THE SENATE OF CANADA

MARCHING TO THE BEAT OF THE SAME DRUM

TRANSPORTATION OF PETROLEUM AND NATURAL GAS NORTH OF 60°

REPORT OF THE
SPECIAL COMMITTEE ON
THE NORTHERN PIPELINE
THE HONOURABLE
EARL A. HASTINGS,
CHAIRMAN

MARCH 1983

First Session
Thirty-second Parliament, 1980-81-82-83

Première session de la
trente-deuxième législature, 1980-1981-1982-1983

SENATE OF CANADA

SÉNAT DU CANADA

Proceedings of the Special Committee of the Senate on the

Délibérations du comité spécial du Sénat sur le

Northern Pipeline

Pipe-line du Nord

Chairman:
The Honourable EARL A. HASTINGS

Président:
L'honorable EARL A. HASTINGS

Wednesday, March 30, 1983

Le mercredi 30 mars 1983

Issue No. 38

Fascicule nº 38

Twenty-first Proceedings on:

Offshore Transportation Study

Vingt et unième fascicule concernant:

L'étude du transport offshore

REPORT OF THE COMMITTEE

entitled:

Marching to the Beat of the Same Drum

RAPPORT DU COMITÉ

intitulé:

Sur la même longueur d'onde

Membership of the Committee

The Honourable Earl A. Hastings, *Chairman*

The Honourable Paul Lucier, *Deputy Chairman*

and

The Honourable Senators:

Adams, Willie
Austin, Jack
Balfour, James
Bielish, Martha P.
Bonnell, M. Lorne
Cottreau, Ernest G.
Doody, C. William
Guay, Joseph-Philippe
Kelly, William M.
Langlois, Léopold
Molgat, Gildas L.
Nurgitz, Nathan
Perrault, Raymond J.
Riley, Daniel
Sherwood, Cyril B.
Thériault, L. Norbert
Yuzyk, Paul

Nota: The Honourable Senators Charbonneau, Hays, Tremblay and Williams also served on the Committee at various stages.

Clerk of the Committee
Timothy Ross Wilson

Published under authority of the Senate by the Queen's Printer for Canada

Available from the Canadian Government Publishing Centre, Supply and Services Canada, Hull, Québec, Canada K1A 0S9

ORDER OF REFERENCE

Extract from the Minutes of the Proceedings of the Senate, July 8, 1981:

"The Honourable Senator Balfour resumed the debate on the motion of the Honourable Senator Hastings, seconded by the Honourable Senator Cottreau, for the adoption of the Fourth Report of the Special Committee of the Senate on the Northern Pipeline.

After debate, and—
The question being put on the motion, it was—
Resolved in the affirmative."

The above-mentioned Fourth Report of the Special Committee of the Senate on the Northern Pipeline contained the following recommendation (*see Appendix to the Minutes of the Proceedings of the Senate of June 23, 1981 at pages 13335-13338*):

"The Special Committee, therefore, recommends that it be authorized to examine, consider and report on the transportation of petroleum and natural gas in Canada, north of the 60th parallel of latitude and any matter related thereto."

ORDRE DE RENVOI

Extrait des procès-verbaux du Sénat, le 8 juillet 1981:

«L'honorable sénateur Balfour reprend le débat sur la motion de l'honorable sénateur Hastings, appuyé par l'honorable sénateur Cottreau, tendant à l'adoption du quatrième rapport du Comité spécial sur le pipe-line du Nord.

Après débat,
La motion, mise aux voix, est adoptée.»

Ce quatrième rapport du Comité spécial du Sénat sur le pipe-line du Nord contient la recommandation suivante (*voir Appendice aux Procès-verbaux du Sénat du 23 juin 1981, aux pages 13335-13338*):

«En conséquence, le Comité spécial recommande qu'on l'autorise à examiner et étudier le transport du pétrole et du gaz naturel au Canada, au nord du 60e parallèle de latitude et toute autre question s'y rattachant, et à en faire rapport.»

Le greffier du Sénat
Robert Fortier
Clerk of the Senate

COVER Photo credits:

Drilling rig, "ITIYOK": Imperial Oil Limited

Ice-breaker: Dome Petroleum Limited

Woman and child: National Film Board Photothèque, photo by Terry Pearce

Pipeline: National Film Board Photothèque, photo by Crombie McNeill

MARCHING TO THE BEAT OF THE SAME DRUM

Transportation of Petroleum and Natural Gas North of 60°

Report of the Special Committee of the Senate on the Northern Pipeline

The Special Committee of the Senate on the Northern Pipeline has the honour to present its Fifth Report as follows:

The Committee was authorized by the Senate, as recorded in the Minutes of the Proceedings of the Senate of July 8th, 1981, "to examine, consider and report on the transportation of petroleum and natural gas in Canada, north of the 60th parallel of latitude and any matter related thereto."

Your Committee, in accordance with its terms of reference, has considered alternate proposals to transport hydrocarbons from the Arctic Region and their technical, environmental and social implications. The Committee found in its investigation that it was not possible to consider the subject of hydrocarbon transportation in isolation from that of hydrocarbon exploration, development and production. While not all the details of production have been covered, many that are pertinent to novel technological developments in the Beaufort Sea and High Arctic Regions have been embodied in the report. The Committee has looked at some of the issues arising out of these developments including regional and industrial benefits. The Committee has also examined decision-making procedures for major projects which determine the choice of a transportation system.

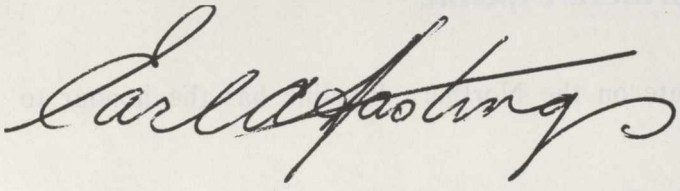
With first oil projected by industry to flow towards the end of the 1980s from the Beaufort Sea-Mackenzie Delta Region, there is some urgency in completing this stage of the Committee's work, and so it was felt advisable to produce a report that concentrates on the Arctic Region. While other areas such as the Eastcoast offshore are also likely candidates for development, these would be the subject of separate study.

The Committee, in fulfilling its mandate, held 23 public hearings in Ottawa (see Appendix A for date of meetings and list of witnesses). In addition, the Committee travelled

to the High Arctic and to Calgary for public hearings and unofficial meetings with native and other northern groups, and officials from industry.

The on-site visits to industrial operations and communities in the Arctic have assisted the Committee in understanding the many complicated issues at stake in developing the North. This direct exposure has contributed profoundly to the Committee's examination of government departments and industry officials who came before the Committee. To all those who made presentations before the Committee, we express our appreciation for their valued contribution.

Particular mention must be made of Ms. Sonya Dakers, Research Officer, Library of Parliament, for her efforts in conducting background research, analyzing briefs and, under the Committee's guidance, drafting the report. It is particularly suitable to underline the contribution of Mr. Eric W. Innes, Clerk of the Committee during part of the present study; he has retired after a long career in both the "other place" and the Senate. To his successor, Mr. Timothy Ross Wilson and to Mrs. Linda McGreevy, Administrative Assistant to the Committee, we express our sincere thanks for their effective handling of the administrative and logistical work of the Committee.



Honourable Earl A. Hastings, Chairman
March 1983

TABLE OF CONTENTS

SUMMARY AND RECOMMENDATIONS

Frontier petroleum resources have been accorded a central role in securing domestic oil self-sufficiency by 1990. A timetable for development that meets regional and national aspirations hinges on clear policies, identified priorities, good planning and effective regulation.

Industry is gearing up to move from the exploration and development phases to the production stage in frontier regions. Yet the priorities for frontier hydrocarbon development remain unclear and ground rules for bringing arctic petroleum resources to market are only just being established.

Until the Federal Government clarifies its position relative to petroleum resource development by providing firm policy direction, neither industry nor those charged with its regulation will be able to proceed effectively.

There are a number of special measures that must be instituted to round out the policy picture, so as to impart to industry the level of clarity in policy direction indispensable for it to operate in Canada's interest.

Unless these policy and planning measures are formulated expeditiously before development proceeds further, the Committee believes options in such matters as land use and resource and environmental management will be foreclosed and the priorities of northern peoples will be relegated to a secondary position. There is a danger that without appropriate planning, the socio-economic and environmental consequences of industry's initiatives will result in long-term negative impacts and increased costs.

The Committee recommends:

That Federal Government policy and planning relating to such matters as northern energy, land use, environmental management, manpower training and infrastructure development be formulated early in 1983.

That the Federal Government give high priority to settling land claims and resolving issues relating to constitutional evolution.

The companies who came before the Committee concentrated much of their evidence on demonstrating that there were no remaining technical barriers to development of the Arctic Region. They consider that state-of-the-art technology is quite able to handle any of the problems which may arise out of the special arctic conditions.

The principal questions of concern to the Committee relate to the prospect of extending the drilling season to year-round, and the incremental introduction of new and untried technology.

The introduction of untried technology is especially risky in the delicate arctic environment where less is known about effects. If a problem develops, remoteness and climate make solving it much more complicated.

The Committee applauds the progress made to date by industry and points to the need to adjust present construction and operating techniques to ensure safety and reliability under winter conditions. Federal Government expertise must match that of industry if it is to anticipate problems associated with introducing new technologies.

The Committee recommends:

That the activities and techniques in each phase of the incremental development proposal for the Beaufort Sea Region be carefully monitored by the responsible Federal Government agency for technical competence and suitability for year-round operation.

The incident of the Ocean Ranger disaster in February 1982 in the offshore East Coast created doubt in the public mind about the ability of innovative petroleum technology to meet the exceptional circumstance. The extremes of the arctic environment are full of demanding circumstances. There is always the human factor as well. The safety of those involved in arctic development must be assured.

The Committee recommends:

That operating and safety standards relating to production and transportation call for an appropriate level of personnel training and experience under arctic conditions.

Despite this cautionary note, new technologies suited to arctic conditions offer an unprecedented opportunity to augment the capacity of Canadian industry.

The Committee believes that the opportunity offered of pushing forward the frontiers of cold ocean technology and learning the skills to operate successfully in this remote region must be grasped.

The Committee recommends:

That high priority be given by government and industry to financial and research initiatives for the development of experimental technologies that advance Canada's position in the forefront of cold ocean technology.

There will be a number of activities proceeding at the same time in the Beaufort Sea-Mackenzie Delta Region during the construction and operating stages of petroleum development.

Whichever transportation mode is chosen, there will be land-use conflicts arising from offshore development, the shorebases and growth centres, their road connections and other services and recreational pursuits of an increased population. Any incompatibility of these activities with existing uses of the land will have to be resolved.

The Committee is convinced that the planning process must not just be a system of allocating land uses but must be developed within the context of comprehensive regional planning. Through this process regional goals can be formulated that address the concerns and aspirations of the region's people. Regional benefits in the future will largely depend on the success of land-use planning.

In the Committee's view, it is essential that the territorial governments, concerned federal agencies, native groups and other interested northerners have meaningful input into the formulation of the land-use plan for the Beaufort Sea-Mackenzie Delta Region.

Until land-use priorities are worked out, it is not clear which uses should take precedence. If land-use planning moves at a snail's pace, the choice of options to meet regional goals will be severely reduced.

The Committee recommends:

That the Federal Government expedite the regional planning process and that the Department of Indian Affairs and Northern Development inaugurate a planning mechanism to allow participatory regional planning to proceed effectively.

The mode of transportation constitutes for the companies operating in the Beaufort Sea-Mackenzie Delta Region a major uncertainty. These companies consider that either tankers or overland pipelines or a combination of both are technically and environmentally feasible to bring hydrocarbons to market. Under appropriate circumstances, both systems are economically viable. Project economics, markets, safety and reliability are all factors pertinent to the choice.

While the sponsors must assume a major responsibility for operating reliably and safely under arctic conditions, it is the Federal Government's function to provide essential marine support services, provision of emergency assistance and enforcement of standards and regulations.

The Committee recommends:

That all support systems in relation to such marine services as ice monitoring, weather forecasting, navigation, search and rescue and marine escort which are necessary to ensure the reliability and the safety of production and transportation systems be in place before production commences.

Government plans for a co-ordinated marine pollution response capability are still in the process of development. The Committee is sympathetic to the difficulties with which the Canadian Coast Guard, Canada's principal marine presence, is faced in spreading its meagre financial and personnel resources across the whole gamut of year-round marine services in

arctic waters. Response to pollution emergencies, where it is a lead agency, is after all only one facet of its surveillance role. Another equally important responsibility is its support function in search and rescue operations and marine distress incidents.

The Committee recommends:

That, in order to upgrade the Federal Government's year-round arctic response capability, the Canadian Coast Guard be provided with adequate financial and personnel resources to conduct R and D, to supply marine support services and to meet emergencies.

Based on the evidence, the Committee agrees that under certain conditions both pipeline and tanker systems are technically and environmentally feasible to transport hydrocarbons from the Arctic Region.

Nevertheless, in both the Arctic Islands and the Beaufort Sea Region cases, there are strong reasons for proceeding on a small scale and expanding incrementally. Given market and other uncertainties, a more flexible system to adapt production rates to meet reserve levels and market demand, including the offshore, appeals to the Committee.

Moreover, the Committee agrees with the operators' proposed development plans to commence on a small scale and gradually build up rates of production and transportation.

The tanker system is, in the Committee's opinion, more flexible in adjusting to incremental development and absorbing changes to production levels, although the Committee can see an eventual need for both tanker and pipeline systems.

The Committee recommends:

That transport of hydrocarbons from the arctic region commence by tanker on a small scale and that consideration be given to various combinations of tanker and/or pipeline systems as other factors warrant.

Major projects like Beaufort Sea Region development can potentially serve as catalysts for changes in the industrial structure of this country. The large volumes of industrial goods and services required by the project sponsors for the production stage thus present a challenge to the Canadian manufacturing sector.

The Committee recommends:

That the Federal Government adopt a stronger lead role in co-ordinating and monitoring the efforts of the project sponsors, the manufacturing sector and labour in the formulation and implementation of an industrial strategy to ensure maximum Canadian participation in major projects such as Beaufort Sea Region development.

The project sponsors project a number of benefits will flow from Beaufort Sea Region development.

There will, however, be a need for Canadian industry to respond aggressively to new demands resulting from proposed transportation projects, in order to avoid dependency on external sourcing.

Development in the Beaufort Sea Region has the potential to create an unprecedented opportunity, especially in the case of the marine transportation option, for domestic shipyard capability to supply the fleet required.

Existing shipyards need to be upgraded, and at least one new shipyard needs to be developed in order to meet the large-vessel demands of arctic transportation.

The Committee recommends:

That immediate consideration be given to developing a Canadian large-vessel shipyard capability to supply not only all vessel requirements for arctic development but also to compete for similar undertakings abroad.

Northern hydrocarbon development is seen as a mixed blessing in the North. While controlled development will provide many benefits, the trade-offs in terms of environmental degradation and changing life-styles are not yet well perceived.

Lack of access to advanced educational and training facilities is hindering northern hiring in skilled occupational categories.

Industry has indicated a willingness to work with government in upgrading skills of northerners. The National Industrial Training Program provides a vehicle for this co-operation to occur.

The Committee recommends:

That the National Industrial Training Program be expanded to insure that northern residents receive the necessary training for participation in northern resource development projects.

Northern business is also experiencing disadvantages from a lack of expertise in providing specialized goods and services required by the petroleum industry. Timing of development and packaging of requirements are important factors in encouraging northern business participation in Beaufort Sea Region development.

The Committee recommends:

That the timing of development and supply requirements be structured to enable northern business to participate in Beaufort Sea Region development with its resulting economic benefits.

Since other regions of Canada will benefit from northern resource development, it is only equitable in the Committee's view if the northern territories reap a fair share of the benefits from this wealth. Part of the resource revenues accruing from development in the Beaufort Sea-Mackenzie Delta Region should be utilized to initiate other forms of economic activity that will provide more stable sources of income.

The Committee recommends:

That a designated portion of resource revenues accruing from hydrocarbon development be channelled into a form of heritage fund to provide an economic cushion and serve as a source of funds suitable for investment to promote a more diversified economic base.

The Committee is also concerned about the social costs of development — a potential increase in social disorder, and a deterioration of services resulting from an influx of population and the assimilation of different social values.

The Committee recommends:

That there be increased Federal Government funding of social programs to aid in infrastructure development and to offset potentially adverse impacts.

The process of arriving at decisions on major development projects has evolved from simple Cabinet approval to a vast and complex array of departmental and regulatory procedures.

A complete overhaul of legislative and administrative requirements leading to a major realignment of responsibilities would in the immediate term create decision-making bottlenecks. Decision-making on current proposals should not be deferred for such an eventuality; in the meantime, however, it should be possible to rationalize some of the present processes to reduce overlapping responsibilities and give industry the clear answers it seeks. There is a pressing need within each department to evaluate how each regulation relates to others and whether old regulations have become outmoded or superseded.

The Committee recommends:

That once the policy framework is in place, the regulatory processes and regulations of appropriate responsible agencies be reviewed to determine whether these fulfill the policy objectives for which they were intended and obvious redundancies be eliminated.

Clarifying these policy objectives could become the task of the Senior Policy Committee on Northern Resource Development Projects which was established as an interdepartmental forum for co-ordinating federal policy on major resource developments in the North. It is charged with reviewing resource developments and their impacts and making policy recommendations to appropriate Ministers. To date, it has existed in name but has apparently failed to provide the policy direction needed to anticipate and provide decisive direction rather than react to events.

The Committee recommends:

That the Senior Policy Committee on Northern Resource Development Projects fulfill the function of promoting interdepartmental discussion of northern development policy outside matters relating to the *Canada Oil and Gas Act*. Based on these discussions, it should forward policy recommendations to appropriate Ministers for action.

Present Federal Government practice discourages exchange of information between some departments. Many assessment processes overlap in subject matter especially in the environmental dimensions of projects. The Committee believes that it is possible to rely much more on existing information and to treat each review process as a segment of a whole regulatory regime so that repetition is avoided.

Not all projects share the same national interest concerns. The stringency of controls should correspond to the national interest considerations of the project.

The Committee recommends:

That certain review procedures should only come into play when the subject matter has not been evaluated in another forum or when public interest considerations warrant. Use of existing information should be emphasized.

Another issue of concern to the Committee is the time taken by regulators to undertake review functions. In the Committee's opinion, procedural fairness dictates that project sponsors are entitled to know how long each process will take and time limits should be attached to assessment procedures. This means that project sponsors must also meet these deadlines and provide material on time.

The Committee recommends:

That time limits be allocated to procedural processes to be met by both sponsors and government.

Even with a tightening up of both the process and its timing, the Committee still feels that there must be a means of expediting the progress of proposals through the procedural maze and of co-ordinating regulatory activities. Prior to authorizing a particular project, the government must marshal advice and opinion on all aspects of the proposal. The applicant must ascertain what regulatory requirements must be met in the event the project receives the go-ahead. Bringing together the foregoing mass of advice and information is a complex, expensive and time-consuming process and one that can be unduly delayed if any of the required components is not in place when needed.

In the view of the Committee, the complexity of decision-making is going to increase and, therefore, warrants a federal official in the capacity of federal co-ordinator/expeditor to assist project sponsors in meeting regulatory requirements. The co-ordinator's other function to co-ordinate federal pre-decision activities would be hampered without a clear ministerial mandate as overseer of the project.

The Committee recommends:

That the appointment of a federal co-ordinator to each major energy project, responsible to a designated Minister, be tried on a pilot basis to test its suitability. After a designated period of time has passed, the mechanism should be reviewed and a decision made on its suitability.

Under the present regulatory system, even if it were to be improved, there is the very real problem of industry absorbing the cost of undertaking a mass of technical work before

having a clear idea of whether the investment fits in with Federal Government priorities. It is not apparent how much information is required before the threshold decision to proceed with a particular project will be made by the Federal Government.

The Committee is optimistic that a means can be found so that proponents of major projects can provide the Federal Government with the broad intent of their proposals without having to go to the expense of conducting all the detailed design and supplying other supporting information. To the Committee, some adaptation of the approval-in-principle concept has merit within the regulatory process.

The Committee recommends:

That Cabinet may introduce approval-in-principle decisions for major energy projects once the nature of the information to be provided has been established.

Chapter 1

INTRODUCTION

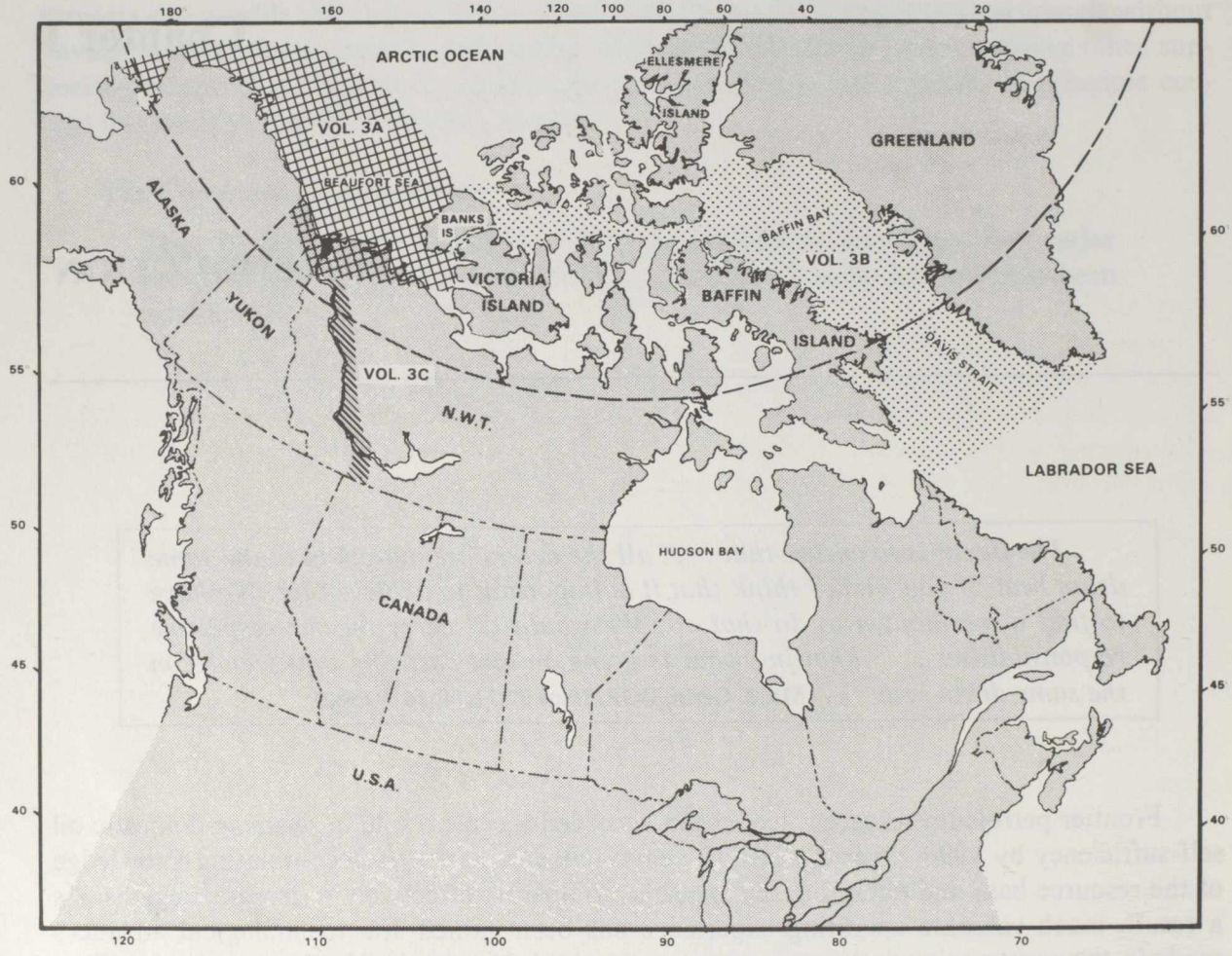
> *The intent is to ensure that . . . . all the actors are marching to the same drum beat, if you wish. I think that it is important to achieve that. We have to find a mechanism to do that. . . . We would all carry on our respective responsibilities . . . . knowing what is going on and ensuring that we are on the same drum beat. . . .* **(Mr. J. Gérin, DOE, Issue 37:72,74, 16-9-1982)**

Frontier petroleum resources have been accorded a central role in securing domestic oil self-sufficiency by 1990. Over the last 10 years, industry has been accumulating knowledge of the resource base and obtaining the expertise to operate effectively in frontier regions. As a result, much valuable operating experience has been gained and technological advances made in the construction and innovative use of artificial islands, subsea and surface drilling systems and alternate transportation systems.

The technical advances achieved to date have, however, been somewhat overshadowed by uncertainties for industry resulting largely from a policy vacuum and unresolved government priorities. Industry has yet to earn its first dollar of revenue from Canadian frontier oil and gas. The point has been reached where clear federal policy is imperative since proposals to produce petroleum resources in the High Arctic, the Beaufort Sea-Mackenzie Delta Region and offshore East Coast have now become a reality. Transport of liquefied natural gas (LNG) by tanker from the Arctic Islands may be possible by the late 1980s; Beaufort Sea developers anticipate that petroleum discoveries will prove to be economically and technologically producible for delivery by the late 1980s or early 1990s; the Hibernia field off Newfoundland appears economically promising by the late 1980s if political, technical and environmental problems can be resolved. The concern of this study is developments occurring in the Arctic Region (Figure 1) since the significance of the Hibernia issue warrants a separate study.

The report is divided into four sections with the Committee's recommendations found throughout and also summarized at the front of the publication.

Figure 1: The Arctic Region



The shaded areas indicate the regional divisions of the Environmental Impact Statement (EIS) of the developers.

Source: *Hydrocarbon Development in the Beaufort Sea-Mackenzie Delta Region, EIS*, Dome Petroleum Limited, Esso Resources Canada Limited, and Gulf Canada Resources Inc., 1982, Vol. 3B, p. 1.1.

To set the scene, the first part of this report concentrates on the plans of the companies active in the Beaufort Sea-Mackenzie Delta Region and in the Arctic Islands area. It is not the task of this Committee to outline and assess all the detailed technical information and issues that form a part of any project. That is best carried out by appropriate government agencies. Consequently, matters such as the economic feasibility of alternate transportation modes — already the subject of another investigation carried out in 1982 on behalf of the Departments of Energy, Mines and Resources (EMR) and Indian Affairs and Northern Development (DIAND) — are not included. The Committee decided to concentrate its energies on several key issues that were highlighted at its hearings. One such issue is the introduction of innovative technologies in Beaufort Sea Region development which arises in any discussion of the companies' activities.

The report devotes an entire section to transportation modes, in view of the relationship of the choice of a transportation system to the rate and timing of development. These two factors are, in the Committee's opinion, crucial to maximizing benefits and minimizing adverse impacts for the people to be most affected by northern megaprojects, Canada's northerners.

> *Timing of resource development projects is a complex issue. Co-ordinating project activities in time will be an important strategy to avoid boom and bust cycles often associated with megaproject activity.* **(The Hon. H.A. (Bud) Olson, Minister of State for Economic Development, Issue 16:9, 9-2-1982)**

The timetable for and pace of development were common themes in the concerns voiced by industry, governments and territorial residents at the Committee's hearings. Industry is worried about the timing and nature of government response to its projected plans. Government officials must oversee the various aspects of the development proposals and expeditiously translate their concerns into the regulatory control process. Some northerners question the risks posed to the environment by the new technologies and how these will impact on traditional resource harvesting. Other northerners want to know what petroleum development will bring in terms of employment and business opportunities.

If arctic development is to proceed with the level of excellence of which Canada is capable, thereby portraying a sensitivity to the concerns mentioned, it will take the co-operation of all those involved whether they be industry, governments, interest groups or northern residents. A continuing dialogue must occur. Meaningful northern participation is essential in this consultative process. In its travels through the North and in its hearings, the Committee has become convinced that northerners want a greater role in northern resource development and expect to receive more of the benefits and bear less of the cost of northern resource activity.

> *. . . .Beaufort oil and gas developments [should] have an obvious net benefit to northern residents with the territorial and community governments being involved in the decision-making process to establish the benefits.* **(Mr. T. Zubko, Beaufort Sea Community Advisory Committee, Issue 34:38, 9-9-1982)**

The Committee welcomes the increasing involvement of territorial governments and residents in northern energy issues and supports development at a pace consonant with maximizing regional benefits. The Committee explores what arctic petroleum development means in terms of the benefits to the region and to Canada in the third section of its report.

A timetable for development that meets regional and national aspirations hinges on clear policies, identified priorities, good planning and effective regulation. The state of Federal Government preparedness forms the subject of the final section of the report.

Industry is gearing up to move from the exploration and development phases to the production stage in frontier regions. Yet the priorities for frontier hydrocarbon development remain unclear and ground rules for bringing arctic petroleum resources to market are only just being established. Until the Federal Government clarifies its position relative to

petroleum resource development by providing firm policy direction, neither industry nor those charged with its regulation will be able to proceed effectively.

> *One of the problems we have been complaining about for a long time is that the government has not come out with firm policy. One thing we have never been told is that there will be both a Beaufort Sea oil development to a production and transportation stage.... That is a national policy decision process.* **(Mr. T. Zubko, Beaufort Sea Community Advisory Committee, Issue 34:40, 9-9-1982)**

The National Energy Program of 1980 was intended to provide a policy framework for industry working in frontier regions. The following year, the *Canada Oil and Gas Act* set up a management regime for oil and gas development on Canada Lands.

> *When I say we need a mandate, I mean we should have an understanding to supplement the national oil policy, to indicate that the government wants a program pursued to develop frontier oil and gas at the earliest date.* **(Mr. C.R. Hetherington, Panarctic, Issue 28:46, 9-6-1982)**

More recently, in June of 1982, the Federal Government outlined its planning strategy to provide a "stable policy framework" within which arctic resource development could proceed. This is a phased approach which would permit northern hydrocarbon development on a gradual scale. Initial production would begin commensurate with proven reserves and would expand incrementally based on demonstrated capability. Examples of this approach are evident in the demonstration projects of Norman Wells and the Arctic Pilot Project. The Beaufort Sea activity also lends itself to various demonstration projects.

In accordance with the same policy, research will be accelerated over the next few years to increase the Federal Government state of preparedness so that a government decision on the method of transportation, for instance, will not only be possible but also informed.

While the foregoing policy positions are a move in the right direction, some decisions cannot await the outcome of years of research. The failure to introduce all the supportive steps that set in place a policy framework for properly planned and controlled hydrocarbon development to proceed, leaves both developers and the region concerned in doubt about Federal Government priorities.

There are a number of special measures — manpower training, infrastructure development, environmental management and research, northern energy supply, and regional and land-use planning to name a few — that must be instituted to round out the policy picture, so as to impart to industry the level of clarity in policy direction indispensable for it to operate in Canada's interest.

The Committee believes that unless policy and planning measures are formulated expeditiously before development proceeds further, options in such matters as land use and resource and environmental management will be foreclosed and priorities of northern peoples will be relegated to a secondary position. Unresolved land claims and issues relating to con-

stitutional development must also be addressed. Development of the North will proceed but it must not be at any cost. There is a danger that without proper planning, the socio-economic and environmental consequences of industry's initiatives will result in long-term negative impacts and increased costs.

The Committee recommends:

That Federal Government policy and planning relating to such matters as northern energy, land use, environmental management, manpower training and infrastructure development be formulated early in 1983.

That the Federal Government give high priority to settling land claims and resolving issues relating to constitutional evolution.

A policy of phasing development gives the Federal Government time to arrive at the proper state of readiness and results in a more manageable task in terms of regulatory response. Nevertheless, in view of the 10-year lead time required to progress from initial exploration to production, any delay due to regulatory processes is costly. The regulatory review process can take several years to complete, depending on the scale of the project in question and the adequacy of relevant data. There must be enough information to assess the key issues and determine whether the benefits outweigh the costs at the regional and national levels. Duplicative and complex regulatory processes prevent government information from being incorporated into the design of projects — one important means of controlling negative impacts and maximizing benefits. Unless the Federal Government upgrades its capacity to prepare for prospective development, there will be no possible way benefits can be maximized. Federal research and planning efforts must work towards timely and informed decisions. Otherwise, industry will not receive the early guidance needed from the federal regulatory process on the general acceptability and timing of proposals.

Are industry and government in fact "marching to the beat of the same drum?" If they are not, the national objective of oil self-sufficiency may well not be met by 1990 and the potential benefits of northern petroleum development could become lost in a tangle of bureaucratic red tape and industry frustration.

The Committee hopes that by addressing some potential impediments to effective Federal Government co-ordination, it can contribute to the dialogue that must precede any innovative approaches to decision-making on major projects.

Chapter 2

ARCTIC DEVELOPMENT

A. Beaufort Sea-Mackenzie Delta Oil Development

> *The frontiers we are looking at present some very significant challenges. We believe from an environmental point of view, from an operational and logistical point of view and from a technological point of view . . . we can meet the challenge . . . our industry has the expertise to develop the technology that is required to find, develop and transport these resources to the marketplace.* **(Mr. D. Motyka, Gulf, Issue 20:5, 23-3-1982)**

1. Exploration to Production

Although there is no specific proposal for review before the National Energy Board (NEB), the three major operators in the Beaufort Sea-Mackenzie Delta Region submitted a proposal to produce and transport Beaufort Sea oil (and gas) for environmental assessment review during 1982. This joint Environmental Impact Statement (EIS) submitted to the Federal Government by Dome Petroleum Limited (Dome), Esso Resources Canada Limited (Esso) and Gulf Resources Canada Inc. (Gulf), is an innovation in the regulatory process, since it is customary for individual companies to submit their own plans separately.

The proposal conforms to the phased approach supported by the Federal Government since the development plan is to take place in stages. Between 1982 and 1987, oil reserves beyond the present level of 159 million cubic metres (1 billion barrels) will be further delineated; production facilities will be assembled; subsea pipelines and onshore gathering systems will be installed; and a means of transporting oil to markets will be developed. All these systems must be in place before oil can be recovered and transported. The choice of transportation mode constitutes for Dome, Esso and Gulf a major uncertainty to be faced and the one where timely government decision-making is crucial. Dome and Gulf appear to favour the marine mode, while Esso has proposed a Beaufort Sea demonstration oil pipeline to connect with the Norman Wells pipeline.

The plan for the second phase covering the years 1987 to 2000 provides for long-term oil production. By 1987, one or two Beaufort Sea and Mackenzie Delta oil fields are expected to be in production. A range of production rates is possible depending on the pace of production. Although it is technically feasible to accelerate development to reach a production rate of 79,000 cubic metres (500,000 barrels) by 1990 and 188,000 cubic metres (1.2 million barrels) by 2000, logistical and economic constraints make this unlikely. According to the sponsors, a more realistic production rate in 1987 (corresponding to the sponsors' proposed "intermediate" rate of development) would be 5,720 cubic metres (38,000 barrels) per day, reaching 43,000 cubic metres (270,000 barrels) by 1990 and 122,000 cubic metres (770,000 barrels) by 2000. Table 1 provides information on the development systems that will need to be in place to support this initial level of production. The level of proven reserves, mainte-

Table 1
Status of Development in 1987: Intermediate Development Rate

EXPLORATION	
Drillships	4
Extended Season Drillships	4
Caisson Drill Systems	3
Exploration Wells Drilled during 1987	8
CONSTRUCTION	
Conventional Dredges	7
Arctic Dredges	1
Crane Barges	3
Pipe-Laying	1
Accommodation Barges	3
PRODUCTION	
Production Islands	4
Arctic Production and Loading Atoll	1
TRANSPORTATION	
Arctic Tankers	1
Small Pipeline	1
SUPPORT SERVICES	
Icebreakers	16
Supply Vessels	16
Other Vessels	36
Helicopters	14
Long Range Aircraft	4
STOL Aircraft	9
PERSONNEL	
Onsite Employment	3800

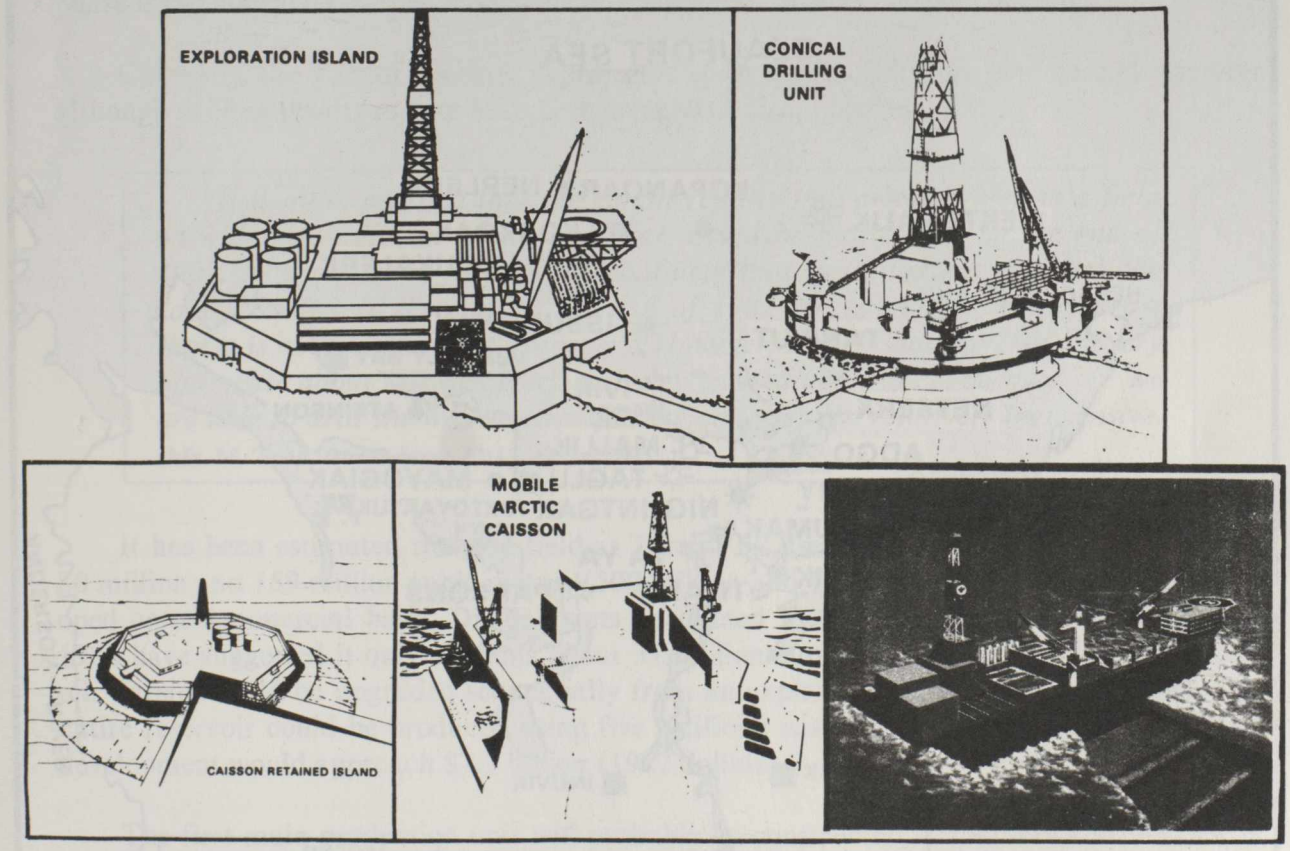
Note: Of the three production schedules considered in the Environmental Impact Statement (EIS), the intermediate development schedule is considered most likely by the sponsors.

Source: *Hydrocarbon Development in the Beaufort Sea-Mackenzie Delta Region, EIS*, Dome Petroleum Limited, Esso Resources Canada Limited, and Gulf Canada Resources Inc., 1982, Vol. 2, p. 3.24.

nance of the construction schedule, and timing of regulatory approvals are all factors that could influence the rate of development.

The emphasis of the exploration and drilling program between 1982 and 1987 will be to delineate reserves. Conventional equipment and drilling techniques have been adapted to meet the unique conditions of the Arctic such as permafrost and ice cover. Technological advances over the last 10 years have prepared the way for moving from the exploration to the production phase, planned for 1987. Onshore, drilling is carried out from gravel pads which prevent permafrost degradation. Offshore, drilling is conducted from artificial islands built on the ocean floor or from mobile drilling platforms such as drillships (Figure 2).

Figure 2: Exploration Drilling Rigs

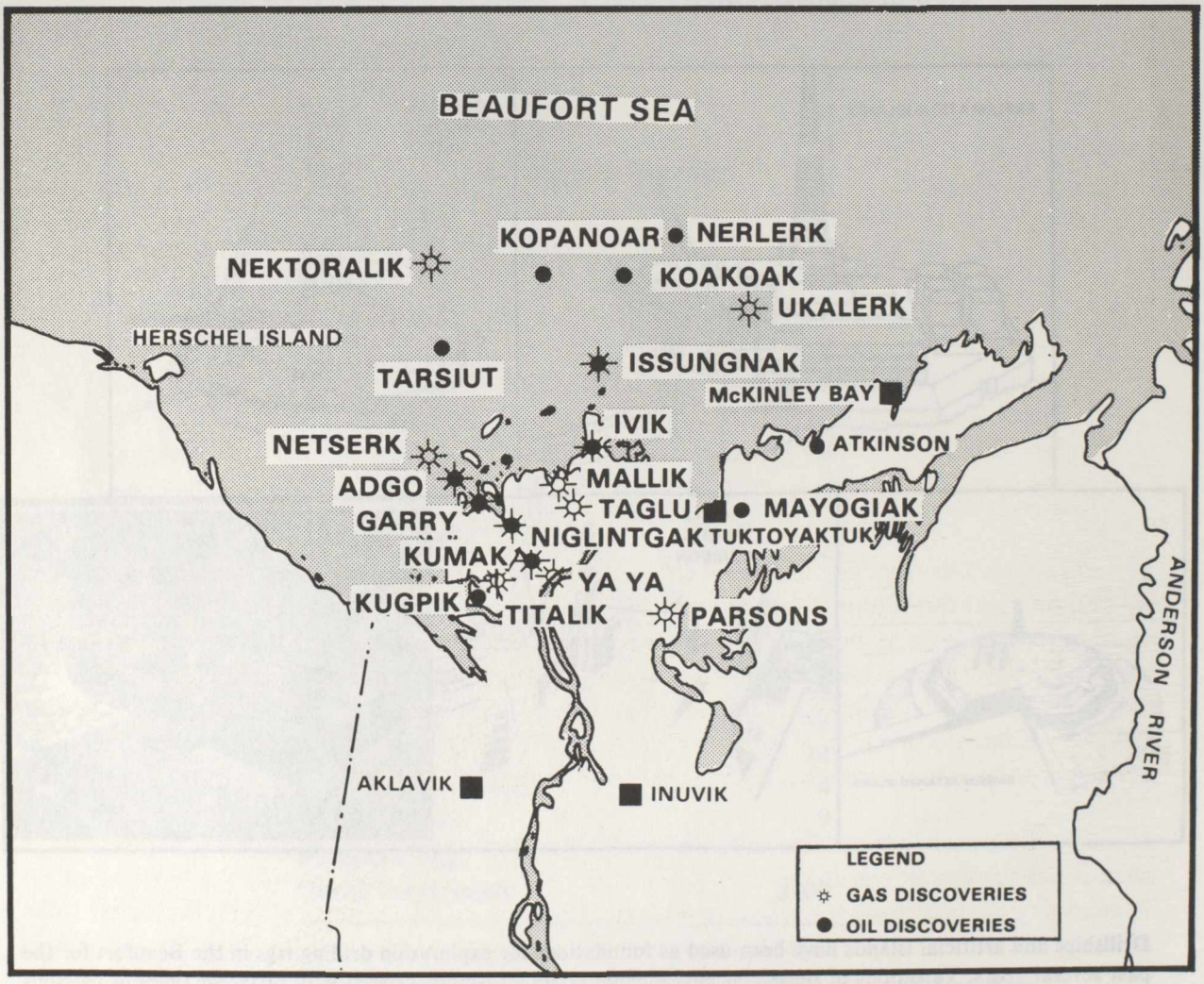


Drillships and artificial islands have been used as foundations for exploration drilling rigs in the Beaufort for the past several years. Variations of these concepts include artificial islands capped with different types of caissons and conical floating systems. Exploration drilling systems are temporary in nature, generally drilling only one well and then moving to a different location.

Source: *Hydrocarbon Development in the Beaufort Sea-Mackenzie Delta Region, EIS*, Dome Petroleum Limited, Esso Resources Canada Limited, and Gulf Canada Resources Inc., Vol. 2, 1982, p. 3.11.

In deeper waters, drillships have been used since 1976, and four presently operate for about 110 days a year. By the time of the EIS submission in 1982, ships had drilled 15 wells in water depths ranging from 23 to 68 metres. There had been four oil discoveries: Nektoralik in 1977, Kopanoar in 1979, Tarsiut in 1980, and Koakoak in 1981; and two gas discoveries: Nektoralik in 1977 and Ukalerk in 1977 (Figure 3). A new-generation exploration system will extend the drilling season to at least six months when Gulf introduces its unique deepwater Conical Drilling Unit (CDU) into the Beaufort Sea drilling program in 1983. The polygonal design of the hull of the CDU helps deflect ice from the drilling platform.

Figure 3: Location of Oil and Gas Discoveries in the Beaufort Sea-Mackenzie Delta Region



Source: *Hydrocarbon Development in the Beaufort Sea-Mackenzie Delta Region, EIS*, Dome Petroleum Limited, Esso Resources Canada Limited, and Gulf Canada Resources Inc., Vol. 1, Summary, p. 2.1.

In shallower waters, drilling takes place from artificial islands constructed of sand and gravel. Between 1973 and 1982, 21 of these islands were built and in the 23 wells drilled, oil was discovered at Adgo in 1973, Garry in 1976, and Issungnak in 1980; and there were gas discoveries at Netserk in 1976 and Isserk in 1978. With the need to develop more permanent island platforms suitable for the production stage, caissons of steel or concrete have been introduced as a method of containing the dredged material and protecting the drilling systems from ice, wind and wave forces. In 1981, the world's first caisson-retained island in arctic waters, Tarsiut, was completed. Its concrete caisson construction suited the water depth of 22 metres and required only 30% as much gravel and sand as conventional dredged islands to complete the structure. An added advantage over these "beach" islands is the platform's flexibility, being refloatable from location to location as required.

Tarsiut also serves as a research laboratory for the measurement of ice forces around the island. The data gathered will contribute to the design of future production facilities in the Uviluk and Koakoak areas. Another ice-resistant structure being considered for this phase is the hourglass-shaped monocone fabricated out of steel and/or concrete.

Currently, the Tarsiut reservoir is projected to be the first offshore commercial reservoir although drilling results to date have been somewhat disappointing.

> *It is quite possible that the commerciality of Tarsiut, which is a field on which we built an island last year, could be established by the end of 1982. As a matter of fact, we are confident that we will either establish the commerciality of Tarsiut by the end of 1982 or, conversely, demonstrate that it is not a commercial discovery. However, I might add that we are very optimistic about this discovery and very excited about it . . . because . . . we are able to drill the wells rather quickly and they are relatively inexpensive.*
> **(Mr. M. Todd, Dome, Issue 21:11, 31-3-1982)**

It has been estimated that the field at Tarsiut by itself would have to contain between 80 million and 159 million cubic metres (500 million and 1 billion barrels) of oil to be developed on a commercial basis. Drilling tests conducted by Gulf, the operator, in the fall of 1982 have suggested it only contains about 57 million cubic metres (350 million barrels) of oil. Tarsiut could be upgraded sequentially from an exploration to a production island. The entire reservoir could be produced using five artificial islands. The capital cost of full field development would approach $7.3 billion (1982 dollars).

The first main production unit will probably be constructed in southern Canada, barge mounted and then towed to the first production island. This installation could be in place by 1986. Further production systems would be installed as other islands are completed. The concept favoured is the Arctic Production and Loading Atoll (APLA), another promising application of caisson island technology. The APLA could contain permanent production, crude oil storage, and processing and loading facilities to transfer oil to arctic tankers; the facility could handle up to 110,000 cubic metres (700,000 barrels) per day, a production rate projected to be reached by 1998. A permanent island would gradually envelop the exploration island, providing a berth for the floating process and storage facility. Once permanent facilities are completed, the island can go into year-round production. At the proposed inter-

mediate rate of development, there will be 25 offshore production platforms built between 1987 and 2000. At the high rate of development, there would be 31. At the APLA site, the oil would be recovered from the producing wells; the well fluids would be separated by conventional methods into oil, gas and water; and final processing would condition the oil for transportation. If arctic tankers are used, storage tanks of 500,000 cubic metres (3.2 million barrels) capacity, roughly twice the volume of a tanker, would be located at the site of the APLA. For an overland pipeline, a tank farm would be situated on land at the northern pipeline terminal.

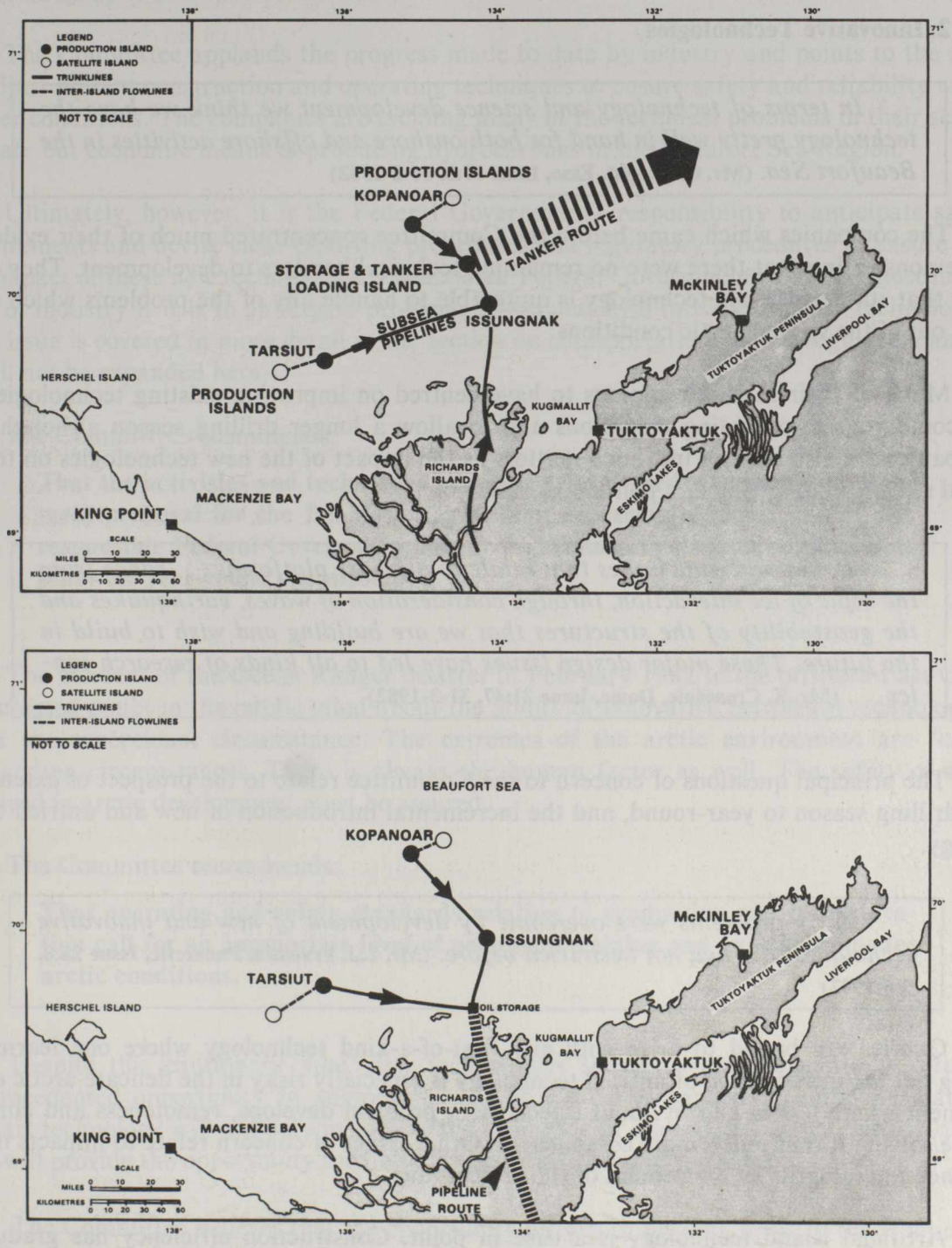
Approximately 375 kilometres of subsea pipelines and gathering systems of small- and medium-diameter would be required for the proposed offshore development (Figure 4). Subsea pipelines will be used to gather oil from satellite production islands for final processing at central production islands. Subsea trunklines will also be used to transport oil to a tanker loading terminal or to a tank farm at the northern pipeline terminal, depending on the method of transportation. Onshore, gathering systems are to consist of small-diameter buried pipelines.

Other associated development includes coastal bases required for the storage of drilling, construction and production materials. These bases will also provide accommodation facilities for personnel and serve as administrative centres of industrial activity. Dome's facilities outside Tuktoyaktuk, which presently accommodate 360, are projected to expand from 19 hectares (47 acres) to 40 hectares (99 acres) by 1986 although personnel numbers are not expected to increase. Esso's present base of 42 hectares (104 acres) located on the east side of Tuk Harbour will be expanded over the next few years to accommodate 200. Gulf's base under construction will eventually house 200 persons. Tuktoyaktuk will continue to be the primary air supply base, at least until the Yukon north coast is developed. Personnel figures suggest accommodation at Tuktoyaktuk will be in short supply, at least until other shorebases are developed.

Depending on the drilling results, particularly at Tarsiut, permanent facilities may be established at McKinley Bay by 1987 if the intermediate level of production is achieved. The base will function as a supply and refuelling centre with accommodation for up to 500 employees. A 400-metre dock is proposed and the present artificial island, harbour and associated developments would by 1987 encompass 150 hectares (371 acres), 25 hectares (62 acres) of it supporting permanent facilities.

Additional shorebase development is expected to be required along the Yukon North Slope. Two proposed shorebase sites at King Point and at Stokes Point are located within a designated wilderness park. An attraction of both sites is proximity to quarry material and the potential to develop a deepwater year-round port. The sites are relatively close to several offshore development locations, and are accessible by river barge or winter road. Only one of the two sites, however, is expected to develop into a major shorebase. If chosen, King Point in Mackenzie Bay would encompass 75 hectares (185 acres) with support facilities and accommodation for 500 persons by 1986. Gulf is considering Stokes Point just southwest of Herschel Island as a mooring basin for its new Conical Drilling Unit commencing in 1983. If Stokes Point were selected for development, up to 100 hectares (247 acres) of land would eventually be occupied there, with accommodation for 150 persons in facilities comparable to those at King Point.

Figure 4: Oil Gathering Subsea Pipelines and Shore Bases



The upper diagram shows a possible gathering system for the tanker transportation option. The lower diagram shows a possible system for the overland pipeline transportation option.

Source: *Hydrocarbon Development in the Beaufort Sea-Mackenzie Delta Region, EIS*, Dome Petroleum Limited, Esso Resources Canada Limited, and Gulf Canada Resources Inc., Vol. 1, 1982, p. 1.19.

Other shore base proposals include the possible construction of a fuel storage facility at Wise Bay on Cape Parry and caisson assembly and winter mooring sites at Tuft Point on the Tuktoyaktuk Peninsula and in Pauline Cove on Herschel Island.

2. Innovative Technologies

> *In terms of technology and science development we think we have the technology pretty well in hand for both onshore and offshore activities in the Beaufort Sea.* **(Mr. G. Haight, Esso, Issue 17:5, 16-2-1982)**

The companies which came before the Committee concentrated much of their evidence on demonstrating that there were no remaining technical barriers to development. They consider that state-of-the-art technology is quite able to handle any of the problems which may arise out of the special arctic conditions.

Much of their research appears to have centred on improving existing technologies to overcome adverse operating conditions and to allow a longer drilling season although the companies are also looking into such matters as the impact of the new technologies on traditional resource harvesting and pollution levels.

> *. . . major design issues that relate to offshore platforms . . . range from the topic of ice interaction, through consideration of waves, earthquakes and the geostability of the structures that we are building and wish to build in the future. These major design issues have led to all kinds of research topics . . .* **(Mr. K. Croasdale, Dome, Issue 21:47, 31-3-1982)**

The principal questions of concern to the Committee relate to the prospect of extending the drilling season to year-round, and the incremental introduction of new and untried technology.

> *Early problems were overcome by development of new and innovative techniques that had not been tried before.* **(Mr. L.J. Franklin, Panarctic, Issue 28:8, 9-6-1982)**

Queries are bound to arise with any first-of-a-kind technology where one learns by doing but the introduction of untried technology is especially risky in the delicate arctic environment where less is known about effects. If a problem develops, remoteness and climate make solving it that much more complicated. Other issues of concern relate to impacts if the engineering integrity of an element of the project fails.

Artificial island technology is a case in point. Construction efficiency has gradually improved with arctic working experience; however, all but three of the present 21 artificial islands have been built in the summer. Since deepwater islands take two years to build, winter construction could be involved in the future. At present, drilling is also only carried out during the summer. Although island designs have evolved to deal with deeper water and ice and current erosion, the challenging technical problems of operating these islands on a year-

round basis have not been confronted. Ice is present in the Beaufort Sea for nine months of the year. The proponents contend that they have sufficient engineering experience to predict ice forces on offshore arctic platforms, such forces probably representing the greatest threat to the integrity of these structures.

The Committee applauds the progress made to date by industry and points to the need to adjust present construction and operating techniques to ensure safety and reliability under winter conditions. The companies are tackling many of the technical problems in their search for safe but economic means of producing hydrocarbons in the Beaufort Sea Region.

Ultimately, however, it is the Federal Government's responsibility to anticipate safety requirements and devise clear reporting procedures and regulatory procedures to ensure that the impact of these new technologies is beneficial. Federal Government expertise must match that of industry if it is to anticipate problems associated with introducing new technologies. This issue is covered in more detail in the section on transportation and on regulation and so it will not be expanded here.

The Committee recommends:

That the activities and techniques of each phase of the incremental development proposal for the Beaufort Sea Region be carefully monitored by the responsible Federal Government agency for technical competence and suitability for year-round operation.

The incident of the Ocean Ranger disaster in February 1982 in the offshore East Coast has created doubt in the public mind about the ability of innovative petroleum technology to meet the exceptional circumstance. The extremes of the arctic environment are full of demanding circumstances. There is always the human factor as well. The safety of those involved in arctic development must be assured.

The Committee recommends:

That operating and safety standards relating to production and transportation call for an appropriate level of personnel training and experience under arctic conditions.

Despite this cautionary note, new technologies suited to arctic conditions offer an unprecedented opportunity to augment Canadian industrial capacity. Improving state-of-the-art technology will not only maximize the efficiency of operations carried out in Canada but will provide the opportunity for Canada to compete around the world.

The Committee believes that the opportunity offered of pushing forward the frontiers of cold ocean technology and learning the skills to operate successfully in these remote regions must be grasped. The advances made in improving Canadian technological capacity, not only by industry but also by governments, the universities and other research groups over the last few years are impressive. Intensive research must continue to maintain the established momentum. This applies equally to the High Arctic, described in the following section.

Canadians have the opportunity to become world leaders in arctic technology. This is a technology that can be exported. Indeed if we develop the industrial capacity to build specialized arctic equipment, we can use the combination of the technology and the industrial capacity to export specialized equipment to other countries. **(Mr. M. Todd, Dome, Issue 21:40-41, 31-3-1982)**

The report by the *Major Projects Task Force on Major Capital Projects in Canada to the Year 2000*, published in June 1981, identified some of these new technologies as fitting for Canadian technological specialization, including subsea production systems and knowledge of the type of ice/sea/structure interaction associated with artificial island construction.

One of the companies working internationally in offshore subsea oil production design and installation is CanOcean Resources Ltd., since 1979 a member of the NOVA group of companies. In recent years, the company has turned its attention to the Canadian offshore and its particular iceberg and sea ice hazards. Work completed on subsea pipelines includes a study, conducted in the spring of 1979 for a consortium of government agencies and companies, into the feasibility and methods of subsea oil and gas production offshore in the Beaufort Sea. The study indicated that year-round, remotely-controlled production of oil and gas is technically feasible. Year-round operation would see pipelines connected to onshore facilities whereas seasonal operation would utilize floating production platforms and tankers for transport. Costs and schedules were found to be comparable to those encountered in less hostile offshore areas.

The Committee was very impressed at its hearings with the number of technical problems being solved on the initiative of companies interested in developing northern petroleum resources. Canadian technological capacity should continue to improve if this country hopes to gain any of the benefits from being at the leading edge of cold ocean technology.

The Committee recommends:

That high priority be given by government and industry to financial and research initiatives for the development of experimental technologies that may advance Canada's position in the forefront of cold ocean technology.

3. Cumulative Activities

Encouragement of innovative but safe and reliable technologies is not the only emphasis the Committee wishes to stress in arctic petroleum resource development. There will be numerous activities occurring simultaneously in the Beaufort Sea-Mackenzie Delta Region that will mark the onset of the production phase and that could contribute to changes to the quality of life in the Region. The Committee touches on just some of them.

The construction of offshore platforms, although modular in form, will require the dredging of large quantities of fill from the ocean floor. Excavation of trenches for the subsea pipeline will also involve dredging. The total quantity of fill required for all offshore facilities has been estimated to be 600 million cubic metres (21 billion cubic feet) up to the year 2000. Nearshore habitats are more likely to be affected, especially in harbour areas like

Tuktoyaktuk and McKinley Bay where dredging associated with onshore facilities is also concentrated. Construction of supply bases and/or a pipeline may impose additional requirements on existing access roads and other community support systems and interfere with present activities. Roads will possibly pose more problems than shorebases with respect to wildlife impact and harvesting activities because of the difficulties associated with controlling such access, environmental disturbance and attraction of more development activities. An influx of 3,500 persons into the region will occur during the year of first oil production. Where this number of employees will be accommodated is not yet clear. An increase in all transportation modes would accompany production activities.

The sponsors limited the breadth of their review of alterations to the existing regime in accordance with EIS requirements. Dividing the region into three locales provides abundant detail at the local level but is weak concerning the effect of overall disturbances.

Whichever transportation mode is chosen, there will be land-use conflicts arising from offshore development, the shorebases and growth centres, their road connections and the other services and recreational pursuits of an increased population. Any incompatibility of these activities with existing uses of the land will have to be resolved. The principal conflicts will come with traditional resource harvesting. Traditional harvesting still occurs in the Yukon coastal zone, the lower Mackenzie Delta islands and the west central portion of the Tuktoyaktuk Peninsula where industrial activities will be initially concentrated. A wildlife reserve has been proposed for the North Slope of Yukon.

> *. . . I am sure we can find a happy solution, a compromise by which their [native] culture can be maintained so that it can remain in the North while we move the oil and gas we would like to have in the South without interfering with them.* **(Senator Guay, Issue 28:23, 9-6-1982)**

Some of the potentially disruptive social effects during the construction and operating stages can be avoided if there is proper land-use planning which enhances the ability of traditional resource harvesting and industrial development to coexist without either encroaching on the other. The stability of the Beaufort Sea Region economy will depend on harmony being achieved.

Indeed, the possibility that accelerated development may proceed in the territories over the next decade has created pressure for the development of land-use policies and programs. While the Department of Indian Affairs and Northern Development has the prime responsibility for the disposition of lands north of 60°, other federal agencies, the territorial governments, companies, native groups, communities and private individuals all represent interests that must be regarded in the accompanying consultative process that is essential to good planning. Although the department has a legislative mandate to impose land-use controls through the *Territorial Lands Act*, its planning ability under this mandate is restricted essentially to assessing the probable consequences of permitting a change in land use. A wider planning mandate is theoretically possible through DIAND's responsibility to co-ordinate federal activities in the North. Its capability to put in place more broadly-based planning depends, however, on the co-operation of the numerous groups who should legitimately be involved or have programs that must be integrated into the process.

DIAND is presently working out its general planning approaches.

> *The process they envision . . . would take people from the community governments, native interest groups, and other directly affected parties, and form a commission which would be given the task of planning land use for specific projects . . . The people who would be given that task would, for the most part, be the people who are being directly affected by the project.* **(Mr. T. Zubko, Beaufort Sea Community Advisory Committee, Issue 34:38, 9-9-1982)**

The Department had anticipated that an interim plan for the Beaufort Sea area would be ready by the end of March 1983, but it is clear that this target date will not be met. One goal of the plan is to try to persuade developers in this region to share facilities so as to reduce impacts at locations such as McKinley Bay.

The Committee is convinced that the planning process must not just be a system of allocating land uses but must be developed within the context of comprehensive regional planning. Through this process regional goals can be formulated that address the concerns and aspirations of the region's people. Regional benefits in the future will largely depend on the success of land-use planning.

Arriving at sound land-use decisions means compromises between conflicting interests. That is why articulation of the goals for a region must form part of the land-use planning process. DIAND intends a northern-based participatory process to take into account the various land uses. In the Committee's view, it is essential that the territorial governments, concerned federal agencies, native groups and other interested northerners have meaningful input into the formulation of the land-use plan for the Beaufort Sea-Mackenzie Delta Region. The Committee is well aware that the proposed political division of the Northwest Territories will complicate this consultative process but will nevertheless make it even more essential.

Until land-use priorities are worked out, it is not clear which uses should take precedence: exploration, traditional use, land claims, special preservation areas and so on. Already the lands under existing oil and gas leases which are being renegotiated by the Canada Oil and Gas Lands Administration (COGLA) are removed from the land-use planning process. If land-use planning moves at a snail's pace, the choice of options to meet regional goals will be severely reduced.

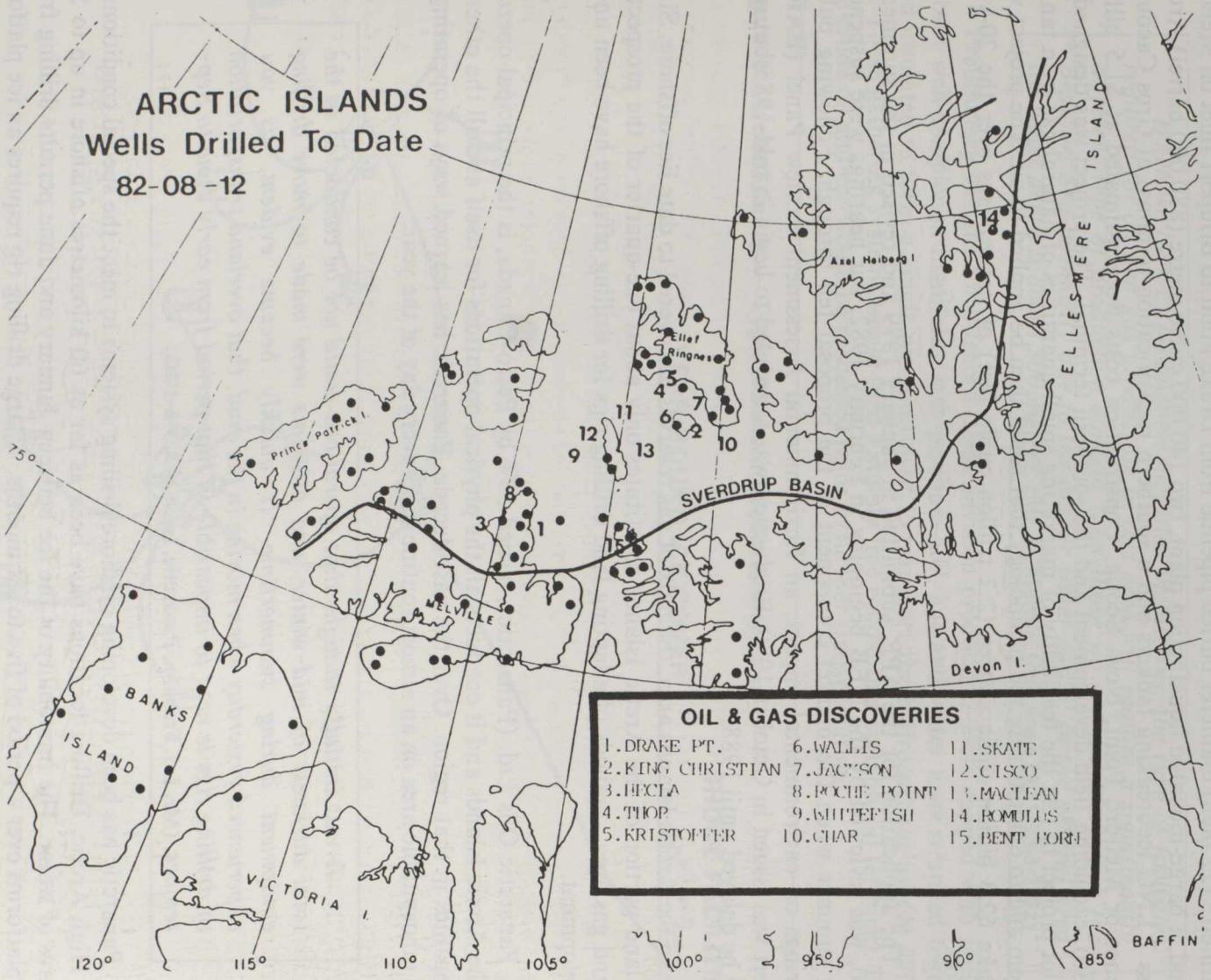
The Committee recommends:

> **That the Federal Government expedite the regional planning process and that the Department of Indian Affairs and Northern Development inaugurate a planning mechanism to allow participatory regional planning to proceed effectively.**

B. Arctic Island Natural Gas Development

Exploration over the last 15 years in the Arctic Islands has resulted in established natural gas reserves of 366 billion cubic metres (13 trillion cubic feet) (Figure 5). The Drake

Figure 5: Arctic Islands — Wells Drilled 1962-1982



Source: Canada Oil and Gas Lands Administration, Presentation to the Special Committee of the Senate on the Northern Pipeline, *Offshore Transportation Study*, 14-9-1982.

Point field alone has 150 billion cubic metres (5.3 trillion cubic feet) which has led to a proposal by Petro-Canada Exploration Inc., NOVA — An Alberta Corporation, Dome, and Melville Shipping Limited to ship approximately 7.7 million cubic metres (270 million cubic feet) per day of liquefied natural gas (LNG) from Melville Island over a 20-year period.

The Arctic Pilot Project (APP) originally comprised a 160 kilometre (100 mile), 56 centimetre (22 inch) diameter buried pipeline from Drake Point to Bridport Inlet on Melville Island, a barge-mounted liquefaction plant, two 140,000 cubic metre (880,000 barrel) Arctic Class 7 LNG icebreaking tankers and a southern regasification terminal at Gros Cacouna, Quebec or Melford Point, Nova Scotia. Construction costs were estimated at $1.5 billion (1980), excluding field development and the southern terminal. The project was designed as a pilot project to test the feasibility of marketing small quantities of natural gas by a tanker system and to demonstrate the technology that could then be applied to oil. The project was to take 62.3 billion cubic metres (2.2 trillion cubic feet) of natural gas over the 20-year period.

The application for the APP, submitted in January 1979 and revised in the summer of 1980, was reviewed by the NEB beginning in February 1982, but hearings were suspended that summer when the market component of the proposal fell through. Following public hearings on environmental impact, an Environmental Assessment Review Panel (EARP) report was issued in October 1980. Production was scheduled to begin in mid-1985 but may now be delayed until 1988.

In the Arctic Islands area, the bulk of gas reserves discovered to date lies offshore. Since the land portion of the Arctic Islands constitutes only about one-quarter of the prospective oil and gas area, methods of adapting land drilling rigs for drilling offshore have been under development.

Panarctic Oils Ltd. (Panarctic), owned 53% by Petro-Canada, is the principal operator in the Arctic Islands and it conducts all the physical operations for itself and all the other oil companies in that region. Over the past decade, Panarctic has learned ways of operating in this inhospitable area on an almost routine basis every day of the year.

> *It was initially thought that operations could not be conducted in the total darkness of mid-winter, and attempts were made to move drilling equipment during summertime. It quickly became evident, as you experienced yesterday when moving in the mud, that overland transportation of drilling rigs is next to impossible in that period from early June to September.* **(Mr. L.J. Franklin, Panarctic, Issue 28:8, 9-6-1982)**

Panarctic has been developing offshore drilling systems to meet the special conditions of the High Arctic. Drilling locations have been as far as 60 kilometres offshore in up to 500 metres of water. The immobility of the ice between January and June permits drilling from ice platforms over a period of five to six months. A large drilling rig requires an ice platform at least 175 metres in diameter and 7 metres thick.

While natural gas is the commodity reaching the shipping stage, Panarctic told the Committee its estimations of proven and probable oil reserves were 120 million cubic metres

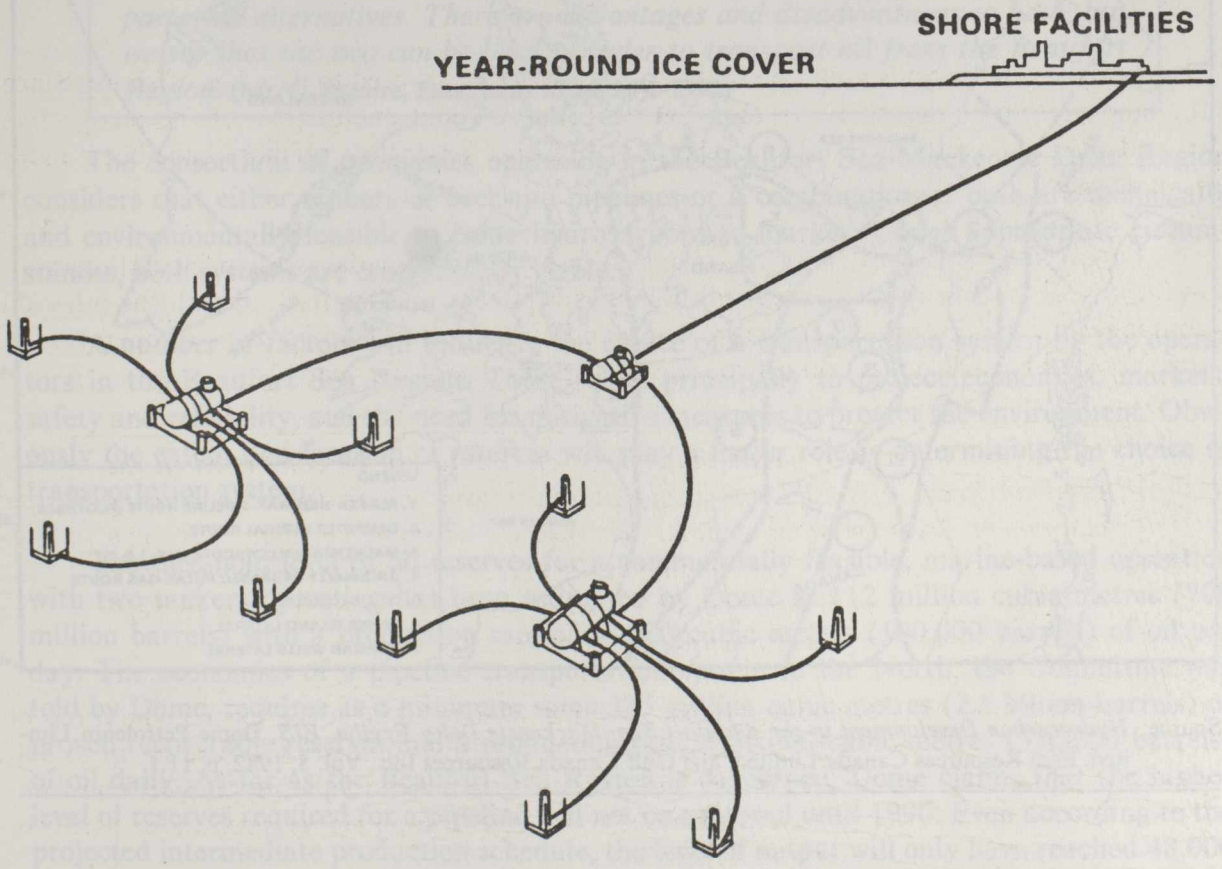
(750 million barrels). There have been three significant oil discoveries at Cisco, Skate and Maclean, and drilling is continuing.

It has been suggested by Gulf that the types of facilities required for oil and gas production in the Arctic Islands area will differ significantly from those proposed for the Beaufort Sea due to the greater water depths involved.

> *When we look at production facilities themselves, the type of facilities required for oil and gas production in this area will require a significantly different type of production concept than those we are considering in the Beaufort Sea, primarily due to the deeper water depth. In the general area the water depth is about 300 metres.* **(Mr. D. Motyka, Gulf, Issue 20:31, 23-3-1982)**

Preliminary designs for offshore fields envision production wells capped with multiple subsea well-completion manifolds with pipelines (oil, gas and water lines strapped together and insulated to form a single pipeline) used to transport the hydrocarbons ashore (Figure 6). These gathering systems would feed a supply line routed to a suitable oil terminal. Here, the crude oil and gas would be processed prior to further transportation.

Figure 6: Arctic Islands — Typical Subsea Production System



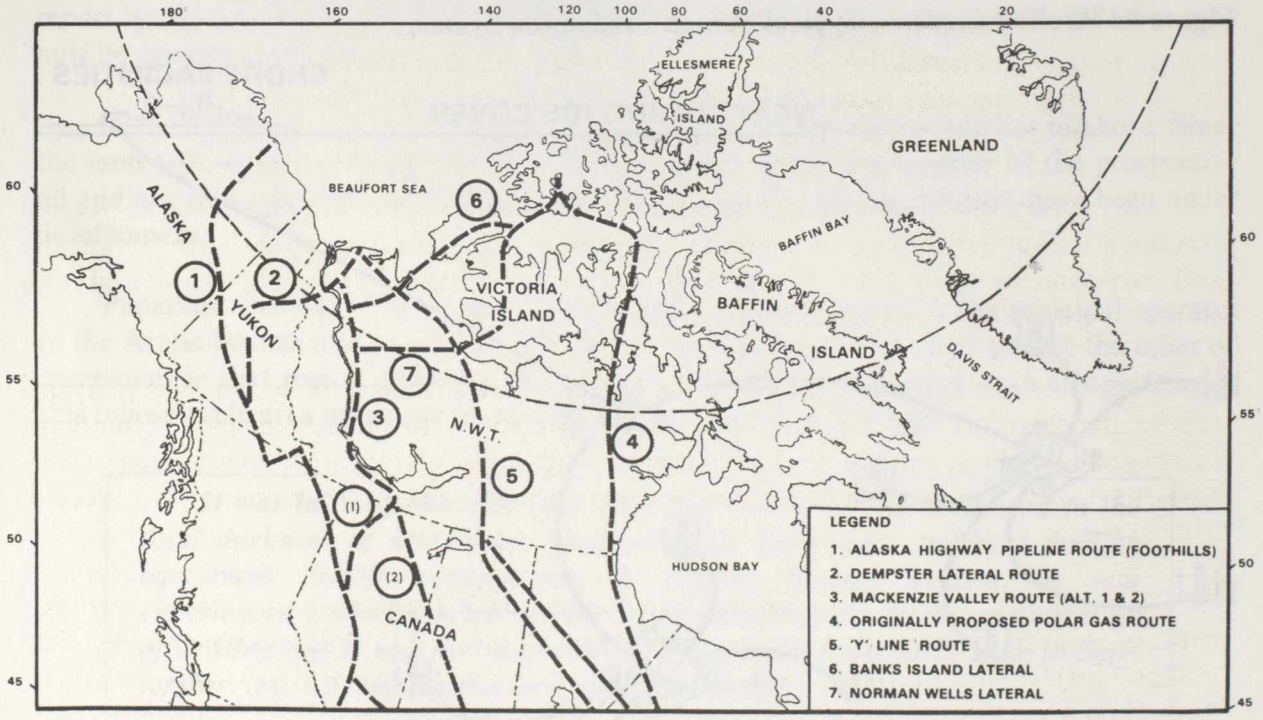
Source: Gulf Canada Resources Inc., Presentation to the Special Senate Committee, *Offshore Transportation Study*, 23-3-1982.

To test the technical feasibility and commerciality of such a system, Panarctic carried out a pilot experiment by completing an offshore well in the Drake Point Field near Melville Island connected to onshore production facilities. All operations were conducted from the surface of the ice and monitored electronically. The pipelines were encased and manifolded into an apparatus called a subsea completion manifold which plugged into the subsea wellhead. The well was successfully flow-tested, first with control from the drilling rig, then with control of the well shifted to the onshore production facilities. The flow rate was about 2.2 million cubic metres (76 million cubic feet) per day.

The execution of all phases of this project was only possible by co-operative interdisciplinary expertise. While only a prototype at this stage, the lessons learned and the technology mastered offer great promise for development of future petroleum discoveries.

Although Beaufort Sea-Mackenzie Delta oil development and Arctic Island natural gas development present the most likely possibilities in terms of reserves, markets and timing, there are a number of other projects on the horizon (Figure 7).

Figure 7: Possible Oil and Gas Pipeline Routes from the Arctic to Southern Canada



Source: *Hydrocarbon Development in the Beaufort Sea-Mackenzie Delta Region, EIS*, Dome Petroleum Limited, Esso Resources Canada Limited, and Gulf Canada Resources Inc., Vol. 5, 1982, p. 11.1.

Chapter 3

TRANSPORTATION SYSTEMS

A. Beaufort Sea-Mackenzie Delta Region

> *. . . I want to emphasize that we see both systems as being viable transportation alternatives. There are advantages and disadvantages to both, but we see that the two can be used in order to transport oil from the Beaufort Region.* **(Mr. G. Bezaire, Esso, Issue 17:24, 16-2-1982)**

The consortium of companies operating in the Beaufort Sea-Mackenzie Delta Region considers that either tankers or overland pipelines or a combination of both are technically and environmentally feasible to bring hydrocarbons to market. Under appropriate circumstances, both systems are economically viable.

A number of factors will influence the choice of a transportation system by the operators in the Beaufort Sea Region. These relate principally to project economics, markets, safety and reliability, and the need for mitigative measures to protect the environment. Obviously the extent and location of reserves will play a major role in determining the choice of transportation system.

The threshold level of oil reserves for a commercially feasible, marine-based operation with two tankers operating has been estimated by Dome at 112 million cubic metres (700 million barrels) with a production rate of 16,000 cubic metres (100,000 barrels) of oil per day. The economics of a pipeline transportation system in the North, the Committee was told by Dome, requires as a minimum some 385 million cubic metres (2.5 billion barrels) of proven recoverable reserves and a production rate of 56,000 cubic metres (350,000 barrels) of oil daily. As far as the Beaufort Sea Region is concerned, Dome claims that the higher level of reserves required for a pipeline will not be achieved until 1990. Even according to the projected intermediate production schedule, the level of output will only have reached 48,000 cubic metres (300,000 barrels) a day in 1990. As mentioned, Dome advocates a tanker system operational by 1987, at a time when the company claims that Canada's oil deficit will be greatest.

Esso's development plan and pipeline system, as outlined to the Committee, anticipates major production commencing in 1989 building up to 64,000 cubic metres (400,000 barrels) a day by 2000. Alternatively, Esso proposes a demonstration oil pipeline project to match the capacity of, and join up with, the Norman Wells pipeline. Gulf, on the other hand, did not see production reaching 48,000 cubic metres (300,000 barrels) a day before the mid-1990s, possibly utilizing a marine system. The development plan in the joint EIS tends to reflect Dome's more optimistic timing although changes in the market situation may retard the project.

The EIS development plan for the Beaufort Sea Region includes both tanker and pipeline options. Both options cover the probable requirement to commence on a small scale, either by a smaller version 80,000 tonne (503,000 barrel) tanker to transport oil from Tarsiut at the rate of 3,200 cubic metres (20,000 barrels) per day or by a small-diameter pipeline of almost identical capacity, connecting to the Norman Wells pipeline. As more reserves are proven, the capacity of either system would be expanded. The descriptions which follow address cases when intermediate/high rates of production have been achieved.

During the early years of production, the industry expects to transport only oil out of the Beaufort Sea Region. Eventually, natural gas will require shipment to markets but probably not before the mid-1990s. These products, as well as such others as natural gas liquids and methanol, could be transported by tanker or pipeline.

The oil would be gathered by buried pipelines onshore and by subsea pipelines offshore to an overland pipeline or to an offshore tanker-loading terminal such as the APLA described previously, depending on the mode of transport chosen.

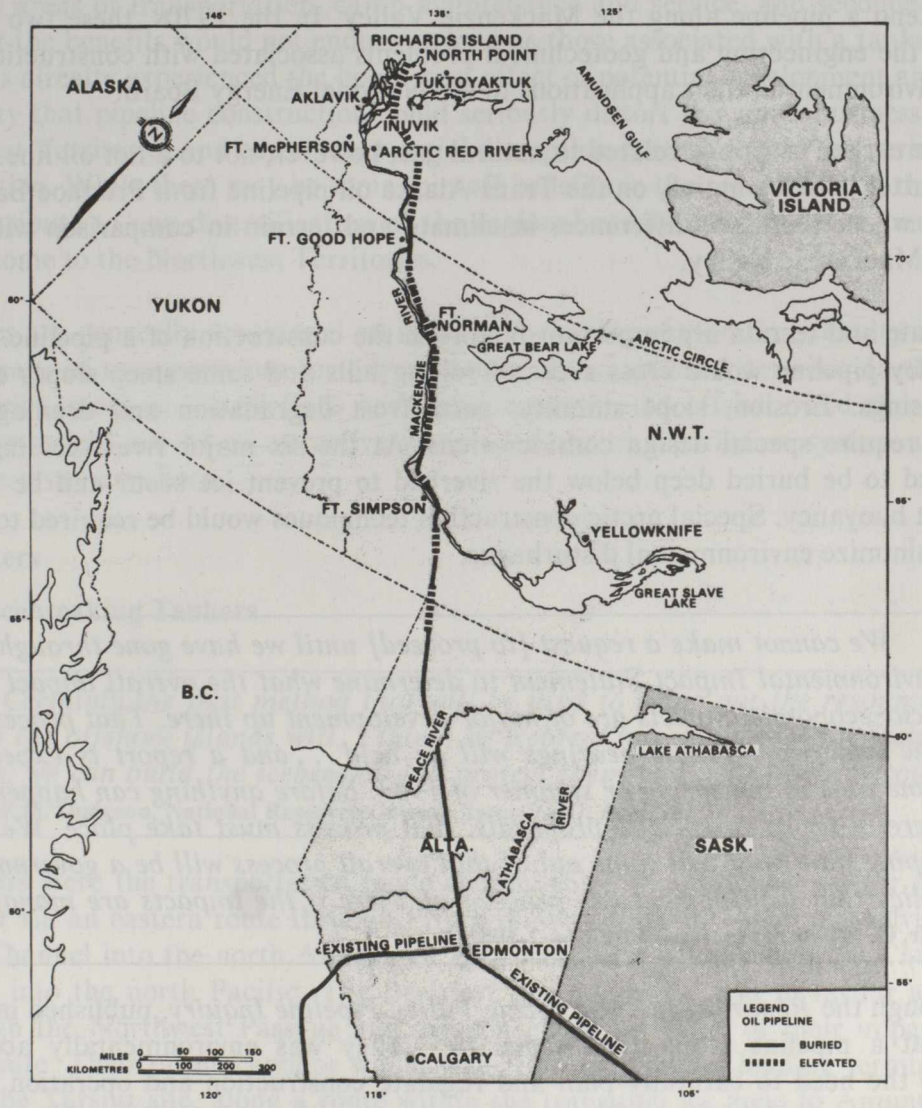
1. Pipelines

An overland pipeline transporting oil from the Beaufort Sea-Mackenzie Delta Region would originate near North Point on Richards Island at the northern end of the Mackenzie Delta. It would extend along the Mackenzie Valley for a distance of 2,250 kilometres to Fort Simpson, from there to Zama in northwestern Alberta and on to a southern terminal near Edmonton to tie into the Interprovincial system for transport to markets in Eastern Canada (Figure 8). A pipeline with an outside diameter of 1.1 metres (42 inches) would be required to satisfy the high production level. For lower production rates, smaller diameter lines could be utilized; a 30 to 40 centimetre (12 to 16 inches) buried line is being considered to link up with the Norman Wells pipeline. Construction would take place over four years, mainly in the winter months. Existing transport systems would be used as much as possible to bring in construction materials, equipment, fuel and personnel.

The pipeline right-of-way would comprise a corridor of land 37 metres wide to accommodate trenching and backfilling. Twenty-four pumping stations would be needed. Each pumping station would require an area of 182 metres by 304 metres. Altogether, land requirements north of 60° would comprise 5,600 hectares (13,830 acres).

Based on the Trans-Alaska oil pipeline experience, one-third of the pipeline would be elevated above ground, in the region where permafrost is prevalent and the warm oil could cause local thawing and settlement. Two-thirds of the line would be buried in the conven-

Figure 8: Pipeline Along the Mackenzie Valley from the Beaufort Sea-Mackenzie Delta to Edmonton



Source: *Beaufort*, Dome Petroleum Limited, Esso Resources Canada Limited, and Gulf Canada Resources Inc., Vol. 2, No. 2, December 1982, p. 15.

tional manner and covered with fill. The depth of the burial would be sufficient to place the line below the normally active permafrost layer present in northern locations. Remotely-controlled surface valves spaced at regular intervals along the line will have the capacity to monitor leaks.

> *Most of our [Esso] remarks here have been addressed to pipeline systems because we have done most of our work on pipeline systems.* (**Mr. G. Bezaire, Esso, Issue 17:28, 16-2-1982**)

Esso advocates a pipeline system on the grounds that it is a known technology. Certainly, considerable permafrost-associated research has been conducted in connection with previous proposals by Canadian Arctic Gas Pipeline Limited and Foothills Pipe Lines Limited to extend a pipeline along the Mackenzie Valley. In the 1970s, these two contestants addressed the engineering and geotechnical problems associated with construction in a permafrost environment in their applications to the National Energy Board.

These earlier proposals related to natural gas, however, not to a hot oil line. Experience with the latter is based mainly on the Trans-Alaska oil pipeline from Prudhoe Bay to Valdez in Alaska where there are differences in climate and terrain in comparison with the route along the Mackenzie Valley.

Climate and terrain are important factors in the construction of a pipeline. The Mackenzie Valley pipeline would cross areas of rolling hills and some steep slopes especially at river crossings. Erosion, slope stability, permafrost degradation and drainage problems would all require special design considerations. At the six major river crossings, the pipe would need to be buried deep below the riverbed to prevent ice scour and be weighted to counteract buoyancy. Special arctic construction techniques would be required to protect the line and minimize environmental disturbance.

> *We cannot make a request [to proceed] until we have gone through the Environmental Impact Statement to determine what the overall impact and socio-economic impacts are of major development up there. That process is now underway. Public hearings will be held . . . and a report is expected some time in the spring or summer of 1983. Before anything can happen up there in terms of specific proposals, that process must take place. We are hoping that what will come out of that overall process will be a government policy that development can proceed up there if the impacts are managed.*
> **(Mr. G. Haight, Esso, Issue 17:17, 16-2-1982)**

Although the *Report of the Mackenzie Valley Pipeline Inquiry*, published in 1977, concluded that a pipeline along the Mackenzie Valley was environmentally acceptable, it pointed to the need to carefully plan and regulate construction and operation in order to minimize environmental impact. The pipeline route runs through traditional harvesting areas around Travaillant Lake, an important winter range for Bluenose caribou, and some critical waterfowl staging habitats.

The 1977 report highlighted the importance of the Mackenzie River as a natural transportation route for industrial activity. It stated the need for comprehensive land-use planning to help resolve land-use conflicts already apparent in the region. One of the most contentious issues in the Mackenzie Valley is the settlement of native land claims. The Committee has already expressed its opinion on the need for comprehensive land-use planning whichever mode of transport is chosen.

A Mackenzie Valley pipeline would definitely have an impact on the Delta and Mackenzie Valley communities, particularly those situated along the pipeline route. There would be regional benefits in the form of employment and training. At peak construction during the third year, 13,000 people could be employed. Once completed, about 200 employees would

be required to operate and maintain the Northwest Territories portion of the line. The period of wage employment, however, would be of limited duration and would be mostly in unskilled trades. The construction phase would afford ample opportunity for northern businesses in the areas of transportation, camp maintenance and service, and secondary service industry, but the benefits would not endure as long as those associated with a tanker system. This area has already experienced the boom-bust effect of potential development and there is the possibility that pipeline construction could seriously distort the small business sector of the Northwest Territories and cause other social disruption particularly in the period following construction. While there may be some spin-off benefits in the service sector, the pipeline will not contribute to any diversification of the regional economy and hence a more stable source of income to the Northwest Territories.

Pipelines are generally considered an impetus to further exploration activity since they provide a means of transportation for any subsequently established reserves. In the Northwest Territories, most of the oil finds have been concentrated offshore and thus overland transportation would not be as attractive as an offshore transportation system until more reserves were proven onshore.

2. Tankers

2.1 Icebreaking Tankers

> *Certainly the first method that will be used to bring out the resources from the offshore islands will, I think, be icebreaking ships. We can design them; we can build the icebreakers to protect them and help them get out.*
> **(Mr. E.H. Dudgeon, National Research Council, Issue 23:37, 4-5-1982)**

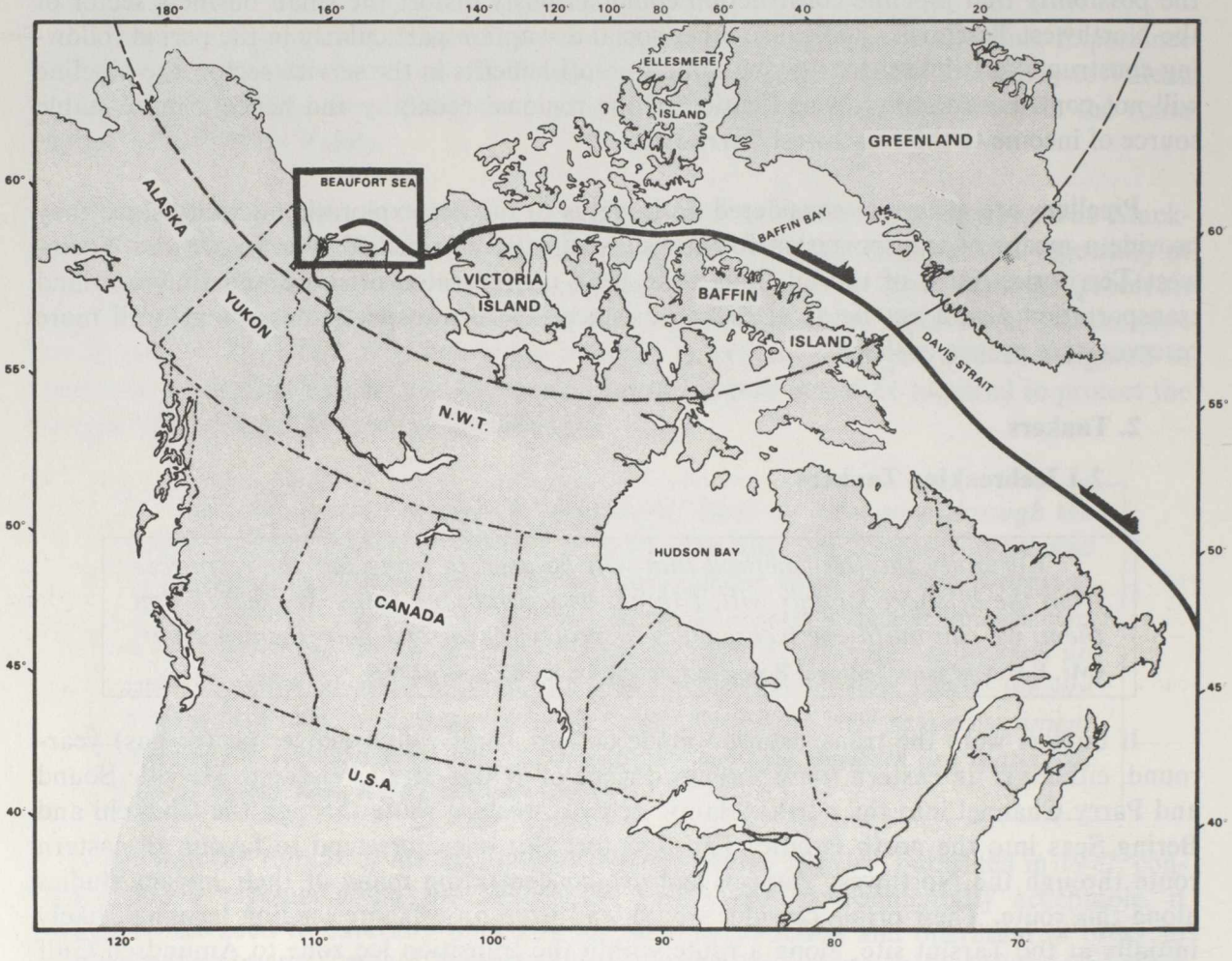
If tankers were the transportation mode chosen, ships would deliver oil (or gas) year-round, either via an eastern route through Prince of Wales Strait, Viscount Melville Sound and Parry Channel into the north Atlantic or by a western route through the Chukchi and Bering Seas into the north Pacific. The Beaufort Sea operators tend to favour an eastern route through the Northwest Passage and are concentrating many of their impact studies along this route. Their prime corridor would lead from an offshore loading terminal, likely initially at the Tarsiut site, along a route within the transition ice zone to Amundsen Gulf and onward through the Northwest Passage (Figure 9).

The tankers used to transport oil through the arctic seas will be Class 10 vessels (Figure 10), each with an oil-carrying capacity of approximately 200,000 tonnes (approximately 1.5 million barrels). Initially in 1987, there would be one tanker but the EIS reports that 16 tankers may be needed to service offshore Beaufort oil fields by the year 2000 to make the 30-day round-trip to Eastern Canada at the intermediate level of production. In that case, tankers would be loaded every second day from their offshore loading terminal.

Each tanker would be 390 metres long, 52 metres wide and have a draught of 18 to 20 metres. The design of these tankers is not yet final. These ships will be powered by two independent propulsion systems capable of generating up to 112 megawatts (150,000 horsepower). The propulsion system is being designed to withstand rapid changes in power requirements. The ability to obtain reverse propellor thrust with a minimum of delay reduces

Figure 9: The Northwest Passage

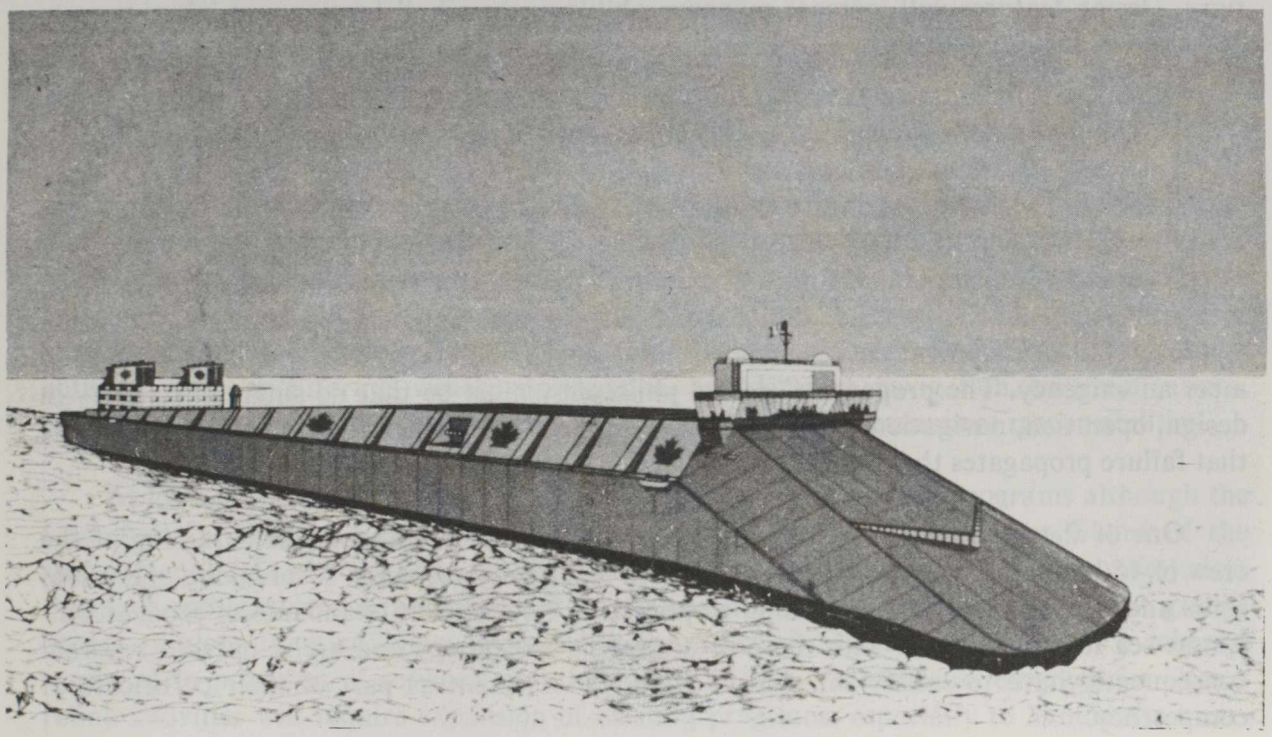
The Northwest Passage will be the route used by arctic tankers to transport oil from the Beaufort Sea to the East Coast of North America.



Source: *Hydrocarbon Development in the Beaufort Sea-Mackenzie Delta Region, EIS*, Dome Petroleum Limited, Esso Resources Canada Limited, and Gulf Canada Resources Inc., 1982, Vol. 1, p. 1.10.

the stopping distance of five kilometres for a conventional tanker to one kilometre in open water for the arctic tanker. These ships will have a double-sided shell and double-bottomed hull which will meet all the Canadian Coast Guard requirements for year-round operation anywhere in the Arctic. Their icebreaking capability will enable year-round travel through the Northwest Passage. The 14 cargo containment tanks located within the inner hull will be protected by a configuration about three times stronger than that of a conventional ship.

Figure 10: Arctic Tanker



The tankers being proposed to transport oil through the Arctic seas will be ice Class 10, double-hulled vessels with an oil-carrying capacity of 200,000 tonnes (approximately 1.5 million barrels).

Source: *Hydrocarbon Development in the Beaufort Sea-Mackenzie Delta Region, EIS*, Dome Petroleum Limited, Esso Resources Canada Limited and Gulf Canada Resources Inc., Vol. 1, 1982, p. 1.22.

> *If you look at the progressive technology of icebreaking, there are really only four important factors, namely, the hull form, the friction, the propulsion and the strength . . . in most cases icebreakers have been designed for either temperate waters or arctic summer operation, and very few icebreakers have taken into account multi-year ice. If you want to operate in the Arctic on a year-round basis, you have to take into account the multi-year ice.* **(Mr. B. Johansson, Dome, Issue 21:62-63, 31-3-1982)**

Severe and variable ice and climatic conditions, 24-hour darkness, and a fragile environment set the Arctic apart from conventional tanker operating areas. While there is a huge body of data and expertise available worldwide for conventional open-water tanker operations, there is relatively little for arctic operations. Thus, although the safety record of tankers is quite good worldwide, operating a ship of this size in the severe arctic conditions presents a technological challenge. Operating year-round is an innovation in itself.

Appropriate tanker design, an understanding of environmental conditions and a sophisticated predictive capacity — both of the tanker's performance and of the setting in which it operates — are all prerequisites to operating safely in the Arctic.

Based on the practical experience of the S.S. Manhattan and Kigoriak trials, marine proponents are upgrading the design of the arctic tanker to withstand the severe arctic conditions. Design features will increase maneuverability, reduce hull friction and improve early detection of surface objects.

> *The whole keynote of new technology will be reliability, to the point of being fail-safe. We simply cannot make errors; we cannot have accidents in our environment.* **(Mr. A.E. Pallister, CanOcean, Issue 27:30, 1-6-1982)**

A tanker will be operated first without cargo under endurance conditions; nevertheless, it is still not possible to predict the tanker's performance under all circumstances. This is where a "fail-safe" operation becomes essential so that no one system alone is expected to meet an exigency. The proponents' design philosophy must be that no single mistake — in design, operation, navigation or mechanics — will lead to disaster either in itself or because that failure propagates through the system leading to other failures.

One of the key components in a safe operation is the recruitment and training of the crew of 45 both in operation of the vessel and in emergency response. Icebreaking operations skills and training programs are being emphasized. Nevertheless, standards of professionalism at sea must keep pace with those of advancing technology and arctic operators should consequently have to satisfy some form of ice-endorsement as part of their certificate of competency.

Good environmental prediction, ice and hazard detection, and navigation systems are vital to safely carry out all activities. Sophisticated navigation and ice reconnaissance programs will be required to select favourable routings and avoid areas of high ice density. All such support systems must be in place to ensure that year-round shipping can proceed safely. The marine proponents are developing these concepts; however, the Committee has some concerns in view of the work that still is required.

A good predictive capability also depends on valuable ice research programs. More must be learned about the arctic ice regime to gain a greater understanding of seasonal and annual variations and their effects on ship movements. The proponents claim that any changes in the ice regime as a result of ship movements in the landfast or transition zones would be indistinguishable from characteristic annual variations.

> *These icebreakers make lanes or channels. How long do these channels last?* **(Senator Yuzyk)**
>
> *The channels are created only when there is ice around. There are basically two kinds of ice, land-fast ice, or ice that does not move very much, and offshore ice, transition zone ice, which tends to move a fair bit. If an icebreaker were driven through land-fast ice in, say, the month of October, early in the season, the track where the ship went through would be there all winter . . . you have something less than a standard first-year type of ridge. In transition zone ice, because of the constant movement of the ice, the track would be obliterated.* **(Mr. R. Hoos, Dome, Issue 21:93, 31-3-1982)**

A number of ice research programs have been conducted and are being planned by marine proponents that will improve the present predictive capability in such aspects as the incursion of multi-year ice in the Beaufort Sea. Studies of tanker tracks conducted over the winter period 1981/82 attempted to establish that ship tracks will not impede the passage of hunters and wildlife in their travels across the ice from island to island.

The evidence presented at the hearings confirmed that the companies are obviously making great strides in conducting research and building preventive measures into the design and operation of their transportation systems suited to the arctic environment. While the sponsors must assume a major responsibility for operating reliably and safely under arctic conditions, it is the Federal Government's function to provide essential marine support services, provision of emergency assistance, and enforcement of standards and regulations. Such activities as ice monitoring, weather forecasting, hydrography, navigation, communications, research, search and rescue, and marine escort and aid are all government responsibilities.

At least half a dozen departments participate in operating these programs although the Canadian Government's principal marine presence is the Canadian Coast Guard of the Department of Transport. Even within the Coast Guard itself, navigation, ship safety, icebreaking and search and rescue-related responsibilities are all handled by different groups organized along functional lines. Functional separation of responsibilities inhibits a cohesive approach to provision of services, especially critical in marine distress emergencies. Year-round activities will require expansion of existing programs, especially to handle the unexpected contingency or unforeseen error.

The Department of Transport is presently preparing a five-year plan to implement the necessary shipping support services for projected year-round activity in the Arctic. Included in the development objectives of this plan are organizational arrangements and research efforts that will improve the Canadian Government's response capability. A newly formed Arctic Shipping Control Authority will regulate ship movements in the Arctic. A Canadian Coast Guard unit located in the Arctic will develop the support services necessary for year-round activity. Work will be continued on the design of a Polar Class icebreaker even though no approval has yet been gained to proceed with actual construction. R and D in ship safety will concentrate on developing knowledge of ship structures and manning requirements as well as of navigation aids and communications systems. The question still remains whether the Federal Government is moving fast enough. The Committee stresses that the emplacement of support services essential to safe and reliable transit of tankers on a year-round basis must be expedited.

The Committee recommends:

> **That all support systems relating to such marine services as ice monitoring, weather forecasting, navigation, search and rescue, and marine escort which are necessary to ensure the reliability and the safety of production and transportation systems be in place before production commences.**

Moreover, unless government research and planning programs keep up with the pace of industry in introducing innovative designs and practices, government is not in a favourable position to assess the effects of the introduction of new technologies or promulgate effective

controls. The need for government to be in a state of readiness is discussed in the final section of the report.

> *We are right out there on the frontier. Nobody has ever built an ice-breaking oil tanker of that size or capability, with the kind of power to go through those conditions, so we would like to proceed cautiously so that we are confident that we know what we are doing, that the industry knows what it is doing, and so we do not wind up with some kind of ecological* disaster or accident on our hands.* **(Mr. G.M. Sinclair, DOT, Issue 30:31, 15-6-1982)**

The Federal Government also bears a major responsibility in assuring that mitigative measures to handle oil spills are in place should a tanker system be used to transport oil either from the Arctic Islands or from the Beaufort Sea Region. Oil spills probably present the greatest single danger of Beaufort Sea Region development to the arctic environment. Since 1973 a considerable amount of research and development work has been carried out in Canada on spill countermeasures. Although much research has been conducted by industry and government on containment and burning measures, it is not yet clear whether the state-of-the-art matches the risk of a major oil spill in arctic conditions. Research and development in clean-up and control of spills has attempted to meet the unique ice conditions, temperatures and remoteness of the Arctic. Contingency plans need to provide a quick, co-ordinated and effective response to spills.

In the case of marine pollution incidents in arctic waters, the Canadian Coast Guard has operational responsibility for the Arctic Marine Emergency Plan. The Coast Guard has lead agency responsibility for all emergencies resulting from marine transport, including ship equipment, cargo, fuel and stores. The Arctic Marine Emergency Plan sets out the response mechanism to respond to a marine pollution emergency and establishes procedures to deploy spill countermeasure resources.

Government plans for a co-ordinated marine pollution response capability are still in the process of development. The Committee is sympathetic to the difficulties with which the Canadian Coast Guard is faced in spreading its meagre financial and personnel resources across the whole gamut of year-round marine services in arctic waters. Response to pollution emergencies, where it is the lead agency, is after all only one facet of its surveillance role. Another equally important responsibility is its support function in search and rescue operations and marine distress incidents.

The Committee recommends:

> **That in order to upgrade the Federal Government's year-round arctic response capability, the Canadian Coast Guard be provided with adequate financial and personnel resources to conduct R and D, to supply marine support services and to meet emergencies.**

*Note: Misquoted in *Proceedings* as "economic".

2.2 Submarine Tankers

Another marine technology that is being advocated to transport LNG from the Arctic is a submarine of 140,000 cubic metre (approximately 5 million cubic feet) capacity, driven either by nuclear or non-nuclear propulsion at submerged speeds of between 12 and 15 knots. Cargo transfer systems have been designed for cargo loading at an underwater terminal in the Arctic or at a conventional surface terminal. Under-ice conditions are generally less severe and a submerged terminal would eliminate the risk of exposure to surface ice conditions.

The nuclear submarine would be 387 metres long while the non-nuclear version would be 487 metres in length. The size of the submarine proposed represents a huge increase in scale compared to existing submarines, since the non-nuclear one proposed by General Dynamics Corporation to the Committee is almost three times longer than the Trident submarine. It is based on well-tested U.S. military submarine technology rather than commercial submarine technology.

Its size gives it limited maneuverability in maintaining the safety margin required between the ice and the seabed. It has been estimated that 150 metres is a safe operating depth but this does not exist, for instance, in Barrow Strait; consequently, the route taken would have to be longer to avoid shallow areas. The shallow waters of the Beaufort would necessitate subsea loading systems far offshore. This would require a more extended gathering system that would not be necessary for surface tankers.

The stopping distance of the proposed submarine is calculated to be approximately three times that of the maximum range of sonar operating to avoid bottom and under-ice reverberations. This limitation is compounded by the cold arctic conditions which tend to affect the accuracy of sonar devices.

The consequences of a problem such as a leak are much more serious aboard a submarine than in a surface vessel. The design must therefore allow for a much greater safety margin than is true of a surface vessel in considering such exigencies as emergency rescue or collisions.

LNG is a low-density cargo with a specific gravity less than half that of water. Since the buoyancy of a submarine must equal its total weight, a submerged craft carrying LNG must also carry large quantities of high-density ballast. The proponents of the submarine consider they have overcome this problem and that their proposal is economically and technically viable. There is less risk of hull damage during continuous journey through the ice. They claim more cargo can be delivered per unit of time by a submarine than by an icebreaking tanker system at uniform, predictable intervals, lowering the transportation cost.

The principal attraction to the Committee of this concept is the lack of surface disruption. The difficulty for the Committee in assessing this system is that most submarine operation in the Arctic has so far been for defence purposes and so data are unavailable. The Committee finds the concept of commercial submarine use in the Arctic interesting especially in those areas where surface conditions are particularly severe; however, this possibility would need to be further explored. This mode of transport could, in the Committee's opinion, be included in the Federal Government's consideration of alternative transport systems.

B. Arctic Islands

> *It is the prospect of a transportation corridor being opened up that is very threatening to us . . . As far as we are concerned not enough environmental assessment has been carried out to ensure that our lifestyle will be protected . . . To participate in further research . . . is a matter of consultation.* **(Mrs. F. Williams, Labrador Inuit Association, Issue 26:14-15, 18-5-1982)**

At present, it is not anticipated that crude oil will be produced from the Arctic Islands until the turn of the century, although this is a function of future discoveries and domestic demand. Gas could be produced by the late 1980s if the Arctic Pilot Project application is reactivated successfully before the National Energy Board. The Arctic Pilot Project group has chosen tankers as the mode of transport to bring LNG from the Arctic Islands to market; they will nevertheless be utilizing arctic pipeline technology on Melville Island to link the natural gas field at Drake Point to the LNG loading facility at Bridport Inlet.

The LNG carrier route from Bridport Inlet would be easterly through Viscount Melville Sound, Barrow Strait and Lancaster Sound, across Baffin Bay and then southerly off the west coast of Greenland and through Davis Strait and the Labrador Sea (Figure 11). This route through the Northwest Passage is also the one favoured for the transport of oil from the Beaufort Sea Region. The terminal location remains undecided pending the identification of a market for the natural gas.

Two Class 7 icebreaking tankers would make 16 trips per ship per year over the 5,200 kilometre journey if terminals in Eastern Canada were involved. The flexibility of ship transportation would also allow European markets to be served, where LNG receiving facilities already exist. Cargo capacity would be 140,000 cubic metres (approximately 5 million cubic feet) and the carrier would be 372 metres long by 43 metres wide. Depth of the vessel would be 29 metres with a draught of 11 metres. The tanker would be operated by a crew of 42. The propulsion system would employ three fixed-pitch propellors, each driven by a separate turbo-electric unit capable of delivering 135 megawatts (180,000 horsepower) at full power, five times that of standard LNG carriers of comparable size. The tankers would exceed arctic shipping standards, utilizing a strengthened hull, special cargo containment features and a powerful propulsion system. Sophisticated sensing, positioning and communication equipment would also be a part of the ship's design.

The LNG carriers have been designed to enter ports at a number of locations on the east coast of Canada and the United States. At this time there is no market in the United States for surplus exports of Canadian gas and this situation is expected to continue for three to six years. The price of Canadian gas is also not competitively favourable at present. Although the proponents are investigating potential markets in Europe, the project is stalled pending market developments.

Although proven natural gas reserves are well beyond the threshold levels required for a tanker operation, this mode is seen as providing more flexibility to change production levels or delivery points. With the fate of the Polar Gas Pipeline from the Arctic Islands undecided, Panarctic told the Committee the Arctic Pilot Project provided a favourable means of proceeding to transport LNG immediately on a relatively small scale.

Figure 11: The Arctic Pilot Project Route

Source: Arctic Pilot Project, *Application to the NEB*, October 1980.

In April 1980, the Federal Environmental Assessment and Review Process Panel recommended approval of the northern components of the project subject to certain conditions. The panel saw the sense of pioneering year-round arctic transportation and developing in this country a greater arctic expertise within industry and government. This relatively small-scale shipping proposal was felt to be one means of testing impacts and researching the effects of year-round shipping in the Arctic.

Routing concerns, however, led the panel to recommend the establishment of a monitoring agency within the Department of Transport to monitor ship movements. This Arctic Shipping Control Authority has since been established and its role is discussed in the section on regulation. The panel also recommended the formation of an advisory committee to ensure biological information was effectively integrated into the route selection process. The advisory committee was to provide advice to the authority on environmental and socio-economic matters arising out of year-round shipping activities.

The small scale of this project presents an opportunity from Canada's point of view to try out new technologies experimentally before full-scale resource development would be initiated. Although the icebreaking tankers were to be built elsewhere, an agreement ensured that the arctic shipping technology would be transferred to Canada. The transfer of this foreign technology would allow Canada to build its own nonconventional ships.

> *Accordingly, and I don't mind repeating this, we feel that it is very important for the Arctic Pilot Project to proceed with its icebreaking LNG tankers to demonstrate the technology that can be applied to the transportation of oil.*
>
> *High technology oil production and transportation systems will be required along with large amounts of front-end money. We have the capability of bringing this oil to market, but we must have the mandate to do so. It will be necessary to know that the government favours such a development and that the oil will be marketed, providing that suitable criteria are met with respect to design, construction, Canadian benefits and environmental and social requirements.* **(Mr. C.R. Hetherington, Panarctic, Issue 28:41, 9-6-1982)**

The value of a pilot project is the pioneering it accomplishes. If this project fails to proceed before Beaufort Sea oil development, some of its technological rationale of proving the feasibility and safety of this mode of arctic transportation will be lost.

> *. . . I would be much happier to see a Class 7 LNG carrying oil up in the Arctic long before we have a Class 10 oil tanker in the Arctic, just like the wise old icebreaker captain who has been up there for 30 years who says, "Yeah, I believe you can do it, but you aren't going to see till you get there!" What he is saying is, "Be careful. Yeah, I think it's possible! Yes, all of us think it is possible, but just be careful. We are fooling around with some pretty serious things here."* **(Mr. G.M. Sinclair, DOT, Issue 30:31-32, 15-6-1982)**

C. Transportation Mode Selection

In the previous selections, the Committee has reported on some of the challenges alternate transportation systems brought to its attention at the hearings. Based on the evidence, the Committee agrees that under certain conditions both pipeline and tanker systems are technically and environmentally feasible to transport hydrocarbons from the Arctic Region.

Nevertheless, in both the Arctic Islands and the Beaufort Sea Region cases, there are strong reasons for proceeding on a small scale and expanding incrementally. In the Arctic Island case, the factors are uncertain markets, the concept of testing a new technology on a limited scale, and a smaller investment that would generate a cash flow early in the project.

In the Beaufort Sea Region, Federal Government policy and the operators support phased development with expansion tied to demonstrated capability; proven reserve levels do not yet justify major production levels; and fluctuating oil prices all support a gradual pace of development.

At high throughput, a pipeline is more economical than a tanker system but the high capital costs associated with a large-diameter pipeline make financing difficult and cost overruns a major concern. The fixed size of the pipeline and its inflexibility, given the uncertainty in reserves (at least in the Beaufort Sea Region case) and markets do not make it a prudent investment at this time, in the Committee's view. A more flexible system to adapt production rates to meet reserve levels and market demand, including the offshore, appeals to the Committee.

Moreover, the Committee agrees with the proposed development plan to gradually build up rates of production and transportation.

> *. . . we have identified what may be a preferable way of going about developing Beaufort oil — that is, through some kind of phase development concept. We could start on a relatively small scale, and this would allow northerners to grow with the development, to gain the skills that they could use in subsequent developments, and also allow industry to talk about real effects rather than speculative effects that the development might have. Once one has this background, one can eliminate or at least mitigate some of the impacts of major oil development.* **(Mr. G. Bezaire, Esso, Issue 17:35, 16-2-1982)**

The Committee has already expressed its opinion on the need for Canada to stay in the forefront of cold ocean technology and shipbuilding of arctic class ships. Tankers as a transportation choice offer this opportunity and their gradual introduction into the arctic environment will provide the time to monitor impacts.

Phasing of development would also allow northerners the time to benefit from development in employment and in business opportunities. The development of a tanker transportation system can take up to 10 years. The longer duration means a sustained level of industrial activity and less inflationary pressures. Delta communities would have time to absorb growth

and could conceivably continue to experience growth during the operating period which would help to cover the costs associated with expanded services.

The tanker system is, in the Committee's opinion, more flexible in adjusting to incremental development and absorbing changes to production levels, although the Committee can see an eventual need for both tanker and pipeline systems.

The Committee recommends:

That transport of hydrocarbons from the arctic region commence by tanker on a small scale and that consideration be given to various combinations of tanker and/or pipeline systems as other factors warrant.

Chapter 4

ECONOMIC BENEFITS OF ARCTIC PETROLEUM DEVELOPMENT

A. Beaufort Sea-Mackenzie Delta Region

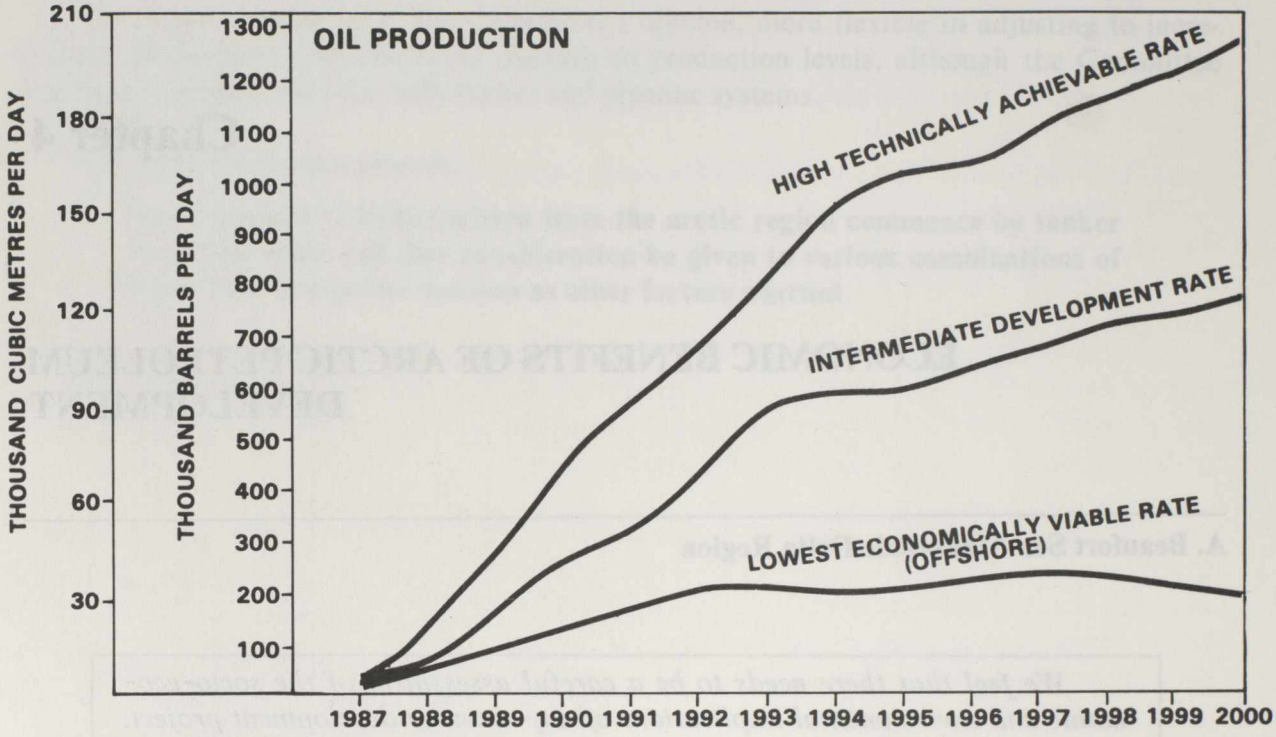
> *We feel that there needs to be a careful assessment of the socio-economic and environmental implications of any resource development project, and we are careful to try to launch studies in this area simultaneously with our engineering assessments. Our general concern is to try to maximize the benefits of developments while minimizing the negative effects.* **(Mr. K. Jesperson, NOVA, Issue 18:24, 2-3-1982)**

1. Introduction

The project sponsors assume that oil production will proceed at one of two rates, either at a high technically achievable rate, or an intermediate development rate. By the year 2000, the difference between these two forecasts in terms of oil production would amount to 80,000 cubic metres (500,000 barrels) per day (Figure 12). Although much of the project sponsors' impact analysis is based on the technically achievable rate, it is likely that the actual development rate will be lower. This prognosis is supported by NEB evidence before the Committee that production in the Beaufort Sea-Mackenzie Delta Region is not likely to proceed before the early 1990s.

Dome, Esso and Gulf have projected investment and employment benefits to flow from Beaufort Sea Region development but there are three reasons for believing that benefits will not be realized at the levels forecast. First, if the NEB is in fact correct in its assessment of when production will commence, the economic benefits to 2000 will be below those levels predicted for both the technically achievable and the intermediate development rates. Second, natural gas production is forecast to contribute benefits from the period 1990-92 as a result of the Dempster pipeline connection to the Alaska Highway Pipeline, a project which presently remains stalled.

Figure 12: Potential Oil Production Rates



Source: *Hydrocarbon Development in the Beaufort Sea-Mackenzie Delta Region, EIS*, Dome Petroleum Limited, Esso Resources Canada Limited, and Gulf Canada Resources Inc., 1982, Vol. 2, p. 7.1.

> *We believe that it would be advantageous to transport Beaufort Sea and Mackenzie Delta gas via the proposed Dempster Lateral pipeline.* **(Mr. D. Motyka, Gulf, Issue 20:28, 23-3-1982)**

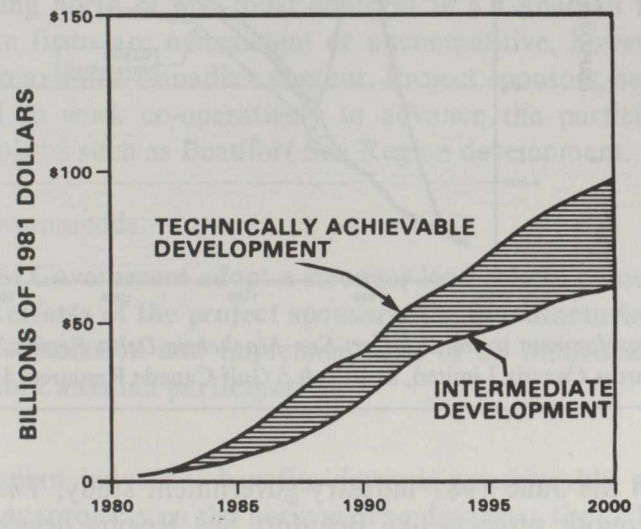
Third, benefits are predicated on world crude oil prices remaining constant at $34.00 U.S. per barrel through 1983, and subsequently increasing at a rate of 1.5% to 2.0% above the U.S. Gross National Product (GNP) deflator (that is, in real terms). In fact, real crude oil prices have recently been declining. To the extent that this decline continues or that the above pricing assumption is not realized, oil production rates and future revenues will be adversely affected.

2. National Economic Benefits

The overall economic benefits from development in the Beaufort Sea Region can be broken down into three types of benefits arising from initial petroleum expenditures. Firstly, a direct impact is felt by those industries whose output is directly stimulated by the project expenditures. Secondly, an indirect or so-called "ripple" effect occurs in those industries which supply inputs to the foregoing industries. Finally, an induced impact in the form of a general increase in economic activity is generated by the spending of household income derived from the project.

In terms of actual capital investment, the sponsors estimate in the EIS that Beaufort Sea Region development will provide a direct injection in project expenditures of between $65 billion (intermediate development rate) and $100 billion (high development rate) into the Canadian economy by the year 2000, depending upon the level of production achieved (Figure 13).

Figure 13: Cumulative Investment Profiles (1981 Dollars)



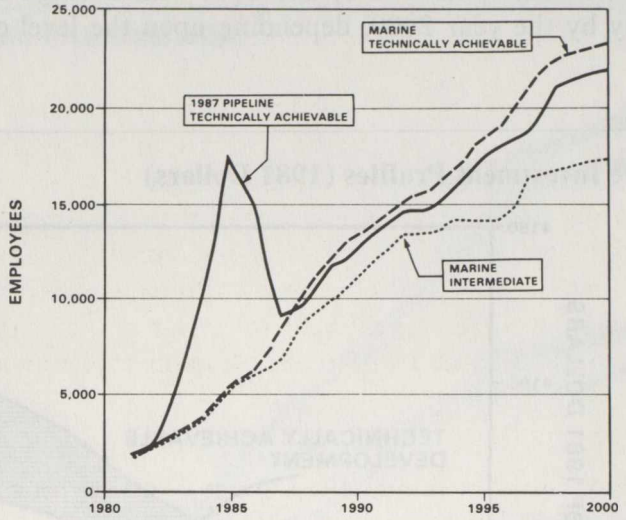
Source: *Hydrocarbon Development in the Beaufort Sea-Mackenzie Delta Region, EIS*, Dome Petroleum Limited, Esso Resources Canada Limited, and Gulf Canada Resources Inc., 1982, Vol. 2, p. 7.5.

At the technically achievable level of production, the project would cumulatively contribute between $210 and $220 billion (1981 dollars) to the Canadian economy by 2000 in direct, indirect and induced economic activity, stimulating annual real growth of 3% in GNP. The Federal Government would receive between $118 billion and $122 billion in royalties and tax benefits to the end of the century, contributing to federal account surpluses commencing in the late 1980s and continuing thereafter.

Development in the Beaufort Sea Region is also projected in the EIS to result in the creation of between 17,000 (intermediate development rate) and 24,000 (high development rate) direct jobs by the end of the century. While pipeline construction employment is projected to peak about 1986, job creation gains for the marine-based mode are steadier (Figure 14). Between 120,000 and 200,000 new jobs are forecast by the Beaufort Sea Region developers from the combined direct, indirect and induced effects of the project on employment. Production at the more likely intermediate rate would reduce employment and investment opportunities by 25% and 35% respectively.

Canadian content with respect to Beaufort Sea Region activities is reported to be approximately 75%. Project sponsors anticipate this could rise to 85% by the year 2000 if Canadian industry responds in a dynamic fashion to new project-related industrial demands in such sectors as manufacture of pipe, valves, pumps and turbines; engineering and management services; shipbuilding- and transportation-related industrial activity; and the services sector.

Figure 14: Total Manpower Requirements



Source: *Hydrocarbon Development in the Beaufort Sea-Mackenzie Delta Region, EIS*, Dome Petroleum Limited, Esso Resources Canada Limited, and IV-A.5 Gulf Canada Resources Inc., 1982, Vol. 2, p. 7.6.

It was stated in the June 1981 industry-government study, *The Major Projects Task Force Report*, that major projects like Beaufort Sea Region development can potentially serve as catalysts for changes in the industrial structure of this country. The large volumes of industrial production required by the project sponsors thus present a challenge to the Canadian manufacturing sector.

> *We have looked at the capability of industry to provide the goods and services required for this development. We expect it would be in the order of 80% and would grow as industry has some capability of responding to the demands placed on it.* **(Mr. G. Bezaire)**
>
> *If you proceeded with the project by phases, would this affect the amount of Canadian content? In other words, would this give industry an opportunity to catch up and supply the equipment necessary?* **(Ms. S. Dakers, Library of Parliament)**
>
> *That would certainly be helpful. What would have a greater impact would be other developments taking place simultaneously. If the oil sands developments, the arctic gas pipeline development, the Hibernia reserves project and other projects were entered into simultaneously, there would be quite a drain on Canadian industry. I believe that would be the primary factor.* **(Mr. G. Bezaire, Esso, Issue 17:31, 16-2-1982)**

The sector needs time to adjust to these new requirements, however, and the sooner the sponsors disclose their needs, the longer will be the lead time available for the manufacturing sector to adjust in order to increase the Canadian content of such major projects. Development of specifications by the project sponsors, based on Canadian manufacturing capability,

would also be of assistance. This would mean utilizing design standards so that Canadian suppliers can compete effectively. It would also mean breaking up the work such as project management, engineering and so on into smaller packages so that Canadian-owned firms can participate and subsequently expand to meet more extensive portions of work requirements.

The visibility of major projects puts pressure on their proponents to perform in a manner that is in the best interests of this country. Because of the significance of major hydrocarbon projects, the level of government involvement is high. Under the *Canada Oil and Gas Act*, companies operating north of 60° must conform to a Canadian Benefits package. In sectors where Canadian firms are nonexistent or uncompetitive, however, project sponsors cannot be expected to maximize Canadian content. Project sponsors, suppliers and the Federal Government need to work co-operatively to advance the participation of Canadian enterprises in major projects such as Beaufort Sea Region development.

The Committee recommends:

That the Federal Government adopt a stronger lead role in co-ordinating and monitoring the efforts of the project sponsors, the manufacturing sector and labour in the formulation and implementation of an industrial strategy to ensure maximum Canadian participation.

Maximizing Canadian industrial benefits depends considerably on the timing of the numerous Canadian megaprojects on the horizon. The data that the Office of Industrial and Regional Benefits of the Department of Industry, Trade and Commerce is collecting could form the basis for an anticipatory approach to megaproject activity in this country so that Canadian business and labour will not be caught off guard by sudden "project-go-ahead" signals. Otherwise, if several megaprojects were to proceed simultaneously, there could be a major problem in the form of supply bottlenecks. Examples of other potential megaprojects are oil sands development, arctic gas pipeline development and the Hibernia project. This would not only have an inflationary effect caused by excessive demands for materials in short supply but would also prevent Canadian suppliers from fully enjoying the opportunities presented.

Project timing and the available pool of skilled labour will also determine Canadian labour's participation in major projects. A number of recent labour market studies, according to the Canada Employment and Immigration Commission (CEIC), have identified possible future manpower shortages in some engineering specialties and highly skilled trades such as shipyard welders, pipefitters and ships' engineering officers. The last item is of special concern to the Committee since the safety and reliability of tanker transport will depend greatly on the level of expertise of crew members. Some of the current surpluses in certain job categories (Table 2) could well turn into shortages when development accelerates. Training programs will be required in order to improve employment skills. Although government is making some headway in providing training programs to meet occupational needs, projects of short duration present a special problem. Peak occupational demands may be followed by a slump in that occupation. Demands that were high when training commenced may have hit a downturn by the time training is completed. That is why forewarning on needs is required so training can be timed to meet them. If other projects go ahead at the same time, Canada will have difficulty in providing a stable supply of trained personnel.

The CEIC is instituting a National Industrial Training Program whereby the Federal Government would enter into a contract with an employer to assist in training employees. Under such a contract, the CEIC would reimburse the employer for the direct cost of training and for a portion of trainee wages. This approach is part of the Federal National Training Program put in place in July 1982 to provide training for new technology occupations generated by resource development projects. Institutional training courses are also covered under this program. Industry operating in the Beaufort Sea Region and the Arctic Islands has indicated a willingness to co-operate with government in training.

Table 2
Selected Occupations Required for Northern Offshore Projects

CCDO No.	Occupation	COFOR Canada 1979 Stock	Employment Insurance Claimants 30/6/82	National Job Bank Vacancies 1/6/82	Current Labour Market Rating
1131	Project Managers	6,650	241	12	Balance
2112	Geologists/Geophysicists	5,745	396	10	Balance
2142	Process Engineers (Chemical)	4,740	143	20	Shortage
2143	Civil Engineers	22,080	820	34	Balance
2144	Electrical Engineers	18,490	323	46	Shortage
2145	Instrumentation Specialists (Industrial Engineers)	21,040	364	24	Balance
2153	Mining Engineers	1,695	59	18	Balance
2154	Petroleum Engineers	2,705	14	5	Shortage
4150	Cost and Scheduling Specialists (Sup. Rec. Schedule)	15,150	816	—	Balance
7711	Derrick Workers	6,065	2,818	2	Surplus
7719	Roustabouts	7,725	1,773	10	Surplus
8335	Welders	75 500	22,216	5	Surplus
8337	Boilermakers	9,575	2,249	4	Surplus
8584	Millwrights (Industrial Mechanics)	117,230	12,601	74	Surplus
8589	Oilers	25,135	2,080	8	Surplus
8719	Operating Engineers (Excavating, n.e.c.)	5,070	1,061	—	Surplus
8733	Electricians (Construction Electricians)	16,525	13,777	15	Surplus
8786	Insulators	4,555	1,694	1	Surplus
8791	Pipefitters	49,710	11,555	2	Surplus
8793	Ironworkers (Structural Metal Erectors)	8,545	5 082	3	Surplus
8798	Labourers (Labourers: other Construction)	85,650	72,916	—	Surplus
9155	Deckhands	6,900	2,625	—	Surplus
9199	Teamsters (Other Transport, n.e.c.)	5,330	290	—	Surplus
9311	Rigers	19,170	3 057	—	Surplus

(1) Canadian Classification and Dictionary of Occupations.
(2) Canadian Occupational Forecasting.

Source: Canada, Senate, *Special Committee on the Northern Pipeline Proceedings*, Issue 36, 15-9-1982, A:111.

CEIC is also developing a capability to project employment requirements and available occupational categories with a view to matching needs and skills. This program will be operative in 1983, and should reveal skill imbalances over a three- to 10-year time horizon on an occupational and geographic basis.

3. Regional Benefits

> *You can see that the benefits of Beaufort oil production would spread right across Canada from the west to the east coast. It would certainly create a number of jobs in Ontario, the province which could supply a substantial amount of equipment such as electrical equipment, some of the mechanical equipment and steel. The east coast provinces and B.C. would be involved in the marine construction aspect. Alberta would primarily supply engineering and logistics services. The benefits of oil development would spread right across Canada, and there would be a relatively minor foreign component.* **(Mr. G. Bezaire, Esso, Issue 17:31, 16-2-1982)**

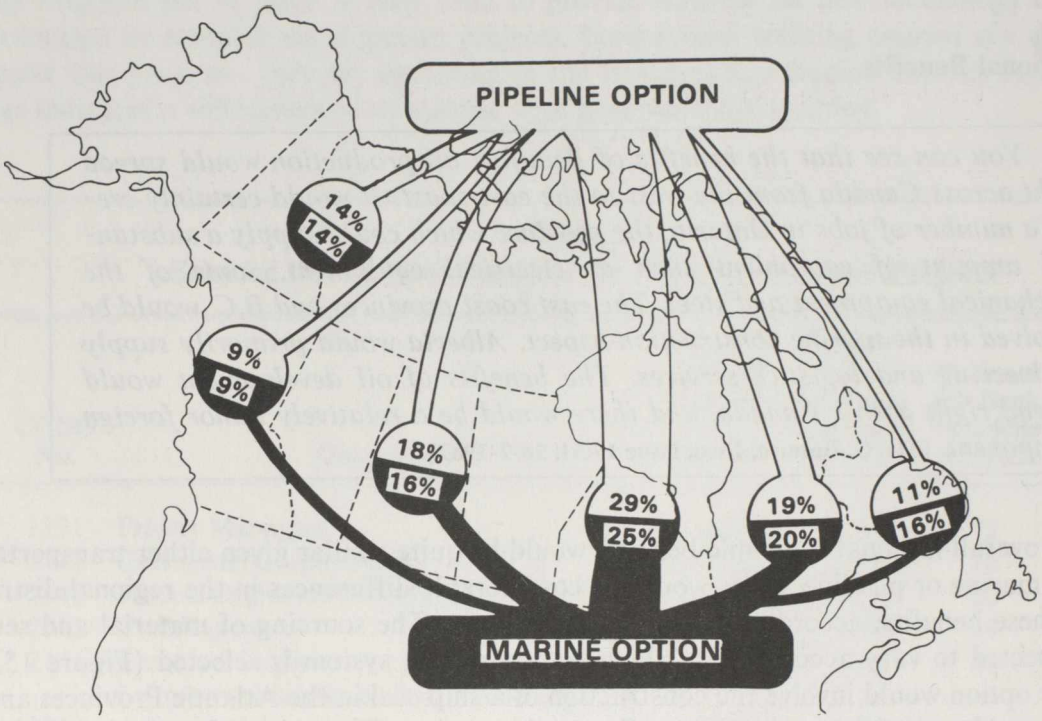
While overall national economic benefits would be quite similar given either transportation mode, marine or pipeline, there would be considerable differences in the regional distribution of these benefits, according to project proponents. The sourcing of material and services is expected to vary according to which transportation system is selected (Figure 15). The marine option would involve the construction of a shipyard in the Atlantic Provinces and would thus confer significant direct benefits to this region. Expansion of the shipbuilding industry in the Atlantic region is also expected to act as a magnet for indirect supply activity. Existing shipyards in the provinces of Quebec and British Columbia would also be enlarged. Alternatively, pipeline components would be sourced primarily in Central and Western Canada, and the distribution of direct economic benefits would favour these regions accordingly. Ontario and the Prairie Provinces will experience as well the largest indirect impact, in the form of inter-regional purchases and supplier purchases respectively.

Direct employment opportunities will be highest in Alberta and the NWT. Indirect employment through the provision of materials and services will centre in Quebec and Ontario where the direct employment effect is negligible in comparison.

> *Offshore and frontier development will create significant opportunities for economic activity in all regions of Canada, including those regions where economic activity is most difficult to encourage . . . We will also have to develop the instruments which will allow us to realize the opportunities which we decide to exploit.* **(The Hon. H.A. (Bud) Olson, Minister of State for Economic Development, Issue 16:8, 9-2-1982)**

If a marine mode is chosen, shipbuilding requirements will represent a major portion of the demand for facilities to produce Beaufort Sea oil. The potential opportunities presented to Canada's shipbuilding industry to meet this demand have led the Committee to explore in more detail the challenges inherent in satisfying it.

Figure 15: Comparison of Regional Sourcing Distribution for Pipeline and Marine Transportation Modes



Source: *Hydrocarbon Development in the Beaufort Sea-Mackenzie Delta Region, EIS*, Dome Petroleum Limited, Esso Resources Canada Limited, and Gulf Canada Resources Inc., 1982, Vol. 2, p. 7.12.

Dome has estimated that the marine construction requirements of marine-based Beaufort Sea Region development could amount to $2.6 billion to 1985. This would compare with a level of existing Canadian shipbuilding activity of only $500 million per year. The importance of Beaufort Sea Region development to the shipbuilding industry was identified by the *Transportation Sub-Committee Report to the Major Projects Task Force* in October of 1980. For a selected but varied list of 12 vessel types, figures indicate that the Beaufort Sea Region accounted for 60% of shipbuilding and marine construction expenditures in the 1980s and early 1990s (Table 3). Even more important, large vessels accounted for approximately half this requirement. By type, large tankers are reported by the same source to have the greatest potential for long-term benefits to Canada, if they are built in Canadian shipyards.

> *We do not have in Canada the capacity to build the size of tanker that would be required for this; the shipyards are not large enough at the present time. That will change with time.* **(Mr. E.H. Dudgeon, NRC, Issue 23:37, 4-5-1982)**

Although Canada is striving to become recognized as a leader in icebreaking technology and in the construction of commercial vessels for ice navigation, there are serious capacity constraints within the Canadian shipbuilding industry which could affect arctic development activity. The problem lies in the inability of existing Canadian shipyards to construct certain

large vessels — the size of these vessels is beyond the present physical capacity of the shipyards of 80,000 deadweight tonnes. Thus, today's yards could not participate either in the construction of the LNG carriers for the Arctic Pilot Project, or the icebreaking tankers and process and storage vessels destined for the Beaufort Sea Region.

Table 3
Total Projected Shipbuilding Expenditure Profile, by Project
($ Million, 1980)

	Project	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	Total	Rating	Percentage
2.1	Beaufort Sea Oil & Gas	—	461	857	1,544	1,598	1,647	1,620	1,189	1,320	604	—	—	10,840	H	60
2.2	Arctic Pilot Project	—	46	117	480	344	241	72	—	—	—	—	—	1,300	H	7
2.3	Can. Flag Deep Sea Fleet	—	—	57	151	213	542	421	426	356	265	169	—	2,600	L	14
2.4	Great Lakes Fleet Expansion	—	10	27	111	81	55	16	—	—	—	—	—	300	H	2
2.5	Commercial & Gov. Fisheries	45	184	199	213	228	217	23	23	24	25	—	—	1,181	M	6
2.6	Coast Guard — Fleet Investmt.	30	40	49	55	57	58	57	58	57	58	57	58	634	M	4
2.7	C.P.F. Program	—	—	—	26	69	98	249	193	195	164	122	78	1,194	H	7
	Total Annual	75	741	1,306	2,580	2,590	2,858	2,458	1,889	1,952	1,116	348	136	18,049		100

Source: *Transportation Sub-Committee Report to the Major Projects Task Force on Major Projects to the Year 2000*, October 1980, p. 32.

Supply of materials to Canadian shipyards could present another supply constraint. According to the *Transportation Sub-Committee Report to the Major Projects Task Force*, the percentage of Canadian materials, machinery and equipment which could be provided under existing supply conditions in the construction of the aforementioned 12 vessel types is only 38%.

> *I think the steel companies in Canada have the capability to produce the materials required, but you must have the market as well, you must have someone who wants enough of it to be able to produce it in the quantities that make it economic. It is a difficulty. Some of these [shipbuilding steels] are very special steels.* **(Mr. E.H. Dudgeon, NRC, Issue 23:38, 4-5-1982)**

Consequently, there will be a need for Canadian industry to respond aggressively to new demands resulting from proposed transportation projects, in order to avoid dependency on external sourcing.

Development in the Beaufort Sea Region would create an unprecedented opportunity, especially in the case of the marine transportation option, for domestic shipyard capability to expand in order to supply the fleet required.

To capture opportunities presented by offshore oil and gas development, within the range of the demand situation illustrated (Table 3), a Department of Industry, Trade and Commerce supply-demand analysis suggests that the industry would have to expand 20%, excluding any expansion to permit building of the very largest vessels.

The pace of offshore oil and gas development and the willingness of project sponsors to place definite orders with shipyards have a bearing on the resolution of shipbuilding firms to expand. The innovative arctic vessels may present some difficulties for expanding existing shipyard facilities, which may best be met by new facilities. Future expansion opportunities also present increased risks relating to the technical demands of building these innovative ships and the boom-bust cycles of activity in the energy resource field.

Over the next five years, nevertheless, the Department of Industry, Trade and Commerce has estimated that $650 million could be invested for expansion to pursue new business and $700-800 million for new facilities, the latter depending largely on the timing of Beaufort Sea Region development. To realize expansion potential, major capital investments by Canadian shipyards would be necessary to increase capacity. Existing shipyards need to be upgraded, and at least one new shipyard needs to be developed in order to meet the large-vessel demands of arctic transportation. There is also an urgent need for ships to be designed, and prototypes to be built, in Canada.

The Committee recommends:

That immediate consideration be given to developing a Canadian large-vessel shipyard capability to supply not only all vessel requirements for arctic development but also to compete for similar undertakings abroad.

4. Northern Benefits

> *In our [Dome] operation, initially we started out with fewer than 100 northerners, who were essentially all in non-skilled jobs. Part of our affirmative action program was a target of getting no less than 50% of the local people into skilled jobs. We have achieved that objective, and our northern work force now approaches 400 people. It includes such categories as pilots, radio operators, secretaries, computer operators and so on.* **(Mr. M. Todd, Dome, Issue 21:102, 31-3-1982)**

Over the past two decades, the petroleum industry has added a third dimension to the Beaufort Sea Region's economy which was previously based on resource harvesting and government.

According to a Northwest Territories Government study (*NWT Data Book*, Outcrop Ltd., 1981), over the period 1976 to 1980, Dome directly accounted for some 390 man-years of employment and $8 million in wages and salaries in the Northwest Territories. Since Dome's base of operations is in the Beaufort Sea Region, most of the benefits would have been felt there. The company purchased some $65 million worth of local goods and services which in turn contributed to 600 man-years of indirect employment and nearly $12 million in wages and salaries for territorial residents. Northern business benefitted in the form of purchase orders and contracts. Similarly, Esso has provided annual employment averaging approximately 70 man-years and has also contributed $36 million in the form of goods and services between 1978 and 1981 to the economy of the Beaufort Sea Region.

The project sponsors foresee that a substantial proportion of the benefits of future Beaufort Sea Region development will accrue to northern residents. Employment opportunities are expected to become available for every northerner who wishes to participate in petroleum activities. It is projected in the EIS that by 1990, between 3,000 and 4,000 direct jobs would be held by Beaufort employees residing in the North; by the year 2000, this employment range is expected to increase to between 5,000 and 7,000. There would also be indirect and induced employment from the project.

Data forming part of the *Beaufort Sea Exploration Agreement* signed by the three proponents Dome, Esso and Gulf, and provided to the Committee, were much more conservative. While northerners represented 46% of employment from offshore development, by 1990 total employment levels for northerners were projected to be only half those forecast in the EIS. The Committee recognizes that these figures predate those of the EIS, but they also accord more closely to figures presented by Esso to the Committee.

Direct sourcing of goods and services in such sectors as construction materials, fuel supply, catering and transportation is forecast to account for approximately 14% of the Canadian total of $47 billion (intermediate development rate) to $60 billion (high development rate) by the year 2000. Substantial non-quantifiable benefits are anticipated to accrue there as well. These would include improvements in educational and transportation systems, as well as medical and social services; contributions to local entrepreneurial activity; and expansion of the northern retail and services sector.

The petroleum industry recognizes, however, that long-term employment is not yet guaranteed and that moving the northern economy to greater self-sufficiency requires more than engaging northerners in petroleum-related jobs and business. Most employment opportunities in the industry are not secure because of the seasonal nature of the present drilling season; however, year-round activity is forecast by Dome as early as 1983. A principal complaint is that there is a lack of skilled jobs available to native northerners because of inability to fill the skills requirements. This situation is expected to improve only gradually as opportunities for full-time employment and technical training facilities expand.

> *A lot of our initial planning is done through the technical school in Fort Smith. Much of the basic infrastructure is already there to provide the training. We are working with them. We are also working with industry-related training vehicles to provide the necessary exposure, so that when we are operational about 15 months from now the people we have up there will have had some prior exposure to the kind of work they have to do, as opposed to learning on the job at that moment in time. For operational safety it is very unwise to throw somebody in and break or make them and expect that they will operate safely.* **(Mr. D. Motyka, Gulf, Issue 20:55, 23-3-1982)**

Industry has indicated a willingness to work with government in upgrading skills of northerners by providing its own facilities for training programs. The National Industrial Training Program, previously referred to, provides the vehicle for this co-operation to occur. Funds under this program can be allocated specifically to provide training opportunities for native Canadians in order to help them take advantage of employment in urban as well as project development areas.

The Committee recommends:

That the National Industrial Training Program be expanded to insure that northern residents receive the necessary training for participation in major northern resource development projects.

In the same way that lack of access to advanced educational and training opportunities is hindering northern hiring in skilled occupational categories, northern business is also experiencing disadvantages from lack of expertise in providing the specialized goods and services required by the industry. A study of goods and services (*NWT Data Book*, Outcrop Ltd., 1981) offered by local firms in fact demonstrates that 22 firms accounted for 89% of goods and services purchased by Canmar in 1980. Such a concentration shows that few northern firms have the range and volume of goods and services to become continuous suppliers of the industry. Business has also complained that the manner in which purchase packages are designed discriminates unfairly against smaller firms. Timing of development and packaging of requirements are important factors in encouraging northern business participation in Beaufort Sea Region development. The comments made by the Committee in relation to Canadian participation are crucial in maximizing regional benefits.

The Committee recommends:

That the timing of development and supply requirements be structured to enable northern business to participate in Beaufort Sea Region development with its resulting economic benefits.

The boom-bust effect of hydrocarbon development already experienced in the Beaufort Sea Region, which resulted in overcapacity in the service sector, has left a residue of uncertainty among suppliers of goods and services. And yet an expanding and innovative entrepreneurship is of prime importance if the North is to diversify and linkages to other sectors of the region's economy are to be developed. Industry is presently trying to do its part in encouraging the service sector with positive policies on purchasing and information on business opportunities. It also sees the potential of joint ventures between existing southern-based enterprises and local firms in the construction and equipment industries. Industry suggests that government could improve training facilities and provide business with additional credit.

Since other regions of Canada will benefit from resource development in the North, it is not equitable in the Committee's view that the northern territories do not reap some of the benefits from this wealth. It should be possible to utilize some of the resource revenues accruing from development in the Beaufort Sea-Mackenzie Delta Region to initiate economic activities that will provide more stable sources of income.

The Committee recommends:

That a designated portion of government resource revenues accruing from hydrocarbon development be channelled into a form of heritage fund to provide an economic cushion and serve as a source of funds suitable for investment to promote a more diversified economic base.

There is evidence that the type of rapid industrial expansion to which the Beaufort Sea Region has been exposed over the past few years raises expectations and introduces new values that can clash with the existing social order. This conflict can lead to such social problems as alcoholism, crime, violence and welfare dependence. The side-effects of megaprojects can also create certain infrastructure demands such as the need for improved education, medical, transportation and communication services. Handling increased social problems and expanding the northern infrastructure impose an added burden on the finances of the territorial governments, already hard-pressed to restrain budgets.

> *. . . we see the provision of public services as best provided through governments. There are ways in which facilities that we put into place for construction or operating purposes become semi-public in their use, or perhaps fully public in their use eventually, although they are constructed entirely by us and at our expense initially.*
>
> *With education, medical services, transportation and communications, the main development of those services, our expectation and our proposal is that those should be furnished by governments . . .* **(Mr. S.R. Blair, NOVA, Issue 18:31, 2-3-1982)**

The Committee is concerned about the social costs of development — a potential increase in social disorder and a deterioration of services resulting from an influx of population and the assimilation of different social values.

The Committee recommends:

That there be increased federal funding of social programs to aid in infrastructure development and to offset potentially adverse impacts.

B. Arctic Islands

1. National Economic Benefits

The design of the Arctic Pilot Project as a prototype for arctic technological development serves a useful purpose in introducing new technological supply requirements into the Canadian economy on a relatively small scale. Assuming that there continues to exist unutilized capacity in the Canadian economy, then the total Canadian income impact of the Arctic Pilot Project will be considerably greater than the direct expenditure impact would indicate since the initial direct project expenditures result in a multiplier effect, as the initial incomes are spent by those receiving them (Table 4).

The project sponsors anticipate that through maximum participation on the part of Canadian industry this project will enhance Canadian technical capability. The sponsors are thus intent on maximizing the long-term benefits accruing from the project, as well as its Canadian content. Canadian content approaches 75% and would be higher if a major expenditure, relating to the construction of the LNG carriers, were not an offshore item. Out of a total cost of $691 million for these tankers, foreign construction comprises $442 million.

Table 4
Arctic Pilot Project Canada Direct Plus Induced Expenditure Effects

Year	Construction Phase	Operating Phase	Total	Direct Plus Induced Expenditure Impact[1]
	(1)	(2)	(3)	(4)
		(Millions 1981 Dollars)		
1982	196.3	—	196.3	412.2
1983	552.2	—	552.2	1,159.6
1984	548.2	—	548.2	1,151.2
1985	294.8	14.8	309.6	650.2
1986	(0.9)	418.3	417.4	876.5
1987	5.3	367.8	373.1	783.5
1988	4.7	352.5	357.2	750.1
1989	(7.2)	305.2	298.0	625.8
1990	(4.3)	300.2	295.9	621.4
1991	(2.0)	280.8	278.6	585.5
1992	(8.4)	270.7	262.3	550.8
1993	(4.7)	258.8	254.1	533.6
1994	1.2	252.3	253.5	532.4
1995	21.5	230.7	252.2	529.6
1996	(1.9)	247.0	245.1	514.7
1997	(1.9)	244.1	242.2	508.6
1998	(1.9)	242.3	240.4	504.8
1999	(1.9)	240.5	238.6	501.1
2000	(1.9)	239.9	238.0	499.8
2001	(1.9)	239.4	237.5	498.8
2002	(1.9)	240.6	238.7	501.3
2003	(1.9)	242.5	240.6	505.3
2004	(1.9)	244.8	242.9	510.1
2005	(1.9)	248.4	246.5	517.7
Total[2]	1,578.3	5,481.5	7,059.8	14,825.6

1. Obtained by multplying Column (3) by the Canada income multiplier of 2.1.

1. Many not add because of rounding.

Source: Arctic Pilot Project, *Application to the NEB*, Vol. 6, May 1982, p. 109.

The desirability of providing a Canadian shipyard capability to handle those ships has already been discussed. The present inability of the shipbuilding industry to manufacture LNG carriers produces a negative impact on the Canadian balance of payments until the completion of the construction phase of the Arctic Pilot Project, from which time the impact is positive.

The project sponsors have predicted direct Canadian construction employment in the order of 7,752 man-years over the period 1982 to 2005. Operating employment, which was expected by the sponsors beginning in 1986, was forecast at an average annual number of jobs of 318 up to 2005. Direct employment plus jobs induced through the multiplier process were expected to total 2,030, on an average annual basis. Slippage of the project delays these benefits by at least several years.

2. Regional Benefits

The regional benefits of the Arctic Pilot Project are difficult to quantify because they were based on a southern terminal being located in Eastern Canada. An offshore terminal, possibly in Europe, would affect the distribution of benefits.

The project sponsors forecast 57% of the investment benefits would go to Quebec, Ontario and Alberta. Arctic Canada would gain 7% of these regional benefits. Atlantic Canada would obtain 4% of the investment benefits.

Manpower requirements for the construction phase are anticipated to be mainly supplied by workers from Quebec and Alberta (46%), with Arctic Canada providing 6% and Atlantic Canada 8%.

3. Northern Benefits

> *Through practical experience and on-the-job training, Panarctic's Inuit employees are being given the opportunity to upgrade their skills and progress from labour positions to semi-skilled and skilled positions.* **(Mr. L.J. Franklin, Panarctic, Issue 28:43, 9-6-1982)**

As part of its employment program connected to drilling, in 1971, Panarctic instituted a Native Employment Program. The program's objective is to integrate more of the region's native population into Arctic Island development. Since that year, the company has transported willing residents of Pond Inlet and Arctic Bay to and from the job site. By 1981, a total of 92 Inuit from seven arctic communities were employed by Panarctic. Many of these workers have upgraded their skills through practical experience and on-the-job training. Employees have also been encouraged to pursue skill training in certain trades requiring journeyman certificates.

Since the Native Employment Program was first conceived, approximately $5 million in salaries has been paid. This has led to improved standards of living in those communities in

which the Inuit reside (Table 5). With the fate of the project undecided, future benefits are uncertain.

> *In promoting employee training and well-being, Panarctic has, in conjunction with the Government of the Northwest Territories and the Canada Employment and Immigration Commission, encouraged employees to pursue skilled training in a variety of trades requiring journeyman certificates as well as other skilled jobs such as operating mobile equipment.* **(Mr. L.J. Franklin, Panarctic, Issue 28:43, 9-6-1982)**

Table 5
Gross Wages Paid by Panarctic to Natives

Year	Number Employed	Gross Wages
1975	102	$ 486,067.00
1976	92	578,944.00
1977	85	527,450.00
1978	80	449,798.00
1979	62	226,649.00
1980	78	400,277.00
1981	92	563,999.00
Total		$3,233,184.00

Source: Canada, Senate, *Special Committee on the Northern Pipeline Proceedings*, Issue 28, 9-6-1982, A:36.

Chapter 5

THE REGULATORY PROCESS

> *We have now put many hurdles in the way of development, with government regulations, permits, licences and so on, which have increased the uncertainty and caused outlays of much larger sums of money without knowing if there is a chance of recovery. The more we can provide a climate where that uncertainty is reduced, it will be beneficial for Canada as a whole.* **(Mr. C.G. Edge, NEB, Issue 36:83, 15-9-1982)**

A. The Present Process — A Commentary

The process of arriving at decisions on major development projects has evolved from simple Cabinet approval to a vast and complex array of departmental and regulatory procedures. In the geographic area north of 60° with which this report deals, these procedures now encompass numerous committees and review boards and as many as 72 federal acts, regulations and Territorial Ordinances. Novel development activities combined with extreme conditions, remoteness and the relatively slow recovery of northern ecosystems lead to closer scrutiny than is the case for southern operations. While each regulation is designed to meet the requirements of a particular set of circumstances and thereby serve the public interest, sponsors and regulators face a confusing array of often duplicating and conflicting requirements when all these regulations are taken together. The problem has been compounded by lack of policy direction, resulting in a fragmented and confused *ad hoc* regulatory system. One is tempted to ask whether the process set in place to safeguard a variety of legitimate interests in fact ends by paralyzing constructive development.

Industry claims that the complexity of the regulatory approval system is undermining our ability to bring resources from frontier regions expeditiously to meet Canada's goal of oil self-sufficiency. According to industry, over the past few years the pace of development has been slowed by government's restructuring of legislation and regulations and by the introduction of elaborate assessment processes to meet the special concerns of the North. The formidable arctic conditions translate into high operating costs and restricted operational periods for industry — government regulatory requirements therefore impose a greater economic

burden on developers in this environment than when applied to oil and gas activities in southern Canada. Project proponents are spending enormous sums in the early years without financial returns and industry would like to see less detailed regulation early in a project. The complaint continually voiced by industry to the Committee was that bureaucratic decision-making is lagging and is hindering timely development.

The Committee recognizes the validity of these concerns but considers that there is an onus on developers to prove that proposed projects will not be destructive. Conforming to regulation gives public assurance in this regard. Moreover, the regulatory decision-making process provides the vehicle for resolving conflicts between the policy of oil self-sufficiency and such northern policies as protection of the environment, public participation in decision-making, regional benefits or the settlement of land claims. Taking into account all the implications of a major energy project is a time-consuming business. The danger is that regulatory delay in meeting the nation's goal of self-sufficiency may cause direct political decision-making, without genuine public hearings, and a tendency to override legitimate concerns in the interest of having timely decisions.

Effective protection, the Committee feels, is not accomplished by duplication or overlapping of procedures. Long drawn-out processes frustrate both developers and those charged with regulating their activities. Streamlining the regulatory system does not have to mean giving less priority to such matters as the northern ecosystem or regional economic benefits but it does mean that the regulatory machinery should be able to respond effectively and responsibly when it is called upon to oversee a major development project.

The report outlines the present regulatory process for major projects north of 60°. The procedures are separated functionally and are generally commented upon in sequential order, although review can in some instances occur simultaneously under separate processes.

1. Oil and Gas Development

Government claims that the new oil and gas management regime introduced in March 1982 as part of the National Energy Program will simplify meeting regulatory requirements by providing one point of contact with the industry in oil and gas operational matters through the Canada Oil and Gas Lands Administration.

> *. . . we need to have a common federal position. That is why the COGLA single window is so critical. Otherwise, the industry is approached from 16 different quarters.* **(Mr. H.A. Reynolds, OIRB, IT and C, Issue 36:11, 15-9-1982)**

The Committee heard from a number of departmental witnesses on their respective roles in the regulation of oil and gas activities in the North, and the evidence clearly established that a number of departments still retain operating responsibilities to oversee various facets of development. Even in cases where they provide an advisory function to COGLA in its negotiations with industry, these agencies continue to have an operational link with industry and COGLA cannot therefore be said to represent the single point of contact.

Under the new *Canada Oil and Gas Act* enacted in March 1982, COGLA issues oil and gas exploration permits and production licences. Among other concerns, COGLA monitors

levels of Canadian goods and services with the assistance of such agencies as the Office of Industrial and Regional Benefits (OIRB) of the Department of Industry, Trade and Commerce, the Canada Employment and Immigration Commission (CEIC) and DIAND. COGLA can also attach conditions to operations and drilling permits which it grants respecting safety, environmental provisions or contingencies. The agency also handles technical approvals for pipelines located totally within Canada Lands.

COGLA exercises broad jurisdiction on behalf of both the Department of Indian Affairs and Northern Development and the Department of Energy, Mines and Resources with respect to petroleum exploration, development and processing within the Canada Lands.

> *To assist us in fulfilling our mandate, we work closely with the Department of Energy, Mines and Resources and the Department of Indian Affairs and Northern Development. As COGLA's administrator, I report to the deputy ministers of both those departments. I also meet regularly with senior officials of both departments to review policy and to ensure that we are all heading in the same direction.* **(Mr. M. Taschereau, COGLA, Issue 35:8, 14-9-1982)**

COGLA's mandate, in this respect, is to administer oil and gas activity in the Canada Lands. To that end, COGLA has been designated as the principal point of contact between government and the oil and gas industry concerning their activities within the Canada Lands.

> *We administer oil and gas activities in the Canada Lands . . . the mandate is rather impressive and obviously crucial to the resource objectives that this government has set for the future of the Canada Lands.* **(Mr. M. Taschereau, COGLA, Issue 35:8, 14-9-1982)**

While a single new body was considered necessary to ensure consistency in applying new policies and regulations under the Canada Lands management regime which followed from the National Energy Program, the two ministers retained their respective areas of responsibility north and south of the line of administrative convenience. COGLA therefore has an unusual organizational status: it is not a program or a branch within a particular departmental framework, nor does it have the independence of a crown corporation. It cannot be compared to most existing federal units of organization. It is an administrative body with dual functional responsibility to northern policy (DIAND) and energy policy (EMR) and whose authority, derived from the ministers of both parent departments, is exercised to the extent that ministerial delegation is made.

Each department, however, retains a substantial number of policy and operational activities with which COGLA activities must be co-ordinated. For example, the Northern Affairs Program of DIAND retains responsibility for environmental management and protection in the northern Canada Lands, socio-economic benefits for northern residents, negotiating strategies and agreements with territorial governments, and the co-ordination of policy and planning in relation to major resource development north of 60°, exclusive of the specific operational responsibilities of COGLA. For its part, EMR retains responsibility for

national energy strategies and policy development, negotiating strategies and agreements with coastal provinces, and a broad mandate by the Office of Environmental Affairs to oversee EMR conformity with the EARP. COGLA maintains a close relationship with the Northern Affairs Program as well as with the concerned branches in EMR in order to ensure consistency in the application of legislation, policies and regulatory processes.

Policy advice to COGLA is provided by the COGLA Policy Review Committee (PRC), which includes senior personnel from both EMR and DIAND. The PRC ensures that COGLA policy decisions are consistent with the requirements of energy policy and northern policy.

Major policy questions concerning northern development that go beyond matters related specifically to the *Canada Oil and Gas Act* are the responsibility of the Senior Policy Committee on Northern Resource Development Projects, which since its formation in 1981 has been designated as the vehicle for interdepartmental discussion of those matters. It is chaired by the Assistant Deputy Minister, Northern Affairs who brings to the attention of the COGLA Policy Review Committee any conclusions reached by the Senior Policy Committee that may impact on COGLA decisions.

> *. . . the oil industry wants COGLA to be a one-window approach. We hear this all the time . . . That may be the ideal situation, but COGLA is not so.*
> **(Mr. M. Taschereau, COGLA, Issue 35:16, 14-9-1982)**

Despite the fact that agencies such as the CEIC and the OIRB provide an advisory function to COGLA, the evidence of these agencies before the Committee demonstrated that they still have operational contact with industry. This is also true of such departments as the Department of Fisheries and Oceans (DFO) and the Department of Environment (DOE) which have responsibilities in the North.

Part of the problem is the ever-increasing stringency of requirements placed on companies operating in the territories. The new oil and gas regime of which COGLA is a part imposes additional obligations on companies that wish to explore and develop oil and gas resources in the North. The imposition of plans for employment, industrial and social benefits, and environmental protection is in addition to, not in place of, programs that already exist. While COGLA, in order to fulfill its co-ordinating role, has an organizational structure which covers such matters as land management, resource evaluation and environmental protection, the tendency is for each department having responsibility in an area to maintain a group of its own (for example, in land management, environmental protection and so on). Thus the new system seems to impose an additional level of regulation on companies rather than replacing the old. It is difficult to see, therefore, how taking responsibilities from two departments and assigning them to a new agency will accomplish the government's objective of simplifying the regulatory regime.

2. Transportation

Transportation aspects of energy projects continue to come under National Energy Board jurisdiction as they have since 1959 when this statutory agency was established. The board has the authority to license oil and gas exports and to certificate interprovincial and international pipelines; it may attach conditions to its approvals. The board follows a quasi-

judicial process in rendering its decisions, holding public hearings and taking into account relevant matters of public interest. NEB review can cover pipelines, treatment facilities, petroleum storage, and ship loading facilities which are also a DIAND and Department of Transport (DOT) responsibility.

The independent adjudicative approach has the advantage that standards and expertise in assessing a large number of similar cases can be developed in an atmosphere of openness and fairness leading to consistent decision-making. The disadvantage is that the NEB, unlike COGLA, does not have direct access to government advice since present government policy prohibits federal departments or agencies acting as intervenors in NEB hearings except through the Department of Justice. This restricts communication between NEB and other departments during the pre-hearing and hearing phases of an application, the practical result being that relevant departmental evidence can only be presented through *ad hoc* arrangements with the applicants and the intervenors. This was the case with the admission of TERMPOL, FEARO and Federal/Provincial Panel Reports as evidence at the Arctic Pilot Project hearings held in 1982. Consequently the NEB tends to rely on its own expertise to review industry's proposals when it could make use of other reviews, particularly in the public interest phase of its hearings, already carried out by those departments which also have environmental and socio-economic surveillance responsibilities.

DIAND has responsibilities in land and water use that are relevant to any review of transportation and support systems. These include approvals for pipeline rights-of-way and use of land for onshore drilling operations, roads and shore installations. Just as the NEB can attach conditions to its certificates regarding pipeline construction and operation, DIAND can attach conditions to the surface easements it grants for the pipeline, creating a potential conflict of requirements for the proponent. Where pipelines cross rivers or where freshwater supplies of any kind are required, a water licensing system gives the department control over any prospective water use. DIAND's environmental responsibilities extend to all non-shipping activities in arctic waters except in Hudson Bay and Hudson Strait which are the responsibility of Energy, Mines and Resources.

In addition to DIAND's mandate to regulate shore installations, marine terminals are subject to review by DOT which may attach conditions to any work that might interfere with navigation. A voluntary assessment referred to as the TERMPOL Code (Code of Recommended Standards for the Prevention of Pollution in Marine Terminal Systems) sets out safety and environmental standards for marine terminals. TERMPOL has, for instance, been used to assess all three proposed sites for the Arctic Pilot Project.

The Department of Transport also has the prime responsibility for regulating all shipping activities in arctic and other waters, including the issuance of permits to operate ice-breaking tankers. Regulations control design requirements as well as safety and waste handling. To meet the requirements of year-round activity, shipping activity in arctic waters is to be monitored by a new federal Arctic Shipping Control Authority under that department in the interests of ship safety, the efficient movement of ships and the protection of the environment. This authority will monitor, assist and regulate ship movements in the Arctic, particularly the Northwest Passage. At present there is a voluntary Arctic Vessel Traffic Management System called NORDREG operating in arctic waters during the summer months, which could serve as a starting point for this control authority. Besides traffic management, the authority would enforce good seamanship and appropriate environmental regulations.

To assist the authority further, DOE and DFO are to form an advisory committee to recommend and approve studies necessary to allow biological information to be integrated effectively into such matters as the route selection process. The advisory committee is to provide a forum for consultation with northern residents, industry, and government specialists on relevant research and development (R&D) and marine planning activities.

3. Environmental Protection

Although a number of the operating requirements outlined above involve assessment procedures, these are limited in scope in comparison to the Federal Environmental Assessment and Review Process (EARP) which has since 1973 provided a means of screening federal projects to determine whether environmental effects are significant enough to warrant a review by an independent panel. The sponsor must prepare a detailed Environmental Impact Statement in accordance with guidelines issued by the panel. The panel reviews the statement and obtains comments from interested persons through public hearings. The panel assigned to that project reports to the minister who can release the report to the public.

Since all oil and gas activities are carried out on public lands, the EARP panel is significant in the planning, design and implementation of major projects. EARP panels have, for instance, reviewed proposals for offshore drilling in Davis Strait and Lancaster Sound. A drilling approval was rejected in the latter case on the recommendation of the EARP panel. As mentioned, the Beaufort Sea Region developers have filed a joint Environmental Impact Statement on which hearings will commence in the spring of 1983.

It is expected that this review will provide a regional socio-economic and environmental impact assessment with recommendations on whether environmental impacts can be kept within acceptable limits and how benefits can be maximized for alternative levels of production and related modes of transportation. This represents one important source of the information necessary for government examination of such alternatives and ultimately whether an approval should be given.

The fact that this comprehensive environmental and socio-economic assessment is taking place has not prevented other agencies from completing their own reviews. Proponents submit this type of evidence during the public interest phase of the NEB hearings. The tendency is for the same material to be presented by the same parties using the same arguments. In the Committee's view such repetition only frustrates the process and does not contribute to protection of the environment.

The authority of the Minister of Indian Affairs and Northern Development over the sale, lease or other arrangement for holding onshore lands and the planning of their uses provides another means of controlling the environmental impacts of development north of 60°.

> *The new* Canada Oil and Gas Act *has provided for changes which introduce the possibility of using it for environmental management and a number of other things. However, in the North the way we are proceeding is to use the* Territorial Lands Act *and its regulations as the principal means for regulating the use of land.* **(Mr. N. Faulkner, DIAND, Issue 31:37, 22-6-1982)**

If territorial lands are withdrawn from disposition by the Minister of Indian Affairs and Northern Development, they are also withdrawn for purposes of the *Canada Oil and Gas Act* and are therefore not available for exploration. Although the department has a legislative mandate to impose land-use controls through the *Territorial Lands Act*, its planning mandate is restricted essentially to assessing the probable consequences of permitting a change in land use, a limitation already noted earlier in the report. The authority to attach terms and conditions to leases, licences and easements also provides a means of environmental control. A key body in this process is the intergovernmental Federal-Territorial Lands Advisory Committee which advises DIAND decision-makers on whether surface rights should be granted and often recommends on terms and conditions.

> *If you are looking at the environment, as you have said, north of 60°, you can forget COGLA. It is not in the picture for that region. It is DIAND who has responsibility there.* **(Mr. J. Gérin, DOE, Issue 37:68, 16-9-1982)**

DIAND holds similar responsibilities for the disposition of offshore lands including the leasing of the sea bottom and the dredging required for artificial island construction.

Inland waters in the NWT and Yukon are protected by the *Northern Inland Waters Act* administered by DIAND. The act provides for the conservation, development and utilization of these waters, and controls the deposit of waste. Water use is regulated through a water licensing system, and licences may contain conditions relating to environmental management. Hearings must normally be held in licence applications by Water Boards set up for this purpose.

Offshore waters used for drilling, navigation and transporting resources and supplies are subject to the *Arctic Waters Pollution Prevention Act* which prohibits unauthorized deposits of waste into arctic waters or on any land where such waste may enter arctic waters and which provides for quasi-criminal sanctions. Administration of the act rests with three federal departments: Indian Affairs and Northern Development for non-shipping activities in arctic waters other than Hudson Bay and Hudson Strait; Energy, Mines and Resources for non-shipping activities in Hudson Bay and Hudson Strait; and Department of Transport for shipping activities in all arctic waters. Pollution prevention certificates constitute proof of compliance with prescribed conditions. At present regulations are aimed mainly at the control and prevention of oil pollution. Developers are liable for clean-up costs.

Other than DIAND, the Department of the Environment is the main agency responsible for environmental protection in the North and it administers about a dozen pieces of legislation relating to pollution control and environmental management north of 60°.

A number of the acts mentioned have limited assessment procedures that form a part of determining whether compliance with standards is achieved. Some of these procedures duplicate the EARP although they are not as comprehensive.

4. The Cabinet Approval Process

Following NEB hearings, the board reports to Cabinet on whether approval of a given proposal should be granted and advises the Minister of Indian Affairs and Northern

Development on its technical and financial feasibility. The minister then reports to Cabinet and requests a decision.

NEB and DIAND approvals are issued if Cabinet agreement is gained, subject to the terms and conditions derived from the various intra- and interdepartmental assessments outlined above. The proponent then applies for the various licences. Agencies consult in fulfilling their operational responsibilities with respect to the applications, and socio-economic agreements are negotiated and signed. Necessary approvals are issued accompanied by terms and conditions. Government agencies continue to monitor activities during the construction and operation phases of the project as required by their mandates.

The next section explores how some of the regulatory requirements outlined may be improved upon.

B. Co-ordination of Regulatory Requirements

> *Co-ordination is a tricky business to get into. There are attempts to co-ordinate through the exchange of information. Given the scarcity of resources, both within industry and within government, it is in everybody's interest to ensure that there is not duplication, and there is a wide range of mechanisms that try to ensure people are not doing projects that duplicate.* **(Mr. N. Faulkner, DIAND, Issue 31:31, 22-6-1982)**

A brief survey of the major regulatory processes in the foregoing section has shown many cases of overlapping responsibilities. The Committee has been overwhelmed by the complexity of the federal decision-making process with its numerous boards, commissions, processes and regulations. How effectively the system for assessing hydrocarbon development operates will depend to a large extent on the relevancy of the mandates of and relations among the responsible agencies. The Committee is well aware that unique physical and sociological circumstances make the North a particularly vulnerable domain requiring special protective measures. Nevertheless, where departments have mandates and policies which are not complementary and lines of authority are unclear, the regulatory review process becomes cumbersome and government's ability to evaluate proposals is diminished. The guidance that industry seeks ends by becoming a source of frustration rather than inspiration.

> *I think the more we can clarify for potential project sponsors the better. The one thing that investors and project sponsors abhor is uncertainty. I think they are faced with very considerable uncertainty from many aspects of government activity. The more you can assist in encouraging early clarity and whether the projects are "go" or not is very worthwhile.* **(Mr. C.G. Edge, NEB, Issue 36:83, 15-9-1982)**

The very least that industry can expect with projects that entail huge front-end costs is procedural fairness — the rules of the game should be well defined in advance; they should be understandable; they should not be changed in midstream; and they should be equitably applied. If rules are perceived to be unfair, they will not be accorded legitimacy, which is the foundation of all decision-making processes in a democratic society.

While one can understand the frustration of project sponsors, the small number of government personnel who must evaluate, process, approve or reject, regulate and monitor the

many competing proposals also deserve sympathy. Projects are complex; the consortia behind them are intricate; the technologies are new; and the financing requirements are complicated. To respond to all of the issues raised by just one proposal is mind-boggling. The complexity of the process coupled with budgetary constraints and loss of key personnel to industry have diluted the government's ability to keep pace with, let alone respond in a timely way to, frequently changing industry plans. These changes in plans often involve substantive financial commitments and short response times, only two of many factors that frequently put undue pressure on the regulatory machinery to respond effectively and responsibly. The Committee sensed no real disagreement on the part of government witnesses that the system is becoming unmanageable.

> *It is a regulatory maze; there is no question about that.* **(Mr. M. Taschereau, COGLA, Issue 35:16, 14-9-1982)**

A complete overhaul of legislative and administrative requirements leading to a major realignment of responsibilities would in the immediate term create decision-making bottlenecks. Decision-making on current proposals should not be deferred for such an eventuality; in the meantime, however, it should be possible to rationalize some of the present processes to reduce overlapping responsibilities and give industry the clear answers it seeks. The Committee is convinced that effectiveness is reduced by over-regulation if one regulation could be as effective as four in accomplishing the same objective.

While northern petroleum development has been under discussion for more than a decade, a policy vacuum has persisted which may have deprived regulators of the framework they require to formulate effective and enduring rules. Regulators must comprehend the objectives of regulation within the policy-making process in order to achieve a balance between efficiently allocating energy resources and protecting vulnerable interests. Regulatory interventions must be directed at solving specific problems and must be informed and well-reasoned if they are to be both regionally and nationally accepted. To whom costs and benefits accrue and how regulation fits the particular circumstances are other questions that must be addressed. In the North, with its diversity of interests, regulation should probably err on the side of protective measures but this will produce a trade-off in terms of timely decision-making.

The Federal Government has started to put in place the elements of its policy framework for northern hydrocarbon development. In the introductory section of this report, the Committee has already made a recommendation about expediting the other measures that are intended to form part of the policy package. This emerging policy framework should provide the parameters for evaluating the relevancy of the existing assessment process.

A beginning has already been made to improve information exchange with the announcement in January 1983 of twice-yearly publication of regulatory agendas. This will provide early notice to the private sector of proposed regulatory initiatives before they become final. As far as can be judged, however, each department will publish new regulations separately without reference to its own existing regulations or another department's activities. There is a more pressing need within each department to evaluate how each regulation relates to others and whether old regulations have become outmoded or superseded. The Committee consequently believes that the reform outlined does not go far enough.

The Committee recommends:

That once the policy framework is in place, the regulatory processes and regulations of appropriate responsible agencies be reviewed to determine whether these fulfill the policy objectives for which they were intended and that obvious redundancies be eliminated.

Clarifying these policy objectives could become the task of the Senior Policy Committee on Northern Resource Development Projects which was established as an interdepartmental forum for co-ordinating federal policy on major resource developments in the North. It is charged with reviewing resource developments and their impacts and making policy recommendations to appropriate ministers. To date, it has existed in name but has apparently failed to provide the policy direction needed to plan rather than react to events.

The Committee recommends:

That the Senior Policy Committee on Northern Resource Development Projects fulfill the function of promoting interdepartmental discussion of northern development policy outside matters relating to the *Canada Oil and Gas Act*. Based on these discussions, it should forward policy recommendations to appropriate ministers for action.

Over the longer term, thought should be given to rationalizing the complete web of diverse controls to eliminate duplication and inconsistency across the whole Federal Government. There is no central control over the formulation of regulations; regulations and agencies to apply them flourish to meet a particular regulatory concern, often overlapping the responsibilities of another agency exercising its responsibilities in the same area. In some cases, this is a matter of definition. What is a vessel to DOT may be a storage tank or part of a production system to COGLA; a semi-submersible is a drill rig when stationary, a ship when moving; iceberg plotting is a navigational problem to DOT, an ocean science problem to DFO and a weather and sea-state mapping problem to DOE. Yet compliance with the requirements of one licensing agency does not exempt an applicant from meeting the requirements of another assessment or regulatory process.

Bearing policy objectives in mind, it should be possible with the assistance of Treasury Board to rationalize the various pieces of the regulatory puzzle into a complete picture. In the interim, thought could be given to organizing regulatory requirements more efficiently. There is, for instance, no ranking under the present regulatory system of review processes (or of projects for purposes of regulation) according to their significance. Not all projects warrant the same level of detailed review, either because of significance or because there is already sufficient information existing to allow decision-making to take place. The merits of using one review process in preference to another where there is repetition should be considered. An example where this approach could be used is the prospective extension of the Esso pipeline from Norman Wells to the Delta. This project has already received considerable attention as a result of the Beaufort Sea hearings, the Mackenzie Valley hearings, and the Alaska Highway Pipeline hearings. Is another NEB or FEARO hearing really necessary?

Referring to the Norman Wells pipeline, there is more than the Board involved. The Board issued a certificate with given conditions. In those conditions we have to look at environmental issues, socio-economic issues, geotechnical issues as well as other issues. DIAND and the Government of the NWT will also look at the same thing. **(Mr. J. Farmer, NEB, Issue 36:78, 15-9-1982)**

Present Federal Government practice discourages exchange of information between some departments, witness the difficulties of introducing departmental evidence in NEB hearings. The NEB as a quasi-judicial body admittedly is a rather special case; nevertheless, there is not much evidence to show that other agencies are relying on each other's expertise in order to cut down on review processes. DIAND, DOT and FEARO all have mandates to carry out separate assessment processes which overlap in subject matter especially in the environmental dimensions of projects.

The Committee believes that it is possible to rely much more on existing information and to treat each review process as a segment of the whole regulatory regime so that repetition is avoided.

While procedural fairness dictates that all project proponents should be treated equitably, not all projects share the same national interest concerns. The FEARO process recognizes these differences and requirements match the impact of the project. The same type of principle could be applied to all regulation, so that the stringency of the controls should correspond to the significance of the national interest considerations of the project.

The Committee recommends:

That certain review procedures should only come into play when the subject matter has not been evaluated in another forum or when public interest considerations warrant. Use of existing information should be emphasized.

Another issue of concern to the Committee is the time taken by regulators to undertake review functions. In its opinion, procedural fairness dictates that project sponsors are entitled to know how long each process will take and time limits should be attached to assessment procedures. This means that project sponsors must also meet these deadlines and provide material on time.

The Committee recommends:

That time limits be allocated to procedural processes, to be met by both sponsors and government.

Even with a tightening-up of both the process and its timing, the Committee still feels that there must be a means of expediting the progress of proposals through the procedural maze and of co-ordinating regulatory activities. Prior to authorizing a particular project, the government must marshal advice and opinion on all aspects of the proposal. Some of this advice will typically be forthcoming from many departments and agencies, from the activation of the Environmental Assessment and Review Process, and sometimes it will emanate from a special inquiry established to consider particular issues. The applicant will also have

been required to demonstrate that steps have been taken to ascertain the myriad approvals, permits, certificates and licences to be obtained from the various federal, provincial, territorial and municipal authorities in the event the project receives the go-ahead. Bringing together the foregoing mass of information and advice is a complex, expensive and time-consuming process and one that can be unduly delayed if any of the required components is not in place when needed.

> *. . . I do know that there is a formidable array of regulations, permits, licences, evaluations — hurdles to be overcome. It is an absolute maze, and that is why we have tried to address part of that problem in a recommendation for a co-ordinator.* **(Mr. C.G. Edge, NEB, Issue 36:84, 15-9-1982)**

One of the more recent attempts to create an office that would act as a focal point for government activities was the Beaufort Sea Office (DIAND), established in 1981. The Office was intended as a link with industry in its Beaufort Sea activities to facilitate the flow of information between industry and government. While it had this responsibility, it did not appear to possess the authority to carry out these functions. After producing a detailed and useful report on government's role in Beaufort Sea development, it was disbanded in the fall of 1982. This was a novel attempt to provide a one-window approach within a department rather than establishing an outside agency. Without a defined legislative or administrative mandate to provide one window, however, the Committee believes that the chance of success of this type of approach is severely reduced. It would nevertheless seem advisable to assist sponsors and their regulators through the regulatory maze.

To minimize this problem at the pre-cabinet decision stage and where warranted by public interest considerations, a senior federal co-ordinator/expeditor could be appointed, responsible to an appropriate minister, to assist the project sponsors in meeting government information requirements and to co-ordinate the pre-decision activities of federal departments and agencies. As required, a small number of experienced personnel from involved departments and agencies could be seconded to facilitate the co-ordination of and response to federal regulatory requirements. Standardized assessment procedures geared to the significance of the project should be developed to ensure that consistent assessments are carried out.

> *. . . We feel that what is needed is a top-flight co-ordinator with a small staff to bring these projects to fruition, and that is the point of view we have expanded on in our report.* **(Mr. C.G. Edge, NEB, Issue 36:77, 15-9-1982)**

In the view of the Committee, the complexity of decision-making is going to increase and, therefore, warrants a federal official in the capacity of federal co-ordinator/expeditor to assist project sponsors in meeting regulatory requirements. The co-ordinator's other function to co-ordinate federal pre-decision activities would be hampered without a clear ministerial mandate as overseer of the project.

The Committee recommends:

That the appointment of a federal co-ordinator to each major energy project, responsible to a designated Minister, be tried on a pilot basis to test its suitability. After a designated period of time has passed, the mechanism should be reviewed and a decision made on its suitability.

C. Approval-in-Principle

Under the present regulatory system, even if it were to be improved, there is the very real problem of industry having to absorb the cost of undertaking a mass of technical work before obtaining a clear idea of whether the investment fits in with Federal Government priorities. It is not apparent how much information is required before the threshold decision to proceed with a particular project will be made by government. Given the huge costs of the types of projects studied, this uncertainty makes it difficult for a proponent to decide whether or not to embark upon a proposal, and to predict how long an initial approval will take. There may be severe financing ramifications. Industry consequently favours the concept of approval-in-principle for major resource developments.

> *We support the approach of approvals-in-principle so that people know things are going to happen, for then we can use that immense talent we have seen mobilized in this country in the last ten years.* **(Mr. A.E. Pallister, Can-Ocean, Issue 27:32, 1-6-1982)**

This initial policy decision must be understood to be conditional only and would have to be made at Cabinet level to prevent one department overriding another and to protect the public interest. Such approval-in-principle would signify that government has no objection from the standpoint of policy and impacts. Project sponsors and the public should be quite clear as to what has been approved and the conditions that apply. There must be no uncertainty to cause misunderstandings or to justify future positions. The possibility remains that further research will disclose clearly unacceptable environmental or socio-economic impacts.

> *. . . if you attempt to evaluate in principle only, you may prejudice certain of the parties who might develop further evidence later which might change a basic decision.* **(Mr. C.G. Edge, NEB, Issue 36:81, 15-9-1982)**

Approval-in-principle can be made relatively easily where there is a clear government priority for a particular development and relatively complete baseline scientific data exist. In the case of frontier projects, initial approvals of this kind may still create fairly onerous information requirements. Continued research and northern experience will lessen this burden, however, for future applicants. There needs to be, nevertheless, a clear indication of the point in the process at which such a decision would be made, and the type and amount of information necessary. Review procedures at the approval-in-principle stage should either be quite different from later stages or, if completed in the early stages of the project, should not be repeated. Otherwise, some of the duplication referred to in the present review processes will again be a problem in the new regulatory review system. Once the threshold decision has been made, detailed terms, conditions and approvals designed to ensure maximum environmental protection could be developed as project design and implementation proceed. In this way, approval-in-principle would not prejudge the regulatory process but would rather be the first step, to be supported subsequently by meeting all the incremental requirements.

The Committee is optimistic that a means can be found so that proponents of major projects can provide the Federal Government with the broad intent of their proposals without having to go to the expense of conducting all the detailed design and supplying other supporting information. To the Committee, some adaptation of the approval-in-principle concept has merit within the regulatory process.

The Committee recommends:

That Cabinet may introduce approval-in-principle decisions for major energy projects once the nature of the information to be provided has been established.

APPENDIX A

WITNESSES WHO APPEARED BEFORE THE COMMITTEE

Issue No.	Date	Organizations and Witnesses
16	Feb. 9, 1982	The Honourable H.A. (Bud) Olson, P.C., Minister of State for Economic Development and Minister responsible for the Northern Pipeline Agency
17	Feb. 16, 1982	**ESSO Resources Canada Ltd.** Mr. Gordon Haight, Vice-President and General Manager Mr. George Bezaire, Frontier Technology Manager
18	Mar. 2, 1982	**NOVA, An Alberta Corporation** Mr. S. Robert Blair, President and Chief Executive Officer Mr. Kent Jespersen, Corporate Vice-President
19	Mar. 16, 1982	**Canadian Arctic Resources Committee** Mr. Murray Coolican, Executive director Mr. Donald Gamble, Director, Policy Studies Mr. François Bregha, Energy Analyst
20	Mar. 23, 1982	**Gulf Canada Resources Inc.** Mr. Dan Motyka, Vice-President, Frontiers Mr. Gary Bruce, Manager, Frontier Development Mr. John Hnatiuk, Manager, Frontier Environment
21	Mar. 31, Apr. 1, 1982	**Dome Petroleum Ltd.** Mr. Murray Todd, Senior Vice-President, Frontier Drilling and Production Mr. Ken Croasdale, Manager, Research, Beaufort Sea Construction Department Dr. Brian Mercer, Senior Research Scientist, Head of Remote Sensing Group Mr. Bengt Johansson, General Manager, Engineering and Design Mr. Rick Hoos, Assistant Manager, Environmental Impact Assessment Mr. Bill Pistruzak, Manager, Environmental Research

Issue No.	Date	Organizations and Witnesses
22	Apr. 27, 1982	The Honourable R.W. Nerysoo, Minister of Renewable Resources and Energy, Government of the Northwest Territories
		Government of the Northwest Territories
		Mr. Al Zariwny, Secretary, Energy and Resource Development Secretariat
		Ms. Gay Kennedy, Socio-Economic Advisor, Energy and Resource Development Secretariat
23	May 4, 1982	**National Research Council Canada**
		Mr. C.B. Crawford, Director, Division of Building Research
		Dr. L.W. Gold, Associate Director, Division of Building Research
		Mr. E.H. Dudgeon, Director, Division of Mechanical Engineering
26	May 18, 1982	Mr. Simon Awa, President, Baffin Regional Inuit Association, Frobisher Bay, Northwest Territories
		Mrs. Fran Williams, President, Labrador Inuit Association, Nain, Labrador
		Mr. John Merritt, Land Claims Research Co-ordinator, Inuit Tapirisat of Canada
		Mr. Milton Freeman, Social Scientist Consultant to the Inuit Tapirisat of Canada
		Ms. Judy Rowell, Environmental Consultant to the Labrador Inuit Association
27	June 2, 1982	**CanOcean Resources Ltd.**
		Mr. A.E. Pallister, Chairman of the Board
		Mr. William A. Talley, Jr., President
		Mr. A.W. Marks, Manager, Business Development, Eastern Canada
28	June 9, 1982 Rea Point, N.W.T.	**Panarctic Oils Ltd.**
		Mr. C.R. Hetherington, President and Chief Executive Officer
		Mr. L.J. Franklin, Vice-President, Operations Brigadier-General C.E. Beattie, Consultant
29	June 9, 1982, Resolute Bay, N.W.T	Mr. Ludy Pudluk, M.L.A. (High Arctic)
		Mrs. Dora Pudluk
		Mr. Solomon Kalluk, Chairman of the Housing Association
		Mrs. Leetia Kallyk
		Mr. Andrew Tagak, President, Hunters' and Trappers' Association

Issue No.	Date	Organizations and Witnesses
29	June 10, 1982	Mr. Sam Omik, Mayor, Hamlet of Pond Inlet
		Mr. Paul Koolerk, Assistant Secretary, Hamlet of Pond Inlet
Pond Inlet, N.W.T.		Mr. David Mablick, Field Services Officer, Government of the Northwest Territories
		Mr. Loti Atagootak, President, Hunters' and Trappers' Association
		Mr. Shahan Deirmenjian, Planner, Hamlet of Pond Inlet
		Mr. Nat Maktar, Translator
30	June 15, 1982	**Department of Transport**
		Mr. Gordon M. Sinclair, Administrator, Canadian Marine Transportation Administration
		Ms. Carol Stephenson, Director, Special Projects and Policy Coordination, Coast Guard
		Mr. James Richard F. Hodgson, Director, Marine Policy Coordination
		Mr. Don J. Douglas, Regional Controller, Civil Aviation, Western Region (Air)
31	June 22, 1982	**Department of Indian Affairs and Northern Development**
		Mr. G. Neil Faulkner, Assistant Deputy Minister, Northern Affairs Program
		Mr. Yvon Dubé, Director General, Northern Environment
		Mr. Robin Glass, Director General, Northern Resources and Economic Planning
		Mr. John Hucker, Director General, Northern Policy and Programming
		Mr. D. Sherwin, Director General Resources Evaluation, COGLA
32	June 29, 1982	**Department of Energy, Mines and Resources**
		Mr. G. Tough, Assistant Deputy Minister, Energy Policy Analysis
		Dr. K. Whitham, Assistant Deputy Minister, Research and Technology
		Dr. P. Dyne, Director, Office of Energy, Research and Development
33	July 6, 1982	**Department of Transport**
		Mr. Gordon M. Sinclair, Administrator, Canadian Marine Transportation Administration
		Ms. Carol Stephenson, Director, Special Projects and Policy Coordination, Coast Guard
		Mr. James Richard F. Hodgson, Director, Marine Policy Coordination

Issue No.	Date	Organizations and Witnesses
		Mr. Don J. Douglas, Regional Controller, Civil Aviation, Western Region (Air) Captain A. Geddes, Ship Safety Officer
34	Sept. 9, 1982, Calgary, Alta.	The Honourable Christopher W. Pearson, Leader of the Government of Yukon
		Government of Yukon Mr. John W. Ferbey, Deputy Minister, Department of Economic Development and Intergovernmental Relations Dr. Tim McTiernan, Project Officer, Department of Economic Development and Intergovernmental Relations
		Beaufort Sea Community Advisory Committee Mr. Garrett Ruben, Chairman Mr. Tom Zubko, Representative for Inuvik Council Mr. Dick Hill, Co-ordinator
35	Sept. 14, 1982	**Canadian Oil and Gas Lands Administration** Mr. Maurice E. Taschereau, Administrator Mr. Robert G. Blackburn, Deputy Administrator Ms. Sheryl L. Kennedy, Director, Policy Analysis and Coordination Division Mr. Rowland H. Harrison, Director General, Land Management Branch Mr. Leo V. Brandon, Director General, Engineering Branch Mr. Don L. Sherwin, Director General, Resource Evaluation Branch Dr. Maurice Ruel, Director General, Environmental Protection Branch Mr. Pat J. Duggan, Director General, Canada Benefits Branch
		Federal Environmental Assessment Review Office Mr. Raymond Robinson, Executive Chairman Mr. David Marshall, Director, Pacific Region Dr. Patrick Duffy, Director, Northern Region
		Department of Fisheries and Oceans Dr. G.H. Lawler, Director General, Western Region Mr. S.B. MacPhee, Dominion Hydrographer and Director General Mr. N.J. Campbell, Director General, Marine Sciences Information Directorate

Issue No.	Date	Organizations and Witnesses
		Mr. J.S. Loch, Senior Policy and Program Advisor, Arctic Fisheries and Marine Mammals Research Dr. G.L. Robins, Acting Director, Native Affairs Branch
36	Sept. 15, 1982	**Department of Industry, Trade and Commerce—Office of Industrial and Regional Benefits—** Mr. H.A. Reynolds, Director General Mr. W. Whiting, Chief, Land Hydrocarbon Resources Division Mr. R.G. Schulte, Chief, Demand and Supply Analysis
		Canada Employment and Immigration Commission Mr. Duncan R. Campbell, Executive Director, Labour and Market Division Mr. Alan L. Cobb, Senior Director, Labour Market Planning and Adjustment Mr. J. Daniel O'Rourke, Staff Economist, Northwest Territories, Economic Services Branch, Alberta and Northwest Territories Region Mr. Grant C. Botham, Director General, Training
		National Energy Board Mr. C.G. Edge, Chairman Mr. J. Farmer, Associate Vice-Chairman Admiral R. St.G. Stephens, Executive Director Mr. K.W. Vollman, Director General, Energy Studies Mr. T.S. Shwed, Director, Pipelines Branch Mr. G. Yorke Slader, Secretary of the Board Mr. H. Wetston, Assistant General Counsel
37	Sept. 16, 1982	**General Dynamics Corporation** Mr. James J. Murphy, Vice-President, Marketing Mr. Roland Jones, Arctic Development Project Mr. Gregory Kane, Counsel
		Department of Indian Affairs and Northern Development Mr. Clovis Demers, Assistant Deputy Minister, Native Claims Mr. J.R. Goudie, Director, Claims Policy, Office of Native Claims Mr. S.A. Kanik, Chief, Oil and Gas Operations, Co-ordination Division, Northern Non-Renewable Resources, Northern Resources and Economic Planning Branch

Issue No.	Date	Organizations and Witnesses
		Department of the Environment Mr. Jacques Gérin, Senior Assistant Deputy Minister Dr. A.H. Macpherson, Regional Director General, Western and Northern Region Dr. E.F. Roots, Science Advisor for the Department Mr. J.W. Maxwell, Acting Director General of the Lands Directorate, Environmental Conservation Service

APPENDIX B

LIST OF ABBREVIATIONS

APLA	Arctic Production and Loading Atoll
APP	Arctic Pilot Project
BRIA	Baffin Regional Inuit Association
BSCAC	Beaufort Sea Community Advisory Committee
CanOcean	CanOcean Resources Ltd.
CARC	Canadian Arctic Resources Committee
CDU	Conical Drilling Unit
CEIC	Canada Employment and Immigration Commission
COGLA	Canada Oil and Gas Lands Administration
DFO	Department of Fisheries and Oceans
DIAND	Department of Indian Affairs and Northern Development
DOE	Department of the Environment
Dome	Dome Petroleum Limited
DOT	Department of Transport
EARP	Federal Environmental Assessment and Review Process
EIS	Environmental Impact Statement
EMR	Department of Energy, Mines and Resources
Esso	Esso Resources Canada Limited
FEARO	Federal Environmental Assessment and Review Office
GNP	Gross National Product
GNWT	Government of the Northwest Territories
Gulf	Gulf Canada Resources Inc.
GYT	Government of Yukon Territory
ITC	Inuit Tapirisat of Canada
IT&C	Department of Industry, Trade and Commerce
LIA	Labrador Inuit Association
LNG	Liquefied Natural Gas

NEB	National Energy Board
NORDREG	Arctic Vessel Traffic Management System
NOVA	NOVA, An Alberta Corporation
NRC	National Research Council
NWT	Northwest Territories
OIRB	Office of Industrial and Regional Benefits
Panarctic	Panarctic Oils Limited
Petro-Canada	Petro-Canada Resources
PRC	Policy Review Committee (COGLA)
TERMPOL	Code of Recommended Standards for the Prevention of Pollution in Marine Terminal Systems