and welfare can be counted as a balance of payments benefit. The benefit is proportional to (but not equal to) the balance of payments impact. Since the state of the art does not permit measuring these benefits presently, estimates of the balance of payments impact can serve only as an indicator of the relative ranking of the five alternatives in terms of balance of payments benefits.

The no-gas version of TAP and MVPL can be compared first. In both cases, domestic is substituted for foreign oil, but in the latter, there is a negative component in the balance of payments impact associated with building and operating the Canadian portion of the pipeline. Hence, MVPL with no gas ranks below TAP with no gas. Comparing TAP with no gas and TAP plus MVPL gas, the latter alternative will have a more favorable balance of payments impact if the additional gas supply further reduces our spending on foreign oil and/or gas by an amount greater than the balance of payments costs of handling and operating the gas pipeline in Canada. Whether this would be the case is problematical. The tableau reflects that assumption, and the question marks indicate the uncertainty. There is similarly great uncertainty regarding the net effect of the MVPL gas and oil alternative. Lacking further information, the tableau indicates that this ties with the TAP no-gas alternative.

F. Royalty Payments to the State of Alaska

Royalty payment calculations are similar in nature to the real resource cost savings calculations. Although the royalty payments are a benefit to the state of Alaska directly and to Alaskan residents ultimately, they constitute, from the national point of view, a transfer payment. Hence they should not be added to the real resource cost savings in calculating a total benefit figure. However, if the value judgment is made that the state of Alaska deserves funds more than the stockholders of the oil companies, then these transfers do have a benefit of unknown magnitude attached to them. Furthermore, the larger the transfer payment, *ceteris paribus*, the larger the benefit. Hence the alternatives can be ranked in terms of the size of the royalty payments to the state.

The *Economic Analysis* reports royalty of \$36 per barrel for TAP. Taking into account the phased in production schedule, and discounting at 10 per cent over 25-year project life, the present value as of 1975 of that stream of payments to the state is \$224 billion.

However, this does not take into account the excess supply in PAD District V. Excess supply will result in a lower present value of the royalty stream from some combination of the following:

- (1) Price reduction in PAD District V;
- (2) Shifting part of the throughput to a lower priced market where the lower price is not completely offset by lower transport costs;
- (3) Shifting part of the throughput to a higher priced market where the increase in transport costs is greater than the price differential.

All of these alternatives reduce the wellhead price on which royalties are based. If MVPL is employed, two things happen. First, the wellhead price on which the royalty is based will be higher, reflecting the higher market price of oil in the midwest. This tends to increase royalties. But there is an offsetting force decreasing the present value as of 1975 of this royalty stream. This is the fact that the Canadian alternative will be delayed in production by up to three years. Assuming a \$0.40 per barrel increase in the wellhead price at Chicago and a three-year delay, the present value of the royalty stream for MVPL is \$1.88 billion, lower than for TAP.

If the delay is only two years and there is some reduction in potential TAP royalties as described above, the relative ranking of the two alternatives is reversed.

The assumptions used here are most conservative. Under different assumptions, the State will receive a higher present value of royalties from MVPL. A major shortcoming of the *Economic Analysis* is that it does not provide any analysis of the different possible royalty benefit streams under varying assumptions.

In comparing TAP with no gas and TAP plus MVPL gas, the latter is preferred if some royalties are collected on the gas as well. Similarly, comparing alternatives (3) and (5), (5) is to be preferred on the basis of the additional gas royalties. And alternative (4) will be preferred over alternative (4) under quite conservative assumptions, although the rankings can be changed under other assumptions which increase MVPL oil royalties relative to TAP oil royalties.

The question marks indicate our uncertainty as to the outcome.

G. Option Value

This is the one economic benefit on which the nondevelopment alternative ranks favorably. The other four alternatives may differ in the extent to which their implementation forecloses future alternatives. But these differences, if they exist, do not permit a more precise definition and comparison.

H. Miles of Route

This section makes use of the data on the miles traversed through different conditions that was developed in Section III. (See Table II-3). The first four columns of the tableau under Item #6 "by Miles," are straightforward. Consider only the first three rows, M, C, and D. Alternative (4) ranks below the first three alternatives because it involves all of the miles and all of the hazards of alternative (2) plus all of the miles and hazards of alternative (3). How to treat the combined oil and gas corridor is a more perplexing question. Obviously the combined gas and oil pipeline poses more environmental hazards per mile than the oil line alone. This is in part because more space is required; partly because more excavation and gravel fill will be required to support two lines; and perhaps because the two lines will diverge in places. Yet, clearly the environmental disruption is less than double that associated with the oil line only.

I have resolved this point by arbitrarily assuming that a mile of combined gas and oil line has one and one-half times the environmental impact of one mile of oil line only. One factor that makes this assumption defensible is that the ordinal rankings of the alternatives for each of the three classes of miles is relatively insensitive to weights in the range of between 1.0 and 2.0. The rankings by seismic zone and tanker route are straightforward. All the alternatives which avoid the Alaskan corridor and marine transport are preferred.

I. The Ordinal Rankings by Class of Impact

I have made use of the *Environmental Analysis's* ordinal rankings of TAP and MVPL according to class of environmental impact. The six classes of impact make up the bottom six lines of the tableau. The cells in the tableau are filled out with reference to Table III-6. The entries for the first three alternatives are directly from Table III-6. In the tableau, a zero indicates no impact; one minus sign indicates the smallest negative impact; while two minus signs indicates a larger negative impact.

The fourth alternative, TAP plus MVPL-gas combines all of the terrestrial and socio-economic impacts of both alternatives (2) and (3). Hence these cells are scored with three minus signs and are given the bottom ordinal ranking. With respect to the fifth alternative (the combined MVPL oil and gas pipeline), the terrestrial biotic effects will be worse than the MVPL oil only, but better than the MVPL plus TAP combination. The terrestrial abiotic effects relate primarily to the route chosen hence the combined MVPL route scores close to the MVPL-oil only alternative. Alternatives (3) and (5) rated equal on socio-economic factors and on the threatened terrestrial impact, largely because the latter threat is primarily associated with the oil line and possible ruptures and spillages. The remainder of the tableau is self-explanatory.

J. Conclusion

The tableau has provided a means of arranging the available information in a systematic way. The purpose of this arrangement is to facilitate a systematic and comprehensive comparison of relevant alternatives by decision makers, and to highlight critical cells where more information and analysis is required to refine the rankings of alternatives. An arrangement of information such as this sometimes reveals that one alternative is dominated or is nearly dominated by another one. Thus, one alternative may rank higher or be preferred in terms of every virtually relevant and measurable characteristic. Inspection of the tableau suggests that this is not the case here. But it does indicate some interesting and relevant comparisons.

(1) *Doing Nothing*.—This alternative poses the real issues in an extreme fashion. It ranks number one in all of the environmental characteristics, while ranking at the bottom in all of the economic characteristics, save option value. Choosing to do nothing yields the environmental benefits; but it also has attached to it an opportunity cost of foregoing the economic benefits that would have been produced by the relevant developmental alternative. Stated another way, each of the developmental alternatives produces economic benefits, but only at the expense of environmental costs. After the various developmental alternatives have been compared by a decision maker, and the "best" one is selected, we must still make the final comparison with the preservation alternative. That is to say, we must find out what price we are paying before we commit environmental and other resources irretrievably.

(2) *Alternative (2) vs Alternative (3)*.—This is the choice that the Department of Interior appears to be analyzing. In the economic dimensions of the problem, the case seems to go against MVPL. However, with the exception of the balance of payments, the lower ranking of MVPL is largely a matter of timing and ignoring the implications of excess supply on the West Coast. The difference in resource cost savings, national security, timing benefits, and royalty payments all depend on the assumptions about the length of the delay, whether or not accelerated throughput is possible with MVPL after 1978, and the assumption of no excess supply. These figures are based on the assumptions which are least favorable to the MVPL alternative and, in the case of excess supply, most unrealistic.

Turning to environmental factors, as we have seen in Section III, the choice hinges basically on the relative weights attached to marine vs. terrestrial hazards. The relatively small margin by which TAP is preferred in the land based miles (M, C, and D) is more than offset by giving due weight to the seismic hazards associated with TAP, and can be swung by the hazards associated with tanker routes unless these are given very low weight.

In summary, a choice of TAP over MVPL would imply a relatively low weight given to marine and seismic hazards and/or relatively high weight given to economic benefits relative to environmental costs. Conversely, if marine hazards are considered serious, giving up the relatively small apparent economic superiority of TAP may be a small price to pay for protecting important environmental resources. Certainly, the most significant point is that the analysis of the most crucial economic variables (timing and excess supply) is inadequate.

(3) *Alternative (4) v. Alternative (5)*.—The previous paragraph has an unreal quality to it, since the *Environmental Analysis* itself admits the near certainty of construction of a gas line through the MVPL corridor. Whether to build the gas pipeline should be a conscious and thoroughly examined choice, itself, rather than an assumption. Nevertheless, we will examine the implications of the presumed gas pipeline on our choice of route for the oil line. Considering first the environmental features, the joint gas and oil corridor appears to be strongly preferred on environmental grounds. Only the higher score attached to the joint pipeline for miles through other than permafrost (in effect, counting each mile of a single corridor twice, and multiplying it by a high value), M, prevents the joint venture from dominating alternative (4) in all environmental characteristics. To prefer alternative (4) on environmental grounds would imply giving an extremely high weight to this one factor in comparison with all others including marine transport.

Turning to the economic comparison, the first observation must be that more analysis is needed to refine our rankings. We do not know the real

resource cost savings associated with the gas pipeline will be, but they may well be sufficient to make the joint corridor preferable in terms of real resource cost savings. And, under different—and I believe more realistic—assumptions regarding oil royalties to the state of Alaska than those employed in the Economic Analysis, the joint MVPL oil-gas corridor also is preferred on this ground. The only relatively certain grounds for preferring the TAP plus MVPL-gas alternative are balance of payments considerations and the national security timing benefit. Even the latter benefit, however, is rendered uncertain by the possibility of excess, secure Canadian oil during the short-term prior to oil deliveries through MVPL.

(4) *Alternative (5) vs Alternative (3).*—This comparison can be interpreted as asking whether, assuming an MVPL oil line will be built, a parallel gas pipeline should also be constructed. On economic grounds the joint gas-oil alternative dominates the MVPL-oil only alternative. On environmental grounds, the picture is reversed with the oil-only line standing higher in five of eleven characteristics and tying in the remaining six. This is a weak dominance by the oil-only line. This comparison has been made in order to raise the question on whether the analysis should presume that a gas pipeline will be built. Economic factors favor it, while environmental factors work in the opposite direction. The strongest conclusion is that more information on this choice is required.

The survey of four kinds of choices is designed to show the inter-dependent nature of several decisions which are going to be made about North Slope Oil, North Slope gas, and the Arctic environment. The Department of Interior's impact analysis is inadequate in that it fails to take this inter-relatedness into account. The Impact Statement reduces what is in fact a complex choice among five interrelated alternatives to an overly-simplified choice among two inaccurately specified alternatives. Furthermore, it fails to marshal the available information in a way which focuses the attention of decision makers on the real issues, the relevant comparisons, and the most significant gaps in our knowledge. I believe that the tableau presented here shows the usefulness of a more systematic gathering together of information. Collection of and display of such information does not in itself make choices, but it greatly assists the process of rational choice.

Dr. FREEMAN. Thank you.

My first concern today is with the environmental impact statement and the economic analysis itself. Right now, that statement comprises the most comprehensive body of data that is now available on the economic and environmental aspects of the Alaskan pipeline route. Some of the legislation that you are considering would ask Congress to make a decision as to which route to develop right now and based on primarily this data included in that statement and the conclusions that the Secretary of Interior has drawn on the basis of the impact statement.

But I think there are at least three reasons why this would be unwise. First, the data included in the impact statement, although the most comprehensive such data available, are inadequate, particularly in respect to the consideration of alternatives to the Alaska route. The impact statement does not include adequate environmental and economic analysis of the joint or common gas and oil pipelines corridor through Canada, as what appears to be the primary alternative.

The second point is: In many respects the analysis of the data conducted by the Department of the Interior are faulty, in the sense the conclusions that are reached are not supported by the basic underlying data. This includes considerations of the economic cost of delay, the considerations of net economic benefit and balance-of-payments considerations. These points are outlined in greater detail in my formal statement.

The third reason why reliance on the impact statement and its conclusion would be unwise at this point is: Even where the data and analysis are adequate, man can disagree on the weights or tradeoffs to be given to essentially noncommensurable environmental and economic aspects of the decision.

I think Congress must look very carefully at the implied weights and tradeoffs, especially in comparing marine and seismic hazards of the Alaskan route versus the different kinds of environmental hazards associated with the Canadian route, and in weighing environmental hazards against economic benefits.

My own analysis of the Department of the Interior's impact statement suggests that the Department of the Interior used the weights which are probably quite different from those that reasonable men would apply in making such comparisons. My own analysis suggests when reasonable weights are applied to marine hazards and seismic rifts, the environmental decision is strongly toward the Canadian alternative.

The second major point of my analysis concerns the economic features of the two alternatives. My formal statement considers five areas: The net economic benefits, the national security analysis, the question of job creation, the economic cost of delay, and balance-of-payments considerations. Since I think the latter two are the ones in which there is most confusion at this point, I want to devote the rest of my verbal statement to a more careful consideration of these two things.

First, the cost of delaying decision or delaying development of Alaska oil. I think at least some Members of Congress seem to be disposed to accept the following kind of argument: That the delivery of oil would be substantially delayed if a decision were made now to build a Canadian route and the cost of such delay would be substantial and outweigh any possible economic and environmental advantages the Canadian route might have.

But there are three factors which must be taken into account in evaluating an argument such as that. We must consider and properly identify, weigh, and measure this real economic cost of the delay. We must consider the length of delay under different kinds of scenarios, but we must also include the possible benefits or advantages that delay would bring in terms of wiser decision.

A major point concerning the cost of delay is the likely trend in the price of foreign crude oil, because this determines what the net economic benefits of development of Alaska crude oil would be. As the price of foreign crude oil rises, the net benefits of Alaskan development rise. This is true whether the oil is brought out through the Canadian corridor or through an Alaskan corridor.

But to the extent that the price of foreign crude oil is rising, this makes that oil in the ground relatively more valuable because the oil is an asset which at a later time can be used to substitute for foreign oil, which has now become available only at a higher price.

The principal point is that, other things equal, the more rapidly the price of foreign oil increases, the lower is the cost of delay, because the economic benefits of that oil when developed are higher.

The significant conclusion, I think, is those that predict rapidly rising world oil prices and use this to argue for the most rapid pos-

sible development of North Slope oil have their logic backward. Oil in the ground is an asset and it should be treated as such and the analysis of decisions about managing it should take that consideration into account.

The second point concerning delay is how long would that delay be. Mr. Dienelt has spoken to this point, concerning possible delays with litigation and the NEPA issues that Congress simply resolves the right-of-way question and turns the NEPA issues back in the court, so I won't elaborate on that.

Also, our analysis suggests there are substantial environmental and economic advantages to the Canadian route and these are then advantages that must be counted as benefits or delaying a decision or accepting the time delay that might, but would not necessarily, certainly be part of the package of deciding on the Canadian alternative.

Concerning the balance-of-payments question, the impact of development of Alaskan oil on the U.S. balance of payments is an important but often, again, misunderstood point. The main question is what difference does it make to the balance of payments whether Alaskan oil is shipped through TAPS or Canada. Both TAPS and the Canadian route would reduce our imports of foreign oil and reduce foreign expenditures accordingly and since the impacts are the same, in that sense, between the two routes, that information shouldn't play a role in the choice of the selection of alternatives. The dominant consideration in comparing the two routes in terms of balance of payments effect is what kind of arrangements will be worked out for financing the construction of a Canadian alternative. Let me illustrate this by considering two polar hypothetical cases.

If the Canadian pipeline were entirely financed by U.S. capital, that would show up during the period of construction as a dollar outflow on our long-term foreign investment in the U.S. balance of payments accounts, but it would be followed thereafter by a return flow of recouped investment interest and profits over the life of the project and the net effect would be positive for the U.S. balance of payments.

At the other extreme—and this is a very unlikely alternative—but if the pipeline were financed entirely by Canadian capital, then it is true the pipeline cost itself, or at least the Canadian portion of the route, would represent a direct dollar drain on the balance of payments. If some combination of American and Canadian financing were worked out, then the balance of payments drain would be proportional to the Canadian share of financing.

How big are these outflows likely to be? It is possible to provide some very crude estimates of the likely first round outflows based on the information in the impact statement. They calculate the cost per barrel would be \$1.20 before the Canadian alternative. If the line is built entirely with Canadian capital, the first round outflow would be \$876 million per year. On the other hand, if the line were built with 50 percent U.S. capital, the direct outflow would be over \$400 million per year. But it is important to put these figures in perspective. The total dollar outflow for imports of goods and services to the

United States is likely to be over \$100 billion per year in 1980, and likely to be over \$150 billion per year by 1985. Thus the net dollar outflow attributable to building the Canadian route rather than TAPS is likely to be only a small fraction of 1 percent of our total overall balance of payments, total volume of U.S. expenditures abroad.

So this argues to me this should not be a major consideration. There is no reason for it to be a major consideration in comparing the two routes.

Finally, in summary, the most striking thing to me about the recent discussion of the two alternatives is how little factual information is available on the real issues which have emerged since the impact statement was released last March of 1972. The real issues are the common corridor oil and gas system and also the possibility of building naturally two oil pipelines rather than one. Also, how much of the discussion is based on mere speculation about outcomes and consequences? So, to me, the need for further study of the issue is clear. It appears now the responsibility lies with Congress to see these studies are carried out and are independent and objective. I strongly support legislation which would require independent study and analysis of the real alternatives and report on these studies to Congress.

I would also suggest that if Congress directs a study, that the study group not be ordered to limit its consideration to one alternative, but it should present appraisals of the environmental and economic aspects of all of the relative alternatives to Congress, so the Congress can then make the ultimate tradeoff and evaluations that are required.

Thank you, sir.

Mr. MELCHER. Thank you very much, Dr. Freeman.

Mr. Stoel, you are the last member of the panel.

STATEMENT OF THOMAS B. STOEL, JR., NATIONAL RESOURCES DEFENSE COUNCIL, WASHINGTON, D.C.

Mr. STOEL. Mr. Chairman, my name is Thomas Stoel. I am an attorney in Washington, D.C., with the National Resources Defense Council, an environmental public interest law firm.

During 1969-1970, I was a staff member of the Cabinet Task Force On Oil Import Control, where my duties included analysis of the relationship between oil imports and national security. I am one of the council for environmental groups challenging the legality of the Alaska pipeline. The views expressed today are my own.

My purpose today is to compare the national security benefits to the proposed Trans-Alaskan pipeline with those of an alternative oil pipeline across Canada to the U.S. Midwest. In my oral testimony, I will briefly summarize the prepared statement which I have already submitted.

Mr. MELCHER. Without objection, Mr. Stoel's entire statement will be made a part of the record at this point.

Hearing no objection, so ordered.

[Mr. Stoel's statement follows:]

STATEMENT OF THOMAS B. STOEL JR., NATIONAL RESOURCES DEFENSE COUNCIL

I. INTRODUCTION

Mr. Chairman, I appreciate the opportunity to appear before this Committee with regard to its consideration of measures relating to the transportation of oil and gas resources from the North Slope of Alaska. The two chief alternative means which have been suggested for transporting Alaskan North Slope oil are the proposed Trans-Alaskan Pipeline and an oil pipeline through Canada to the U.S. Midwest. My purpose today is to compare the national security impacts of these two alternatives. My conclusion is that a Canadian oil pipeline clearly would be of greater benefit to our national security than the proposed Trans-Alaskan Pipeline.

For the Committee's information, I am an attorney in Washington, D.C., with the Natural Resources Defense Council, an environmental public interest law firm. During 1969-70, I was a staff member of the Cabinet Task Force on Oil Import Control, where my duties included analysis of the relationship between oil imports and national security. I am one of the counsel for environmental groups challenging the legality of the proposed Alaska line. However, the views expressed today are my own.

II. SUMMARY

The proposed trans-Alaskan pipeline might provide some extra security against foreign supply interruptions during a two- to five-year period, beginning about 1977, when a Canadian pipeline could not yet be in operation. However, the Alaskan line would deliver oil to an area of the country—the West Coast—which could almost certainly develop sufficient domestic or secure foreign supplies to deal with any emergency during that period even in the absence of North Slope oil. In return for this largely unneeded extra security in the late 1970's and perhaps the early 1980's, the trans-Alaskan pipeline would substantially diminish the Nation's security during the more hazardous period which will follow. By satisfying West Coast needs, the Alaskan line would reduce incentive to develop for domestic use such promising areas as offshore California, the Gulf of Alaska, and Western South America. The magnitude of estimated recoverable reserves in these areas gives them great potential for enhancing our security. In addition, oil delivered via a trans-Alaskan pipeline would be vulnerable to physical interruption by enemy attacks or earthquakes.

A trans-Canadian pipeline, on the other hand, would assure a West Coast market for oil from the domestic and secure foreign areas mentioned above. By trailblazing the Canadian pipeline route, it would accelerate development of oil reserves in the U.S. and Canadian Arctic, the areas with the greatest secure oil potential. Most important, a Canadian line would deliver Prudhoe Bay oil and the extra supply flowing from accelerated Arctic development to the rest of the United States east of the Rockies. This area will account for more than 80% of the Nation's oil consumption in 1980-85 and will be more dependent on non-Canadian imports than the West Coast even if North Slope oil is excluded from the calculation. In addition, this area has fewer domestic and foreign sources of emergency oil supplies than the West Coast. The Canadian line would thus deliver oil supplies to the area of the country where the threat to security is by far the greatest. It would also be more physically secure than an Alaskan line.

III. BACKGROUND

In 1968 the largest oil field in North America was discovered near Prudhoe Bay on Alaska's North Slope. Oil companies proposed in 1969 the construction of a 789-mile pipeline to transport oil from the field to southern Alaska for shipment by marine tankers to the United States West Coast. In May 1972, the Secretary of the Interior indicated his willingness to grant the necessary rights-of-way across public lands. Construction of the trans-Alaskan line still depends upon Congressional amendment of the Mineral Leasing Act and perhaps the outcome of environmental litigation. If construction

were to begin in the spring of 1974, the Alaskan line might be completed sometime in 1977. Deliveries of oil would begin at a rate of about 600,000 barrels per day (b/d), and the pipeline would reach its full 2 million b/d capacity about 1982.¹

Both environmentalists and persons concerned about national security have pressed the alternative of a trans-Canadian pipeline to the United States Midwest.² A trans-Canadian pipeline would be economically competitive with a trans-Alaskan line, and many believe it would be environmentally superior, but it would take two to five years longer to construct.³ With the notable exception of the Secretary of Defense, federal officials have claimed this delay makes a trans-Canadian pipeline less beneficial to national security than a trans-Alaskan line; the Secretary of Defense found each line equally advantageous from a security viewpoint.⁴ The Secretary of the Interior cited national security as one of the grounds for his decision to reject the Canadian alternative and approve the Alaskan line.

The national security importance of Alaskan North Slope oil is that it will relieve the United States of the necessity to import an equal amount of foreign oil.⁵ By the time any pipeline can be completed, much of the foreign oil thus "backed out" is expected to be Eastern Hemisphere oil, which is considered relatively insecure.⁶ In its 1970 report, the Cabinet Task Force on Oil Import Control found the chief danger of dependence on foreign oil to be a politically inspired interruption of oil supplies from the Middle East and North Africa, but noted that Eastern Hemisphere oil might also be interdicted in a "shooting war" with another superpower.⁷

IV. THE CASE FOR THE TRANS-ALASKAN PIPELINE

The national security argument in favor of the proposed trans-Alaskan pipeline, as opposed to the Canadian alternative, is based on the anticipated two- to five-year delay in construction. As noted above, an Alaskan pipeline might be able to start delivering oil in 1977, in amounts beginning at 600,000 b/d and rising to the 2 million b/d pipeline capacity by about 1982. A Canadian line would not begin delivering oil until 1979 to 1982.

In order to assess the maximum contribution of the trans-Alaskan pipeline to national security, it will be assumed that sometime during the delay period a national security emergency reduces the supply of foreign oil. It will be assumed for the sake of analysis that the emergency is not a shooting war but a one-year boycott by some foreign suppliers other than Canada. It will additionally be assumed that no major earthquakes occur on the Alaskan pipeline route during that year, and that by extraordinary measures shipments through the pipeline can be increased by an average of 25% during the one-year emergency (up to the maximum capacity of 2 million b/d).

Under these assumptions, oil would be delivered to the southern coast of Alaska in the amounts shown in Column 1 of Table I.⁸ If the Elk Hills Naval Petroleum Reserve in California were utilized at 350,000 b/d, and inventories and spare capacity were drawn upon as postulated by the Cabinet

¹ See U.S. Department of the Interior, *An Analysis of the Economic and Security Aspects of the Trans-Alaska Pipeline*, vol. 1, p. E-16 (March 1972) (hereinafter "Economic and Security Analysis").

² For a national security perspective, see Letter of S. D. Freeman to Interior Secretary Morton, May 4, 1972.

³ An estimate of two years' delay was made by Canadian Energy Minister MacDonald at a press conference following his meeting with Secretary of the Interior Morton on March 30, 1972. This agrees with the estimate of Mackenzie Valley Pipeline Research, Ltd., in a January 22, 1973, press release. A five-year estimate recently was offered by Secretary Morton. See *Harper's Magazine*, Dec. 1972, p. 8.

⁴ See *Economic and Security Analysis*, vol. 2, pp. M-5-2 to M-5-3.

⁵ The Prudhoe Bay field also contains natural gas. The gas cannot be produced until oil begins flowing. The gas too will enhance national security by reducing U.S. reliance on oil imports. This paper nevertheless focuses on alternative oil delivery systems because: (1) Prudhoe Bay gas almost certainly will be delivered by pipeline through Canada to the U.S. Midwest; and (2) the problems of constructing a Canadian oil line are essentially similar to those of a gas line, so choice of a Canadian rather than an Alaskan route for oil should not substantially delay gas deliveries.

⁶ See *Economic and Security Analysis*, vol. 1, App. D.

⁷ Report of the Cabinet Task Force on Oil Import Control ¶¶ 413, 415 (hereinafter "Task Force Report").

⁸ See *Economic and Security Analysis*, vol. 1, p. E-16.

Task Force on Oil Import Control,⁸ the West Coast supply-demand gap would not absorb all the North Slope oil available, as shown in Tables I and II.¹² If it were vitally necessary, a large proportion of that oil could be made available to the part of the country east of the Rocky Mountains, either directly or by diverting Canadian oil previously consumed on the West Coast. Let us assume that all the excess North Slope oil could thus be made available. The results for the area east of the Rockies are shown in Tables III and IV.¹³ They indicate that during 1977-82 the proposed trans-Alaskan pipeline, in addition to satisfying all the West Coast oil demand that would otherwise have to be met from non-Canadian sources during the postulated emergency, could reduce the proportion of demand east of the Rockies which must be met from these sources by from 2% to 5%, depending on the year.

TABLE I.—WEST COAST SITUATION DURING 1-YEAR OIL INTERRUPTION, 1977-82, WITH ALASKAN PIPELINE

(Quantities in thousands of barrels per day)

Year	1 Crude oil available from North Slope via Alaska pipeline	2 Daily deficit without North Slope oil (from table II, col. 4)	3 Daily deficit with Alaska pipeline	4 Amount of crude oil available for shipment east of Rockies
1977	750	467	0	283
1978	1,000	581	0	419
1979	1,000	702	0	298
1980	1,200	837	0	373
1981	1,750	958	0	792
1982	2,000	1,096	0	904

TABLE II.—SITUATION ON WEST COAST DURING 1-YEAR OIL SUPPLY INTERRUPTION, 1977-82, WITH NO NORTH SLOPE OIL

(Quantities in thousands of barrels per day)

Year	1 Estimated daily crude oil demand	2 Daily deficit if production of 1,153,000 bbl/d, net inflow from Canada and Rocky Mountain area 437,000 bbl/d, and no non-Canadian imports	3 Daily deficits if Elk Hills N.P.R. produces 350,000 bbl/d	4 Daily deficit if spare capacity and inventories are utilized	5 Percentage total demand that must be met by crude oil from other sources
1977	2,842	1,247	897	467	16
1978	2,973	1,378	1,028	581	20
1979	3,110	1,515	1,165	702	23
1980	3,253	1,658	1,308	827	25
1981	3,403	1,808	1,458	958	28
1982	3,560	1,965	1,615	1,096	31

⁸ The Interior Department estimates Elk Hills could attain 350,000 b/d of production with an investment of \$100,000,000. Economic and Security Analysis, vol. 3, p. VI-29. The Cabinet Task Force found 5% excess capacity and inventories equal to 45 days of normal consumption available for emergency use in the U.S. and Canada. See Task Force Report ¶¶ 239-40, Tables F-E and accompanying notes.

¹² In addition to the inventory and spare capacity assumptions stated above, Tables I and II assume that demand will grow at the 4.6% annual rate postulated by the Interior Department in its Economic and Security Analysis. Domestic production and Canadian and Rocky Mountain shipments are Interior estimates for 1980. See *id.*, p. C-7 (Fig. C-4).

¹³ Tables III and IV assume the same conditions as Tables I and II. They describe the situation east of the Rockies; the Rocky Mountain region itself is not included in any of the tables because its production is expected approximately to equal its demand. See Economic and Security Analysis, App. C.

TABLE III.—SITUATION EAST OF THE ROCKIES DURING 1-YEAR OIL SUPPLY INTERRUPTION, 1977-82, WITH NO NORTH SLOPE OIL

(Quantities in thousands of barrels per day)

Year	1 Estimated daily crude oil demand	2 Daily deficit if production 9,532,063 bbl/d, net inflow from Canada and Rocky Mountain area 1,013,000 bbl/d and no non- Canadian imports	3 Same as col. 2 because no reserves anal- ogous to Elk Hills	4 Daily deficit if spare capacity and inventories are utilized	5 Percentage total demand that must be met by crude oil from other sources
1977	16,975	6,430	6,430	3,810	22
1978	17,756	7,211	7,211	4,495	25
1979	18,573	8,028	8,028	5,211	28
1980	19,428	8,883	8,883	5,991	31
1981	20,332	9,777	9,777	6,745	33
1982	21,257	10,712	10,712	7,564	36

TABLE IV.—SITUATION EAST OF ROCKIES DURING 1-YEAR OIL INTERRUPTION, 1977-82, WITH ALASKAN PIPELINE

(Quantities in thousands of barrels per day)

Year	1 Amount of North Slope crude available (from table I, col. 4)	2 Daily deficit with Alaska pipeline	4 Percentage of total demand that must be met by crude from other sources
1977	283	3,527	21
1978	419	4,076	23
1979	298	4,913	26
1980	373	5,588	29
1981	792	5,953	29
1982	904	6,660	31

V. THE CASE FOR THE CANADIAN ALTERNATIVE

The national security argument for an alternative Canadian pipeline has two parts. The first details the ways in which the Nation could cope with an overseas oil interruption during the two- to five-year period when an Alaskan pipeline could be delivering oil but a Canadian line could not. The second describes the very substantial advantages of a Canadian line after its completion.

A. National Security During Delay Period

It has been assumed that construction of an alternative Canadian pipeline would delay delivery of North Slope oil from 1977 to sometime between 1979 and 1982. Column 5 of Table II shows the dependence of the West Coast on non-Canadian sources during a one-year interruption of the type postulated previously. It ranges from 16% of consumption in 1977 to 31% in 1982. East of the Rockies, the degree of dependence—shown in Column 5 of Table III—ranges from 22% of demand in 1977 to 36% in 1982.

There are a number of ways of coping with this situation. First, the Nation could in the near future adopt a system which assures security by storing oil for use in emergencies. The Cabinet Task Force recommended that such methods be the subject of "intensive study."²² Professors Walter Mead and Philip Sorenson assert that one such method—"storage" in shut-in oil fields—would be cheaper than the present quota system and more responsive to security needs.²³ In his recent Energy Message, the President at last directed the Oil Policy Committee to study these ways of assuring security.

²² Task Force Report 5-456.

²³ W. Mead & P. Sorenson, "A National Defense Petroleum Reserve Alternative to Oil Import Quotas," *Land Economics*, vol. 47, p. 211.

Even in the absence of a nationwide storage system, West Coast security could be substantially enhanced by standby production from domestic oil fields presently shut in. Mead and Sorenson state that the Elk Hills Naval Petroleum Reserve could, at a relatively modest cost, be made capable of producing an average of more than 1.2 million b/d in a one-year emergency.²⁴ This production alone would reduce the West Coast's maximum dependence on non-Canadian foreign oil during the postulated one-year emergency in the period 1977-82 from 31% of demand to only 6%. In addition, the *Oil and Gas Journal* has estimated reserves in the shut-in Santa Ynez field off Southern California at 3 billion barrels;²⁵ an Interior Department working group has identified another area off Southern California with an estimated 1 billion barrels of reserves.²⁶ If these estimates are correct, development of these offshore reserves could make available another 1,000,000 b/d of secure, easily delivered oil during the period 1977-82.²⁷ This supply—entirely apart from increased Elk Hills production—would reduce maximum West Coast dependence on non-Canadian foreign oil to less than 3% of demand should the postulated emergency occur during that period. Taken together, the Elk Hills and offshore supplies just described would make the West Coast more than self-sufficient during the postulated emergency.

Third, imports could be increased from Canada or from other countries not involved in a boycott. The possibility of increased imports from Canada—the most secure foreign source—is especially noteworthy. It appears that Canada currently could produce considerable additional oil from known reserves in Southern Canada.²⁸ Canada apparently would be willing to boost production and exports to the U.S. West Coast specifically in order to meet U.S. needs resulting from delay in completing a trans-Canadian pipeline. The Canadian Minister of Energy, Mines, and Resources in April 1972 was asked in the House of Commons:

In light of American concern over their supply of oil during the two-year period required to evaluate alternative transportation routes to the trans-Alaska pipeline system, may I ask the minister whether he has made clear to his United States counterpart Canada's willingness to make oil available to the United States during this period so that a proper evaluation of a route can be undertaken free of short-term security considerations.

He replied:

Both in my discussions with Secretary Morton and other officials of the United States administration in Washington and recently with Secretary Rogers last week, I made it perfectly clear that Canada was prepared to supply additional quantities of oil to the United States not only for a two-year period but a longer period. . . .²⁹

In a March 18, 1973, interview televised in Canada, the Minister was asked:

Does your . . . statement still stand that said (1) we are willing to entertain applications for a Mackenzie line and (2) supply them with oil in the interim if they choose a Canadian line?

He replied:

One, yes, and I think we can meet two, the second objective, as well. . . . We are now supplying the Puget Sound refineries on the American West Coast through the Canadian Trans-Mountain system. They are starting to get some tanker shipments from overseas. But I

²⁴ *Op. cit. supra* note 13, at 219. The annual cost would be \$0.22 per barrel. *Id.*, at 219-20.

²⁵ *Oil and Gas Journal*, May 1, 1972, p. 198.

²⁶ Unpublished Preliminary Report, Geological and Technical Working Group of Interior Department Outer Continental Shelf Task Force, May 1972.

²⁷ This estimate assumes a reserve-to-production ratio of 10 to 1, a common ratio for domestic fields.

²⁸ At the end of 1970, Canada's proved oil reserves totalled 10.4 billion barrels. Production in 1970 was only 1.4 million b/d, a reserve-to-production ratio of more than 20 to 1. At a feasible reserve-to-production ratio of 10 to 1, production would have been over 2.8 million b/d.

²⁹ Commons Debates, April 19, 1972, p. 1440.

think that we would make every effort to try and meet the increased demand of the Puget Sound system in that period of years before the whole system, the whole Alaskan system, could come into operation.²⁷

Increased imports from other nations are also a possibility, especially for the West Coast. For example, exploration is accelerating in Western South America.²⁸ Deliveries from new fields in Ecuador have already begun,²⁹ and the Interior Department believes Ecuador has a potential of "one or two million barrels per day."³⁰

B. National Security After Completion of Canadian Line

After completion, a trans-Canadian pipeline would have very substantial national security advantages over a trans-Alaskan line. One of the main reasons is that a Canadian line would deliver oil to the part of the country where the threat to security is greatest. Since the inception of the oil import program in 1959, the West Coast has been treated separately from the rest of the country because of the difficulty of shipping oil across the Rockies. The rest of the country has generally been treated as a single unit because oil can be transported throughout. By 1985, overall demand on the West Coast is expected to be less than 15% of the total in the Nation. It makes sense from a security point of view to channel the entire 2 million b/d of a security point of view to channel the entire 2 million b/d of North Slope production to this small, isolated market—as an Alaskan pipeline would—only if its potential supply deficit without North Slope oil is proportionally greater than that east of the Rockies and the prospect for supplying it from other domestic or secure foreign areas is very dim. Precisely the opposite is true. Tables II, III, V, and VI show the situation on the West Coast and east of the Rockies, respectively, during the period 1980-85, assuming a one-year emergency of the type postulated previously and no oil from the North Slope.³¹ In each year the dependence of the area east of the Rockies on non-Canadian imports not only is much greater in absolute amount than that on the West Coast but also constitutes a larger proportion of demand.

The West Coast would be much easier to supply from secure domestic sources than the part of the country east of the Rockies. As noted earlier, Mead and Sorenson estimate the Elk Hills Naval Petroleum Reserve could produce 1.2 million b/d in an emergency with a modest investment. Even in 1985, this would reduce West Coast maximum dependence on non-Canadian imports during the postulated emergency from 40% of demand to 17%. By the 1990's, known oil fields off Southern California could be producing more than 1,000,000 b/d if estimates of their potential are accurate. This offshore production, together with expanded Elk Hills capacity, would make the West Coast completely independent of non-Canadian foreign oil should the postulated emergency occur in 1985 and no North Slope oil be delivered. Meanwhile, the much larger area east of the Rockies would be 41% dependent on non-Canadian foreign oil.

²⁷ Transcript, *Question Period* (Canadian Television production), March 19, 1972, p. 4.

²⁸ See *Oil and Gas Journal*, Dec. 20, 1971, p. 19; *id.*, Feb. 28, 1972, p. 95; *id.*, April 17, 1972, p. 25.

²⁹ *Id.*, Aug. 28, 1972, p. 31.

³⁰ *Economic and Security Analysis*, vol. 1, p. C-14.

³¹ Domestic production estimates in Tables V and VI are averages of Interior's 1980 and 1985 estimates. See *Economic and Security Analysis*, vol. 2, pp. L-2-13 to L-13-17 (Tables 2-B to 2-F). Net inflows from Canada and the Rocky Mountain region are assumed the same as in Tables II and III, and the assumptions about Elk Hills production, inventory drawdown, and use of spare capacity are also the same. Demand estimates are by interpolation from Interior's estimates for 1980 and 1985. See *id.* Very recently, estimates of future U.S. oil demand have been revised upward based primarily on the necessity of substituting oil for coal if clean air goals are to be met. See, e.g., *Oil and Gas Journal*, Nov. 12, 1972, p. 92. These revisions are not reflected in the tables. However, the increases are expected to be heavily concentrated in a few states, all east of the Rockies. *Id.*, p. 92. Thus, the tables probably understate the relative dependence on imported oil of the area east of the Rockies.

TABLE V.—SITUATION ON WEST COAST DURING 1-YEAR OIL SUPPLY INTERRUPTION, 1983-85, WITH NO NORTH SLOPE OIL

[Quantities in thousands of barrels per day]

Year	1 Estimated daily crude oil demand	2 Daily deficit if production 1,033,000 bbl/d, net inflow from Canada and Rocky Mountain area 437,000 bbl/d, and no non-Canadian imports	3 Daily deficit if Elk Hills N.P.R. produces 350,000 bbl/d	4 Daily deficit if spare capacity and inventories are utilized	5 Percentage total demand that must be met by crude oil from other sources
1983	3,662	2,185	1,836	1,311	36
1984	3,878	2,334	1,984	1,440	38
1985	3,963	2,487	2,137	1,574	40

TABLE VI.—SITUATION EAST OF THE ROCKIES DURING 1-YEAR OIL SUPPLY INTERRUPTION, 1983-85, WITH NO NORTH SLOPE OIL

[Quantities in thousands of barrels per day]

Year	1 Estimated daily crude oil demand	2 Daily deficit if production 9,121,000 bbl/d, net inflow from Canada and Rocky Mountain area 1,013,000 bbl/d, and no non-Canadian imports	3 Same as col. 2 because no reserves anal- ogous to Elk Hills	4 Daily deficit if spare capacity and inventories are utilized	5 Percentage total demand that must be met by crude oil from other sources
1983	21,384	11,250	11,250	8,107	38
1984	22,079	11,945	11,945	8,716	39
1985	22,797	12,663	12,663	9,345	41

Another promising domestic source of oil for the West Coast in the 1980's is the Gulf of Alaska. Former Undersecretary of the Interior Pecora, himself a geologist, estimated the crude oil potential of the Gulf of Alaska at 40 billion barrels.²⁰ This compares with the 9.6 billion barrels of known reserves at Prudhoe Bay, which are expected to yield 2 million b/d. In his recent Energy Message, the President directed federal agencies to study the environmental impact of oil and gas production in the Gulf of Alaska, a step toward a federal leasing program.

The West Coast is the obvious domestic market for Gulf of Alaska oil, since shipment to other domestic markets would be expensive and environmentally hazardous. If a trans-Alaskan pipeline were constructed, it would shut off this market by supplying virtually all West Coast oil demand until well into the 1980's. The Interior Department's own analysis of economic and security aspects of the trans-Alaskan line concludes that "substantial Gulf of Alaska production could produce a substantial and inconvenient surplus [on the West Coast] if North Slope oil were to go there."²¹ A strong national security advantage of a Canadian line is that it would leave a West Coast market for Gulf of Alaska oil and thereby stimulate exploration and production in the Gulf.

A foreign source which offers both substantial security and considerable oil potential is the West Coast of South America. As mentioned previously, exploration is accelerating, shipments from Ecuador have already begun, and the Interior Department estimates potential production in Ecuador alone at one to two million barrels per day. The natural U.S. market for this oil is the West Coast. Shipment to other parts of the country through the Panama Canal or around Cape Horn would be expensive, environmentally hazardous, and in the case of Cape Horn shipments less physically

²⁰ *Oil and Gas Journal*, Jan. 17, 1972, p. 62.

²¹ *Economic and Security Analysis*, vol. 1, p. C-14.

secure. Construction of a Canadian line would assure a West Coast market for this oil, increasing incentives for its development and enhancing our security.

Another major reason for the substantial security advantage which would be enjoyed by a Canadian line after completion is that it would stimulate production of the enormous oil and gas reserves thought to exist in the Arctic regions of the United States and Canada apart from the Prudhoe Bay field. Rapid discovery and development of large amounts of oil from these areas would obviously make us more secure.

The most promising unexploited domestic source of oil is the Alaskan North Slope outside the Prudhoe Bay field. Former Undersecretary of the Interior Pecora estimated the total crude oil potential of the North Slope at 140 billion barrels, compared with 9.6 billion barrels known at Prudhoe Bay.²⁷ The *Oil and Gas Journal* recently estimated recoverable reserves on the North Slope at 75 billion barrels.²⁸ Part of these reserves are thought to lie within Naval Petroleum Reserve No. 4, located near the Prudhoe Bay field. Estimates of recoverable reserves in NPR No. 4 range from 4.99 to 2.4 billion barrels, which would make possible an emergency standby capacity of 1.52 to 8.7 million b/d.²⁹

The only U.S. markets with demand sufficient to absorb the large quantities of oil which could be produced from these North Slope reserves are the Midwest and East Coast. The only ways of delivering North Slope oil to these markets are by trans-Canadian pipeline or ice-breaking tankers. The environmental and technical problems of ice-breaking tankers remain to be solved,³⁰ and tankers would be less physically secure than a pipeline. Hence, if this North Slope oil is to be delivered east of the Rockies by the mid-1980's, it must be by trans-Canadian pipeline. Construction of that line would have to begin by the early 1980's.

The problems and costs of pipeline construction would be much diminished if such a pipeline were the second rather than the first on the Canadian route. The Interior Department's current justification of the proposed Alaskan line as no more environmentally harmful than a Canadian line depends on the assumption that no Canadian oil line will be built for many, many years. Hence, environmentalists would oppose strenuously any proposal by the Department to authorize a Canadian line in addition to the Alaskan line, thereby unnecessarily multiplying environmental harm. Building a Canadian rather than an Alaskan line now to carry Prudhoe Bay oil would eliminate these obstacles and increase the incentives to develop the vast amounts of secure oil—estimated at more than twice the total of presently known reserves in the entire U.S.—thought to exist elsewhere on the North Slope.

Perhaps the most promising source of secure oil imports is the Canadian Arctic. Oil and gas have been discovered there. Although oil discoveries have thus far lagged below expectations, potential reserves were conservatively estimated in 1969 at 44 billion barrels;³¹ the *Oil and Gas Journal* recently estimated them at 105 billion barrels.³² As with the North Slope, the only U.S. markets able to absorb these quantities of oil are the Midwest and East Coast, and a Canadian pipeline is the only feasible means of delivery by the mid-1970's. Again, construction problems would be diminished if the pipeline were the second on the route. Hence, construction of a trans-Canadian rather than a trans-Alaskan pipeline from Prudhoe Bay would provide incentives for early development of Canadian Arctic oil resources.

The final major advantage of a trans-Canadian pipeline is its greater physical security. In a shooting war, the marine tanker leg of a trans-Alaskan system would be more vulnerable to enemy attack than a pipeline. Moreover, the Interior Department predicts at least one major earthquake on the trans-Alaskan pipeline route during the life of the pipeline.³³ If it

²⁷ *Oil and Gas Journal*, Jan. 17, 1972, p. 62.

²⁸ *Oil and Gas Journal*, Oct. 28, 1972, p. 70.

²⁹ See Task Force Report, App. J, 11-21.

³⁰ See Economic and Security Analysis, vol. 1, pp. C-20 to C-21.

³¹ DeGolyer & McNaughton, Report on Estimates of Additional Recoverable Reserves of Oil and Gas for the United States and Canada, pp. 17, 27 (June 1969).

³² *Oil and Gas Journal*, Oct. 23, 1972, p. 70.

³³ Department of the Interior, Final Impact Statement on Proposed Trans-Alaskan Pipeline, vol. 1, p. 97 (1972).

should occur when foreign supplies were interrupted. North Slope oil deliveries could be delayed and national security jeopardized. There is no significant risk of a major earthquake on the trans-Canadian route.

VI. CONCLUSION

Despite the national security advantages of a trans-Canadian pipeline which have just been described, the Secretary of the Interior cited national security as a reason for approving the proposed trans-Alaskan line. Perhaps major federal actions with significant impacts on national security should be required to be accompanied by "national security impact statements." For it is sobering to realize that if our Government's national security analysis of the trans-Alaskan pipeline were subjected to the same standard of completeness and candor as its environmental analysis, it would surely be found deficient.

Mr. STOEL. Thank you.

I believe the Canadian pipeline would be superior on national security grounds to the proposed trans-Alaska pipeline, for three reasons, which I will summarize very briefly.

First, a Canadian pipeline would deliver oil to a part of the country where it will be desperately needed in case of severe interruptions of foreign oil supply, while the Alaska line would not. The only security advantage of an Alaska pipeline, which has been cited, is that it would be completed before a Canadian line. Informed estimates of delay of completing the Canadian compared with the Alaskan range from 2 to 3 years. The shorter estimates appear to be more credible. A year ago, Canadian Energy Minister MacDonald estimated the delay period at 2 years. Even more recently, an industry group, Mackenzie Valley Pipeline Research, Ltd., estimated delay at even less than 2 years.

The security benefit of the Alaska pipeline even during this delay period would be very meager because the Alaska line would deliver their oil to the west coast, which is likely to be secure in any event. The analyses in my prepared statements show that during the anticipated period, emergency production from the Elk Hills Naval Petroleum Reserve in California and production from known but undeveloped fields offshore in California, could make the west coast completely self-sufficient during the 1-year cutoff of all non-Canadian, foreign oil. The west coast is also likely to receive added foreign oil supplies during the delay. Some of these sources could be Canada, which has promised increased supplies to the Puget Sound area and Ecuador. A Canadian line by contrast would deliver oil to a part of the country where it would be very badly needed.

Without North Slope oil, my analysis indicates the area east of the Rockies, which in 1985 will account for more than four-fifths of the Nation's oil consumption, will be over 40 percent dependent on non-Canadian oil, much from the Middle East even after emergency measures have been taken.

It seems wrong from the point of view of security to direct 2 million barrels of fuel from the North Slope production to a small isolated oil market which will not even need it and leave a much larger area east of the Rockies sadly short of oil in an emergency.

Second, a trans-Canadian pipeline would provide incentives for production of large quantities of oil estimated to exist in domestic and secure foreign areas. The Alaska line would reduce these in-

centives. The area to which I refer includes the Gulf of Alaska, Alaska North Slope outside Prudhoe Bay, and Canadian Arctic. Each of these areas has been estimated to control oil reserves much larger than those already known to exist at Prudhoe Bay. The oil potential of these areas represents perhaps our best chance of achieving real oil security during the period of the 1980's.

Third, and finally, a trans-Canadian pipeline would be more physically secure than a trans-Alaska pipeline. In a shooting war a marine tanker laying off the trans-Alaska would be more vulnerable a system to an enemy attack. Moreover, the Interior Department prediction of one major earthquake on the trans-Alaska route during the life of the pipeline. If it should occur when foreign supplies were interrupted, the North Slope oil deliveries could be delayed and the national security jeopardized. There is no significant risk of major earthquake on the trans-Canadian route.

For these reasons, I believe the national security advantages of a trans-Canadian oil pipeline clearly outweigh those of the proposed trans-Alaska one.

Mr. MELCHER. Thank you very much, Mr. Stoel.

We thank all of the members of the Panel. They have presented expert testimony for us. I will start questioning now.

Mr. DIENELT, you indicated, and others on the Panel indicated that the Canadian Government is favorable to a trans-Canadian pipeline. We had the impression from our government witnesses that they really hadn't indicated all that much interest. I think perhaps the committee will want to consider requesting some Canadian official to appear before the committee to factually state the case for the Canadian Government. Your testimony flies in the face of what we have been told by our government officials.

Now, Mr. DIENELT, it seems to me you are recommending that Congress study the findings of the Secretary of the Interior concerning the environment impact statement, also study a comparative route, or comparative routes across Alaska and across Canada. You think then, on the basis of that, Congress should make a finding, as I interpret your statement, and legislate according to their finding?

Mr. DIENELT. That is the position of the three groups I am speaking for.

Mr. MELCHER. Now, just so we clearly understand each other, then you are recommending this subcommittee make this study and comparison?

Mr. DIENELT. No, sir: I am recommending that it be a congressionally sponsored study, that it be conducted by an independent body. I believe on the Senate side, Senator Mondale introduced a bill, cosponsored by a number of other Senators, indicating the study would be conducted by the National Science Foundation. It is my understanding bills have been introduced in this subcommittee which would provide for a study by the National Academy of Sciences. It would be a study which is sponsored by and authorized by the Congress, directed by them, on which the Congress ultimately would act. But the subcommittee itself would not conduct the investigation.

Mr. MELCHER. The subcommittee would make the findings; is that correct? Is that what you are suggesting?

Mr. DIENELT. I have not gotten a copy of the bill which I understand was introduced yesterday—

Mr. MELCHER. My point is, let's get beyond this broad language that Congress make a finding and who in Congress is to make this finding? We know, if we are going to embark on that, we might want to take the advice of independent groups or at least consider their advice, but they are not part of the Congress. Whatever group you are talking about, or any number of groups, they are not a part of the Congress, they can't make a finding. So what you are suggesting is this subcommittee, having jurisdiction in this matter, should discuss and look at information supplied by groups—

Mr. DIENELT. No, what to be—

Mr. MELCHER. Stop me when I am wrong, because I want to find out what you are talking about.

Mr. DIENELT. What we understand to be the essence of legislation introduced in this subcommittee yesterday, which we don't have a copy of, and what has been introduced on the Senate side, would provide for a 6 to 9-month study by a group such as the National Science Foundation and the National Academy of Sciences, which would put together the information and present a study with recommendations, presumably through the respective committees of the Senate and House, which would then make its legislative recommendation with respect to the Alaska or Canadian line, based upon that study.

I presume that the committee would also, and I hope and expect it would satisfy itself during the process of the study and at the end of the study, the study was complete and adequate to permit an informed judgment. And that is what we understood the legislation to be in its broadest view.

Mr. MELCHER. The point, in summary, Mr. Dienelt, is that you are dissatisfied with the findings of the Secretary of the Interior. You are recommending that the subcommittee or some body of Congress ask for a study by another group. Then having that—and I would assume comparing it with Secretary Morton's findings—a decision would be made.

Now, we already have the environmental impact study by Secretary Morton so it would be a comparison with that. Is that correct?

Mr. DIENELT. It would be an additional study which for the first time would provide an adequate analysis of the Canadian route. Let me give you one example which relates back to the comment you made with respect to the attitude of the Canadian Government.

In my testimony, I indicated public statements by the Government. You have stated the administration has argued that the Canadian Government is unfavorable. The plain fact is, and the administration can't deny this, there have never been negotiations or discussions with the Canadians. I think your suggestion of having the Canadian Government officials down here is an excellent one. But the alternative is to have a study by an independent group, such as NSF or NAS, which is authorized to go to Canada and find out the facts with respect to feasibility of a Canadian alternative.

That is one example, and that would allow for an informed decision which can't be made now. The Interior Department's analysis is inadequate under NEPA and our point is the Interior Department

hasn't and won't make that kind of analysis that needs to be done for Congress by an independent, unbiased, objective group, after which Congress can make a decision.

Mr. YOUNG. Mr. Chairman.

Mr. MELCHER. I will yield in a minute. I want to complete my line of thought.

Your recommendation is to have this done, and then the finding is to be made by Congress. My line of questioning goes to whether you are suggesting that this subcommittee make that finding.

Mr. DIENELT. I am suggesting that Congress make the decision. So I suppose necessarily I am suggesting that this subcommittee get the study that has been done, assure itself it is adequate, and make a recommended finding, which I assume ultimately would be argued out on the floor of the House and in the Senate, and a bill would be passed authorizing—we fully expect the study would indicate the superiority of the Canadian alternative. But, in any event, the bill would pass.

Mr. MELCHER. I appreciate your opinion, but you would want this committee to be objective, would you not?

Mr. DIENELT. For the first time we would like an objective evaluation.

Mr. MELCHER. I think if we are going to be objective, we should not have the results told to us prior to looking at it.

Mr. DIENELT. That is only my expectation. But the point is, the bill would be passed, findings would be made, a bill would be passed, and Congress would act and it would be an informed and unbiased judgment.

Mr. MELCHER. You would also recommend those on the basis of autonomy; is that right?

Mr. DIENELT. That is right.

Mr. MELCHER. Thank you, Mr. Dienelt. Those are my questions.

The gentleman from Guam.

Mr. WON PAT. I would like to make a short comment.

Generally, I would like to commend the panel of witnesses for their very illuminating comments, or rather, testimony. I do not intend to question the witnesses individually with respect to various aspects of their testimony. I am sure that hearing your testimony, your valid testimony warrants, I believe, reconsideration of the other aspect of this matter.

This is the first time I heard such arguments, of course, before this committee. In the past I have heard, of course, mostly the argument for the trans-Alaska pipeline. There are bills, of course, introduced supporting the Canadian pipeline. Now, whether the Canadian pipeline is more efficient and economic, or the trans-Alaska, has yet to be resolved. That, I believe, will be the responsibility of this committee before it reports to the Congress.

Mr. Chairman, that is all I have to say. I am very much enlightened from the testimony of these gentlemen.

Mr. MELCHER. Thank you.

I apologize to the gentleman from Alaska. I said I would yield, and I forgot to.

Mr. YOUNG. Mr. Chairman, you followed through on my line of thought and I am okay.

Mr. MELCHER. The gentleman from Pennsylvania.

Mr. SAYLOR. First, Mr. Chairman, I would like to commend the witnesses. As I commented before, they have taken up most of the time in making their presentation, which I think could have been used to better advantage by questioning from the members of the committee.

Now, let's start with Mr. Dienelt. On page 6, top of the page, you say, "A proper evaluation of the Canadian route and adequate negotiations with the Canadian Government can, in other words, take place in relative short order."

Every Member of Congress the other day got a letter from the gentleman who is a member of this committee, Mr. Meeds, pointing out that after consultation by him with members of the Canadian Government who are dealing with the native claims, that until the native claims of the people of Canada are taken care which will be a matter of 5 to 10 years, there will be absolutely no negotiations taking place at all.

What do you have to say about that?

Mr. DIENELT. Mr. Saylor, I am very disturbed by that prospect and I should think this Nation would be. If there are no negotiations for 5 or 10 years because of no Canadian claims, there will be no gas-lines in Canada. It is expected the gas companies will make an application for gas pipeline this year. With respect to that, there is optimism as to the expeditiousness with which it can be achieved.

It is clear that if the gas pipeline is going to go through, there is going to have to be a resolution of such issues as native claims. That pipeline is expected, as I say, for application by the end of this year. The estimate is by the company that it could be on line in 1978. So I am quite surprised at the statement that you indicate was made in the letter by Congressman Meeds. I haven't seen the letter. I don't know what Canadian official made that statement, but to me the contrast between that and between the statements with respect to the urgent need for the gas pipeline and the fact it is expected to be built within, approved and built within 5 years, is only another illustration such as the one as I discussed with Congressman Melcher, of the need for discussions by officials, some official discussions between this Government and the Canadian Government to iron out those problems.

Because if we aren't going to get a gas pipeline for 5 to 10 years, we are not going to be able to get gas out of Prudhoe Bay, and, as I understand it, after the oil is flowing for awhile, they have to get the grass growing. The State of Alaska won't let them flare it, and that will be irresponsible in any event. They can only be injected in the ground for a certain period of time.

What you are saying and Congressman Meeds is saying, if true, means we are going to stop the gas pipeline and we are going to stop the delivery of oil even after the Alaska pipeline is built, after it has been on line for awhile, because gas is going to have to prevent the oil from coming out of the ground.

Mr. SAYLOR. No; that is not correct. In other words, there will be an application probably for a gas pipeline, which has been one of the things that has been kept under the table for a long period of time. Some of us have known about it but it isn't going to go through

Canada. It is going to go through Alaska. The application will come through Alaska, not Canada. If Canada wants to build one from the fields that are there, it will be for Canadian gas and not the gas that comes out of Prudhoe Bay.

Mr. DIENELT. My only comment with respect to that is, it certainly has been kept under the table, because the Department of the Interior and everyone else has widely assumed the only feasible way to bring the gas out is through Canada. Naturally, the gas is going to come out through Alaska as well, we are going to have quite a different situation and a different environmental situation and a different situation in the court under the National Environmental Policy Act, and we will have a great deal of litigation with respect to it.

Mr. SAYLOR. I can tell you that there is going to be a gas pipeline. They are going to apply for their permit to build a gas pipeline through Alaska and not through Canada. Everyone I have talked to tells me that they don't intend to apply for the gas pipeline down through Canada.

Now, you say there have been no negotiations, or no consultations, except the Interior Department.

Mr. DIENELT. I'd say there has been none by the Interior Department.

Mr. SAYLOR. There may be none by the Interior Department. It just so happens that Congress has had a group called the Inter-parliamentary Conference Between the Canadians and the United States Congress, and they meet in Canada and they meet in the United States. This had been one of the subjects of their conference every time they have met. The next meeting is coming up fairly shortly, and I have been asked by the chairman of the Foreign Affairs Committee, who is chairman of the conference, to meet with them again on the energy situation.

So I would recommend that you don't make such blanket statements, as much as I approve of what you are trying to do. Just be a little surer of your facts when you do it.

Mr. DIENELT. Congressman Saylor, if I can comment on that, I think it would be a real service to the American people if reports with respect to the parliamentary discussions that have taken place regarding joint energy policy or pipelines from Alaska and from Canada, if such a report would be made to the American people. I think the American people are not aware of it. My statements are based on the public record, which I believe I have examined carefully, and if this kind of information is made public, I certainly would be willing to reconsider my statements.

Mr. SAYLOR. All right. And when you say, on page 15, at the bottom, "Long overdue negotiations, which would be required as part of the congressionally-sponsored study," of course, a portion of this has been going on with leading members of the Canadian Parliament and with members of the U.S. Congress. It will continue to go on because there are a number of joint problems, many of which are environmentally oriented. For example, the height of the water on the Great Lakes, which vitally affects not only this country, but Canada. And particularly with regard to changes that are occurring