

**INLAND WATERS DIRECTORATE
DELPHI-NORTH**

February 15, 1974

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Department of the Environment**

DELPHI FORECAST OF EVENTS IN THE CANADIAN NORTH
THAT WILL AFFECT WATER RESOURCE MANAGEMENT

A study commissioned by:

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SYNOPSIS

This study provides part of the data base required for long range planning within the Inland Waters Directorate. For the purpose of planning, Canada can be divided into regions according to the natural drainage basins, modified by the rights of the federal government to operate in a given region. The region chosen for this study is generally north of the 60th parallel. A map is in Appendix I.

The first step in this planning is to get a broad picture of the future events of each region for the next 20 years. An example of a broad picture is provided by the Delphi forecast contained in this report. It is a pilot study for in-depth forecast studies which could follow when the planning methodology is fully developed and tested.

This pilot study makes use of the expertise of fifteen panelists who have experience in the north, and expertise relevant to the data base required. It was completed in a near record time of three months of part time effort. A typical Delphi study has about fifty panelists, uses mailed questionnaires, and takes about one year to complete. One of the contributing factors in reducing the time for this Delphi study was the use of a courier to deliver and pick up questionnaires in the Ottawa region.

The data obtained in this pilot study is adequate for a first round of long range planning. When recommendations are made for long range policies and plans, it may be found that some of the data should be checked and updated. Future Delphi studies for the Inland Waters Directorate may use larger panels. The time required for a larger study may be speeded up greatly by the use of computer conferencing techniques.

THE DELPHI TECHNIQUE OF FORECASTING

The Delphi technique is a rational and systematic way to make use of expert opinion. In a Delphi "round", the panelists are individually asked for their opinion and their reasons for it. The opinions are given to a confidential analyst who will then classify the opinions and send them to all of the panelists in the next round. In each round, the members of the panel reconsider their opinions. They are asked again for an opinion, which is sent to the analyst. After several rounds of opinions, a consensus of opinion is usually achieved.

The Delphi technique may be used to get opinions about:

- Forecast dates for future events which are expected to occur
- Forecast probabilities of events occurring by a given date
- Forecast markets
- Changes in technical, economic and social trends
- Benefits of a proposed project
- Probabilities attached to benefits which are expected to follow a decision
- Consequences of new policy proposals

Naturally, much depends on the quality of expertise that is contained in the panel. Both depth and variety of expertise are desirable on a panel.

The Delphi technique has many variations in its use, but a good Delphi should meet the following four criteria:

1. Anonymity

The forecast or opinion of any panelist is anonymous. Panelists may or may not discuss the issues involved in a face to face situation, but the actual forecasts of each panelist must remain anonymous forever. Any pressure to conform, follow a leader, or oppose a personality, is minimized by anonymity.

2. Iteration

The panelists are asked to make several forecasts or opinion statements in a succession of "rounds". There are usually two to four rounds. A questionnaire format is frequently used for each round.

3. Feedback

The opinions, forecasts, and comments of each panelist, are given to the other panelists so that they can reconsider. This is done through the anonymity of a confidential analyst. The feedback is usually included with each round of questions.

4. Uncertainty indication

The uncertainty that panelists have in their forecasts or opinions is included in the feedback and in the final report. The uncertainty is included by some indication of the extreme forecasts or opinions, as well as the central one. If the forecast is in numbers, the statistical measure used is the interquartile range. Twenty-five percent of the responses are above this range, and twenty-five percent are below it.

The Delphi technique got its start in the 1950's by the RAND corporation, a prestigious "think tank" research organization in the U.S.A. The technique was developed and tested with technological forecasting. Some of these forecasts are old enough now to be compared with what has actually happened. The results are good. More recently, the Delphi technique has been extended to forecasting social and economic trends. As yet there is no validation for non-technical forecasting. The argument in favour of the Delphi technique, is that it is a rational approach to futures forecasting. About the future, we have no facts, only opinions. Delphi is the best known way of using expert opinions.

Cross Impact Analysis is a sophisticated addition to the basic Delphi technique. With it, one can determine whether or not a set of numerical forecast events are consistent with each other. Moreover, one can assess the impact of advancing or delaying a potential event by assessing the change on other event forecasts. This procedure can lead to a rational assessment of policy proposals.

Some of the uses of the Delphi technique by the Canadian Government are shown in Appendix II. Governments, industries, and institutions all over the world are becoming aware of forecasting techniques, especially of Delphi. The record of use is impressive, even if so far small. A list of references are included in Appendix III.

OBJECTIVES AND CRITERIA FOR THE DELPHI STUDY

The following objectives were developed on November 20, 1973.

Objectives state what is to be achieved when the problem solution is working. (i.e. the Delphi study is under way)

In order of importance, they are:

1. To produce forecasts for Northern development which will affect hydrology, in order to develop alternative policy and goal recommendations to meet over-all IWD objectives.¹
2. To take into account the seasonal nature of the Department's and the panelists' activities.
3. To actively encourage the involvement of IWD personnel in the development and use of the forecasts.

¹ The IWD objective is to manage the use of the water resources in Canada in the optimum² manner.

² Optimization is to be done with respect to the Montebello priorities.

The following criteria were developed on November 21, 1973:

Criteria are to be used for judging the merit of various experimental designs of the Delphi study.

1. The forecast, if in the form of a median date and its Interquartile Range,* (IQR), should have an uncertainty measure equivalent to:

$$IQR \leq \frac{\text{Median date} - \text{base date}}{3}$$

If the standard deviation σ , is known, then

$$IQR \equiv 1.4 \sigma$$

2. The median date minus the base date is to lie in the range of 2 to 20 years.
3. Events which have a direct impact on water resources are to have priority over events having an indirect effect, when there is a trade off of resources available for the study versus data available from the study.
4. The criteria for involvement is that the experimental design be expandable for the involvement of more IWD personnel in some phase of the forecast-to-goal cycle, with the future Delphi initiated planning cycles.
5. 75% of the people involved in a post assessment would agree that they were truly involved.
6. The Delphi study and its report are to be completed by February 18, 1974.

* 25% of forecasted dates are below the lower quartile and 25% are above the upper quartile. Thus the IQR contains 50% of the forecasts. An extreme forecast is earlier (or later) than 75% of the forecasts.

PANELISTS

On November 26, 1973, we developed the following criteria for selecting panelists:

1. Expertise is the most important criterion. The ideal panelist has been involved for more than one year in a major undertaking of the North.
2. The expertise is in at least one of the fields of hydrology, economics, mining, resource development, petroleum, tourism, transportation, political science, building technology, ecology.
3. Preference is for panelists with broad experience of the North and with expertise in many fields.
4. Panelist must be willing to reply to 3 rounds before February 4, and preferably be interested in contributing his time and expertise.

Those panelists who consented to their names being published in this report are shown in Appendix IV. We are extremely grateful to them and to the other panelists. Of fifteen panelists selected, only one dropped out after round one, and we were forewarned that this could happen, as the panelist was extremely busy.

Because of panelists being away or sick during the week allowed for a reply, we anticipated that fifteen panelists would result in ten replies per round. This was about right for the replies received in the first week, and enabled us to revise the questionnaire for the next round. A few replies came back in the second and third weeks after the start of a round, so that the final totals were -

Round one - 13
Round two - 14
Round three - 14

We attribute this excellent response to the interest that the panelists had in participating. It is also significant that we used a private courier and express delivery mail. Some Delphi studies have lost so many panelists that they have had only fifteen replies from round three when starting with fifty at the beginning.

Expertise was self rated by the panelist on the four word semantic scale shown below. The weighting used in calculating the range is shown on the right, but this weight was not known by the panelists.

EXPERTISE: Rate your own level of expertise with respect to each question answered according to the following categories.

	<u>Weight Used</u>
- <u>Expert</u> (E): A member of the <u>top 50 experts</u> on this question; having recognized expertise on the topic through publishing, consulting or advising.	8
- <u>Quite Familiar</u> (QF): Devote a large part of your time to the topic of this question and know about most of the work of others on this topic.	4
- <u>Familiar</u> (F): Keep reasonably well informed by reading and conversing, but not a specialist on the topic of the question.	2
- <u>No Rating</u> (NR): The forecast dates are an assessment on general reading and conversing in the field of this topic.	1

In many cases the weights had no significant effect on the calculated range, because the panelists generally agreed on the forecast. However, in a few cases the more expert panelists disagreed with the lesser experts, and the high weight given to experts had a significant effect on the final range.

The panelists had a general tendency not to use the "Expert" category of expertise, even when it appeared that they could have rated themselves among the top fifty experts on the question.

The time taken to fill out questionnaires varied from ten minutes to three hours, with an average of one hour and fifteen minutes.

UNCERTAINTY MEASURE

The variation in the forecast dates of this study is expressed as a "range". With only ten to fourteen forecasts on a question being available, to indicate the median, lower quartile and upper quartile, as is usually done,

would be a distortion of the data. Instead, calculations of the weighted mean WM, and its standard deviation, σ , were made, and the equivalent upper and lower quartiles were calculated as -

$$\text{Lower quartile} \equiv \text{WM} - .7 \sigma$$

$$\text{Upper quartile} \equiv \text{WM} + .7 \sigma$$

A sample calculation is shown in Appendix V.

RESULTS

The forecasted events were expanded from twenty-six to thirty-one as a result of additions suggested by panelists in rounds two and three. The results are summarized in figures 1, 2, and 3.

Much of the data meets the uncertainty measure established in the beginning as a criterion. That is, the range is less than one-third of the weighted mean time from the present. However a significant number of forecasts have a large proportion in the category of "never or later than 2000", with a significant cluster of forecasts about a date about ten years from the present. These are often due to dual thought modes, which were not resolved by rephrasing the question.

For example, 40% of the weighted replies forecast the occurrence of a pipeline in the Mackenzie Valley in five to ten years, yet 30% were forecasting very much later or never. Examination of the comments will show that there is uncertainty about two main factors. These were the existence of enough gas in Canada to warrant a pipeline, and the ability of the Canadian and U.S. governments to agree to share a pipeline. The forecasts are therefore impacted by the event of a Canada-U.S. accord on energy sharing. It would probably be possible to reduce the forecasts to one mode by changing the question to: "Given a Canada-U.S. accord, when will a major oil pipeline on the Mackenzie Valley be completed?"

The dual thought modes are apparent in the soon or never forecasts of a few other questions, where there are very different points of view and no middle ground. Informative comments of all rounds are included in Appendix VI.

For planning purposes, the data base is most useful. A few events are forecast so early in the future that long term planning for research would be a waste of time. These early events will be responded to in the traditional crisis fashion. Other events are clearly very likely in the next five to fifteen years, and their forecasts can be useful in planning. About six events are forecast with less than a 50% chance of occurring at all in the foreseeable future. Consequently planners can address themselves to such events with a lower priority than the events with a high chance of occurring.

Thus, the first objective, to produce forecasts for developing alternative policy and goal recommendations, has been achieved.

The second objective, to take into account the seasonal nature of the department and panelists' activities, has been achieved by completing the study well before the spring thaw.

The third objective, to encourage the involvement of IWD personnel, was partly achieved by having them as one-third of the panelists. Another one-third were from other parts of DOE, and one-third from outside DOE. By means of the Delphi, IWD panelists interacted with other experts and became better informed. Most panelists reported that they found their participation to be interesting and indicated their willingness to be participants in another Delphi study.

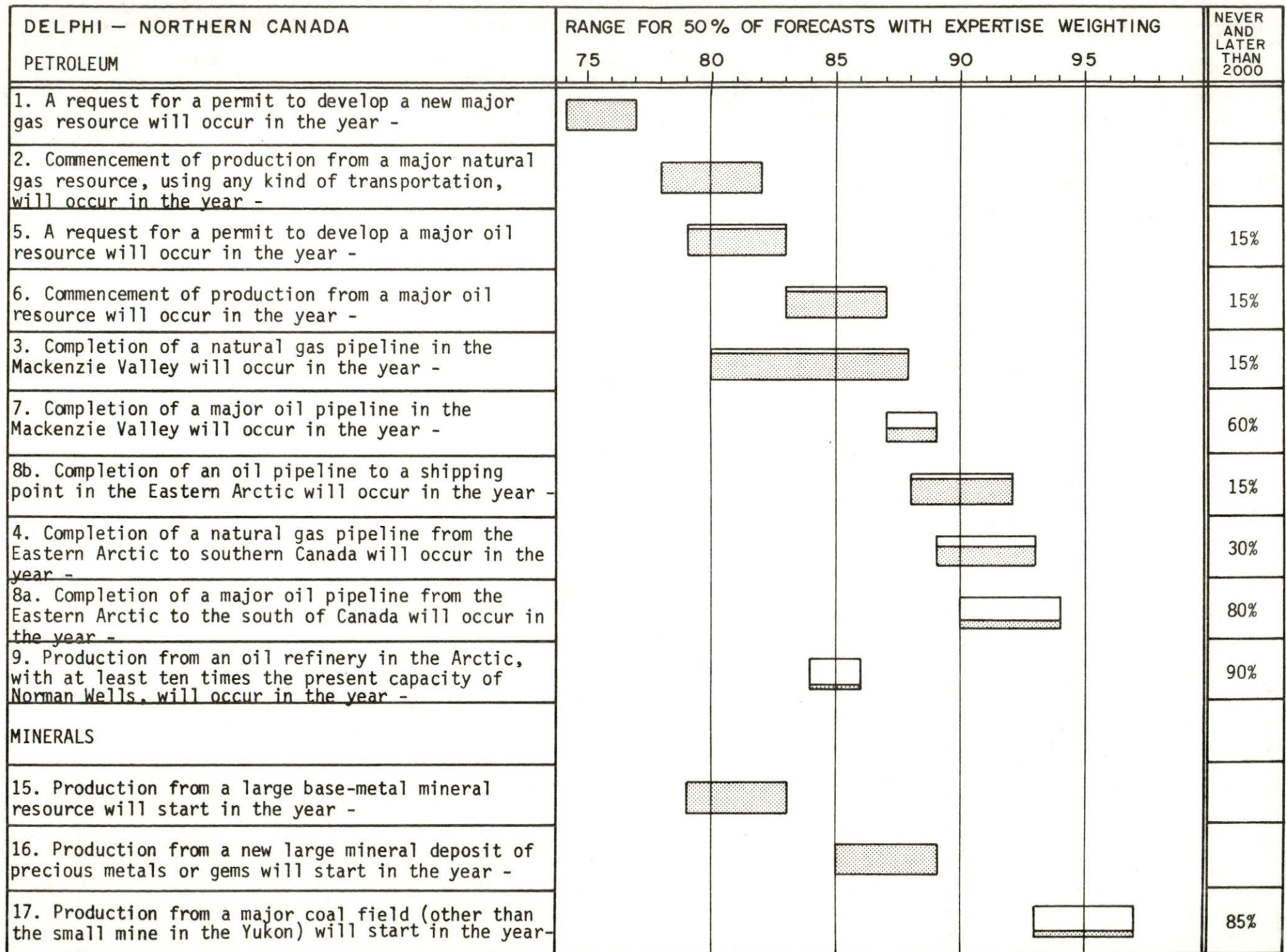


Figure 1

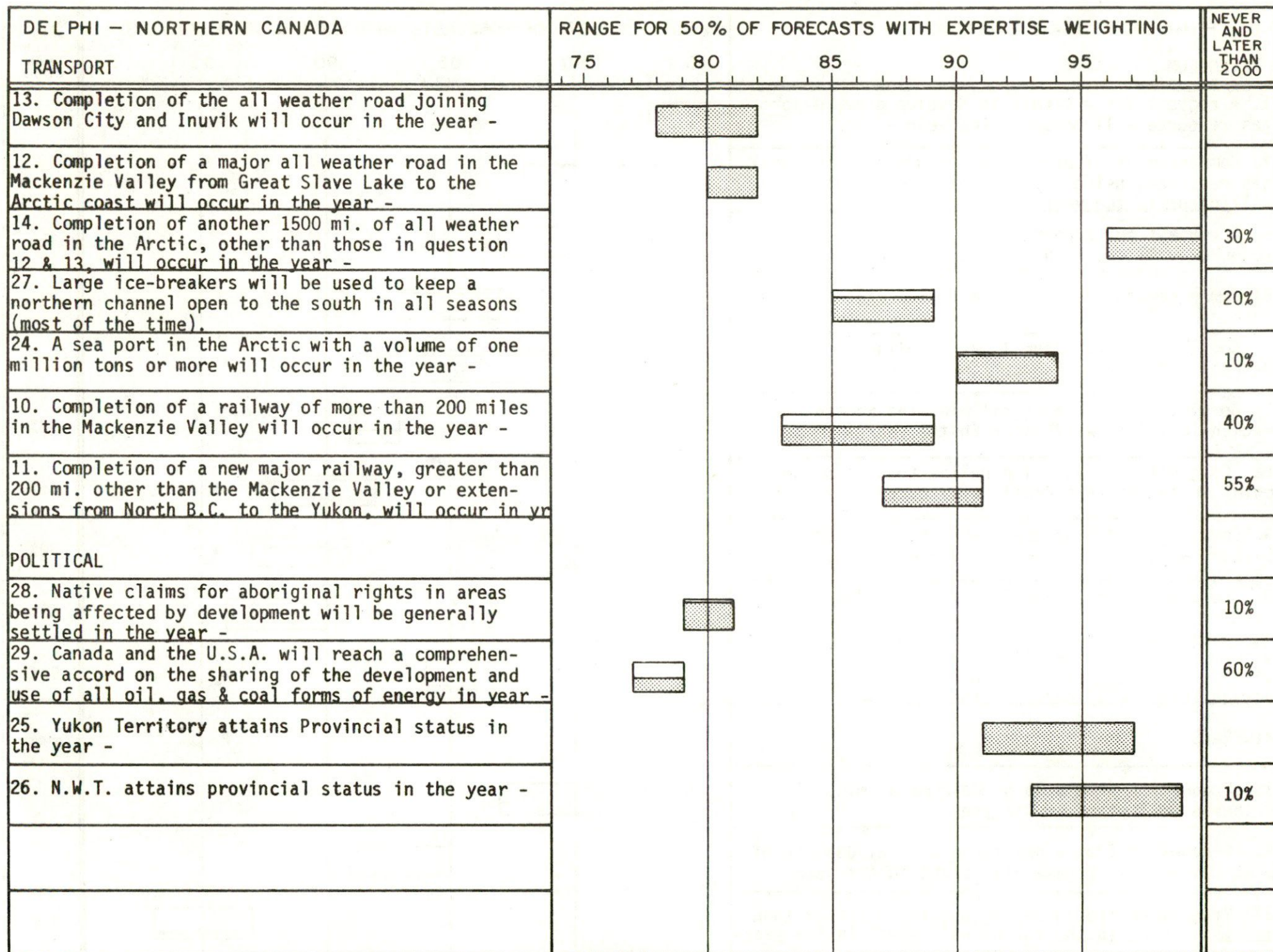


Figure 2

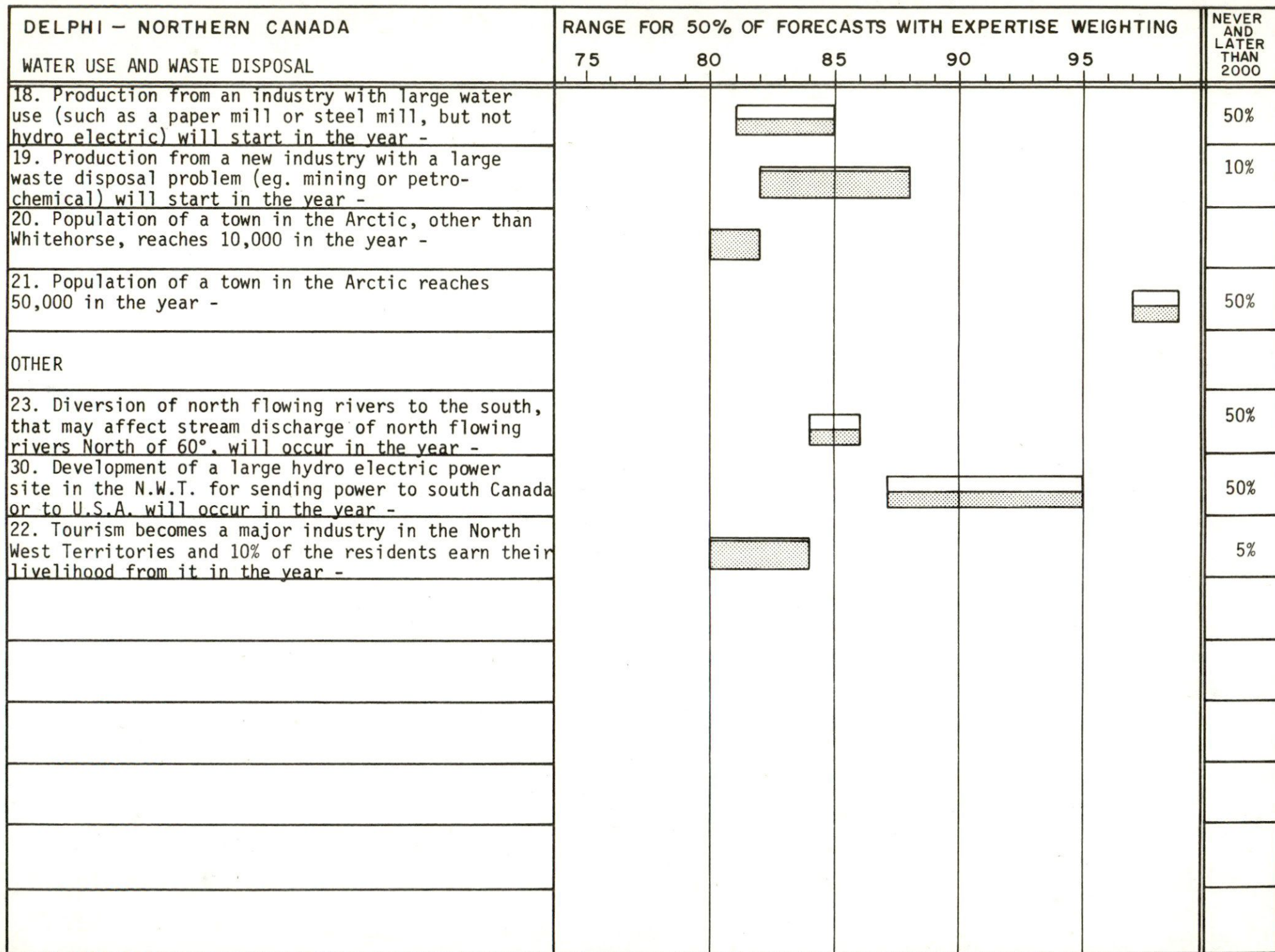


Figure 3



DELPHI FORECASTING IN GOVERNMENT

Prepared by S. F. Love - February 1974

DPW, Policy Research Group:

GOVERNMENT EMPLOYMENT FORECAST (FOR FACILITIES PLANNING)

DOE, Fisheries & Marine Service:

AN EXPLORATION OF THE FUTURE IN FISHERIES DEVELOPMENT ON
CANADIAN ATLANTIC COAST

DOE, Inland Waters Directorate:

EVENTS IN THE CANADIAN NORTH THAT WILL AFFECT WATER RESOURCE
MANAGEMENT

PO, Market Development Branch:

LABOUR MANAGEMENT TRENDS IN THE FUTURE

TRANSPORTATION

FUTURE OF POST OFFICE

ECONOMIC COUNCIL OF CANADA:

SOCIAL INDICATORS NEEDED AND THEIR PRIORITIES

MUA

URBAN TRENDS, ISSUES AND CONCERNS

HWC

PUBLIC PARTICIPATION

FUTURE OF GENETIC COUNSELLING

MSST

PETROCHEMICAL INDUSTRY

REFERENCES

CETRON, RALPH, Industrial Applications of Technological Forecasting, Wiley, 1971.

BRIGHT, JAMES R., Technological Forecasting for Industry and Government, Prentice-Hall, 1968.

MARTINO, JOSEPH P., Technological Forecasting for Decision Making, Amer-Elsevier, 1972.

INSTITUTE FOR THE FUTURE, Futures Research as an Aid to Government Planning in Canada: Four Workshop Demonstrations, Menlo Park, Calif. Report R-22, 1971.

DALKEY, N., The Delphi Method: An Experimental Study of Group Opinion, The RAND Corp., RM-5888-PR, June 1969.

PANELISTS FOR DELPHI - NORTH

Fifteen panelists started, fourteen finished and eight gave permission for their names to be included in this report.

Miss Moira Dunbar
Head, Geotechnical Section, DREO
Defence Research Board
Ottawa, Ontario

Dr. J. Ross Mackay,
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University of British Columbia
Vancouver 8, B.C.

Mr. E. D. Fowler, Head
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Dept. of Energy, Mines & Resources
Ottawa, Ontario

Mr. L. A. C. O. Hunt
Chief, Information and Liaison
Dept. Indian and Northern Affairs
Ottawa, Ontario

Mr. A. S. Qureshi, Head
Hydrometric Network Planning &
Forecasting Section
Applied Hydrology Division
Water Resources Branch, DOE
Ottawa, Ontario

Prof. Cecil E. Law
Executive Director
Can. Inst. of Guided Ground Transport
Queen's University
Kingston, Ontario

Dr. E. F. Roots
Science Adviser
Department of Environment
Ottawa, Ontario

Forecast Analysis of Question 5, Round 3, Synopsis: Permit for oil

Date: February 4, 1974

Recorded Data	Expertise Weights w	Time from 1980 t	Weighted time wt	Deviation from Weighted Mean d'	(d') ²	w(d') ²
1982	2	2	4	1	1	2
79	2	-1	-2	-2	4	8
79	1	-1	-1	-2	4	4
N	4					
81	1	1	1	0	0	0
82	1	2	2	1	1	1
78	2	-2	-4	-3	9	18
80	4	0	0	-1	1	4
86	2	6	12	5	25	50
84	2	4	8	3	9	18
82	1	2	2	1	1	1
82	2	2	4	1	1	2
79	1	-1	-1	-2	4	4

n = 12

W = $\sum w = 21$

$\sum t = 14$

$\sum wt = 25$

$\sum w(d')^2 = 112$

n_N = 1

W_N = 4

$\sum /n = 1$

$\sum /W = 1$

$.7 \sqrt{\frac{\sum}{W-1}} = 2$

Mean = 1981

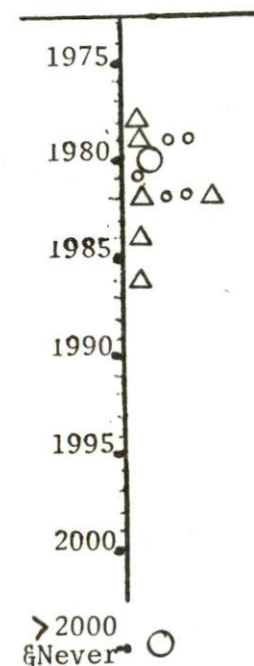
Weighted

Mean = 1981

Weighted Range = 1979-83

%N = $\frac{4}{21+4} \times 100 = 16\%$

Plot



No. of
Modes = 2

■ Expert $\frac{w}{8}$
 ○ Quite familiar 4
 △ Familiar 2
 ○ Not rated 1

COMMENTS ON QUESTION:

1. A request for a permit to develop a new major gas resource will occur in the year -

ROUND ONE

QF - 1974; I have had contacts with the consortium involved and am familiar with their plans. I have also visited test sites, the basic problem is that at present there is insufficient Canadian gas resources to warrant the diameter of the pipe suggested.

E - 1973; It is possible that the request will be made in January or even February 1974. I am assuming undeveloped resources such as Mackenzie Delta and Prudhoe Bay to be "new".

F - 1990; The Mackenzie Valley pipeline construction will be delayed due to existing political climate whereby Canada appears to be an unreliable source of oil and gas to the U.S.A. and it will take 15 years to prove a field of adequate potential in Canada to justify a pipeline to transport a higher priced gas. If a Canada-U.S.A. agreement can be reached soon, then the request date could be moved ahead to as soon as 1978.

QF - 1974; The date is contingent upon no decision, by U.S. authorities, to build a gas pipeline parallel to the Alaska oil line. Also, settlement of native claims.

ROUND TWO

QF - 1974; It now appears that the presentation date has been deferred considerably. The reason is not yet known.

F - 1992; It will take 15 years to explore a gas field, and U.S. is not likely to consider Canada a reliable country to pipe gas through.

QF - 1980; I favour a later date because the native land claims issue will have to be settled first.

ROUND THREE NOT REQUIRED

COMMENTS ON QUESTION:

2. Commencement of production from a major natural gas resource, using any kind of transportation, will occur in the year -

ROUND ONE

QF - 1979; Any application for permit will take the National Energy Board up to eighteen months to consider. In addition there are local hearings under the Territorial Land Act. Following satisfactory hearings a pipeline could not begin transportation for (3 years).

F - 1983; Meaning shipping by ship or L.N.G. or local use for petro-chemical---on assumption that local fuel market (eg. Mackenzie delta) is not economical or insignificant and that for some reason pipeline denied or found impractical.

F - 1990; It will require 15 years for El Paso Oil to develop the technology of compressing gas economically. The price of gas will rise substantially in that time.

NR - 1985; First, a source needs to be found; then transport would need to be by road/rail/air/boat. The most likely for the Western Arctic is a pipeline; but for the Eastern Arctic, with ice breakers, boats might transport liquid gas.

ROUND TWO

QF - 1979; The next six months are critical, from the point of view of price and policy developments. There may be real merit in re-asking this question in six months' time.

NR - 1983; Eastern Arctic gas will be produced first. Environmental impact studies, under sea ice pipeline technology development, permit hearings and construction will place production about 1983 if required reserves are proven by 1975.

F - 1995; It will require another three years to commence production.

ROUND THREE NOT REQUIRED

COMMENTS ON QUESTION:

3. Completion of a natural gas pipeline in the Mackenzie Valley will occur in the year -

ROUND ONE

- 1979; While there is a shortfall of 15 trillion cu. ft. of gas to warrant a pipeline, unless the Americans can be persuaded to send their Prudhoe Bay gas via Canada, there could be a delay in building the pipeline. Much depends on current drilling in the Beaufort Sea.

QF - 1980; Assuming granting of a permit, though native peoples claims could defer this.

F - 1993; This will occur three years after No. 1 because it will require three years to complete construction of the pipeline.

QF - 1980; So far, not enough gas is available (found) to justify a Canadian line without U.S. gas.

F - Never; My guess is that Delta gas will go south via Prudhoe Bay and southern Alaska where it will be liquefied for tanker transportation to markets.

ROUND TWO

QF - 1980; I believe a natural gas pipeline will be completed in the period 1977-83.

QF - 2000; I anticipate construction of a pipeline in Alaska for transport of natural gas to U.S. markets. Without Alaskan gas, Mackenzie gas pipeline not economically viable.

NR - Never; Prudhoe Bay gas will parallel the Alaska oil line and Canadian proven reserves will not support a Mackenzie pipeline. By the time Delta gas reserves are economic the Alaska gas pipeline will be the financially sound route to move Canadian gas.

F - 1979; Assuming that pipeline is the route chosen.

ROUND THREE

QF - 1989; As events of questions 1 & 2 are probable, and gas in the Delta in large quantities is not yet found, 1981 seems too early.

NR - Never; The odds now favour the El Paso application for an Alaska gas pipeline to compressor stations on tidewater. Gas must be produced from Prudhoe Bay simultaneously with proposed oil production in 1978. It now appears too late for the Mackenzie line to make this target date.

QF - 1995; Much depends on Canada - U.S. relations. If relations improve the date range is reasonable.

F - 1985; Construction will be delayed for a combination of above reasons. (Alaska line and not enough gas from Mackenzie alone).

NR - 1980; It will be an oil and liquid gas pipeline.

COMMENTS ON QUESTION:

4. Completion of a natural gas pipeline from the Eastern Arctic to southern Canada will occur in the year -

ROUND ONE

NR - 1985; If, as Hetherington of Pan Arctic Gas has stated publicly, an Eastern Arctic gas pipeline will be built before the Mackenzie Delta pipeline. Granted he has sufficient reserves, but the technology is far from solved. It may still be sent in Liquid Natural Gas vessels.

F - 1986; There is no normal course of events yet established here. Estimate easily displaced many years either way by any one of several events.

QF - 1990; Technical problems are vast, particularly in underwater, under-ice, entry and exit to ice.

NR - 2020; The problems of ice scour of a pipeline and the requirement for pumping gas 200 miles or more between islands in the Arctic are difficult. It will take many years to find a pipeline route and to study it. At present there is no solid program to accomplish this work.

ROUND TWO

F - 1990; But it may well be only to an Arctic transshipment port, in which case it could be earlier.

QF - 1995; I envisage the possibility of a pipeline to Lancaster Sound across Ellesmere and Devon Island thence liquid natural gas to the south.

F - Never; If the Americans are talking seriously of shipping gas by tanker from Valdez to the U.S. West Coast, a complete eastern Arctic pipeline seems improbable.

NR - 1983; Pressing energy demands in the eastern U.S. & Canada will spur development of Eastern Arctic gas fields now nearing threshold volumes for pipelining. Native land claims and environmental impact should be less of a problem than in the Mackenzie Valley and therefore advance completion date.

F - Never; I do not believe that a pipeline to Eastern Canada is an economic mode.

QF - 1995; Mackenzie Delta gas and gas from fields in S. Canada (which will be marketed due to higher prices) will satisfy our needs in the eighties and early 90's.

ROUND THREE

F - Never; I think the pipeline will go only part of the way---the remainder as liquid gas.

F - Never; I think a combination of pipeline and liquid natural gas tanker more likely.

NR - 1983; Pressing energy demand, escalating prices and eastern Arctic gas discoveries now close to threshold volumes for economical pipelining, together with government involvement in E. Arctic, gas exploration and production and technological research already under way, will speed this gas to market.

QF - After 2000; The practical problems of crossing long stretches of the Arctic Ocean will take much time to solve.

F - 1993; Forecast depends on rate of technological advance and availability of huge capital and political decisions re export of gas.

Question 4 - Round Three (Cont'd)

F - I accept the proposition of liquid natural gas through Ellesmere Island as the route most likely to occur. It may take many years before a satisfactory under ice pipeline can be constructed. Underwater technology with possibility of ice scouring is still unknown.

QF - 1995; I am assuming that the Mackenzie Valley gas pipeline will be approved. (This is presently my best judgement). In this case there will be no need for Arctic Islands gas until mid-late 1990's. If my assumption is wrong the Arctic Islands line will be completed in 1982.

COMMENTS ON QUESTION:

5. A request for a permit to develop a major oil resource will occur in the year -

ROUND ONE

F - 1980; It will likely take three or four more years to prove out sufficient reserves.

F - 1982; If exploration is significantly increased in the north, the chances of a major discovery improve. In any case, aboriginal land rights may delay exploration, and the government may wish to resolve these. With the current energy crisis and government financial involvement, we may see a major oil resource quickly.

F - 1995; No oil field which is adequate to justify a pipeline has been discovered in Canada. It will take 20 years to explore a field which will justify a pipeline to transport an anticipated higher priced gas.

F - 1980; So far, no large oil resource has yet been found sufficient to justify a pipeline.

- 1978; If they find one: - there is a good deal of counting chickens before they are hatched going on at the moment.

ROUND TWO

QF - 1990; Unless there is an upsurge in oil exploration far in excess of today's operations, a major oil resource may never be discovered. Government policy will dictate the time frame.

F - 1975; Recent price trends and income forecasts reduce the size of proven reserves needed before application for permit will be submitted, and much of regulatory, environmental, etc. groundwork being done ahead of schedule for gas line.

F - 1985; No oil has yet been found to justify even a small pipeline.

F - 1978; The two most likely areas will take at least 6-8 years to explore, but pressures for development will still be high. By 1985 or so the story may be different.

F - After 2000; So far no substantial oil field has been discovered.

ROUND THREE

QF - After 2000; So far no substantial oil field has been discovered.

F - 1982; Oil exploration must be intensified in the Arctic---well head prices will dictate whether the returns on investment capital is justified.

F - 1986; The short sightedness of current government and lack of incentives and forward thinking may delay 1985 date. There will be very limited northern oil exploration in 70's unless government changes.

COMMENTS ON QUESTION:

6. Commencement of production from a major oil resource will occur in the year -

ROUND ONE

F - 1985; Approximately five years will be required after sufficient reserves are proven to raise capital and construct the pipeline.

F - 1985; So much depends on finding the resource. Exploration over the past 15 years has revealed little. Only major investment and a concerted and co-ordinated effort, involving millions of dollars will bring results, and this cannot be guaranteed.

F - 1980; In Mackenzie Valley.

F - 1984; Limited production (Mackenzie area) with barge or tanker movement is possible at an earlier date. I am ignoring Alaskan and East coast production except Prudhoe Bay which could affect Canada.

F - 1992; No oil field which is adequate to justify a pipeline has been discovered in Canada. It will take 20 years to explore a field which will justify a pipeline to transport an anticipated higher priced gas.

ROUND TWO

QF - 1990; Unless there is an upsurge in oil exploration far in excess of today's operations, a major oil resource may never be discovered. Government policy will dictate the time frame.

F - 1990; Oil must be found; application must then be made and approved before production can start.

F - After 2000; So far no substantial oil field has been discovered.

ROUND THREE

F - 1995; The schedule 1984-88 is too tight. It is only 14 years away.

NR - 1983; The Alaska pipeline will be in operation and make the relatively short line from the Mackenzie Delta oil field to Prudhoe Bay economic at an earlier date and will also shorten the time required for public hearings and construction. The government has also recently stated that land claims will not deter pipelining.

QF - After 2000; So far no substantial oil field has been discovered.

F - 1986; The sedimentary area in the Arctic is so large that the volume you estimate of petroleum potential could be as high as 50 billion barrels. Only by intensified exploration will it be found.

QF - 1982; Production will start at an early date to construct refineries which will satisfy local needs.

F - 1993; It takes 9 years on the average from the find to the commencement of production.

COMMENTS ON QUESTION:

7. Completion of a major oil pipeline in the Mackenzie Valley will occur in the year -
ROUND ONE

F - 1995; Very debatable even in the long term. Results so far have been disappointing. Am pessimistic about new discoveries.

QF - 1985; Perhaps never, as sufficient oil has not been found.

F - Never; I believe Delta and offshore oil will move in the same direction as gas via Prudhoe Bay and southern Alaska. Very prolific new discoveries could alter the picture however.

QF - 1990; I am thinking of a trunk pipeline along the valley of 1000+ miles in length.

ROUND TWO

QF - Never; Insufficient oil reserves so far discovered; no foreseeable possibility.

NR - Beyond 2000; Economics and disappointing oil discoveries in Mackenzie and availability of southern oil supplies e.g. Tar sands.

F - Oil must be found; application must then be made and approved before production can start.

NR - Never; Delta oil will move via pipeline to Prudhoe Bay and South Alaska to largely American markets. Athabasca Tar Sand development will handle Canadian requirements.

QF - Never; I doubt that an oil pipeline will be acceptable in the Mackenzie Valley, and further, oil discoveries so far won't support one.

F - After 2000; So far the only northern oil fields are in Alaska.

QF - 2000; The TAPS route or oil tankers will be used as either of these are likely to be more economical than a Mackenzie Valley pipeline.

ROUND THREE

QF - Never; I don't believe an oil pipeline will be acceptable in the Mackenzie Valley.

NR - Never; Two major pipelines from the Western Arctic are not economically viable. Delta oil if producible will go via Prudhoe Bay for export (mostly), and Athabasca oil sands will supplement Canadian market requirements as conventional oil in Alberta depletes.

F - Never; Influenced by comments above.

NR - After 1990; Oil reserves slow to accumulate unless major discoveries found in the next few years. Exploration rate in this high cost area will decrease.

F - 1987; If oil is found in sufficient quantities a pipeline will be built---tar sands notwithstanding. I think, provided oil exploration is intensified, that a major source will be found, maybe offshore in the Beaufort sea.

COMMENTS ON QUESTION:

8a. Completion of a major oil pipeline from the Eastern Arctic to the south of Canada will occur in the year -

ROUND ONE

F - Never; I see no possible oil pipeline now or in the future. Should oil be found say in the Fosheim Peninsula, I can see a pipeline to tidewater in Baffin Bay, thence by icebreaker tanker.

F - Never; There are no oil fields in the Eastern Arctic although there are favorable geological indications. A very large oil field would have to be found to justify a pipeline.

NR - 1990; Requires a discovery of major size.

- Never; Probably tanker if discoveries warrant production.

ROUND TWO

NR - Never; Boats will transport oil in this region.

F - Never; Probably would be simpler when and if a viable field is found to carry by some form of tanker (air or submarine are possibilities) to east coast ports.

NR - Never; Oil will be shipped out by boat.

NR - Never; If oil is discovered in producible quantities icebreaker tankers will likely prove less environmentally hazardous than sea-bed under-ice pipelines.

F - Never; As stated, no oil fields, only favourable indications.

F - After 2000; So far the only northern oil fields are in Alaska.

QF - Never; We have no indication that large oilfields will be discovered in the area. Even if some were found, oil tankers will be more economical.

ROUND THREE

F - Never; Combination of short pipeline and tanker more likely.

NR - Never; Environmental risk too great. No oil discovered to date. Transport by icebreaker tankers if discoveries warrant.

QF - After 2000; No oil field has been found as yet, although there are favorable indications.

- Never; Indications are Eastern Arctic is potential for gas but much less oil potential.

COMMENTS ON QUESTION:

8b. Completion of an oil pipeline to a shipping point in the Eastern Arctic will occur in the year -

ROUND ONE

No comments.

Question 8b. - (cont'd)

ROUND TWO

QF - 1986-90; Panarctic oil claims there is sufficient technology to build such a line, when and if sufficient oil reserves are found.

F - 1990 or later; Will require at least until 1990 to prove up an adequate supply and develop collector system.

NR - 1988; Field collector lines to tidewater only. May be a number of Eastern Arctic tanker shipping points, if discoveries are made.

F - 1986; Later development is less likely for some time because of world energy developments.

F - After 2000; So far the only northern oil fields are in Alaska.

ROUND THREE

F - 1990; If it has not occurred by 1990 it will probably not happen for a further 20+ years, or until other world supplies badly reduced.

NR - Never; Indications are that Eastern Arctic has potential for gas, but much less for oil.

NR - 2000; I agree that by 1990 adequate supplies may have been found but a pipeline would take at least another 10 years to complete.

QF - 1987; Summer shipping from an ice-free port will require only a relatively short pipeline and can thus start early.

COMMENTS ON QUESTION:

9. Production from an oil refinery in the Arctic, with at least ten times the present capacity of Norman Wells, will occur in the year -

ROUND ONE

F - Never; Except for purely domestic purposes. I see no possibility of an oil refinery in the Arctic. The one at Norman Wells is uneconomic, because its volume is too small. When icebreaker tankers can penetrate the Arctic, it may be cheaper to ship in the processed products from the South.

F - Never; The oil refinery at Norman Wells is operating. If you mean a new refinery then this would await depletion of the N.W. oil fields, which is 100 years plus away.

ROUND TWO

NR - 1990; It would not make sense to forecast a refinery operating earlier than a producing source of crude (1985).

NR - Never; Oil will be shipped bulk to southern refineries.

QF - Never; The Norman Wells refinery is uneconomic due to the limited range of products produced. The same would apply to any refinery in the Arctic. I favour bringing in supplies by tanker.

F - Never; My guess is never for a very large refinery. Several small specialized refineries may materialize.

Question 9 - Round Two - (cont'd)

F - Never; Major air pollution problems associated with a northern refinery in a fragile environment will materially increase costs of refined materials, if solutions to problems can be found. As a result it will probably be economical to transport major amounts of products back to north.

NR - Never; Capacity of this order will not be required within practical shipping range of an Arctic refinery.

F - 1982; A local refinery may well be essential to field development in the Mackenzie Delta.

F - After 2000; So far the only northern oil fields are in Alaska.

QF - Never; Refinery capacity will never be developed beyond the needs of the Arctic Region itself.

ROUND THREE

QF - After 2000; No large oil field has been discovered and only large refineries fed by large sources are economic at present.

NR - Never; Any oil discovered will be shipped to southern refineries.

F - Never; For economic reasons it would be cheaper to import the refined products by sea.

COMMENT ON QUESTION:

10. Completion of a railway of more than 200 miles in the Mackenzie Valley will occur in the year -

ROUND ONE

F - 1998; Currently an alternative to a pipeline to carry oil and gas---has implications for extending the continental rail network northward into the Territories. MOT/CN/CP study not completed. (\$3 billion cost and \$200 million operating cost to move two million barrels of oil per day by rail)

F - Never; This is another scheme of dubious economic advantage. Current feasibility studies are almost bound to turn down a railway for a variety of reasons. I cannot foresee any volumes of traffic that would warrant its construction in the foreseeable future.

F - Never; In Mackenzie Valley proper---doubtful. Greater possibility of railway along route farther east.

F - 1985; Dependent on finding base metal deposits.

F - Never; Railheads will soon be existing in the Yukon Territories which will be closer to Inuvik than to Hay River.

ROUND TWO

NR - 1990; Inclined to say never, but fuel shortage may boost railway construction, and it can carry more than just oil.

F - 1990; Railroad may well be used to service mines---not oil.

QF - Never; No justification in foreseeable future for a railway.

Question 10 - Round Two - (cont'd)

F - 1990; Willing to gamble on a mineral deposit justifying 200 miles of railway within 15 years. Fuel prices alone will rule against trucking and for rail traffic.

F - Never; No reason for a railway that boats and trucks cannot handle.

NR - Never; The Mackenzie Highway and seasonal river transportation will handle the traffic and have less environmental impact.

E - 1980; A 200 mile extension from Hay River is not much.

F - After 2000; New railheads in the Yukon will provide adequate service considering the load.

ROUND THREE

E - 1980; 200 miles is not far. A railway is more economic and less damaging than it appears. It is less damaging than a road.

QF - After 2000; Adequate service will be provided by roads to the Yukon railheads and road and river transportation along Mackenzie.

COMMENTS ON QUESTION:

11. Completion of a new major railway, greater than 200 miles, other than the Mackenzie Valley or extensions from Northern B.C. to the Yukon, will occur in the year -

ROUND ONE

F - 2010; Much depends on logistic requirements defined by Polar Arctic Gas and Canadian Arctic Gas study.

F - Never; I see no demand for a railway. While the river can handle any given load for 5 months in the year, other heavy traffic can use winter haulage over frozen ground, should it be required.

ROUND TWO

F - 2000; Only unless major economic developments occur which so far are unknown.

F - 1990; Increased fuel costs will continue to encourage oil transport over road and air. Almost inevitable that rail network will grow.

QF - Never; Other methods will likely be used---hovercraft---large scale snowmobiles---tractor trains over winter period and aircraft and water transport in summer.

F - Never; Railways will not be as suitable as trucks and boats.

NR - Never; Highways will serve not only extraction industries but tourist development as well.

QF - 1985; Baffin Land is a possible location of a special purpose railway.

F - After 2000; Alternative freighting methods and routes can cope with the traffic load.

Question 11 - (cont'd)

ROUND THREE

E - 1988; There is potential for rail operations in several possible areas, especially if the Great Slave Lake route is extended.

QF - After 2000; There is even less likelihood of a railway outside of the Mackenzie Valley.

NR - Never; Other methods will be used.

F - 1992; The possibility of railroad extensions, in Northern B.C. and southern Yukon are genuine and will take place with extensions to Ross River (anvil) and possibly to the Crest ore body by the suggested dates.

COMMENT ON QUESTION:

12 - Completion of a major all weather road in the Mackenzie Valley from Great Slave Lake to the Arctic coast will occur in the year -

ROUND ONE

QF - 1980; Technology pretty well advanced now and a major assessment of Mackenzie corridor is nearing completion.

F - 1985; Although the P.M.'s announcement in 1972 sparked a drive to build this road, economic events have caught up with reality. Who wants the road? The natives, No. Oil companies, No. It looks like a political play which backfired. However, it will be built in time.

F - 1977; It is possible to construct 200 miles of road per year, but the money votes for this project are not likely to average more than enough to construct 90 to 100 miles per year.

ROUND TWO

F - 1985; Government is beginning to change its priorities and the Mackenzie road is low on the list. A little will be done each year to eventual completion.

QF - 1980 or never; Feel that by 1980 it will be possible to drive to Tuktoyaktuk in almost any season of year, but doubt greatly that it will become a major road in the sense that the Alaska Highway was 1950-65.

F - 1984; There is no road construction now between Ft. Simpson and Arctic Red River.

F - 1985; An all weather road to the coast is a pretty significant undertaking. Nobody wants it, but it may well be built anyway.

ROUND THREE NOT REQUIRED

COMMENT ON QUESTION:

13 - Completion of the all weather road joining Dawson City and Inuvik will occur in the year -

ROUND ONE

QF - 1977; Location pretty well settled and much of assessment has been completed.

F - 1979; This road is far more advanced in construction than the Mackenzie Highway. It doesn't make a lot of sense economically but construction has been going on for some years. I think the government is obliged to continue until it is completed.

QF - 1978; This is a stupid, wasteful, ill-conceived disaster. It will be done.

F - 1977; This road has been surveyed and its cost-value justification warrants its completion in three years.

ROUND TWO

F - 1980; There's still a great deal of work to make the road all-weather.

ROUND THREE

F - 1980; Terrain difficulties. All-weather requires some doing.

NR - 1976; Date now given by engineers associated with actual construction.

COMMENT ON QUESTION:

14 - Completion of another 1500 miles of all weather road in the Arctic, other than those in question 12 and 13, will occur in the year -

ROUND ONE

F - 2000; Unless there are major resource discoveries in the Keewatin in the foreseeable future, I see no Arctic highways until 2000. I suspect there will be a highway connecting Thompson, Manitoba and the port of Churchill, within 5 years. It may even reach Rankin Inlet by 1985.

F - 1980; Yellowknife---Coppermine? Doubt if both highway and railway will be built to same areas (rather, mineral development sufficient to justify railway will lead to satellite highway network few years later; otherwise roads will network first, starting earlier.

F - 1985; Dependent on base metal deposits being found in District of Keewatin.

QF - 1980; Once started it will go for years. I'm ignoring the Yellowknife Highway.

F - 1990; The Yellowknife-Coppermine road should be started soon after the Mackenzie Valley road is completed. It should take about 15 years.

F - 1995; I see no major project on the horizon.

ROUND TWO:

F - Never; Road construction will remain part of the culture, and astonishing mileages have already been built.

F - 1992; 150-170 miles of construction is as much as federal budgets seem to be able to stand.

Question 14 - (cont'd)

ROUND THREE

F - 1999; Roads are still part of the culture, but 1500 miles is a lot of road.

NR - 1994; Extractive industries, tourist development and pressure from native groups and territorial government.

NR - Never; Can't see need for 1500 miles of road to service the potential of the region.

NR - Simpson to Ft. Nelson via Liard Valley, Yellowknife, Great Bear, Coppermine.

F - 1995; Almost inevitable, regardless of economic policy---provided you interpret literally what you mean by all weather road.

NR - 1993; Mounting political emphasis on the 'opening' of the north.

COMMENT ON QUESTION:

15. Production from a large base-metal mineral resource will start in the year -

ROUND ONE

F - 1979; From discovery to a producing mine can take anywhere from 5 to 50 years. Arvik on Little Cornwallis may be a major producer within the next 5 years.

QF - 1976; Shipping date estimate---will follow production by $\frac{1}{2}$ year. Based on government policy estimates as much as likelihood of large ore bodies being proven.

F - 1980; Cominco deposit - Little Cornwallis Island.

F - 1976; A lead-zinc mine is proposed at Strathcona Sound on Baffin Island.

- 1980; Assume iron ore is included here.

QF - 1977; Little Cornwallis Island.

1980; Mary River iron deposits, Strathcona Sound and/or Little Cornwallis about the same time.

ROUND TWO

QF - 1985;- Prices of raw metals are constantly rising on world markets---both Strathcona Sound and Baffin Island mines should be in production by 1985.

ROUND THREE NOT REQUIRED

COMMENT ON QUESTION:

16. Production from a new large mineral deposit of precious metals or gems will start in the year -

ROUND ONE

QF - 1980; Sometime---Contuoyta Lake - N.E. Yellowknife, dependent on price and supply of gold and its future as a monetary base.

Question 16 - (cont'd)

ROUND TWO

QF - 1990; A forecast is difficult as it depends on gold prices and rate of inflation and stability of gold prices.

NR - Impossible to forecast---large scale mineral deposits in the N.W.T. have been hard to discover. The region may not be as fabulously wealthy as many commentators have suggested.

QF - 1985; If you include uranium.

F - 1985; A new gold or uranium strike is always possible under current conditions.

ROUND THREE NOT REQUIRED

COMMENT ON QUESTION:

17. Production from a major coal field (other than the small mine in the Yukon) will start in the year -

ROUND ONE

- Never; Coal in the Arctic is an unwanted resource. A small coal mine operates in the Yukon. Alberta and B.C. have the large deposits capable of sustaining Canada's requirements for the next 300 years.

- 1981; This is based on the assumption that no major coal deposits exist in the area, but that small ones might be developed to meet local needs. The year refers to the Pond Inlet coal, which might be used in connection with Baffin Land Iron development.

ROUND TWO

F - Never; Except for very local usage---coal in the Arctic will be one of the last energy resources exploited in the world.

NR - 2000; The coal may be required if the low grade iron ore deposits are mined---but very debatable.

QF - After 2000; Major coal field---after 2000. Minor small mines---50% chance by 1995.

NR - Never; Not economical to transport to major demand centres.

NR - Never; Will not be required owing to very large more economically extracted coal resources in the south.

F - 1985; Coal could be used to power gas liquification.

F - After 2000; There is no need for a major coal mining operation in the North when the coal in the prairies is adequate.

ROUND THREE NOT REQUIRED

COMMENT ON QUESTION:

18. Production from an industry with large water use (such as a paper mill or steel mill, but not hydro electric) will start in the year -

ROUND ONE

QF - Never; On basis that you mean larger user than, say Pine Point or Baffinland Iron, answer seems to be likely never in N.W.T. (excluding water use S. of 60 degrees which affects N.W.T.) and until Melville Island bituminous sands are developed.

F - 2000; The price of gold should rise to a point where placer mining on a large scale can be reintroduced in the Klondike vicinity. The cost of meeting environmental standards will be higher than they were when large scale placer mining operators were stopped.

ROUND TWO

F - 1983; A large refinery or liquification operation could be such a major user, as could a base metal benefaction operation.

F - 2000; The lead-zinc mine at Strathcona Sound will use a substantial amount of water prior to that, but placer gold is the only foreseeable major industry.

ROUND THREE

QF - 2000; Placer gold mining is the only foreseeable major industry, assuming mills at mine sites are not major consumers.

QF - 1987; The first will be a mineral-concentrator in the Cordillera Section, but the current economic slow down and price rises will favour the development of existing low grade mines in the south rather than new mines in the North.

COMMENT ON QUESTION:

19. Production from a new industry with a large waste disposal problem (eg. mining or petro-chemical) will start in the year -

ROUND ONE

- 1985; Pulp mill in Laird Valley.

F - 1986; Solid waste disposal problems from arsenic-bearing ores (as well as effluents and emissions) already a problem. Waste sulphur from Liard gas fields minor problem, would increase. Same for Mackenzie delta gas, or Arctic Islands gas.

F - 2000; Placer mining with turbidity pollution is the next large scale water-consuming operation.

ROUND TWO

F - 2000(After); Discounting oil and gas production and existing mines etc. Adequate technology available for anticipated developments.

F - 2000; Placer gold mining with turbidity pollution. Lesser pollution by lead at Strathcona Sound before that.

QF - 1979; Mining development on Little Cornwallis Island.

ROUND THREE NOT REQUIRED

COMMENT ON QUESTION:

20. Population of a town in the Arctic, other than Whitehorse, reaches 10,000 in the year -

ROUND ONE

F - 1982; Total population - Yukon 19,000.

F - 1985; Probably develop at Yellowknife due to a combination of small mineral developments, native population moving into a population centre and the decentralization of Federal government employees from Ottawa.

F - 1985; Inuvik will rise to 6,000 in the next 5 years, 10,000 by 1985 if pipeline is built by then. Hay River may become commercial centre.

F - 1990; Inuvik will reach a population of 10,000 when gas production in the delta commences.

F - 1983; The present possibilities seem to be Yellowknife, or Inuvik in 10 - 20 years.

ROUND TWO

QF - 1984; Inuvik is the most likely town which will expand to 10,000 by 1984.

ROUND THREE NOT REQUIRED

COMMENT ON QUESTION:

21. Population of a town in the Arctic reaches 50,000 in the year -

ROUND ONE

F - 2000; Whitehorse has the potential for growth, a lot will depend on paving the Alaska Highway, railway to Faro of standard gauge and connecting with B.C. railway to Prince George B.C.

F - 1993; Assume that 50,000 or just short of it, will be reached if major mining complex develops, or a general service centre if offshore petroleum development succeeds.

F - 2025; This data is in line with the gradual growth of Whitehorse consistent with that of other cities across Canada.

ROUND TWO

NR - Beyond 2000; Technology and automation does not require large permanent population base and availability of modern transportation.

F - Never; Several major industries in one area will be required to support city of this size. This does not appear likely in view of information presently available.

QF - Never; Believe we will reach a no-growth period by 2000.

NR - Never; Towns in the Arctic will be limited to the population required for renewable or non-renewable resource extraction and will not attract people beyond this point.

F - After 2000; Whitehorse, in line with gradual increase.

ROUND THREE NOT REQUIRED

COMMENT ON QUESTION:

22. Tourism becomes a major industry in the North West Territories and 10% of the residents earn their livelihood from it in the year -

ROUND ONE

F - 1983; Currently in 3rd place. In 1959, 600 tourists spent \$350,000 and in 1968, 9,000 tourists spent \$3 million. In terms of the doubling effect and a 2 million tourist potential and the probability of new roadways and reductions in air transport cost would result in the forecast year.

F - 1982; After completion of an all weather road about 2 years will be required to develop facilities and mount the necessary advertising program.

F - 1980; Once more hotels are constructed, and road to Ft. Nelson from Ft. Simpson is built plus a road from Ft. McMurray to Ft. Smith---tourism will increase substantially.

F - 1974; Everything is relative. Tourism is now an important industry in their economy---the third largest after resource development and government.

F - 1980; The tourist industry potential exists now. It awaits no more than the coming of an imaginative entrepreneur.

F - 1980; Tourism will become important, but not as a "major" industry. I suppose the problem is what "major" means. If we are talking about a 10 fold increase in tourism, then I would put a date of about 1980.

ROUND TWO

NR - Never; If resource development goes as expected, increase of population will decrease relative percentage making living from expanding tourism. If resources go bust, tourism will exceed 10% five years later.

NR - 1985; Further development of the highway system and access to National Parks will be required before a great percentage of southern people can afford it.

F - 1975; 10% of the residents probably earn much of their livelihood that way now.

ROUND THREE NOT REQUIRED

COMMENT ON QUESTION:

23. Diversion of northward flowing rivers to the south, that may affect stream discharge of northward flowing rivers North of 60°, will occur in the year -

ROUND ONE

E - 1988; Water shortages are already developing in southern Alberta and Saskatchewan; these with the current energy crisis are going to require major diversions into the South Saskatchewan system and development of N. Sask. River. In order to maintain these supplies diversion from North flowing rivers will occur. These will require about 10 years to plan and build after diversion take place into the S. Sask. River.

F - Never; Estimate based on assumption that economic considerations will prevail. Fully aware that other factors may over-ride.

Question 23 - Round One (Cont'd)

F - 2025; To date no substantial study has been made on any river. It will require several years to solve the political implications after the economic need is identified. The Bennet Dam and proposed downstream dam will satisfy the power needs for many years in the only areas where diversion is feasible.

F - 1985; Upper reaches of Mackenzie drainage---however regulation of flow is likely to be as important as diversion of flow.

ROUND TWO

NR - Never; Major rivers N. of 60 deg. not well placed for diversion to S. and have relatively low annual flows.

QF - Never; Still might happen about 1985, but with each passing year the net economic gains seem less and the environmentally-based social obstacles greater.

NR - Never; Believe the northward flowing rivers will be developed and power exported rather than water.

F - Later than 2000; There is the need but it takes many years politically.

ROUND THREE

NR - 1985; The Peace has already been "diverted".

QF - Later than 2000; The political and environmental problems would take years to hurdle.

- 1993; No foreseeable water supply shortage in Southern rivers.

COMMENT ON QUESTION:

24. A sea port in the Arctic with a volume of one million tons or more will occur in the year -

ROUND ONE

F - 1988; Economic break-even point 15 million tons yearly. Mackenzie River (Northern Transportation Co.) 400,000 tons yearly, 1972. Fog, ice, shallow depths, dredging costs are constraints. 150,000 - 250,000 ton capacity tankers (nuclear or conventional).

- 1984; Baffin

F - 1990; When natural gas can be compressed and shipped by tanker, a large port will be developed.

F - 2000; Milne Inlet (Baffin Island) appears as the most likely spot.

ROUND TWO

QF - 1992; Eastern Arctic pipeline port probably Makinson Inlet.

F - 2000+; Only when the iron ore of Baffin Island is required and I do not think this century.

F - 1990; Baffin Island is still the best bet.

ROUND THREE NOT REQUIRED

COMMENT ON QUESTION:

25. Yukon Territory attains Provincial status in the year -

ROUND ONE

F - 2000; Depends on economic viability and a population to form a tax base to meet all normal financial requirements. Would expect a minimum population of 100,000 by 2000.

F - 1985; Assuming that status of provinces is changing---thus interpret that Yukon will have legislative and fiscal responsibilities essentially equal to those of southern Canada.

F - 1995; Political pressures are limited to a few individuals without strong backing other than a sympathetic press. There is no cabinet level desire to reduce the involvements of federal departments.

ROUND TWO

QF - Never; I do not think the Yukon will have a population of 100,000 by 2000 A.D.

NR - 1981; Revision of national view of what is a "Province" may make Yukon essentially a province in principle in five years; and it may be politically expedient with little real change taking place to declare it so.

ROUND THREE

No comments.

COMMENT ON QUESTION:

26. N.W.T. attains provincial status in the year -

ROUND ONE

F - 2000; I do not see Provincial status for N.W.T. in its present geographical form. I envisage a separate Province for the Mackenzie District and the rest Keewatin and Franklin as Territories. Again, if the N.W.T. is broken up into three separate Territories, only the Mackenzie has an opportunity of reaching economic viability and a population growth to warrant provincial status by 2000.

ROUND TWO

NR - 1995; Mackenzie District only.

NR - 1990; For at least part of N.W.T.

QF - 2000; N.W.T. shows little likelihood of reaching a viable economy and a population to support it before the year 2000.

NR - 1992; Whatever the economic or rational justification, at least part of N.W.T. is likely to follow Y.T. politically within ten years.

F - Never; Because of much larger area covered by N.W.T. will require a population approaching 500,000 to be economically viable.

NR - 1990; Mackenzie District will split off from the rest of the N.W.T. making a viable province at an earlier date.

F - 1995; Assuming Mackenzie District only.

COMMENT ON QUESTION:

27. Large ice-breakers will be used to keep a northern channel open to the south in all seasons (most of the time) -

ROUND TWO

QF - 1990; Eastern Arctic pipeline port - and/or lead-zinc or iron mines, Eastern Arctic.

QF - The U.S.A. has completed its first of four large icebreakers. Canada cannot be far behind, if it wishes to ensure complete sovereignty over its Arctic waters, and to uphold the present law---Arctic Water Pollution Prevention Act. Therefore Canada has no alternative but to embark on an icebreaker building program.

QF - Never; Large icebreakers or icebreaking cargo carriers capable of negotiating Arctic areas (say N.W. passage) in almost all seasons are likely to be in operation by 1985, but it is extremely unlikely that they will attempt to keep a channel open all year round. They could however be used to ship ore or oil at all seasons of the year.

F - 1990; Pollution risks involved with the use of large tankers which will use these channels will slow the progress in this direction.

F - 2000; Technology to keep channels open every year all year round is not currently available in Canada---major effort required to acquire technology and large capital costs involved to design and build necessary icebreaker fleet.

NR - 1985; Will be used for oil/gas/mining.

NR - 1990; Production from Mary River iron deposits (Baffinland Iron Mines) together with other large base metal producers in the Eastern Arctic and possible oil production will make year round navigation mandatory and economically feasible.

F - 1985; This seems a likely development in the Baffin Area. For base metals or petroleum or both.

F - After 2000; This will be a gigantic operation and only a gigantic industry could support it. Ice breaking tankers such as the Manhattan could be in operation before 2000.

COMMENT ON QUESTION:

28. Native claims for aboriginal rights in areas being affected by development will be generally settled in the year -

ROUND TWO

QF - 1978; The settlement will come in steps - first the areas and groups covered by Treaties 8 and 11, the aboriginal rights (which apply to the Eskimos) will come later.

F - 1988; There is no major impediment to the settlement of the land claim.

F - 1980; Who knows? But some action will be required before ten years have gone by, and before significant "developments" will proceed past early stages.

Question 28 - (cont'd)

ROUND THREE

F - 1980; The "areas being affected" is pretty general. Some settlement by 1980. Some will go on "forever".

F - 1982; In view of the negotiations between Indian Brotherhood and Minister of Indian Affairs the earlier date is now more likely.

F - Beyond 2000; Settled from who's point of view?

COMMENT ON QUESTION:

29. Canada and the U.S.A. will reach a comprehensive accord on the sharing of the development and use of all oil, gas and coal forms of energy in the year -

ROUND TWO

NR - Never; I express a hope. Such accords are not necessary for Canada over and above contracts for sale of resources to U.S.A.

NR - Never; The sharing of our energy with the U.S.A. involves all forms of energy---oil, coal and particularly our waters. I cannot foresee in the future any such arrangement which may deprive future Canadian generations of its rightful heritage. Indeed, I believe a common North American energy policy between the U.S.A. and Canada would erode Canadian sovereignty and weaken our international position, and our independence as a sovereign state.

F - Never; "Accord" will never be reached unless Canada is politically absorbed into the U.S.A. Otherwise there will be continued confrontation, co-operation, conflict, and flexible semi-integration as now.

QF - International agreement now in effect!

F - 1978; Canada will find in U.S.A. a lucrative market to sell energy resources.

QF - 1980; Present energy crisis and increasing costs will force two countries to come to an agreement on these matters.

NR - 1978; Recent developments will force the issue.

NR - 1978; Adhoc agreements will undoubtedly take place at an earlier date, but a general accord on all energy development is I believe 4 or 5 years away.

NR - 1987; Joint studies will be initiated within a year, that should produce results within two more years.

NR - This question must be clarified - our existing trade agreements, IJC agreements Columbia Treaty, pipeline agreements etc., all fall under the broad umbrella of this question.

ROUND THREE

- Never; Such an accord is not to Canada's advantage. Our best approach is to control American or foreign use of our energy resource by short term agreements based on conservative short term potential estimates.

F - I do not see ever any accord between the U.S.A. and Canada to share their energy resources.

NR - Never; Both nations will seek to become self sufficient in energy.

COMMENT ON QUESTION:

30. Development of a large hydro electric power site in the N.W.T. for sending power to the south of Canada or to the U.S.A. will occur in the year -

ROUND THREE

F - 1985; There is the demand and there are the sites.

- 1990; Hydro is seen as so "cheap" and clean that every conceivable site will eventually be developed. Some NWT sites are pretty conceivable.

NR - Never; Any hydro power developed in the N.W.T. will be for local use or possibly feed to a Canadian grid---not to U.S.A. Large N.W.T. hydro sites are either in National Parks or on navigable waters.

QF - 1998; Power from the Slave River in Alberta be sufficient for the next demand for large power. Further development on the Taltson could make power available if the proposed industrial belt of northern Alberta is developed. Bear and Mackenzie River developments will await new technology in long transmission lines.

F - Never; Before this becomes economic other sources such as nuclear power will be further developed.

NR - Never; Potential isn't that great for large power sources without huge environmental changes.

F - 1985; The Pelican Rapids (Slave River), Bear River Rapids are the two best known hydro sites in the N.W.T. which could be exploited for power hungry southerners. But to export to the U.S.A.---this may never occur.

- 1990; Unquenchable energy thirst of U.S.A. and southern parts of Canada. Also almost all other major potential dam sites have been tapped already.

QF - Never; Major power sites are not plentiful in N.W.T. and costs of long transmission lines is very high.

DELPHI - NORTH - ROUND TWO -

- Other questions you may wish to add -

As this is a questionnaire related to water resource management, perhaps there should be some questions about seasonal changes of populations in towns, and on land which greatly affect water demands and stream quality.

At least 32 possible Hydro sites in N.W.T. with an undeveloped potential of 1 billion KW. Which year and site will project commence?

F - 1976; Major emphasis will be placed on community planning to make the North a more acceptable habitat.

F - 1975; Major emphasis will be placed on sounding the Arctic channels and studying the scour of ice on the bottom of the Arctic Ocean channels.

F - 1978; Substantial improvements in inter-community communication.

