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SUMMARY OF THE

ECONOMIC AND TECHNICAL FEASIBILITY STUDY OF DISTRIBUTING NATURAL GAS AND/OR LIQUID FUELS TO NWT COMMUNITIES

AND THE

FOLLOW-UP ASSESSMENT OF PARSONS LAKE AND CAMERON HILLS NATURAL GAS FEASIBILITY

Studies done by
Stone and Webster Canada Ltd.
for the
Energy, Mines and Resources Secretariat,
Government of the Northwest Territories
and the
Department of Energy, Mines and Resources,
Government of Canada

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INTRODUCTION

Communities have expressed a great deal of interest in the possibility of replacing high cost petroleum products used in heating and electrical generation, with lower cost natural gas or propane delivered from local sources.

Past studies into this possibility for the Inuvik area have resulted in contradictory findings on the economic viability of such projects. In the Hay River area, there has been a general consensus that large government capital grants would be required to ensure favourable consumer prices.

The studies described following were initiated by the Government of the Northwest Territories and the Government of Canada to reassess the possibilities and to determine if new approaches to natural gas or propane supply could be brought to bear that would result in favourable consumer prices. If it was found that natural gas or propane supply would still be more expensive for consumers, the consultant was to estimate how large a grant in aid of construction would be required to bring the consumer price down to favourable levels.

SCOPE AND METHODOLOGY

The study area included Hay River, Pine Point, Fort Resolution, Fort Smith, Enterprise, Fort Providence, Rae-Edzo, Yellowknife and Detah in the Great Slave Lake area, and Inuvik, Tuktoyaktuk, Arctic Red River and Fort McPherson in the Mackenzie Delta area.

The consultant prepared a detailed forecast of the energy demand in the principal communities for the years 1986 to 1996. All energy users were included in this forecast including residential, commercial, electric generation and other industrial customers. An estimate was then prepared of the extent to which natural gas or propane could be substituted for current energy sources in order to establish the volumes of product that would be required. The cost of conversion was also forecast.

Having established natural gas or propane requirements and the cost of conversion, the consultant calculated the price for gas that would make it advantageous for consumers to convert. This was called the equilibrium price. To be considered advantageous, the price had to be low enough that residential customers could recover their conversion costs within 3 years, without paying more for energy in any year than otherwise. For non-residential customers, the payback period used was 5 years. After the payback period, all consumers would continue to pay the same low price for gas as before, and hence would benefit through energy savings.

The equilibrium price essentially establishes an equality between energy sources during the payback period. It was assumed that if gas could be supplied at a price at or below the equilibrium price, it would be in the consumer's interest to convert. If it was supplied at a price above the equilibrium price, consumers would not convert. Equilibrium prices were computed for each class of customer in each community.

With estimates of the gas requirements in hand, the consultant reviewed the known sources, inside and outside the N.W.T. that could reasonably be expected to supply the needed energy over a minimum 20 year period.

For each of the possible sources, transmission systems to bring the energy from the fieldgate to the town gate were designed and the capital, operating and maintenance expenses were forecast. In all supply configurations, transmission by pipeline was considered. The transmission cost of trucked or barged liquified natural gas (LNG) or compressed natural gas (CNG) was also estimated where those alternatives were practicable.

As a next step, the consultant designed a distribution network for each community to deliver natural gas or propane from the town gate to the individual consumer. In all cases this consisted of an underground piped network. The capital, operating and maintenance costs were then forecast.

By summing the transmission and distribution costs, the consultant was able to determine how much a private sector gas company would have to charge for the energy in order to obtain full cost recovery and make a normal return on its investment. For the purposes of this calculation, it was assumed that gas could be purchased at the fieldgate from the producer for the Alberta Border Price.

The price that the company would have to charge was then compared to the equilibrium price. If the company's required price was above the equilibrium price, it was obvious that the project was uneconomic in its own right and would not be developed without outside assistance. The consultant then computed the amount of a grant in aid of construction that would be required to bring the company's capital costs down to the point that they would charge the equilibrium price.

SUMMARY OF FINDINGS

1. Great Slave Lake Area

Natural gas is available at Zama Lake, the northernmost extension of the Alberta pipeline system, and from wells on the Cameron Hills located in the N.W.T. Zama Lake could serve all N.W.T. communities in the area whereas Cameron Hills has sufficient proven reserves to serve only Hay River, Pine Point and other communities to the South of Great Slave Lake.

a. Pipeline from Zama Lake to Hay River, Pine Point and Yellowknife

A pipeline could be constructed from Zama lake, Alberta to Hay River and Pine Point. At Enterprise the line would fork, with a lateral paralleling the road system to Yellowknife. Gas is assumed to be purchased at the Alberta Border Price, and consumers would be charged with the capital construction costs of the line from Zama Lake to the N.W.T. border.

Under "most likely" conditions, and after allocating a share of transmission costs to each community, prices in Hay River would be significantly lower than other energy alternatives. In Yellowknife and Pine Point, however, prices for natural gas would not be competitive. A capital grant of $55.4 million would be required today in order to deliver natural gas at equilibrium prices in all communities.

b. Pipeline from Zama Lake with Liquified Natural Gas (LNG) Supply to Yellowknife

A pipeline could be constructed from Zama lake, Alberta to Hay River and Pine Point. At Enterprise a liquefaction plant would produce LNG for truck transport to Yellowknife and subsequent regasification. A propane storage facility would be required at Yellowknife to deliver propane vapour during the periods that normal road transportation is interrupted. Gas is assumed to be purchased at the Alberta Border Price, and consumers would be charged with the capital construction costs of the line from Zama Lake to the N.W.T. border.

Under "most likely" conditions, and after allocation a share of transmission costs to each community, prices in Hay River would be lower than other energy alternatives. However, in Yellowknife and Pine Point, prices for natural gas would be significantly higher than competing alternatives. A capital grant of $69 million would be required today in order to deliver natural gas at equilibrium prices in all communities.

c. Pipeline from Cameron Hills to Hay River and Pine Point

A pipeline could be constructed from Cameron Hills in the N.W.T. to Hay River and Pine Point. Proven reserves in this field are not sufficient to serve the Yellowknife market as well. Gas is assumed to be purchased at the Alberta Border Price.

Under "most likely" conditions, and after allocating transmission costs to each community on the basis of relative consumption, prices in Hay River would be significantly lower than other energy alternatives. Prices in Pine Point, however, would be higher than other fuels. In balance, a capital grant of $5.3 million would be required today to deliver natural gas at equilibrium prices in both communities.

d. Pipeline from Cameron Hills to Hay River Only

Gas from Cameron Hills can be supplied at favourable prices without government assistance. Under "most likely" conditions, a total economic benefit of $5.3 million is forecast over the 10 year study period, in today's dollars.

Enterprise is favourably situated thereby allowing service to this community without causing an adverse economic impact on Hay River gas rates.

e. Pipeline from Cameron Hills to Hay River and Yellowknife

Proven gas reserves at Cameron Hills are insufficient for a reliable 20 year supply at both communities. However, other sources at Kakisa Lake and Indian Cabins, Alberta could provide reserves that, in combination with Cameron Hills, appear adequate for the expected load. It is uncertain that these quantities would be available at the benchmark Alberta Border Price. If they were, gas could be provided to Hay River at favourable prices after allocating transmission costs between the two communities. The 10 year benefit to Hay River consumers in today's dollars would amount to $11.5 million. However, a capital grant of $17.4 million would be required to deliver gas at equilibrium prices in Yellowknife.

f. Propane Vapour Systems

i) HAY RIVER

Propane would be shipped by rail to the town border station and distributed within the community in an underground distribution network.

Under "most likely" conditions, favourable prices below equilibrium would result. No grant in aid of construction would be required for an economic project. The benefit to the community over the first 10 years in today's dollars would be $1.9 million.

ii) YELLOWKNIFE

Propane would be shipped by rail to Hay River and trucked from there to Yellowknife. Storage would be required in Yellowknife to account for the periods that normal road transportation is interrupted. Distribution within the town would be through an underground distribution network. A $43.6 million grant would be required to render equilibrium prices.

iii) PINE POINT

Propane would be shipped by rail to the community and distributed by an underground distribution network. In the most likely case, aid to construction of $8.4 million would be required.

g. Liquified Natural Gas (LNG) and Compressed Natural Gas (CNG) Options

LNG or CNG would be produced at Zama Lake, Alberta and trucked to the various communities for delivery to underground distribution networks. Detailed estimates were prepared for Hay River using a share of production and transportation related costs. Both alternatives are significantly less economic than pipeline gas and would require greater contributions in aid of construction.

2. Mackenzie Delta Area

Natural gas is available in sufficient quantity at Parsons Lake, lying midway between Inuvik and Tuktoyaktuk on the mainland, and at Titalik 65 km. west northwest of Parsons Lake.

a. Pipeline from Parsons Lake to Inuvik and Tuktoyaktuk

Gas could be produced at Parsons Lake and piped in a buried line North to Tuktoyaktuk and South to Inuvik. Gas is assumed to be purchased at the Alberta Border Price. No serious technical problems are expected coincident with line construction and operation in permafrost conditions. Distribution would be in underground lines laid beneath the roadways. The utilidor would not be used in Inuvik.

In the "most likely" case, and after allocating a share of transmission costs to each community, prices in Inuvik would be significantly lower than the current fuel oil alternatives. The benefit to the community over the first 10 years of operation in today's dollars would be $13.7 million.

Prices in Tuktoyaktuk would be higher than current alternatives. A $6.5 million grant would be required to achieve an economic project.

The system as a whole is viable, with a $7.2 million net benefit over the first 10 years in today's dollars.

b. Pipeline from Parsons Lake to Inuvik Only

Gas from Parsons Lake could be supplied at favourable prices without government assistance. Under "most likely" conditions, an economic benefit of $9.6 million is forecast over the 10 year study period, in today's dollars.

Gas prices at the Parsons Lake fieldgate could be significantly higher than the assumed Alberta Border Price without making the sale of gas in Inuvik economically impossible.

c. Pipeline from Titalik to Inuvik and Tuktoyaktuk

Gas could be piped East from Titalik to the mainland, where the line would fork going North to Tuktoyaktuk and South to Inuvik. The Titalik supply is high quality sweet gas and hence the probability of acquiring it at the Alberta Border Price is higher.

In the "most likely" case, prices in Inuvik would be marginally higher than competing fuel oil for the first 5 years of operation, requiring a grant in aid of construction less than $200 thousand.

Prices in Tuktoyaktuk would be significantly higher than competing fuels over the first 10 years of operation. An $8.3 million contribution would be required for economic viability.

d. Propane Vapour Systems

Propane could be shipped by rail from Edmonton to Hay River and barged down the Mackenzie River in the open navigation season. During the winter, propane would be trucked from Taylor Flats B.C. on the Dempster Highway. Tuktoyaktuk would be similarly supplied, with the inclusion of truck transport from an Inuvik central storage facility during the winter months.

Distribution within the town would be through an underground network, similar in configuration to a natural gas network, but larger in size to prevent condensation of the vapour due to low soil temperatures.

For both Inuvik and Tuktoyaktuk, large capital contributions would be required in order to deliver propane at prices competitive with oil. These would amount to $47.4 million in Inuvik's case and $8.4 million for Tuktoyaktuk.

AVAILABILITY

Copies of the full report are available through the Energy, Mines and Resources Secretariat, Government of the Northwest Territories, Yellowknife, N.W.T., X1A 2L9.