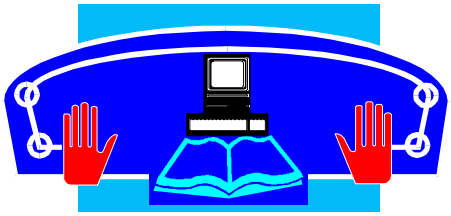

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Standing Senate Committee on Energy and Natural Resources

Northwest Territories Minister
Energy, Mines and Resources

NORTHWEST TERRITORIES ENERGY RESOURCES DEVELOPMENT

SUBMISSION OF the Government of the Northwest Territories to the Standing Senate Committee on Energy and Resources Development.

Energy, Mines & Resources Secretariat
Government of the Northwest Territories
April 2, 1985

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RECOMMENDATIONS

Oil and Gas Development

1. Effective incentives should be provided to promote oil and gas activities in the NWT.

2. To assist in the reduction of front end development risk, the Petroleum gas Revenue Tax should be removed or at the very least amended to allow for the deduction of Capital related costs.

3. Land for exploration purposes should be made available to the oil and gas industry in the NWT in accordance with federal and GNWT goals and priorities.

4. There should be a shift in Energy Policy toward the creation of jobs, business opportunities, training and long term economic growth and away from short term revenue collection and Canadian ownership.

5. Investment capital should be welcomed in the NWT from any source, domestic or foreign, private or public, provided the resultant resource development projects meet government goals and priorities.

6. The Federal Government should move quickly to devolve to the GNWT provincial-like authority over northern resource development, including those areas of responsibility specific to environmental regulation.

Conservation

7. Conservation funding in the North should be increased commensurate with the potential for high return from investments sponsored through conservation programs. The Federal Government should work jointly with the GNWT to define conservation program goals, priorities, funding levels and delivery mechanisms to allow for the blending of Federal and GNWT objectives with regional energy conditions.

Alternative Energy Development

8. Alternative energy development funding in the North should be increased in recognition of the current high level of per capita petroleum product consumption and the availability of reasonable alternative energy sources.

9. The Federal Government should work jointly with the GNWT to design and deliver programs which reduce the front end costs of alternative energy developments in the NWT.

EXECUTIVE SUMMARY

Objectives

"This submission describes the importance of hydrocarbon exploration and production activities in the North. It also provides an economic rationale for continued emphasis on northern hydrocarbon development in the N.W.T.

Also, our submission stresses the importance of conservation and alternative energy programs to the North and provides an economic rationale for their continuation.

The last section of our submission deals with the role of the GNWT in energy development.

Preamble

Inexpensive sources of conventional oil may be increasingly cliff cult to find. Energy prices will ultimately increase to reflect the expense of new exploration, research and development technology made necessary to an increas nq reliance on unconventional sources of fossel fuels. If Canada is to remain self-sufficient in energy, oil prices will have to be increasingly influenced by the economic cost of developing incremental oil reserves. Conservation and alternative energy development must continue to play an important role in the shift away from oil as a primary energy source.

Despite the North's distance from markets and its geographical characteristics, it is possible that this region's resources can be developed profitably. Once the transportation system and the development infrastructure are in place, the marginal expenditures necessary to bring on incremental oil and gas production will be minimal in relation to current costs.

The GNWT believes that oil and gas development shou d continue in the North. Such development provides opportunities, economic growth and ultimately government resource revenues for the North.

The GNWT also believes that northern oil and gas development is good for Canada. Expenditures and exploration efforts made to date, combined with the need for a secure, stable source of domestic oil and the possibility of a reasonably priced product make northern hydrocarbon activities good economic sense.

Conservation and alternative energy development should be increased in those regions of Canada currently using the highest levels of oil as measured on a per capita basis. The economics of these programs in such areas should be greatly improved over national averages.

The GNWT recognizes that conservation and energy alternative expenditures in the South may have a long payback period. This is not, however, the case in the North. NWT consumers use more petroleum based energy per capita than other Canadians. The GNWT believes that provided with appropriate funding levels, program designs and program delivery mechanisms, Federal money North of 60° will be well spent to the benefit of all Canadians.

In the last several years the GNWT has made significant progress in increasing its level of control over resource developments. The Resource Development Policy, the Renewable Resource Compensation Policy and the Energy Policy serve as three examples of this progress. As well, the GNWT has developed a GNWT-Canada Resource Management and Revenue Sharing Proposal.

A. OIL AND GAS DEVELOPMENT IN THE NUT

1. History of Hydrocarbon Activities

a) Western Arctic

Western Arctic hydrocarbon exploration began onshore in the late 1950's. Between 1965 and 1975 about 140 onshore wells were drilled. Significant onshore oil finds were made in 1970 at Atkinson Point and in 1971 at Mayogiak. Major onshore gas fields have been discovered at Parson's Lake and Taglu. Offshore hydrocarbon exploration began with seismic activities in the early 1970's. Using artificial islands in shallow waters, 23 wells had been drilled by 1982. Major oil finds were made at Adgo (1973), Garry (1976) and Issungnak (1980). Gas discoveries were made at Netsert (1976) and Isserk (1978).

b) Beaufort Sea

Drilling ships began operation in the Beaufort Sea in 1976. Fifteen wells were completed from drillships by 1983 leading to four oil discoveries; Nektoralik (1977), Kopanoar (1979), Tarsuit (1980), Koakoak (1981) and two gas finds: Nektoralik (1977) and Ukalerk (1977).

Most recently two encouraging wells were drilled by Gulf Canada Resources; Pitsiulak A-05 at 2290 BPD through a half inch choke and Amauligak with a possible reservoir size of 400 million barrels.

c) High Arctic

Oil and gas activities in the High Arctic are being undertaken primarily by Panarctic Oils Limited. In both 1981 and 1982 five wells were drilled. During this time there were four significant discoveries made. Panarctic continued exploring in the High Arctic during 1984. Approvals for offshore island construction and dredging numbered 17 compared to 15 in 1983. In early 1985 Panarctic's Bent Horn Pilot Project on Cameron Island was approved as the first commercial oil development in the Arctic.

d) Western Mainland/Hudson Bay

There is considerable activity in the western mainland of the NWT. Besides the Norman Wells field expansion and pipeline construction, there are a number of smaller firms engaged in oil and gas exploration activities. Seismic work continues in the Hudson's Bay area. Table 1 which incorporates reserves plus resources of average expectation, identifies the oil and gas resource estimates for the different areas of Canada. Those reserves and resources made available through enhanced oil recovery and oil sands technology are included.

Table 1 Canadian Oil and Gas Reserves and Resources

	OIL Millions of Barrels		GAS Trillions of Cubic Feet	
Beaufort Sea-Mackenzie Delta				
(7000-30,000)[2]	9200		(110-145)[1] 76	
Arctic Islands	4800		(90-140) 92.5	
Mainland N.W.T.	600	15770	12.5	193.7
Hudsons Bay	820		3.2	
Eastern Arctic	350		9.5	
Alberta, Saskatchewan, Manitoba (Western Sedimentary Basin)	8000		150	
Eastern Canada (Offshore)	12890		85	
Eastern Canada	240		4	
B.C., Yukon (Cordilleran Basin)	315		9.5	
Resources of Canada	37215		**442.2**	
Oil Sands (Synthetic Oil	24300			
Enhanced Oil Recovery	3150			
Total Oil and Gas Resources	64665		442.2	

Source: GSC

1. Polar Gas potential gas reserve estimates
2. Beaufort EIS resource estimates

2. Economics of Oil and Gas

Canadian sources of non conventional oil reserves are extensive. They are, however, considerably more expensive to produce than conventional oil.

a) Production Costs/Barrel

Table 2 identifies the costs per barrel of producing oil under a range of scenarios for different classes of development. Costs of production do not include government royalties, well head taxes, and exploration expenditures since the latter are "sunk" and occur regardless of whether a discovery is made.

Table 2 Estimated Costs of Oil Production

Conventional Alberta Oil	Enhanced Oil Recovery from Conventional Fields	Beaufort Sea Oil	Hibernia	Al sands
$4.50 - $6.00	$16 -$25	$8 -$36	$10 - $14	$33-$48

Source: Economic Council of Canada

Notes:

1. Enhanced oil recovery and Beaufort Sea scenarios both incorporate a 10% discount rate only. Hibernia and Alsands scenarios incorporate a range of discount rates from 5 to 10%. Conventional oil incorporates actual financing costs.
2. The Beaufort Sea scenario assumes a single island in the shallow offshore. Minimum economic reserve size was assumed at 200 MMB (max. of 1000 MMB). Onshore developments are considered less expensive than deep water developments.
3. All costs FOB wellhead, in constant 1983 dollars.
4. Hibernia development based on reserves of 1200 MMB. Technological difficulties in North Atlantic (iceberg alley) may result in differing platform designs increasing oil costs somewhat.

b) Supply/Price Estimates

Before committing resources to the development of oil, an assessment of world oil prices and their general direction is paramount. Canada uses more energy on a per capita basis than most other nations. Canada's economy is closely tied to the production and use of energy. Expensive energy supplies could effect Canadian competitiveness in world export markets and affect our living standards.

Supply and price estimates for oil range from substantial increases to moderate declines. Oil prices increased in the past (from $1.59 in 1970 to $34 in 1984) not because of resource scarcity but because of the concentration of oil production in the hands of a few producers. In 1972 OPEC produced 50% of the world's oil, had 66% of the world's proven oil reserves and accounted for 92% of the world's oil exports. By 1976 OPEC was producing 68% of the world's oil, by 1980 they produced only 46%.

Tables 3 and 4 represent estimates of world oil reserves and life index and estimates of ultimate recoverable resources of fossil fuels. The tables illustrate that a hydrocarbon shortage in the immediate future is unlikely. In fact, at current consumption rates, ultimate recoverable resources could last another 600 to 1100 years. Even allowing for a 5% annual compounding increase in energy consumption, estimated resources could last another two hundred years.

Table 3 World Oil Reserves
(Billions of Barrels)

YEAR	RESERVES	INDEX	YEAR	RESERVES	INDEX
1947	66	22	1973	650	34
1950	82	22	1975	640	34
1955	181	33	1977	630	33
1960	285	37	1979	610	28
1965	333	30	1981	650	33
1967	400	33	1983	640	33
1969	500	36			
1971	600	35			

Table 4 Estimates of Ultimate Recoverable Resources
(Billions of Barrels of Oil Equivalent)

COAL	17360 - 30690
OIL [1]	1640 - 2050
NATURAL GAS	1640 - 2400
TOTAL	10640 - 35140

-1

Source: Economics of Resource Depletion

[1] Oil estimate includes tar sand and shale.

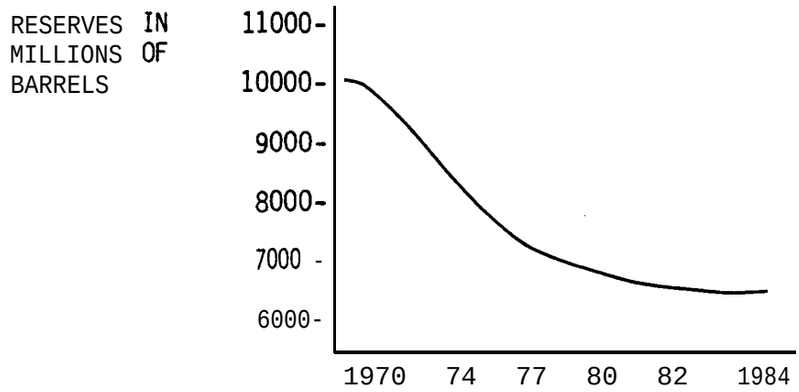
It is however, clear that inexpensive sources of conventional oil may be increasingly difficult to find. Energy prices will ultimately increase to reflect the expensive new exploration, research and development technologies made necessary by an increasing reliance on unconventional sources of fossil fuel.

Currently the bulk of Mideast oil can still be produced inexpensively. If major oil producers chose to be competitive, oil prices could drop as low as $15 a barrel. At this price few of Canada's new energy developments would be economical.

Under a $15-barrel-scenario industrialized nations could consume oil for several years without the need to embark on expensive incremental energy developments. The OPEC oil price increases over the last decade have, however, exemplified the need for energy security - a goal which most industrialized nations have endorsed. Most oil pricing experts agree that beyond 1985, oil prices should remain relatively stable in real terms, increasing slightly in the 1990's.

If self-sufficiency in oil remains a national objective, Canadian oil prices have to be increasingly influenced by the economic cost of developing incremental oil reserves. Although oil sands, enhanced recovery oil and offshore oil reserves are available in relative abundance, the cost of all new development and production is high by traditional standards. Canada is running out of inexpensive conventional oil as indicated by Graph 1 and Table 5. New sources of oil must be located and developed.

Graph 1 Canadian Conventional Oil Reserves (Millions of Barrels)



Source: Canadian Energy Trends

Table 5 Canadian Conventional Oil Reserves

YEAR	BARRELS	LIFE INDEX	YEAR	BARRELS	LIFE INDEX
1970	10214	20.2	1977	7050	13.1
1971	9971	18.5	1978	6860	13.1
1972	9592	15.4	1979	6809	11.6
1973	9008	13.4	1980	6751	12.0
1974	8375	12.4	1981	6693	13.2
1975	7833	13.6	1982	6426	12.9
1976	7432	14.1	1983	6436	12.2

Source: Canadian Energy Trends

Note: Life Index is calculated as reserves divided by corresponding year's production.

3. Oil and Gas in the NWT Economy

The NWT is 3.4 million km^2 or one third of Canada's area. There are fewer than 50,000 inhabitants and the population is predominantly native. The NWT has nearly 10% of the world's fresh water. Nine percent of the land mass is forested. Over two million hectars of land is believed to be suitable for some form of agriculture. In excess of three thousand people engage in commercial fur production. Traditional arts and crafts provide an important source of income for small communities. The tourism industry is a major employer. Government is the largest single employer with the communications and service sector in second place.

The non-renewable resource sector, including oil, gas and minerals, accounts for 17% of employment opportunities and pays above average wages. The gross value of mineral production is estimated at over a half billion dollars for 1983. Expenditures in oil and gas amounted to 2.6 billion in 1983, down from 2.8 billion in 1982.

The Oil and Gas industry has become a very important component of the NWT economy. The activity it pursues has contributed significantly to northern economic growth, to the creation of opportunities and to government revenues. A reduction in activity would have an immediate impact on employment and business. Ultimately it would effect all communities and most people as the downswing in activity rippled through the NWT economy.

Table 6 Oi 1 and Gas Industry Expenditures in Northern Canada to 1981

	1947-75	1976	1977	1978	1979	1980	1981*
Exploration	1534.7	282.4	333.9	416.7	403.9	448.8	580.0
Development	30.0	11.4	7.1	22.4	14.6	32.6	20.0
Land	72.4	3.3	3.7	4.9	6.1	6.9	7.0
Production Facilities	58.8	0.6	10.7	27.5	26.7	95.3	56.5
Production costs	18.3	5.9	4.8	4.3	8.2	18.9	23.6
Gas Plants	3.7	7.9	2.1	5.0	3.1	0.4	0.2
Royalties	7.8	4.8	4.8	4.3	5.2	5.0	5.7
Other	20.5	1.8	1.8	4.4	0.7	5.6	6.7
TOTAL	1746.2	318.1	368.9	488.9	468.5	618.5	699.7

Source: NWT Data Book

* Estimates

Table 7 Oil and Gas Exploration Activity NWT

	1982	1981		1982	1981
Seismic programs run	25	20	Discovered Resources		
Km. of seismic shot	20,469	15,802	Gas (billion m^3)	689.5	628.2
Wells spudded	15	13	Oil (million m^3)	103.5	175.2
Wells completed	1 4	13	$ spent by Operators (millions)		
Metres drilled	47,028	47,830	Seismic	72.2	33.7
Rigs active	15	12	Drilling	743.5	602.9

Source: NWT Data Book

a) **Tuktoyaktuk/Inuvik Labour Effects**

As an illustration of economic impacts at the community level, the experience of Tuktoyaktuk and Inuvik are good examples to examine. Oil and gas related expenditures in both communities accounted for a significant portion of income in 1980. In Tuktoyaktuk these activities resulted in the employment of half of the labour force and generation of 55% of community income. In Inuvik oil and gas activities result in the employment of 9% of the labour force and 10% of community income. While other regional communities are not illustrated, a similar, though not as significant an impact, is considered reasonable.

For 1980, in Tuktoyaktuk, out of a total labour force of 289 persons, 140 received oil and gas related employment and 62 were employed by Government. This left 87 persons to fill all other occupations in the community.

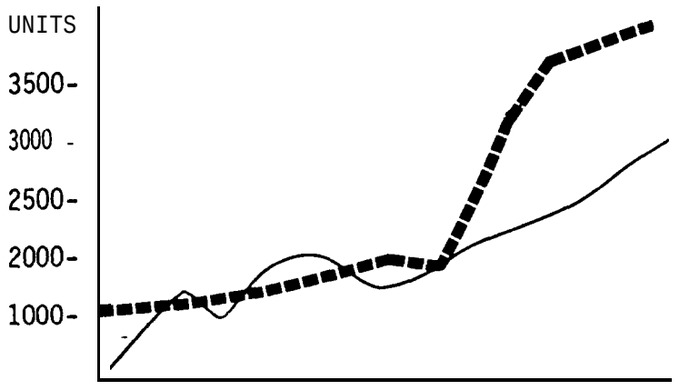
By 1981, in Tuktoyaktuk, the local labour force was almost fully employed. This gave government and industry the opportunity to rely more heavily on labour from other western Arctic communities thereby distributing the benefits of development over a wider region.

Dome, Esso and Gulf, in their respective 1983 Northern Benefits reports, indicated that between 20% and 30% of their labour force was "northern". All three companies also indicated a significant northern business component under contract.

Obviously there are limits to the extent to which local people and local businesses can participate in the current oil related activities. The limitations are based on population size, education levels, and infrastructure bottlenecks. However, there has been no comprehensive studies done to date to indicate how close the regional economy is to reaching its limitations on indigenous employment and business growth.

Graph 2 provides an indication of the extent of northern employment from 1971-72 to 1982 plus the average income per month of employment. Because most oil industry related work is seasonal, these employment statistics do not represent full time employment. For example, in 1982 Tuktoyaktuk residents worked almost 1000 person months. With an average employment period being four months, 250 jobs would be filled. Most of these jobs would occur at the same time. Contract and service jobs relating to oil activities would be in addition to these figures.

Graph 2 Income Per Person Month
Employment and Income (Beaufort)



Source: Beaufort EIS
Socio-Economic Supplement

— person month employment
■■■ average into-ne per person ninth of employment in dol 1 ars

It would appear from Graph 2 that the local labour force available for work is not yet near saturation. Moreover, longer drilling seasons due to improved technology has the effect of increasing the number of man months worked without increasing the need for personnel.

b) **Benefits of Hydrocarbon Production**

The NWT also has two producing commercial oil and gas operations; Pointed Mountain and Norman Wells. Tables 8 and 9 provide an indication of the current importance of this activity.

Table 8 NUT Oil and Gas Gross Production Revenues - Millions $

	1947	1957	1967	1977	1978	1979	1980	1981
Crude Oil	.5	.3	.5	4.2	6.2	7.6	10.8	13.3
Natural Gas				34.6	31.1	39.2	42.0	38.5
Total	.5	.3	.5	38.8	37.8	46.8	52.8	51.8

Source: NWT Data Book

Table 9 NWT Oil and Gas Production

	1982	1981
Pointed Mountain, gas	4 wells	6 wells
(million m^3)	218	351
Norman Wells, oil	59 wells	55 wells
(thousand m^3)	176	173

Source: NWT Data Book

c) **Norman Wells Expansion and Pipeline Project**

Significant employment, training and business opportunities are also available to northerners from the construction phase of hydrocarbon activities. The Norman Wells Expansion and Pipeline Construction Project is one such example. Tables 10 and 11 and Graphs 3 and 4 illustrate some of the socio-economic benefits which flow from projects of this size and nature.

Table 10 Northern Business and Employment Report Participation Statistics

	1 Firms/ Vendors	Contracts Awarded	Contract Value(M$)	2 Residents	Positions	Person Days Empld.
Norman Wells	24	118	9.859	79	112	3,672
Fort Norman	9	56	2.951	124	259	6,565
Wrigley	3	13	1.613	60	122	3,419
Ft. Simpson	34	182	5.861	221	450	10,658
Other Communities	12	17	2.753	145	225	5,522
NWT Project Area Comm.	82	386	23.037	629	1,169	29,836
Other Northern	83	289	21.588	378	565	17,629

Source: IPL Socio-Economic Monitoring Report 1984

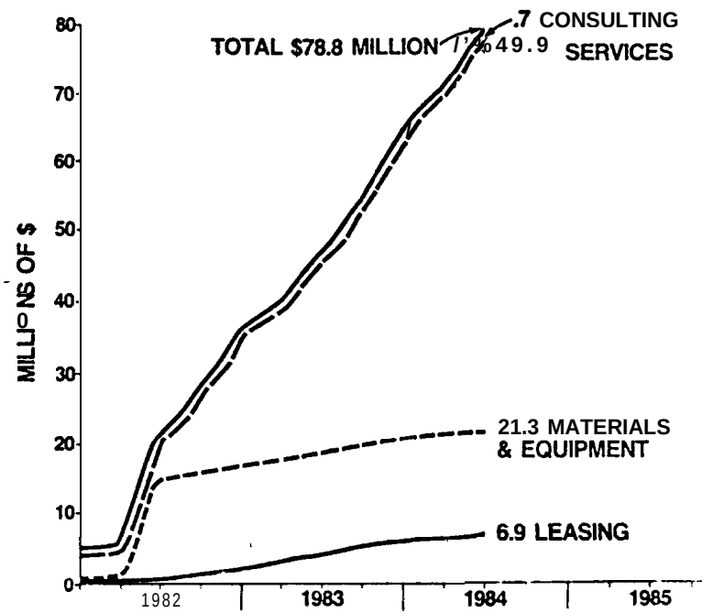
1 Northern business participation statistics to June 20, 1984
2 Northern employment participation statistics to June 30, 1984

Table 11 Norman Wells Expansion Project Training
April 1 - June 30, 1984
Esso Resources Canada Limited

WNG TERM OCCUPATIONS	PORT FRANK	FORT GOOD	FORT MCPHER	FORT NORM	FORT PROV	FORT RES	FORT SINP	FORT SMITH	HAY	INU	NW	PINS	us	WRIG	YELLOW	TOTAL
DERRICKHAND	2									1					3	6
ELECTRICIAN		1						1	2		1	2			4	11
FIELD OPERATOR	1	1	1				1	1	2	2	1			1	3	14
FLOORHAND	2	4	5	2				4		1	2				5	2s
HEAVY EQUIPMENT OPERATOR	1							1								2
INSTRUMENTATION											1					1
LABORATORY TECHNICIAN											1					1
MECHANIC/HELPER				1			2	3			2				1	9
MOTORHAND			1						1	1					1	4
OM L S OPERATOR								1	1	1	4				1	8
PLUMBER/PIPEFITTER								4	3							7
RECRUITER											1					1
RIG MANAGER TRAINEE											1					1
STATIONARY ENGINEER															2	2
SUPPLY ASSISTANT/WAREHOUSE	1	2			1		1	2		3	3			1	3	17
Subtotal	7	a	7	3	1		4	17	9	9	17	2		2	23	109
SHORT TERM OCCUPATIONS																
CLERICAL/WORD PROCESSING	1		1	1	2			3	2		5					15
HEAVY EQUIPMENT OPERATORS			1					2	1	1	1	1	2	1	4	14
subtotal	1		2	1	2			5	3	1	6	1	2	1	4	29
TOTAL	8	8	9	4	3		4	22	12	1 0	2	3	3 2	3	2 /	13f

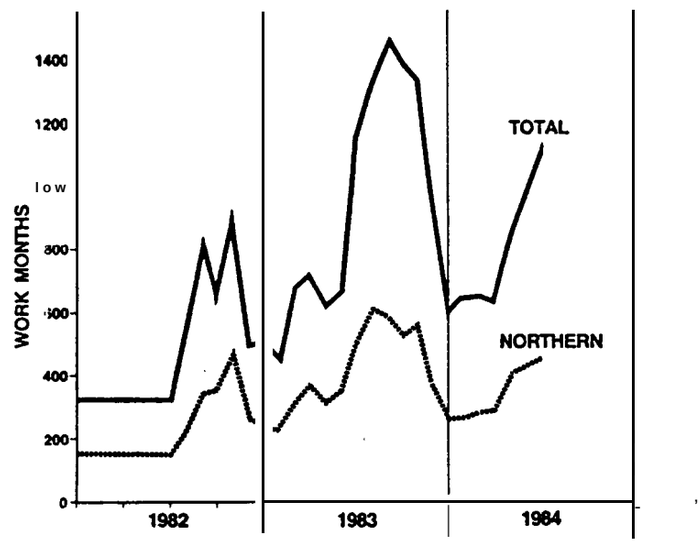
Source: Esso Resources

Graph 3 Northern Business Disbursements for UD to June 30, 1984
Norman Wells Expansion Project Esso Resources Canada



Source: Esso Resources

Graph 4 Work Months of Employment for Nonnan Wells Expansion Project
Esso Resources Canada - January 1, 1982 to June 30, 1984



Source: Esso Resources

d) **Beaufort Labour and Business Effects**

Recent statistics have been made available by Dome Petroleum which indicate the size of its northern employment and business component. These are illustrated in Table 12.

Table 12 Dome Petroleum Northern Employment and Business Expenditures (1984)

Community	Employment	1983 Business Expenditures	To Oct. 1984
Aklavik	23	438,000	-
Coppermine	20		
Fort McPherson	23	90,000	60,747
Holman Island	2		
Inuvik	26	5,188,000	3,340,845
Paulatuk	6		
Sachs Harbour	7		
Tuktoyaktuk	38	3,528,000	4,993,072
Yellowknife	5	288,000	212,697
Hay River		2,634,000	695,280
Other NWT Communities	7	798,000	480,550
TOTAL	157	12,964,000	9,793,836

Source: Dome Petroleum

4. Northern Development Perspectives:

a) **Industry**

(i) Esso Resources

There is every indication that Esso Resources will continue its Western Arctic hydrocarbon activities provided land is made available for future exploration work. The company has expressed optimism with respect to Beaufort Sea-Mackenzie Delta oil and gas, stating that U.S. markets for gas could open up in the early 1990's. Esso Resources already has 200 MMB of oil in the Delta and may need only 100 MMB more to consider a project.

(ii) Polar Gas

Polar Gas Limited has made application to the National Energy Board to transport gas from the Mackenzie Delta. A 36" pipeline costing $3.3 billion (1984 dollars) would deliver gas to Alberta at a rate of 800 MMCFD. The main supply field would be Taglu (Esso) with a secondary line collecting gas from Parsons Lake (Gulf, Mobil).

(iii) Gulf Canada

Gulf Canada Resources has had an encouraging year in 1984 with its Amauligak and Pitsiulak discoveries. Continued exploration over the next two years seems a certainty. If the results of this work are positive oil production in the Beaufort could occur within the next several years.

(iv) Dome Petroleum

Dome Petroleum and its subsidiaries have made some significant oil and gas discoveries in the Beaufort. If the fiscal regime applied to the hydrocarbon industry is changed to promote development and production, Dome may engage in Beaufort development or farm out its leases to other operators. Financial difficulties would appear to be a significant limiting factor in Dome Petroleum's future operation in the North.

(v) Panarctic

The Bent Horn Pilot Project of Panarctic's has just been approved. This project represents the first commercial oil development from the High Arctic. The Bent Horn field will produce 16,000 m³ (100,000 barrels) for shipment each year. The project will test the environmental, regulatory, technical and economic aspects of Arctic development.

b) **Northern Issues**

(i) Activity Downturn

The NWT has enormous resource potential but there are some difficult problems to overcome. The economic prosperity of northerners is unavoidably tied to resource development whichis necessary for employment, training, business opportunities and long term economic growth.

A significant downturn in oil and gas activities would result in social disruption. It would also require government to take a lead role in creating alternative employment utilizing other indigenous resources. This could not be done without sizeable public funding.

(ii) Constraints to Growth

Exploration must be permitted to result in development and production as adequate reserves are located. The existence of the Petroleum Gas Revenue Tax and the 25% Crown Back-in Provision reduce the desirability of development. Another constraint to development is the perceived complexity of the regulatory and approvals process through which a project must go before it can proceed. It is in the interests of industry and both levels of government to rationalize and streamline this process.

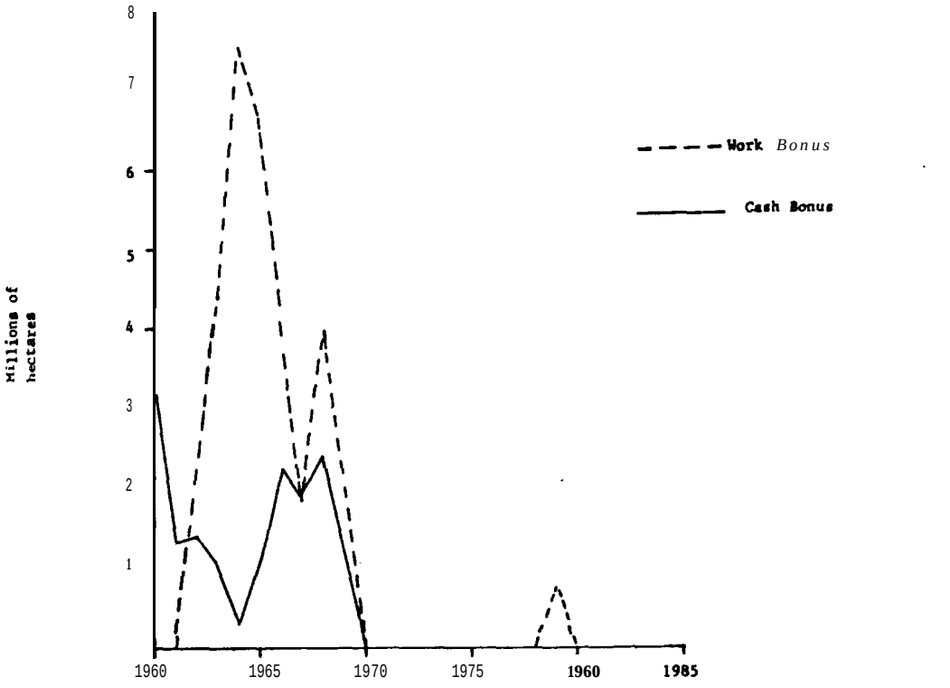
(iii) Land Availability: Another Constraint

Another major constraint to the continued existence of an oil industry in the North is land availability. By 1986/87 current oil company exploration agreements will have expired. This means their land and exploration rights will be surrendered. No agreement as yet has been made for continuing exploration after 1986/87. Companies plan in advance because limited, expensive, private resources cannot afford to be idle for long.

As an example of the importance of land availability to exploration, consider the NWT mainland. Graph 5 shows the amount of land made available through permit sales on the mainland to firms for exploration purposes. Notice that no new land has been issued since 1969. Land available for exploration peaked in 1969 and has been declining ever since as Graph 6 indicates. There is a direct correlation between the amount of land available and the number of wells drilled. This can been seen by comparing the number of wells drilled in Graph 7 with Graph 6.

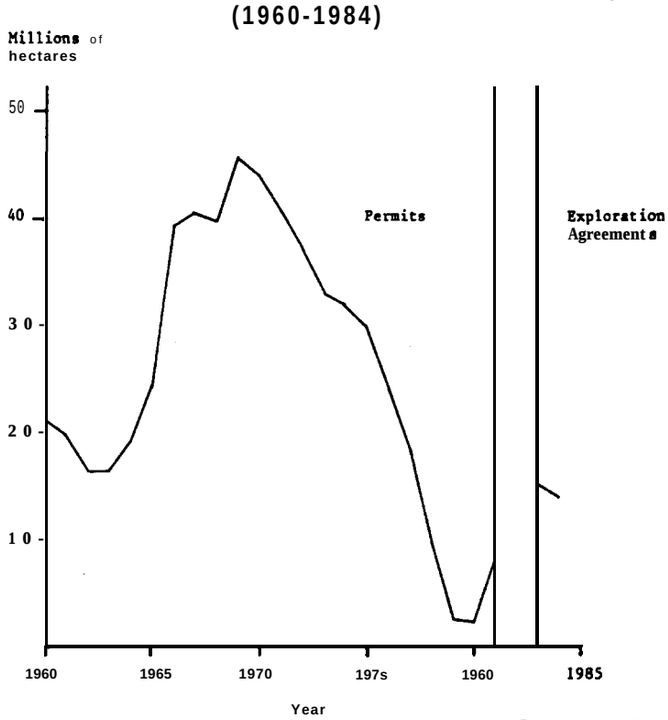
Exploration in the offshore is extremely expensive, as seen by Graph 8, so the minimum economic size of a development would be very large by historical standards and therefore less likely to occur. On the other hand., exploration costs onshore are relatively low. This reduces the minimum economic size of a project. Furthermore, with the Norman Wells pipeline now in place, the logistics and transportation cost of products would be greatly reduced.

Graph 5 **Canada Lands North of 60" - 1960-1984**



Source: Consultant - Russell Banta

Graph 6 **Area Within NUT Mainland Available for Exploration (1960-1984)**

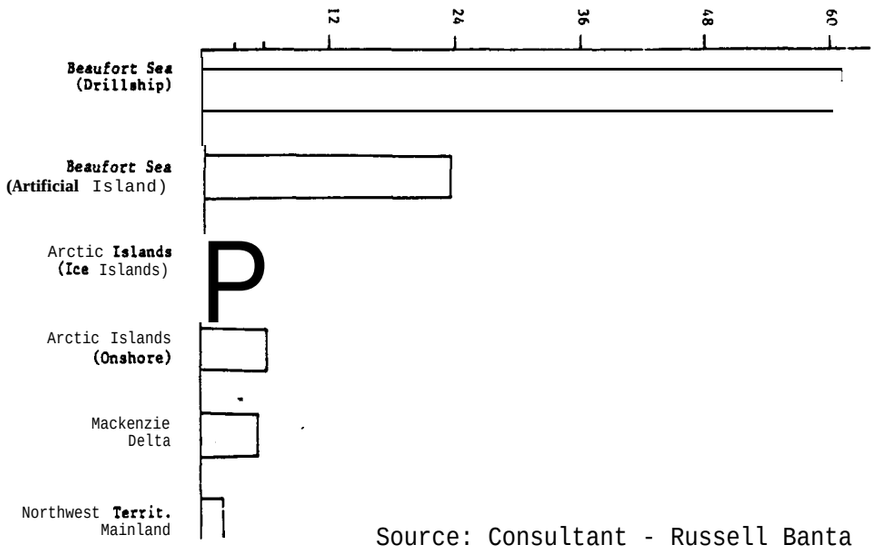


Source: Consultant - Russell Banta

Graph 7 **Exploratory Wells Drilled in the NUT Mainland (1960-1983)**

Source: Consultant - Russell Banta

Graph 8 Average Cost of Northern Exploratory Wells Drilled Between 1976 and 1981 by Region



Source: Consultant - Russell Banta

c) **Land Claim Issues**

The Western Arctic (Inuvialuit) Claims Settlement Act was proclaimed in force on July 26, 1984.

The Inuvialuit Final Agreement of which this was the enabling legislation, establishes, among other things new land-ownership and wildlife management regimes in the Inuvialuit Settlement Region. The Inuvialuit are now the owners of 35 thousand square miles in the Western Arctic. Developers are required to negotiate access where Inuvialuit Lands are concerned with the Inuvialuit Land Administration, subject their proposals to Joint Inuvial uit-Government Environmental Screening and Review processes, and enter into participations agreements with the Inuvialuit Land Administration. Such agreements may cover wildlife compensation, restoration and mitigation, employment, service and supply contracts, education and training and equity participation.

In addition to rents the Inuvialuit obtain from leases of their lands, the Agreement entitles them to royalties on Sand & Gravel from all Inuvialuit Lands. On Section 7 (i)(a) lands, comprising 4,200 square miles, the Inuvialuit have resource ownership rights and are be entitled to royalties.

With respect to the liability of developers, the Agreement establishes compensation measures where it is established that actual wildlife harvest loss or future harvest loss was caused by development.

The Inuvialuit Final Agreement is the first of three comprehensive claims in the Northwest Territories. The others being those of Tungavik Federation of Nunavut and the Dene/ Metis, cover most of the remaining land area in the NWT. These

claims, when settled, may be expected to have similar features to the Inuvialuit Settlement. As an interim measure, until these remaining claims are settled, developers are required to comply with GNWT Renewable Resource . . Compensation Policy. Developers will also have to comply with Northern Land Use Planning Agreements when implemented.

The GNWT supports the land claims process and recognizes the importance of the land selections the Dene/Metis and Inuit must make.

The equitable distribution of the North's resources, a key objective of the claims process, will present challenges to industry and Government.

5. National Energy Program: An Assessment

a) NEP: Objectives

The National Energy Program was introduced by the Federal Government on October 28, 1980. Objectives of the NEP included encouraging Canadian oil industry ownership and control, increasing Canada Land exploration activities, securing national oil self-sufficiency, developing a "made in Canada" oil price, and providing the Government of Canada with greater control over oil industry activities as well as a significant share of hydrocarbon related revenues.

b) Basis for NEP

The National Energy Program was based on two critical assumptions which subsequently proved to be unrealistic. Firstly, the price of oil and gas was to continue increasing significantly in real terms. In fact, the price of oil and gas did not increase significantly. During the ensuing disagreements between the provinces and the Federal Government over resource revenues, oil and gas industry profits were squeezed and industry development proposals were used in some cases for negotiating leverage by political jurisdictions.

Secondly, development was to occur as reserves were proved because of higher prices and greater industry profit expectations. However, the only significant Canadian oil developments which have occured under National Energy Program tenure result from major tax breaks and other concessions provided by Federal and provincial governments. Two major features of the program inhibiting development include the 25% back-in provision and the Petroleum Gas Revenue Tax.

c) **Back-in Provision**

Under the Canada Lands fiscal regime, the Federal Government has the option to take a 25% working interest in petroleum development and production operations. The Crown incurs 25% of all development expenditures and receives 25% of all production. The legislation provides that back-in entry occurs at the time that the development plan is approved. For exploration expenditures made after 1980 the Crown is deemed to contribute in relation to back-in exploration costs, through PIP grants. The oil industry considers these conditions to be the equivalent of expropriation without compensation and a major deterrent to development.

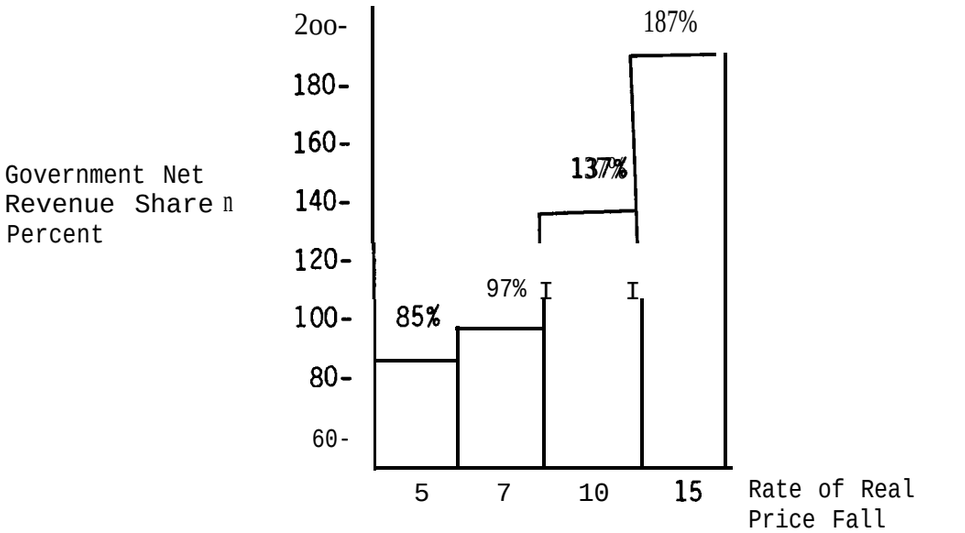
d) **The Petroleum Gas Revenue Tax (PGRT)**

The Petroleum Gas Revenue Tax (PGRT) is a 16% tax on production revenue net of operating costs, non-Crown royalties and, where Crown royalties or taxes based on production are payable, a 25% resource allowance. The PGRT is not deductible for Income Tax purposes. The significance of this tax is that it is payable on the basis of production revenues and not profits. As a result, new developments in frontier areas or in tar sand plants, which tend to be both expensive and capital intensive, are discouraged because of the regressive nature of PGRT.

For example, based on an analysis done through the Economic Council of Canada of Beaufort oil development, it was demonstrated that industry's share of net revenue would drop significantly as oil prices drop. According to the study a 7% drop in real oil prices would result in government collecting 97% of total net revenue. With a 10% drop in prices, government would collect 137% of total net revenue. Similarly, an increase in the discount rate has a significant negative impact on profitability. The government percentage of net revenue shares do not increase significantly under scenarios of rising oil prices.

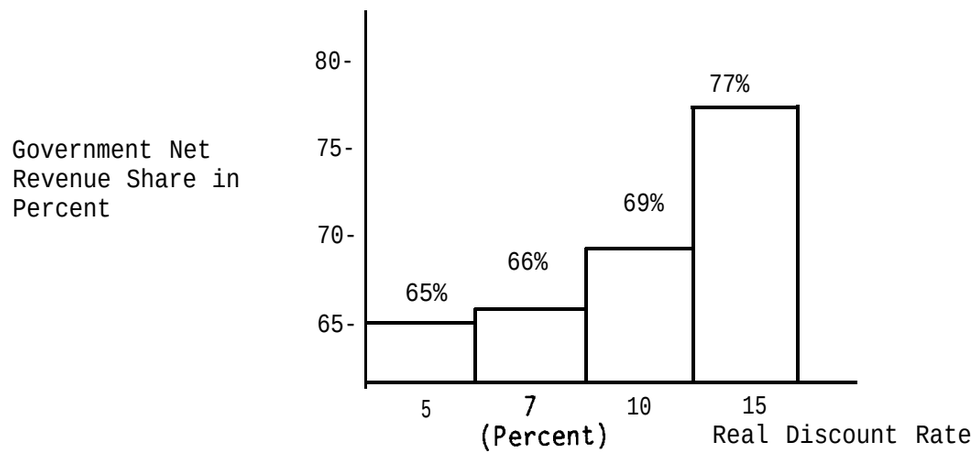
Graphs 9 and 10 illustrate the impact on the oil industry of the current NEP tax regime as applied to the Beaufort Sea area.

Graph 9 **Petroleum Gas Revenue Tax Effect**
Government Revenues/Price Declines



Source: Economic Council of Canada

Graph 10 **Petroleum Gas Revenue Tax Effect Government Revenues/ Interest Rate Increases**



Source: Economic Council of Canada

Notice that as oil prices drop, government revenue shares increase. The same holds true for interest rates; as rates increase government revenue shares also increase. Hence, industry development risks are aggravated rather than offset by government taxation policy. Under a scenario of increasing oil prices, government revenue share remain relatively constant.

e) **Petroleum Incentives Program (PIP)**

The National Energy Program has been more successful in encouraging exploration than development through the use of Petroleum Incentive Program (PIP) grants. Oil industry participants can get reimbursed for up to 80% of eligible exploration expenditures to qualify for the maximum grants. Companies or consortiums have to explore in Canada Lands and maintain a high Canadian Ownership Rate (COR) to qualify.

Exploration activities in Canada Lands have increased significantly over the duration of the National Energy Program.

One major flaw in the Petroleum Incentives Program (PIP) is that it rewards the oil "search" effort rather than the oil "discovery" record. The goal of the NEP has proven to be to develop a general idea of what Canada has in way of oil and gas stocks rather than to promote the rapid discovery, development and production of new oil fields.

Another undesirable impact of the PIP program is its discriminatory nature against the investment of foreign capital. By discouraging foreign investment in high risk areas, government may be reducing the level of exploration activity and exposing Canadian investors to higher levels of risk than foreign companies within the same industry. Some noteable Canadian firms stand as examples of this over exposure to risk.

Overall, however, the Petroleum Incentives Program has provided industry with the capital needed to justify northern oil and gas exploration. This activity has benefited northerners.

B. ENERGY USE IN THE NWT

1. The Situation Today

a) Energy Demand

Living in the NWT is an energy intensive activity. The vast distances between communities and from Southern supply points create a tremendous demand for transportation fuels. The long winters and harsh temperatures demand large quantities of energy for heat.

The generation of electricity with diesel engines requires great amounts of liquid fuels. In fact, Northern (NWT and Yukon Territory) residents consumed approximately 37% more energy per capita than the Canadian average during the first three quarters of 1983.

The largest portion of energy consumed in the NWT is in the form of refined petroleum products. Eighty four percent of the energy territorial residents consume is in the form of one petroleum product or another (see Table 13). The balance is in the forms of *electricity,* wood and natural gas.

Table 13 **End-Use Energy in the NWT (1983)**

The Types of Energy Demanded by the Final Consumer in the NWT	
Wood Products	2%
Natural Gas	4%
Electricity	10%
Refined Petroleum Products	84%

Source: EMR Secretariat

The dependence upon petroleum products is even greater than indicated on the preceding page. Fully, 40% of the electricity consumed by NWT residents is generated by diesel electric plants. These consume about 65 million litres of fuel in 1983. In this case almost 90% of energy consumption in the N.W.T. is generated from petroleum. This dependence on petroleum products has led to some severe problems for the NWT, chief among which is an abnormally high energy cost burden on territorial residents.

Petroleum products can be broken down into the basic fuel types as follows:

Table 14 Petroleum Products Used in **the NWT** (1983)

FUEL	000's Litres	TJ	%
'—Diesel Fuel	161,734	6250	39.0
Fuel Oil (Light & Heavy)	120,886	4742	30.0
Aviation Turbo	66,291	2380	15.0
Kerosene Stove Oil	17,866	673	4.0
Motor Gasoline	42,491	1471	9.0
Aviation Gasoline	8,748	303	2.0
Other	3,141	100	1.0
	,7	15,925	

Source: EMR Secretariat

The industrial sector, primarily the mining industry, accounts for one third of all NWT consumption of energy. Commercial and residential consumption split the remaining 25%. This is contrary to the commonly held notion that residential heating is a major Part of energy use in the North. While the actual value is not small, it is considerably less than transportation and industry.

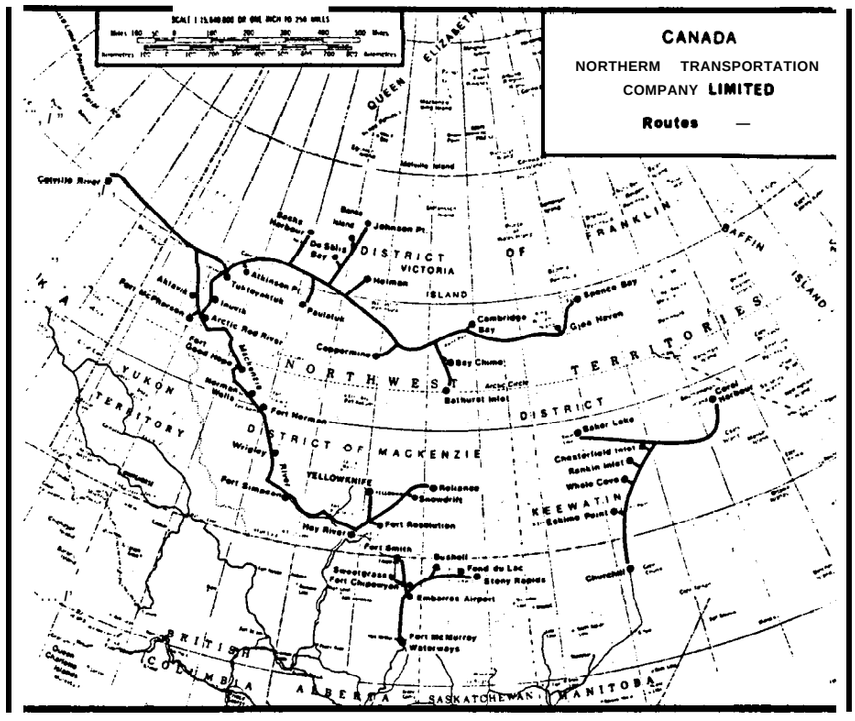
b) **Energy Supply**

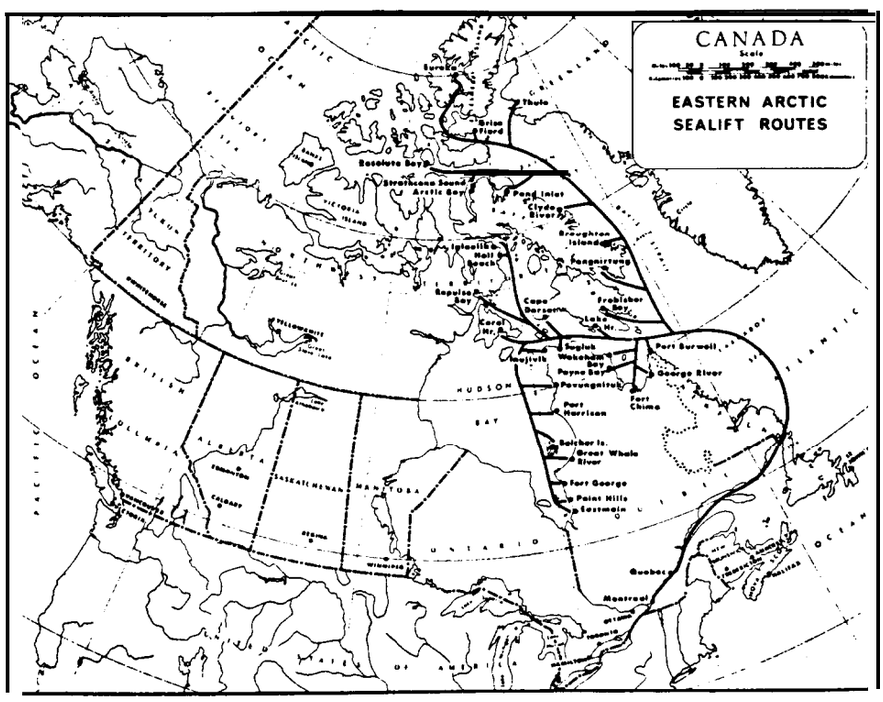
Aside from the production at Norman Wells, all of the petroleum products (liquid fuels) are imported from southern Canada. The Baffin Region imports from Montreal mainly. Churchill supplies the majority of the Keewatin while Edmonton supplies to the Fort Smith Region and parts of Kitikmeot Regions (see Chart 1).

Norman Wells, the only local supply point, services the northern Mackenzie and its Delta as well as some Kitikmeot communities as far east as Spence Bay.

Methods of supply range from sea haul to trucks to railroads to air-lifts. The vast distances, harsh climate and few roads cause high transportation charges applied to the retail price of these liquid fuels. Attempts to reduce these costs by only shipping supplies once a year have resulted in high storage costs in the remote communities.

Chart 1 NUT Petroleum Products - Supply Points and Routes





Source: NORTH Jan. 1983

The Territorial Government plays a large role in the supply of petroleum products to NWT residents primarily in the more remote settlements. Through the POL Division, the government acts as a supplier to the communities that do not have a private dealer. The division purchases the fuels, transports them to the communities, stores them, and then contracts the retailing to a local individual. Such a method of operation is expensive considering that 43 communities are handled this way, each with their own needs and storage facilities, and the large volumes of fuel that must be carried as inventory.

The supply of electricity, wood and natural gas is a different story. All are produced in the NWT. Northern Canada Power Commission (NCPC) is the main supplier of electricity in the NWT while industry supplies itself with a minimal amount. NCPC operates both hydro and diesel generating stations across the Territories.

The geographic realities of the NWT also pose difficulties in the supply of electrical power. Due to low population densities, supply is characterized by a large number of small generating stations with a limited transmission network. This has led to a heavy dependence on diesel generation. Potential hydro sites are often remote from the communities and much larger than required, and thus, much more expensive to construct. Diesel plants, on the other hand, have lower capital costs, greater salvage value, shorter construction time, and can be scaled to the needs of a community. However, diesel plant operation costs are higher than hydro mainly due to the cost of diesel fuel. This fuel is much more expensive than in Southern Canada due to the factors mentioned earlier, and the prices are expected to continue rising.

NCPC has not chosen to develop additional hydro capacity to offset diesel generation and for expected increases in electricity demand. This is in part due to its capital structure which is comprised entirely of interest bearing debt. Since NCPC has no equity component, it does not have the ability to accumulate retained earnings with which to finance capital additions.

Wood supply is mainly in the southwestern area of the Territories but its practicality as a source of energy depends on the growth and quantity of the forests surrounding a particular community. Normally, only fire killed stands located relatively close to the demand centre are presently utilized.

Natural gas is currently being produced at two locations in the NWT but only the Norman Wells production is consumed in the NWT. Produced mainly as a by-product of oil production at this location, natural gas is a major source of energy for the Norman Wells community since it is relatively cheap and environmentally safe.

Distribution to other communities from this and other fields has been hampered by the geographic constraint. Communities are usually too far away or too small to warrant the necessary production and distribution costs. Therefore, Norman Wells remains the only supplier and consumer of natural gas in the NWT.

c) The Cost of Energy

The delivered cost of different energy form varies widely. Table 15 sets out the average delivered cost of the main types of energy in the NWT. The Southern Canada average is derived from ten cities, one in each province.

Table 15 shows that electricity produced from hydro stations is considerably cheaper than diesel engine generated electricity. Wood for home heating, in all locations where it is available, is cheaper than furnace oil.

Table 15 Delivered Unsubsidized Cost of Various Energy Forms (Dec. 1983)

	NWT	$/GJ	Southern Canada +/GJ
Hydro Electricity	9.3¢/kwh	25.83	4.4¢/kwh 12.22
Diesel Electricity	25.22¢/kwh	70.05	N/A
Wood Spruce 20% moisture)	$100 /cord		
Heating Oil	55¢/litre	14.00	34$/1 itre 8.70
Natural Gas	Norman Wells $4. 50/MCF or $160/1000 m^3	4.30	

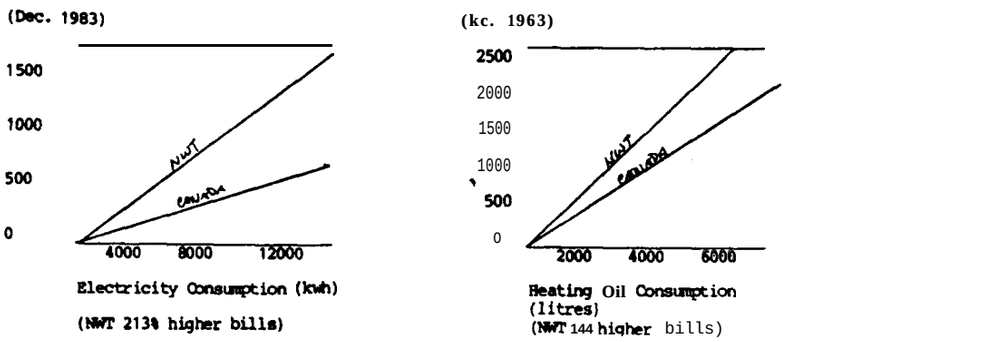
Source: EMR Secretariat

In Southern Canada consumers have a relatively wide selection of energy sources from which to choose. For example, houses can be heated with low cost electricity, propane, natural gas, wood or heating oil. Business and industries have the same options for St. John's, Charlottetown, Halifax, St. John, Montreal, Thunder Bay, Winnipeg, Saskatoon, Edmonton and Vancouver.

In the NWT, however, the list of choices is much smaller. Often there is no choice at all. Consumers are then dependent upon particular fuel which may be quite expensive. Diesel engine generated electricity, for example, is the only source available to the majority of NWT communities. It is an inefficient method of generation, producing *only* about 32% of the energy value of the diesel fuel burned up in useable electricity. The individual consumer is generally unable to change this situation because of the large costs involved with developing a new electrical generating source. It is not surprising that energy prices in the NWT are generally higher than similar products elsewhere in Canada due, principally, to the transportation costs hat must be paid by Northerners.

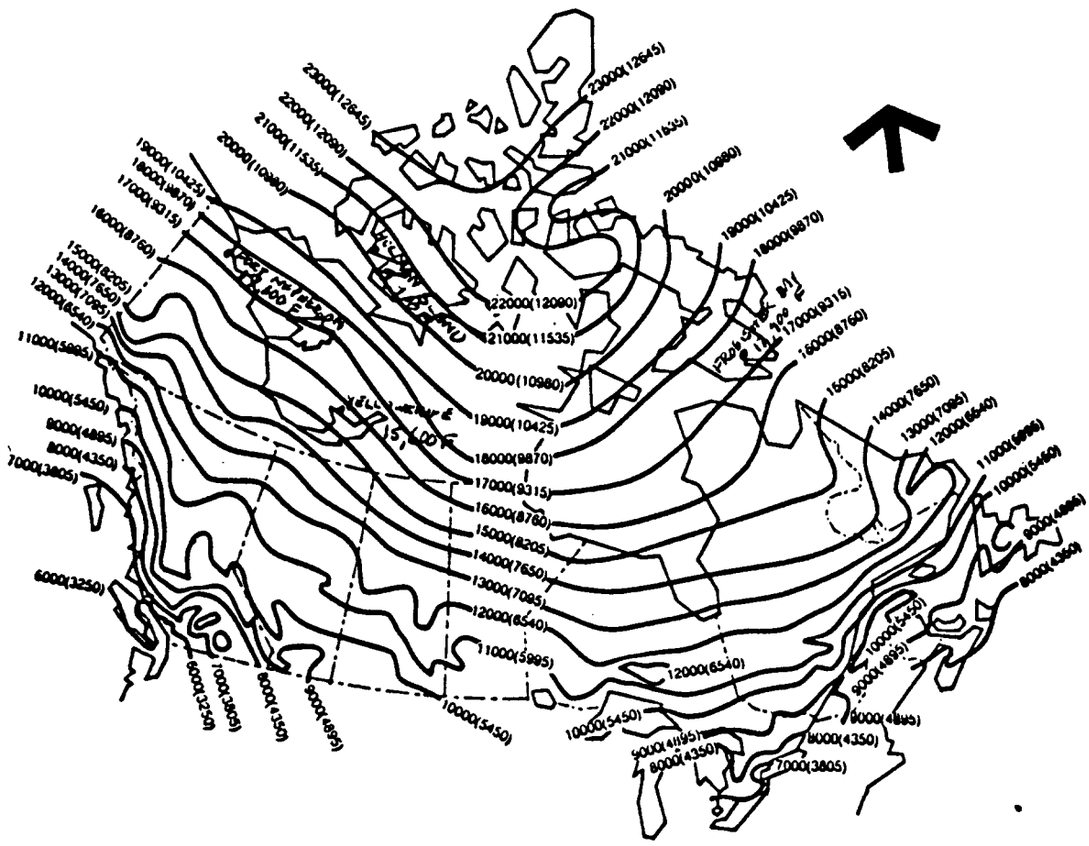
Graph 11 provides a comparison of heating oil and electrical costs across the country. The charts show electrical rates that exceed by a wide margin the Southern norm. On the other hand, the "typical" remote community has fuel prices that appear reasonable in comparison to Southern Canada. In fact, both charts actually grossly understate the difference between NWT and Southern energy costs. There are essentially two other considerations that apply in this equation. Firstly, the colder northern climate increases the final requirement per unit of

Graph 11 **Electricity Bill and Heating Oil Bill Comparisons** for a Remote NWT **Community Consumer vs. a Southern Canadian Consumer**



Source: EMR Secretariat

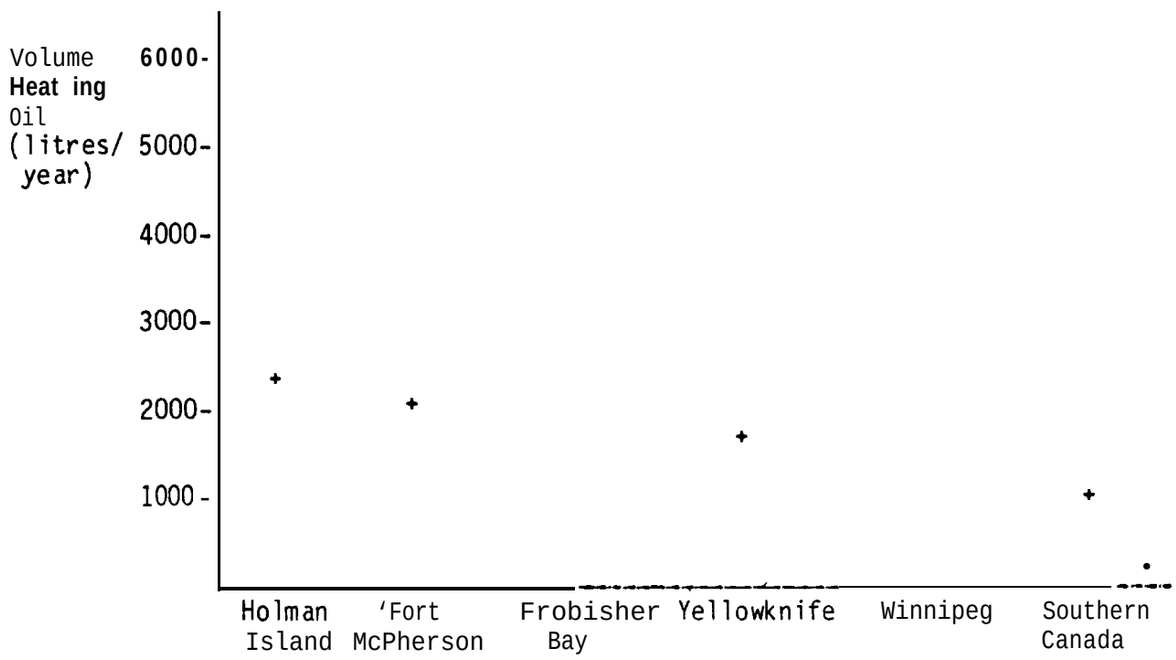
Chart 2 Annual Degree Days in Canada in Fahrenheit (Celsius in parenthesis)



Source: Conservation of Energy in Housing, CMHC 1981

building area. Chart 2 plots "degree days" for Canada as a whole with key communities noted. Though "degree days" is an imperfect measure of residential building heating load, it does provide a rough indication of relative requirement. The point made is that, not only are Northern community prices higher, but residents of the area must consume greater quantities to maintain the same comfort level. Graph 12 illustrates this affect. indicating relative consumption for a comparable dwelling in various places.

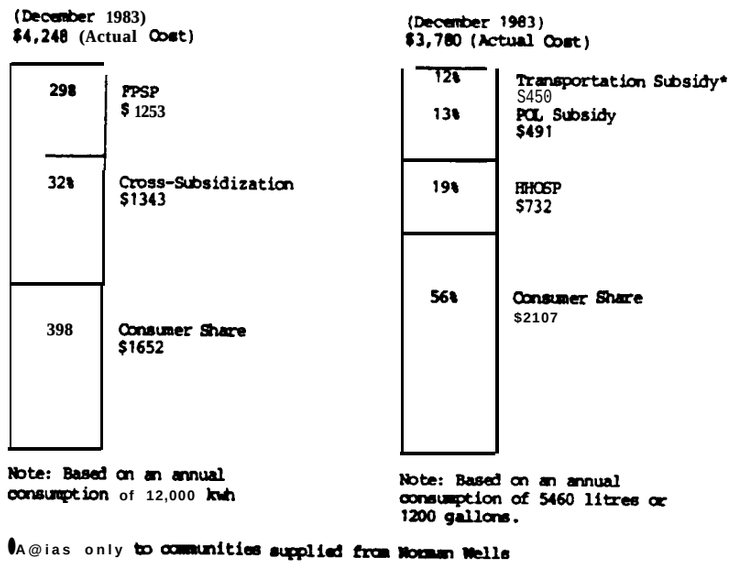
Graph 12 Average Consumption of Heating Oil for a Standard Three Bedroom Single Storey Detached House (December 1983)



Source: EMR Secretariat

Secondly, the price that private northern residents pay for their fuel is highly subsidized by the territorial and federal governments. It was an economic necessity for government to establish these subsidies. Graph 13 shows the current level of subsidization in the average NWT community not on the Snare or Taltson Hydro systems and serviced by POL. It records the fact that domestic consumers pay roughly 56% of the cost of their heating oil, and 39% of the cost of their electricity.

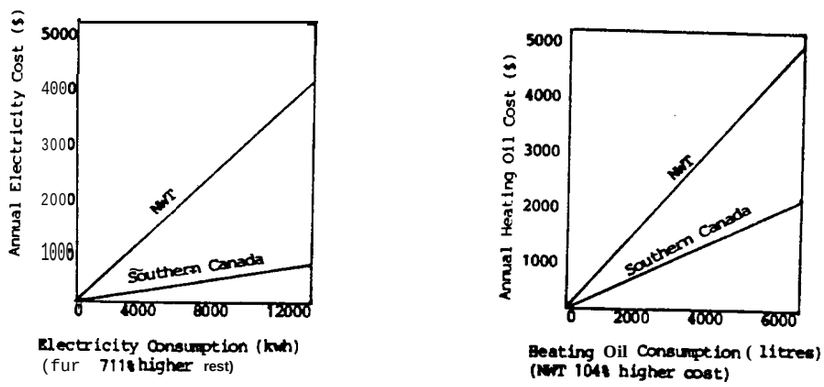
Graph 13 Electrical and Heating Oil Subsidies for a Private Residential Consumer in a Typical Remote NUT Community (December 1983)



Note: Electricity is diesel generated. Source: EMR Secretariat

Considering these two factors, the naturally higher consumption and subsidies, it is possible to compare in a rough way the actual domestic energy burden in the NWT to that of Southern Canada. This comparison is shown in Graph 14.

Graph 14 Cost of Electricity and Heating Oil for a Private Residential Consumer in a Typical Remote NWT Community (December 1983)



Note: Electricity is diesel generated.

Source: EMR Secretariat

Obviously, there are very grave problems here. It is difficult to see how private residents could ever cope with their full energy costs under the existing supply system.

2. Conservation

It has often been said that the cheapest source of energy is conservation. It is cheaper to save a gallon of oil or a kilowatt of electricity than to buy it. There is little doubt that this is valid in the NWT today.

In the private residential, commercial and industrial sectors there are ample incentives to conserve considering that consumers bear the cost of their own consumption. In addition, the Federal Government established programs that assist the residential customer to improve the energy efficiency of his home. These programs, the Canadian Home Insulation Program (CHIP) and Super CHIP, offered up to $1,300 in grants for insulation and other conservation measures. These programs were been well publicized and widely used.

For the private commercial and industry sectors there is a program designed to provide technical assistance and advice on conservation through a free "energy audit" of the customer's premises and operations. Called the National Audit Program, this effort is administered by the province or territory and cost shared with the Federal Government. The GNWT has recently undertaken this program in conjunction with a similar program of its own called the Business Energy Conservation Incentive Program (BECIP).

In the public residential sector, 77% of all residential heating oil is consumed in public housing which comprises about 66% of the total housing stock. This consumption is almost totally subsidized and there is little incentive to conserve. The GNWT is making an effort to stimulate "user-pay" practices. However, it must be realized that for the foreseeable future, given the economic nature of the remote communities, it will not be possible to transfer a large part of the costs to the consumer. Thus the price mechanism, as a force for conservation, will remain largely impotent in these instances.

Also in the public sector, municipal conservation is fostered by the GNWT in a variety of ways, including: advice and assistance and the development of better community design standards.

There is a Federal Program that offers another way to achieve energy savings. Called the Municipal Energy Program, this plan will fully fund the first year costs of a specialist to work with a community to find ways to save energy. With some redesign, this program could provide assistance to a number of communities on a part-time basis.

In all sectors of the NWT economy, there appears to be a need for a more explicit building code that enforces standards appropriate to the climate. These new standards could ensure that future energy costs are considered as important as initial building or retrofit costs in the construction or upgrading of any structure. With this in mind, the Federal Government has begun to develop a new Arctic Housing Standard.

3. Alternative Energy Development

It is highly improbable that the NWT could diversify away from imported petroleum products completely due to the present state of technology and existing economic realities, especially in the transportation sector of the economy. However, there is room for major reductions in petroleum dependency through diversification. Some alternative fuels that could provide new or larger segments of NWT energy supplies are mentioned below. The list is not comprehensive, however those described here can provide a benchmark towards further investigations.

a) Wood

Approximately 9%, or 15,094,000 hectares (37,298,000 acres) of the total Territorial land mass is productive forest. The Boreal Forests on the west side of Great Slave Lake down the Mackenzie River to the Delta comprise 37% with a mean average annual growth rate of 0.8 m^3 per hectare. The Boreal Barrens, northeast of Great Slave Lake and the Mackenzie River to the treeline, cover the remaining 63% with a mean average annual growth rate of 0.4 m^3 per hectare. These figures can be compared to the Canadian average annual growth of 1.7 m^3 per hectare.

Therefore, while the growth is slow, the total volume of wood is high, especially in per capita terms. There are many ways to utilize the energy stored in "biomass solids". The most obvious is to burn the wood in a stove or fireplace for space heat. Currently 14% of the buildings in ten Mackenzie Valley communities utilize wood to some degree. Almost 9% rely exclusively on wood. In fact, up to the late 1940's, that figure would be closer to 100%. Home ownership has an effect on the amount of buildings that utilize wood space heating. Fully 35% of privately owned homes in these 10 communities use wood while only 4% of government houses and building do likewise.

Wood can be used in other generation processes as well. It can be chipped and gasified for small scale production of electricity, similar to the Snowshoe Inn experiment in Fort Providence. Since the 18 month test period (October 1981 to April 1983) the conclusion is that should the minor, yet significant, operation problems be overcome, the advantage of using such a system on a community basis would be cheaper power, increased local employment through wod harvesting, and the conversion away from petroleum products. This is definitely an area for further on-site testing.

Wood can also be converted into methanol, a type of alcohol, and used in much the same way as gasoline and other petroleum products. The conversion process is highly complex and technical and while it is currently produced from natural gas, wood waste and other biomass can be used as the feed with the price of methanol less than gasoline assuming methanol is not subject to the taxes and royalties that currently apply to gasoline.

b) **Hydro**

Similar to the wood gasification scheme noted earl ier, small scale hydro involves tapping a local water source to create electricity on a community by community basis.

In the past, studies were undertaken to investigate hydroelectric potential in the NWT. Most were focused on large scale development in anticipation of high industrial demand from northern oil and gas mega-projects. The studies found the potential was present, but the demand was not.

The focus is now turning towards community based hydroelectrical generation. A Science Advisory Board of the NWT study in August 1983 identified nine communities to have potential for small hydro plants. An additional thirteen communities were also identified and could be included when a "vertical axis" generator passes the development testing stage currently underway in Nova Scotia.

Construction costs of a hydro facility of proportions large enough to accommodate peak demand were weighed against the present value of petroleum fuels estimated to be burned for electrical generation (and, in some cases, space heating) over a forty year period. As a result, the nine and thirteen communities were deemed "economically feasible". Even more communities would be economic if plants generating less than full peak, supplemented by a diesel generator, were considered.

Currently, NCPC is conducting a study of six communities for the purpose of determining the most feasible location for a further in depth study. Should that location he deemed economically and environmentally satisfactory, a demonstration and development small scale hydro plant may be constructed.

With improved technology it may be possible in the near future to . convert many diesel generation plants in the NWT to renewable hydro-generation plants.

c) **Wind**

Only recently has there been a concerted effort on research and development into intermediate scale electrical generation from wind turbines. Many problems have surfaced from these studies, one of which is the variability of wind speeds. Electricity demand requires a constant voltage and frequency. Wind driven turbines power generators with the variable wind speed causing output voltage and frequency to fluctuate. One solution to this problem is to utilize storage batteries but the costs can be quite high, **especially on a** community basis. Another solution is to use the wind turbine, or turbines, as "fuel savers" in conjunction with existing electrical generation means. The wind electricity would be fed into the electrical grid reducing the need for total diesel generation, for example.

An alternative to direct electricity generation from wind power beinq studied is a wind/hydro combination where wind turbines power cylinder pumps to transfer water to a high level reservoir. That water can then be utilized in a conventional hydroelectric generating system.

The Science Advisory Board of the NWT wind energy study of 1982, concluded that the Keewatin Region, along the west coast of Hudson's Bay, has potential as good as any other site in North America. However, the study also noted that there indeed exists periods of calm and, if the wind were used as the principle source of electricity, substantial storage was needed. The harsh environment of the NWT also poses unique problems for wind turbines. The cold and ice force the development and testing of lubes and greases needed to withstand them. Also, overly high and turbulent winds can cause damage to either the wind turbine or the electrical generator.

Currently, unmanned weather and beacon stations in the north are powered by wind turbines. As well the 50 KW vertical axis turbine erected at Churchill, Manitoba is being monitored where climactic conditions are similar to many NWT remote communities. After initial reliability problems, the wind machine now operates at a reliable 90% of its rating. As well, a number of locations are now being studied in depth to determine the capabilities of converting wind energy into a usable, renewable form.

The Science Advisory Board estimated in 1982 that intermediate units (ratings up to 200 KW) could serve a remote community provided some form of storage (batteries, water reservoir) were available, and that a project of this scale would require substantial government support.

d) **Coal**

Coal deposits, primarily of medium and low quality sub-bituminous and lignite, are scattered throughout the Western NWT. Deposit concentrations are near Fort Liard, Norman Wells, the Mackenzie Delta and the adjacent north coast with numerous locations in the northern Arctic Islands. Most of the coal is adequate for home heating purposes but the lower grades do not presently allow for commerical mining for this purpose. However, research and application indicate that coal gasification may be an appropriate conversion technology. The process is currently at the same technological stage as wood gasification, in other words, it is possible but not quite problem-free or economical.

The possibility of a total community coal fired energy system, where coal or coal gas provides electricity and heat, is still open to question. The GNWT has approached the Federal Government in the past with a view to studying this and other types of coal energy alternatives.

Meanwhile, the many large deposits of coal provide a possible future source of northern energy.

e) **Natural Gas**

Natural gas consumption in Canada is currently almost 28% of total energy consumption while the NWT rate is only 4% even though the NWT has 50% (4769Bm3) of Canada's known and potential reserves of natural gas.

Current technology allows natural gas to be used for space heating, electrical generation and natural gas household appliances. However, the production equipment and distribution systems are expensive and lead to higher consumer prices in some NWT communities than other sources of energy. There have been studies by both levels of government and industry on how to best extract and transport natural gas to both northern and southern demand centers. Natural gas can be used as a gas or converted to liquid methanol for most conventional uses. The gas can be transported as a gas or methanol as well as in a liquified or compressed form.

It is not presently feasible to use liquified natural gas (LNG) for remote community use because of costs and safety hazard problems associated with large storage facilities. Also, the "boil-off", liquid returning to its normal gaseous state, would normally be too high for community use when the needed volumes could only be supplied once a year.

Methanol, a safe and non-polluting fuel which can be used in a conventional oil furnace, can be produced in the arctic from natural gas and transported and stored in much the same way as oil products. Supplies can be obtained from almost any proposed natural gas project such as was planned with the Arctic Pilot Project on Melville Island. Estimates made in 1981 place production and capital costs at approximately 43 cents per litre energy equivalent of diesel oil. This can be compared to GNWT diesel costs nearly twice that amount for some remote communities in the High Artic.

In the Western NWT, conventional natural gas seems to be the most feasible and economic form of all the natural gas products. The Federal and Territorial Governments recently commissioned a study on this subject focussing on Great Slave Lake and Mackenzie Delta communities. Supply points, forms of natural gas, supply routes, and serviced locations were examined. The study recommended two proposals: Cameron Hills natural gas to Hay River and Pine Point by pipeline, and Parsons Lake natural gas to Inuvik and Tutktoyaktuk by pipeline. It was estimated that a capital grant of $5.3 million would be needed for the southern system, Hay River and Pine Point, in order to bring the final price down to where consumers would be willing to convert to natural gas. *However, no* grant would be needed if ony Hay River were supplied.

Chart 3 Alternative Energy Options for NWT Communities

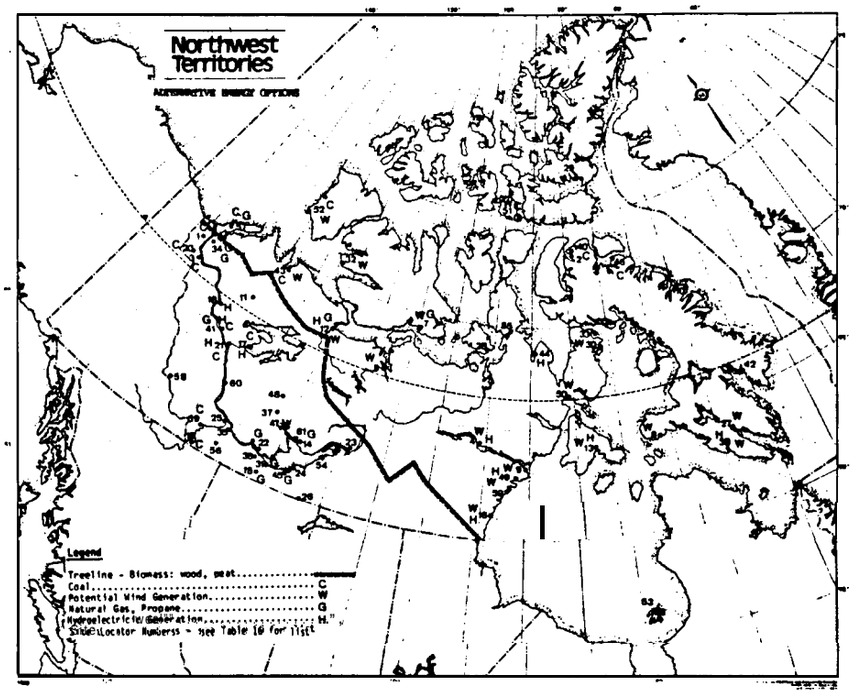


Table 16 Alternative Energy Options for NWT Communities

Community	Locator#	Wind	Coal	Biomass	Gas	Hydro
Aklavik	1		C			
Arctic Bay	2		C			
Arctic Red River	3		C	B		
Baker Lake	4	W				H
Bathurst Inlet	5	W				
Broughton Island	6					
Cambridge Bay	7	W			G	
Cape Dorset	8	W				
Chesterfield Inlet	9	W				
Clyde River	10					
Colville Lake	11					
Coppermine	12	W			G	R
Coral Harbour	13	W				H
Detah	14			B	G	H
Enterprise	15			B	G	H
Eskimo Point	16	W				H
Fort Franklin	17		c	B		H
Fort Good Hope	18			B		H
Fort Liard	19		C	B		
Fort McPherson	20		C	B		
Fort Norman	21		c	B		H
Fort Providence	22			B	G	H
Fort Reliance	23					
Fort Resolution	24			B		H
Fort Simpson	25			B		
Fort Smith	26			B		H
Frobisher Bay	27	W				
Gjoa Haven	28					
Grise Fiord	29					
Rail Beach	30	W				
Hay River	31				G	H
Holman Island	32	W			•	
Igloolik	33	W				
Inuvik	34		c	B	G	
Jean Marie River	35			B		
Rakisa Lake	36			•		H
Lac la Martre	37			B		
Lake Harbour	38	W				H
Nahanni Butte	39		c	B		
Nanisivik	40		c			
Norman Wells	41		c	B	G	R
Pangnirtung	42					
Paulatuk	43	W	c			
Pelly Bay	44					s
Pine Point	45			B	G	H
Pond Inlet	46		c			
Rae Edzo	47			B		H
Rankin Inlet	49	w				S
Repulse Bay	50	W				
Resolute	51	w	c		G	
Sachs Harbour	52	W	c			
Sanikiluaq	53					
snowdrift	54					H
Spence Bay	55					
Trout Lake	56			B		
Tuktoyaktuk	57		c		G	
Tungsten	58			s		
Wha le Cove	59	W				
Wrigley	60			B		
Yellowknife	61			s	G	H

Source: EMR Secretariat

The opposite was true for the northern system. The study estimated a net benefit reduction *in* total energy cost to Inuvik and Tuktoyaktuk of $7.2 milion. One problem with the northern supply, Parsons Lake, is that the gas has a high sulfur content.

f) Other **Energy Alternatives**

Solar Energy, whether through sun heat or solar electrical cells, has limited potential in the NWT.

Solar heat collectors for domestic hot water is the most viable use of direct sun heat in the NWT, however the equipment and installation costs of $2000 (1982 Southern Canada Average), and the fact that many remote northern communities barely glimpse the sun in winter, make the application severly limited.

Nuclear energy, specifically the Slowpoke Reactor, while an extremely controversial issue, has been making great development and safety strides in Canada in the last ten years. The development may have particular application to many NWT remote settlements where space heating and electricity costs are overly high. The NWT Science Advisory Council has been requested by the NWT Legislative Assembly to review the concept and the economics behind the Slowpoke Reactor.

Neat Recovery Systems on NCPC generators are now installed in seven NWT communities and all are judged successful. MeanMile, the GNWT, NCPC and industry are currently looking into additional sites as well as improved and more complete heat recovery systems in current sites.

Chart 3 and Table 15 provides a summary of the Alternative Energy Options available in the NWT. Potentially anything inside the tree-line could utilize biomass in the form of wood and in some cases peat. It is important to realize that many of these alternatives are uneconomical at current petroleum product cost levels. As well, in some cases insufficient energy would be produced to meet current or future energy needs. Lastly, in many instances diesel back-up generation would be required.

C **ROLE OF THE GNWT IN ENERGY RESOURCE DEVELOPMENT**

The increased economic value of hydrocarbon and mineral resources throughout the 1970's generally and the National Energy Program specifically changed the basic economic structure of the NWT. The economy has moved from one based primarily on renewable resource harvesting to one relying much more heavily on the non-renewable resource sector. While hydrocarbon and resource prices are generally depressed for the moment it can be expected that population and per capita income growth will continue worldwide and that this will create continued upward pressure on limited resources.

Northern resource development will be massive by traditional standards. Each potential project - Beaufort, Norman Wells, Arctic Pilot Project, Polar Gas and Slave River Hydro Developments - has been called a mega project in its own right. Such projects could provide tremendous opportunities for northerners. These projects could also seriously damage the socio-economic fabric of northern lifestyles, and the natural environment on which these lifestyles depend. Clearly northerners must be given the opportunity to participate in resource development but they must also have the choice of pursuing traditional activities. The opportunity to follow traditional pursuits cannot be compromised by resource development activities.

The GNWT's goal is to increase its influence over resource developments so that northerners can have an effective voice in determining what the north of tomorrow will be like and to benefit from resource development.

The National Energy Program, in particular Bill C-48, was of great concern to the GNWT. The former Minister of Energy, Mines and Resources, the Honorable Richard Nerysoo, summed up GNWT sentiments on Bill C-48 when he spoke to the Standing Committee on Natural Resources and Public Works in Ottawa on April 2, 1984:

> "Bill C-48 would hamstring further constitutional development in the NWT. The bill firmly reserves the benefits of all oil and gas " resources to the control and benef t of the Federal Government. ..the entire NWT - mainland and islands, underground and underwater."

Generally speaking, the National Energy Program may have slowed down constitutional development but at the same time it caused the GNWT to examine its role in the resource development process carefully. Where Federal legislation and mandate was clear, the GNWT demanded the right to participate. Where there were gaps in Federal mandate, the GNWT moved to fill them with their own policies. The GNWT has a long way to go before reaching a satisfactory level of control over resource development but it has made some noteable progress including the Resource Development Policy, a Resource Management and Revenue Sharing Proposal, Renewable Resource Compensation Policy and the Energy Policy.

The following list of initiatives provides a clear indication of the GNWT goal of obtaining a reasonable level of regulatory and management control over the development of resource and energy related projects.

1. Resource Development Policy

In 1982 the Executive Council approved the GNWT Resource Development Policy. The policy identifies nine principles used in the evaluation of resource development projects. The policy was a preliminary step to increase the GNWT role in development project reviews.

The Government of the Northwest Territories will approve a resource development project when its overall economic, social and environmental implications are judged to result in net benefit to the people of the Northwest Territories.

The Resource Development Policy is based on the following principles:

a) Opportunities for jobs, training, and business development shall be maximized to ensure economic benefits.

b) The NWT shall derive energy benefits and secure energy supply from energy producing projects to help offset the loss of resources and to contribute to achieving energy self sufficiency.

c) The environment and renewable resource activities shall be protected.

d) Northern lifestyles and cultural heritage will be protected.

e) Local communities and interest groups will participate in consultation programs to ensure that resource projects are responsible to public concerns.

f) The interests of native groups shall be recognized.

g) Social and economic disruption shall be identified and monitored, and corrective measures developed and assigned to industry and appropriate levels of government.

h) Expansion of existing communities to support resource development shall occur in an orderly manner in keeping with the wishes of residents, and when this expansion is uneconomic or undesirable, new single-resource communities may be established.

i) An equitable share of resource revenues should accrue to the NWT.

The Resource Development Policy also involves the designation of Development Impact Zones and the formation of Zone Groups. Development Impact Zone (DIZ) groups represent the public interests of the zone and are formed largely from existing bodies such as municipal, band and regional councils as well as from native organizations. The DIZ groups' role is to identify local and regional issues associated with impacts related to resource development proposals. As well DIZ groups recommend mitigative measures. DIZ groups are accountable directly to and advise the GNWT Minister of Energy, Mines and Resources.

Four such groups have already been formed. The first was established in response to the Slave River hydro project, the second due to Mackenzie Delta-Beaufort development, the third in the Great Bear region in response to the Norman Wells project and the fourth in the High Arctic in response to the Bent Horn Project.

Resource Development Policy action plan activities to date have been ineffective and not fully implemented. A key issue underlying GNWT credibility in these activities is the lack of legislation and the assumption that the GNWT has limited jurisdiction to enact legislation. Recent studies have supported the GNWT's mandate concerning the development of legislation on socio-economic and certain environmental matters. As a result, it is concluded that the GNWT has the legislative mandate to enact an ordinance dealing with these matters pursuant to Section 13 of the Northwest Territories Act . It is to be noted that GNWT legislation would not duplicate or conflict with any existing federal act used to control resource activities.

2* Resource Management and Revenue Sharing

A Resource Management and Revenue Sharing Agreement with the Government of Canada would secure for the Territorial Government a wide range of provincial type authorities and responsibilities over resource development activities.

The GNWT began its resource management and revenue sharing preparations in 1982 at a time when Provincial governments were negotiating agreements of a similar nature. The initial Federal response was cool but the GNWT remains confident that intergovernmental discussions will begin in 1985.

Most recently the Honorable David Crombie, Minister of Indian Affairs and Northern Development, in a speech to the 10th Legislative Assembly of the NWT, stated that he intended "to seek the support of Cabinet colleagues to start discussions in this regard with " territorial governments. These discussions could lead to joint Federal/Territorial natural resource management and the sharing of revenues derived from development." As well, the Honorable David Crombie made a commitment that the GNWT will share resource revenues from the recently announced Bent Horn project.

A Resource Management and Revenue Sharing Agreement will provide a basis from which government can effectively manage northern resources. It is the GNWT's hope that such an agreement, in concert with other GNWT initiatives, will go a long way to reducing the complexity which is perceived to surround the current development approvals process. A number of issues such as native claims and division have been dealt with in relation to GNWT revenue sharing aspirations.

Native claim negotiations and settlements are not jeopardized or compromised by GNWT resource revenue sharing negotiations because where aboriginal organizations have ownership of subsurface rights the GNWT recognizes their right to royalties from resource extraction.

When division occurs, any resource revenue sharing agreement signed could be transferred to the new political bodies established.

The Canada Oil and Gas Lands Administration (COGLA) currently deals with oil and gas related issues in the NWT concerning land management, engineering, resource evaluation, environmental protection and Canada benefits. The GNWT has no role within this organization. This situation is unacceptable to the GNWT. Ideally a management structure similar to the Canada-Nova Scotia Offshore Oil and Gas Board would be preferred. This would allow the GNWT to have a much greater role in the management of hydrocarbon developments.

The GNWT is looking at the Newfoundland and Nova Scotia agreements with interest. These two agreements, more than any others, stand as useful precedents because of the jurisdictional issues involved.

3. Renewable Resource Compensation Policy

This policy, as revised on November 7, 1984, applies to any developer proposing a new resource development project which could directly affect renewable resource harvesting. The policy applies to land, sea, ice and water resources which are used by northern renewable resource harvesters.

The Government of the Northwest Territories requires that any developer proposing a resource development project which could affect renewable resource harvesting activities must prepare a detailed Compensation Plan that will be submittal prior to approval of development proposals.

The Compensation Plan will form the basis for a compensation agreement to be developed directly between the developer and the community or individual affected

This policy is based on the following principles:

1. Persons who are dependent upon or gain livelihood from the renewable resource base, or who share in, or are directly dependent on the products of the harvest require protection against the effects of resource development on their property, on the renewable resources, and on their ability to harvest renewable resources.

2. Costs associated with the loss of renewable resources will be taken into account in the overall planning, design and approval of resource development projects.

3. The resource developer is responsible for payment of costs associated with those impacts which result from development activity.

4. Prevention and mitigation of impacts of the renewable resource base and economy to the degree possible are the first priority in managing the effects of development. Mitigation is prerequisite to considering any compensation arrangements.

The policy's intent is to guide non renewable resource development so it will be more compatible with the renewable resource sector of the NWT economy.

A recent example of policy application is Panarctic's commitment to develop and implement compensation agreements as a safeguard against any adverse effects on renewable resource harvesting activities from its newly approved Bent Horn oil project on Cameron Island.

4. Energy Policy

This policy, approved on October 19, 1983, provides direction to all departments and agencies of the Government of the NWT relating to the production, delivery and use of energy within the NWT, in order to guide the creation of appropriate programs and to provide a basis for joint consultation with other governments and the private sector.

The Government of the NWT will promote the efficient use of energy in the NWT and increase the utilization of NWT energy resources in a manner consistent with the economic and social well being of its people.

The Government of the Northwest Territories will act according to the following principles:

1. Residents will be helped to recognize and avoid waste.

2. Consumer financial responsibility for energy purchases will be increased.

3. Energy efficiency in buildings will be encouraged.

4. Administrative practices within government relating to energy use will be redesigned to promote conservation.

5. NWT energy use will be monitored to provide the basis for energy planning.

6. New sources of energy will be identified on a community by community basis.

7. Industry shall be encouraged to contribute to the identification of community alternative supply.

8. Projects proposing to supply energy to NWT residents will be evaluated and approved according to their long run ability to deliver a sure and low cost supply that is consistent with the interests of the people affected.

The Energy Policy provides a framework for continued emphasis on conservation and alternative energy development. This initiative would be hampered by a failure on the part of the Federal Government to recognize these issues as priorities and to fund and cooperate accordingly.

STATEMENT OF DATA SOURCES

In the preparation of this submission, the GNWT has relied heavily on public sources of information. Some organizations and publications whose data is frequently used include:

1. Economic Council of Canada
   Principally discussion papers numbers 235, 251, 258, 259, 260 and 262

2. Geological Survey of Canada Paper 83-31, EMR 1984

3. National Energy Program 1980, Subsequent provincial agreements

4. Canadian Petroleum Industry Monitoring Survey

5. Canadian Energy Trends

6. Report of Special Committee on Alternative Energy to Canada 1981

7. Newspapers - Globe and Mail, Financial Post

8. Outcrop, NWT Data Book 1984

9. Statistics Canada, Statistics NWT

10. NWT Science Advisory Board

11. Northern Canada Power Commission

12. Energy Conservation Division - GNWT

A detailed list of sources is available at request from the Energy, Mines and Resources Secretariat, GNWT