ALASKA STATE LEGISLATURE
SENATE RESOURCES COMMITTEE
February 19, 2001
3:40 p.m.

MEMBERS PRESENT

Senator John Torgerson, Chair
Senator Kim Elton

MEMBERS ABSENT

Senator Drue Pearce, Vice Chair
Senator Rick Halford
Senator Pete Kelly
Senator Robin Taylor
Senator Georgianna Lincoln

OTHER MEMBERS PRESENT

Senator Gary Wilken
Senator Loren Leman
Senator Dave Donley
Senator Alan Austerman
Representative Joe Green
Representative Lesil McGuire

COMMITTEE CALENDAR

Comparison of Northern versus Southern Gas Pipeline Route by
Foothills Pipeline Ltd.:
Mr. John Ellwood, Vice President
Engineering & Operations
Foothills Pipeline, Ltd.

Mr. Brian Blair, Director
Engineering Northern Development
TransCanada Pipelines Limited

WITNESS REGISTER

None

ACTION NARRATIVE

TAPE 01-14, SIDE A

Number 001

CHAIRMAN JOHN TORGERSON called the Senate Resources Committee meeting to order at 3:40 p.m. and announced they would hear a presentation from Foothills Ltd. concerning the differences in pricing of the Southern routes and the Northern routes.

MR. JOHN ELLWOOD, Vice President, Foothills Ltd., said this study is a joint undertaking of TransCanada Pipe Lines and Foothills Pipe Lines and it was a due diligence exercise for their companies.

MR. ELLWOOD explained that the figures he was using were pulled together by Foothills Ltd. and its shareholders, TransCanada Pipe Lines and West Coast Transmission. It represents the thinking of their group of companies of how best to undertake the development of northern gas resources. He said some consultants had input, but none from other parties who are proposing one or the other of the routes for their own purposes.

MR. BRIAN BLAIR, TransCanada Pipe Lines, said that first he would review the merits of the different options and then break that into cost estimating portions.

They had spent over 50,000 man-hours investigating the different route options. The objective was to assess the technical, commercial and environmental merits of each route. The companies brought their experience and information into the study. They engaged AXYS Environmental Group as environmental and social/cultural consultants for each one of the routes, EBA Engineering Consultants with their Beaufort Sea experience in designing some of the off-shore platforms (they designed BP's NorthStar platform), and Pegasus International Inc. (located Houston) for the marine design portions of the plan.

MR. BLAIR explained that the alternatives they examined were the Alaska Highway gas pipeline as a standalone project; Mackenzie Valley pipeline and the combined alternatives of the under-the-top(UTT) route or the over-the-top (OTT) route; and an Alaska Highway plus MacKenzie Valley pipeline. The criteria they used in the valuation were identifying constraints that would be labeled critical, serious or minor for all of the routes. The definition they used for critical was potential showstopper, based on either known technology, current environmental conditions, socio-economic or political conditions. A critical constraint on a route could make it in part or in total not viable. So it's potentially an insurmountable issue.

The next level of category was serious which is either a cost or a schedule ladder. If something would have significant cost implications, it would definitely affect the routing of the line, the timing or the type of construction.

The third category was minor constraints that could be managed with proper research, mitigation, or advanced timing and would have minor cost impacts. For brevity, they left the minor constraints out and are dealing with critical and serious constraints only.

MR. BLAIR said the OTT route is the shortest geographic distance, but has very serious risks. It is 2,900 kilometers long with twin 42-inch pipelines under Prudhoe Bay and a single 48-inch line going down the Mackenzie River with an operating pressure of 2050 psi, initial volumes of 3.3 Bcf/d and ultimate volumes of 5.2 Bcf/d.

He said they had to make some assumptions to do comparisons and cost estimates. The information they used was from producers in the Prudhoe Bay area whose initial volumes were 2.5 Bcf/d ramping up to an ultimate volume of 4 Bcf/d. They designed a pipeline for an initial volume of 2.5 Bcf/d, which could handle a 4 Bcf/d system with compression. "Similarly, for the Mackenzie River Delta, the producers were talking about a .8 Bcf/d pipeline going up to a 1.2 Bcf/d."

The combined alternatives used initial volumes of 2.5 Bcf/d of North Slope gas coming across and picking up .8 Bcf/d on the MacKenzie Delta. This would add up to 3.3 Bcf/d going down the line. Ultimately, that would build up to 5.2 Bcf/d. That would be 4. Bcf/d coming from Prudhoe Bay, picking up 1.2 from the Delta and coming down as 5.2 Bcf/d.

> To move those type of volumes, particularly on the offshore, the options that we had available to us were, if you went with a 42-inch and a high pressure, to keep the gas moving, you'd have to add two offshore compressors stations or you would be looking at twin lines offshore. As we got into the study, the technical feasibility of putting two offshore compressor stations really became almost an insurmountable option.
>
> So then we opted for the two pipelines. Two pipelines also give you the added flexibility that if something was to happen to one pipeline, you could continue to operate. One of the issues they have is, if you did have an event on one of the pipelines, your ability to do maintenance on it, you could be anywhere from six months to a year to get access into a pair of pipelines. If you're out of

service that long, that's definitely an economic impact to the producers and the throughput.

Three years construction is what we are looking at. On the main line portion, you could put a 48-inch pipeline with compressor stations spaced. The three years construction is primarily for the 48-inch pipeline down the MacKenzie Delta area and then we matched in the three years construction for the offshore.

When we looked at the marine portion, it became pretty evident that there's kind of three main distinctive regions. We looked at routing for each one of those regions. The first one we characterized is foreshore, where the ice in the wintertime actually freezes right to the seabed. The idea of that was we were thinking of being able to construct that in the wintertime off the ice. Extending that to the next level would be the near-shore where you would actually be characterized by land fast ice.

MR. BLAIR explained that pack ice is continually rotating around the Arctic Circle at about one to five kilometers a day. When it impacts on the shore, it starts bunching up and starts trying to push the pack ice right up on the shore. When it bunches up and overlaps, it actually starts becoming a rubble field or a stamukhi zone, about four to six meters in height and 47 - 50 meters deep. When it builds up high enough, it drifts into the shore and starts creating gouges and scouring of the sea floor.

Throughout the whole winter, the ice pack is continually moving and building-up on to the shore. In some places it actually scours straight up the shoreline 0.5 to 2 meters deep creating rubble fields five to 10 meters high. The area characterized across the whole route has bottom fast ice for the foreshore 0 to 2.0 meters deep and ranges from 0 to 2 kilometers offshore. The stamukhi zone is generally in the 10 to 30 meter depth, which is the high scour area and typically ranges from 5 to 25 kilometers offshore. The pack ice zone continually moves and there isn't any way they could build off of that. "You can't build off the stamukhi because of the rubble pile and as you get into the floating land fast ice, you have a potential to build. But if you're trying to put ice roads in and have been stable for any length of time, you continually get cracking, which is an issue of stability and safety for ice roads."

MR. BLAIR said the pack ice zone is typically 25 to 50 kilometers offshore. They made the last zone greater than 60 meters, because historically most of the scours start dropping off at that depth. The size of the rubble ranges down to about 50 to 70 meters.

Number 1170

MR. BLAIR explained that the green part of the graph is where the ice actually freezes to the sea floor, the foreshore area. The blue is land fast ice and this is where building could occur. The stamukhi zone is pink and the pack ice is outside that and continually pushes in. He pointed out that the Barrier Islands provide a protective break for the pack ice that is pushing down into the bay area. That is where the producers are looking to drill offshore.

MR. BLAIR said in pack ice without a sheltered bay, you can drill where the ice doesn't come right up against the shoreline on a protected west side. He pointed to the chart showing where the stamukhi zone is actually impinging almost to the shore for 25 percent of the route, precluding winter construction. He pointed to an area where producers were exploring on the lee side where some winter construction could occur.

MR. BLAIR said they looked at two compression stations. The first was about one third of the way, at Camden Bay, an active seismic area of recently as much as 5.6 on the Richter scale, a point at which buildings start falling down. Any compression station built in that area would have to withstand 6 on the Richter scale and be on an island in the 30 to 60 meter depth range, like Hibernia with a floating compressor station. The site would have to be breakable in case a large ice mass came in and you would have to float it away. He said they had looked at studies of these situations; the Air Force had tried to bomb them, the Army tried to drill and blast them, and they couldn't break them apart. The only thing you can do is get out of the way. This is one of the challenges with offshore compressor stations he said.

MR. BLAIR said dual pipelines would be spaced a considerable distance apart in case a major ice feature came in. If it looked like the first pipe would be impacted, that line could be evacuated and the second one could be kept operating - providing some flexibility and reliability. Hopefully, the first one would slow it down. He explained that the pipes would be at different depths to further balance risks.

Number 1200

SENATOR AUSTERMAN asked how they monitored the depth of icebergs coming in along the length of the pipeline.

MR. BLAIR answered that icebergs move at 1 to 5 kilometers per day and would have to be continually monitored, probably by satellite. So you would try to identify which feature would impact the pipeline. Once it was coming in, you would be stuck with just reacting.

For winter construction, they would have to put an ice road in along the route about 350 miles long to maintain support for camps and all the transportation for manpower and equipment. "Ideally, you would have staging areas on land, but currently that's not allowed in ANWR or Ivvavik. So everything would have to be on ice in those areas. The unstable ice mass pretty well precludes winter construction and pushes them into the summer construction areas.

MR. BLAIR pointed out an international offshore boundary dispute that would have to be resolved showing the boundaries on the chart along with Ivvavik National Park, which has essentially the same anti-development policy as ANWR. Herschel Island Territorial Park has a one-kilometer workboat pass where a pipeline could be put, but there are environmental areas it would come close to. Mackenzie Valley trough is a tectonic plate that sinks one to two millimeters per year and has filled in with very soft sediments. So if you put a pipeline in, it's very difficult to establish a trench or to keep a trench stable in that area. They started to preclude that area because of a whole series of environmental issues that started pushing them onto shore. He noted that the North Slope, management zone D, needed both short term and long term environmental and socio-economic impacts mitigated before development could happen.

The consultants identified the Arctic National Wildlife Refuge as critical for the OTT route, because it precluded the majority of the route for doing any winter construction and any support on land for staging areas or camps. Similarly for the Ivvavik National Park and the Herschel Territorial Parks on the Yukon side. The Barrier Islands are identified as possible to construct on, but are nesting habitat for squaw duck and sea duck. In the summer time, it's also their molting and staging area.

Using satellite photography, MR. BLAIR said, they can tell the Barrier Islands are actually migrating from east to west - away from Canada. They are actually eroding on the east and starting to deposit on the west side. The sub-sea area is continually eroding and any pipeline would have to deal with that challenge.

MR. BLAIR said the coastal erosion storm surge caught them by surprise:

> Most of the coast is permafrost area, so it's ice-rich areas. In the August/September storm periods, it actually melts. The warm water and the waves build up on it and it actually collapses the banks. So you're actually losing about one to three meters on the shoreline per year. Also, if you think about it on the seabed portion of it, it's actually dropping as well, about one meter every ten years. That's for about the first half kilometer from the

shore. If you're to put a pipeline in that area and were to bury it in the first year, in ten years you would have lost one meter of cover. In 20 years, you've lost two meters. So, if you buried it with two meters of cover, you'd have an exposed pipeline.

In extreme events, in the stamukhi zone, it comes right up to the banks. They've had events where they actually lost 50 meters of shore in any given year. That was a significant event. We talked quickly about the Camden Bay seismicity, which is primarily for the compressor station.

MR. BLAIR said that the Jones Act requires when working in U.S. waters, one needs to use U.S. flag ships, which would be used for lay barges and probably support vessels as well as trenching equipment. Most of the contractors that have North Sea experience have international flagships, which would have to be taken into account.

MR. BLAIR said that coming out of Prudhoe Bay there is a unique environmental feature called the Boulder Patch with arctic kelp and all the associated fish and wildlife. This is an area the pipeline would have to be routed around. The Barrier Islands have migratory birds and ringed seals. Bowhead whales feed off the Herschel Islands in the spring and in September/October there is the Alaskan whale hunt, a key activity for the Native population there. One of the consultants pointed out that if the activities of the two pipelines were pushing the whales into the deeper water where they couldn't get hunted, there could be a requirement to shut down construction activity. So you might be losing one month out of their two-month window for construction.

The Mackenzie Valley has two beluga whale zones - one right in the mouth of the Delta. That is one of the reasons the pipeline was pushed on shore. The study touched quickly on the eastern North Slope, management zone D, where they would have to address the fish and wildlife and preservation of natural uses. Kendall Island Bird Sanctuary again pushes them on shore as quick as possible. There is the Inuvialuit beluga whale hunt in the June/July period and the consequences of that.

For winter activities, Mr. Blair said you would be looking at the shore approaches building out to where the lay barges would start. By the end of winter, you would be off the ice and starting land activities. You would have winter construction building out to about a 10-meter depth and then the lay barges would take over for the offshore.

Down in the Mackenzie Valley, there is an evolving regulatory process with the Canadian government and some unresolved land claims in the southern Northwest Territories and at the top of the Mackenzie Valley.

MR. BLAIR showed the committee the gouge density and the number of gouges per square kilometer at the different depths. In the 20 to 30 meter zone (stamukhi) you get the highest frequency of gouges per square kilometer dropping off in the 50 to 60 meter zone. The maximum gouge depth is where the big ice features come in. The Arctic pack ice pushes them deeper and deeper until they either ground-out and continue along that ridge from east to west or they may break up and start pushing in.

> From the standpoint of a pipeline, you're looking at burying not just below where the ice field is, but the ice field works like a bulldozer pushing and compressing the ice. If you have a pipeline sitting on the bottom, if the ice keel actually impacted on the pipeline, it could buckle it. So you want it down below, so if your ice pushes in, your pipeline can actually flex in a trench. So it will start to flex versus actually buckling it. One of the things you'll have to do is build a wider trench and that's what the Northstar project and BP did.

MR. BLAIR said that you could backfill the trench with select material, which Northstar did, so the pipeline would not get locked in. The shallow areas where there are continual sea-bed movements is a problem. Even select fill gets eroded out and filled back in eventually starting to freeze the pipeline in place.

> For the stamukhi zone, if you were to construct in the 30-year area, you would need to have at least three to four meters of cover - five and a half meters of actual trench depth. Width-wise, you would have to go about eight to 10 meters wide. So you're excavating an area about as wide as this room and half again as high to put your pipe in. Of course, if you're thinking about doing that, you're about 60 meters up, you're in water that's continually moving and the technique you use is actually called a suction hopper dredger which is like a vacuum cleaner on the bottom. So you're 30 meters up trying to vacuum over the same area continually until you get that kind of depth. You take about a foot at each pass with the suction dredger.

For perspective, one pipeline actually goes from a wellhead to a loading facility. It's a two-kilometer line and they buried it below any of the area of ice scours so they could actually lay it straight on the bottom. The only time you get the trenching activity is when you are going from the land out deep enough so that you pass the shoreline influences. Getting a quote for 500 kilometers of trenching isn't reliable, because nobody does more than 10 kilometers of trenching.

Number 1900

CHAIRMAN TORGERSON asked what they do with the material.

MR. BLAIR replied that normally at the end of the day, you would fill up your suction hopper dredger and take it to an area where you need fill material. In this case, they would probably backfill the trench with it. It would be very fine material causing siltation, so the area would have to be contained from adverse environmental impacts.

Pegasus did some work for them and said that in any of the areas the width and depth of the trench is really a potential showstopper. The amount of suction hoppers needed for trenching and backfilling aren't available and then that turns the project into a critical timeline period. You would be limited to a 1.0 to 1.5 point five meter trench in the 60-meter zone, which they found was most cost effective.

MR. BLAIR continued saying that the next item was the restricted open ice windows. With a lay barge, you have to figure out how much time you actually have in the wintertime to construct. Over the years they have a good satellite base and one can see where the ice starts to break up along the route and starts to form again. He showed the committee a graph of open water days. He added that there are areas along the route that are never completely free of ice. During storm events, the rubble fields will move in and out and that has to be worked around. Another impact is that there are about 90 days of open water where the pack ice actually recedes. Counter to that is the larger fetch, which is the time the wind can actually build the waves up. So you end up with higher waves. Waves over one meter in an ice area start to impact on the ability of support tugs that move ice away from the lay barges and their anchor lines. The ice will start fouling the anchor lines, so you have to continually move the it away. If the swells get to two to three meters and more frequent, you actually have to start shutting down the lay barge activities. He summarized that there is a high degree of uncertainty about what year you're going to get the high open water season. On the probability chart of years 1970 to 1998, it comes out to a 50 percent chance of having 40 days available for construction. That takes into account the mobilization and getting the equipment up into the area around Pt. Barrow from Seattle.

MR. BLAIR said they looked at storing equipment over the winter and a winter harbor site. Currently, there isn't any place they could over-winter the equipment. Even if the lay barges were over-wintered, they would have to be ice-proofed. Currently, all contractors, like Crowley Marine, move their equipment out at the end of the season and back in at the beginning. The cost of doing that versus establishing a winter harbor and winterizing all the equipment balanced out. He said they are left with a 50 percent chance of having 39 days for construction (taking into account mobilization, demobilization, ice days, storm and wait days). There is a 70 percent chance of having 30 construction days.

MR. BLAIR continued the analysis and said, "If you mobilized all the equipment up there and hit a year like this year, where the ice either doesn't allow you to get past Pt. Barrow or doesn't move out enough that you can do any significant construction, you could be delayed one year. If you are delayed one year on construction, that's typically another 10 to 50 percent added to the cost."

The construction days required per line is 150 to 200 days and three or four pipeline [indisc.] to do that over a three-year period. They would need three to four lay barges and currently there's only one or two that are capable of doing the construction. So they would have to build some lay barges and some icebergers and tugs for support. Equipment would need to be built for the trenching and backfilling. However, a delay of one or two years is like actually buying all the equipment yourself. From a contractors standpoint, if you're delayed a year, you've probably bought the equipment as far as the cost goes, but it's not yours. So you might as well buy it and sell it at the end. You would also need to have lay barge capability for maintenance. If Foothills designed their own lay barge, they would probably use dynamic positioning and those are expensive and haven't been proven in arctic environments.

MR. BLAIR said the conclusions the consultants came up with for the OTT route was the foreshore route was not viable, primarily because you couldn’t have any support off the land. The nearshore route was probably not viable because you get into the Barrier Islands and Herschel Island, sensitive wildlife, ice scour, etc. Additionally, there is restricted summer access with 25 percent of the route being very steep with pack ice right next to it. In the summer time you couldn't get in, if something happened to your pipeline. It's not safe for the ships to try to use a lay barge to get any vessel close to shore with the waves. If there were construction in the summer time, you would have to do the maintenance in the winter time. A ruptured pipeline in the summer would have to wait six months for repairs.

They found that the offshore was probably viable with routing modifications around the Boulder Patch and environmental areas. Already short season windows of about 40 days could be reduced if bowhead whales were pushed out of their feeding area.

MR. BLAIR said that despite all the information, there were significant data gaps. Significant technical design work would be required with a trench to make sure the pipe would flex instead of buckle. A deep wide trench to avoid ice scour, even at 60 meters might need to be wider and deeper. The biggest concerns were highly unpredictable and uncontrollable weather risks, a short open-water season and limited access for maintenance. If there were an event on the pipeline, you wouldn't be able to repair it in the wintertime, because there are two to four meters of pack ice that is continually moving. They looked at monitoring using submarines, but found that diesel submarines don't have the span, so they would need a nuclear submarine to do leak detection.

MR. BLAIR said the UTT route is 2970 kilometers long and similar to the OTT route. They kept the same operating pressure of 2050 psi. Currently, most of the operating pipelines are in the 1000 to 1440 psi. rate. The highest operating line rate now is Alliance at 1760 psi. The study used 2050 psi because they are pushing the technology, but not so far outside the bounds of being able to get creditable cost estimates from the venders and suppliers.

TAPE 14, SIDE B

MR. BLAIR said this route follows the Alaska Highway under ANWR, through the Yukon Flats Wildlife Refuge and ties into the MacKenzie Delta. It would be a 42-inch pipeline and a 30-inch pipeline tied in at Inuvik. A 48-inch pipe would be needed for the combined flows of 2.5 Bcf and .8 Bcf, 3.3 Bcf initially and going to 5.2 Bcf. They assumed a five-year buildup from the initial volumes to the ultimate volumes. Over a five-year period, compression would be added in equal increments to build up to 4 Bcf. They estimated three years of construction, primarily because of the 48-inch pipeline challenge in the south. They have access for moving manpower and equipment up the Highway for over the top and from the sea. On one side, all the equipment would move into Hay River and come up the Mackenzie River, which is open two months (mid-July to mid-September). But they would be stuck with a 700-kilometer stretch where there is a little bit of access to the Dempster Highway. The rest of it is essentially a bit of a logistics challenge. He noted that instead of a two-lane road, they would need to have a multilane highway for transportation back and forth and passing. Therefore, the footprint, from an environmental standpoint, would need to be bigger. So there are more short term and long term environmental impacts such as opening up a brand new corridor where the Porcupine Caribou herd migrates.

The one critical constraint that was found for the UTT route was the Yukon Flats Delta. He originally thought they could go through it, but consultants talked with the Refuge manager who said one of the first requirements to build a pipeline through there is that there has to be an existing infrastructure within the Yukon Flats area - and there is none. So a natural gas pipeline would have to feed a community. The next requirement is you have to prove there is no alternative viable route and there is an alternative route - following the existing utility corridor. He said they looked at routing the line following the Highway and coming around and "by the time you actually do that, you're better off just following the Highway."

One of the most serious UTT problem is opening up a brand new corridor with transportation and supply logistics in what is primarily the Porcupine caribou migratory corridor. The Gwich'in communities rely very heavily on the caribou for a subsistence lifestyle. Add to that the evolving regulatory process with the Canadian government going down the Mackenzie Valley. They would need a detailed protection plan for protected areas, primarily because of developing new corridors. Branching off the Mackenzie Valley corridor and the TAPS, many areas need a lot of base line environmental information and similar protection plans. Unresolved land claims in the bottom of the Mackenzie and significant data gaps through the 440-kilometer corridor make it more complicated. One of the reasons this route was abandoned earlier was they found some ice-rich areas that would present stability problems, if they thawed. So they would have to reroute the pipe or build it up on pilings like the TAPS.

The conclusion for the UTT route is that it's probably not viable because of the Yukon Flats restriction and significant data gaps in the 700-kilometer corridor.

Number 2150

The Alaska Highway Gas Pipeline Project is 2820 kilometers long following the Highway down through Alaska to the Yukon and into B.C. He pointed out that they used the same terminus for all of the routes, at Gordondale, for equitable comparison.

MR. BLAIR said that the Alaska Highway project would be a 42-inch pipeline, building up compression from 2.5 Bcf to 4 Bcf and two years construction. The construction time is shorter because both summer and winter construction seasons could be used and all the supply logistics are off the Highway, a distinct advantage. He explained, if a contractor has continual access so he can get another piece of equipment for whatever reason, he knows he can get it in off the Highway. But if he is bringing all his material in in a two month window, like on the Mackenzie, he would bring in more equipment than was needed, in case something broke. You're stuck otherwise. If you bring all your equipment in the summer time, you have to pay for it, from the contractors' standpoint, to be on standby for the time you're not using it.

There were no critical constraints identified for the Alaska

Highway. Unresolved land claims in the Yukon were one serious constraint. The conclusion they had was that the Alaska Highway Gas Pipeline Project was a viable route and had winter and summer construction seasons.

MR. BLAIR explained that the Mackenzie Valley pipeline route was 1700 kilometers long going from Inuvik to Gordondale. They kept the same operating pressure of 2050 psi with initial volume of 0.8 Bcf/d to 1.2 Bcf/d and it would take two years to build. He noted if the volumes go up on any of the routes that the costs and requirements will go up proportionately. Consultants for the Mackenzie Valley identified no critical constraints. On the serious side there were the evolving regulatory process, detailed protection plans and unresolved land claims. The conclusion was that the Mackenzie Valley was a viable route, but was primarily winter construction. The only parts that wouldn't be winter construction would be the compressor stations.

The first thing they did for the cost estimates was make a Key Milestone Gantt Chart or a detailed schedule of all the activities from conception through permitting, EIS, design, procurement of materials, through construction, preconditioning, conditioning and operations of the lines. They chose a low-risk option for their comparison. They assumed permits and regulatory approvals were in place before committing to material orders. For the OTT and UTT, that worked out to a nine or 10-year timeline; on the Mackenzie Valley an eight to nine year timeline and on the Alaska Highway Project six to seven years. Mr. Blair said that any one of the timelines could be advanced by taking some calculated risks.

CHAIRMAN TORGERSON asked if the two-year construction time assumed the materials were already on site.

Number 1900

MR. BLAIR responded that the two years was actual construction time. Infrastructure would have to be built, which would take about one year for all the projects. This is when the camps and stockpile sites are built while the pipe was being fabricated.

He explained that for their cost estimates, they built crews for each of the sections taking into account variables in terrain, weather conditions, etc. They got budget cost estimates from the pipe venders and built on their historical database. Cash flows were worked out, indirect costs, operating and maintenance costs were added for the different routes.

MR. BLAIR said the pipe would have to be moved in in the summertime, but would have it sitting there until it could be installed in the wintertime.

> When you're looking at actually buying your equipment in advance, you're paying a higher interest during construction for having acquired either that piece of equipment early until you actually use it. So it's a higher financing cost. That actually does play a big role in the pipeline. But it gives significant advantage to any of the routes that have similar weather like the Alaska Highway Pipeline route where you're able to move equipment and manpower just in time and in advance of when you actually need it than having to deal with the weather windows to bring it in.

MR. BLAIR said they would look at on-site fabrication shops for things like joining two twelve-meter pipes to get a 24-meter pipe. Fewer joints in field construction means higher productivity. He said they had modularized compressor and chilling stations in a southern area, some of it for the Anchorage facilities that are there.

The objective is minimizing the amount of hookups you need in the field. Data and control communications would have to be installed if there wasn't any. Most of the activities need a one-year advance ramp-up time. Crew size dictates the size of the camp and at -40 degrees, you need to run your equipment 24 hours a day. So you have to know how much equipment and fuel you actually need to do that. Down south, you just run it when you need it. In the northern environment, the length of the construction season has to be taken into consideration.

Permafrost, buoyancy control and trenching need a lot of research and development and the productivity rates are different than if you trench through unfrozen grounds. The study touched on the cost of stranded construction equipment, which is brought in, but only gets used during the winter. The indirect costs of business, financing, community, social and economic are typical for any project. They have based their estimates on grade E steel, but are doing some R&D on different grade. So if you go to a higher grade of steel strength, you can actually reduce your roll thickness and save money on steel costs and welding time.

MR. BLAIR said they would actually have to prove the chilled gas decompression theory as with permafrost directional drilling. Colville River did one directional drill, but it was a small diameter. So they have to do a lot of R&D to confirm information and that is built into the cost estimates for things like insurance and interest during construction and operating costs like salaries, wages, transportation, materials, accommodations, utilities, property taxes, overhaul. Fuel gas is not included typically except for the actual [indisc.] calculations.

He pointed out that their pipeline designs assumed a 2050 psi output, but that estimate was based on the figures from a year and half ago when gas was $1.50 - $3.00 range. "If you're projecting gas in the $4.00 - $5.00 range and are burning it in the compressor stations and looking at the lowest operating costs of your facilities over the whole life of the pipe, then you've got maintenance on your compressors, plus the cost of fuel gas, if you're having a very compression intensive design. What you may opt for is a larger diameter line, which usually has a higher capital cost initially, but over the life of the pipe, you're burning less fuel gas. So when you're putting a higher price on the fuel gas, you have to run a more efficient system."

MR. BLAIR said the "apples to apples" cost they came up with was Alaska North Slope route for 2.5 to 4.0 Bcf/d and Delta 0.8 to 1.2 Bcf; a combined total of 3.3 Bcf to 5.2 Bcf/d. The Alaska Highway gas project (standalone) starts off with $7.6 billion U.S. adding up to $9.7 billion using two percent per year escalation. The Mackenzie Valley starts at $2.7 billion going up to $3.1 billion.

The combined OTT route goes from $11.6 billion to $13.0 billion, the UTT routs goes from $10.0 to $12.5 billion. The Alaska Highway and Mackenzie Valley goes from $10.3 billion to $12.8 billion. He said the ultimate costs are essentially the same for all the projects. The initial costs are a little bit higher for the OTT route because of the second line, but the buildup is less, because there is less compression.

MR. BLAIR said that even though they cost the same to install, when you balance off the risks associated with each one of the projects, they found the OTT and UTT have "showstopper" environmental and technical challenges and other "serious" or cost-adding environmental challenges greater than the other options.

> The conclusion was the Mackenzie Valley was the shortest, least cost route for the Delta gas that could be advanced on its own timeline, and had minimal technical and environmental risks. The Alaska Highway Pipeline project being linked to the existing utility corridor and transportation route was the quickest least-cost route for ANS gas, with minimal environmental and technical risks.

MR. ELLWOOD said this was the most comprehensive study and assessment of these alternatives that is out there today.

SENATOR WILKEN asked how much money his consortium had invested in this year and a half study.

MR. ELLWOOD replied about $6 million U.S. and 50,000 man-hours.

SENATOR ELTON asked if they shared this information with the over-the-top and the Mackenzie Valley people and what was their reaction.

MR. ELLWOOD replied that they had shared it last week with the North Slope producers, the government in Ottawa, and the government in the Northwest Territories. They have shared it with some first nations. There were lots of questions from some groups. It is contrary to the popular belief that the Alaska Highway route was going to be $2 billion more expensive than anything else.

REPRESENTATIVE GREEN said there were some indications that maybe instead of 2.5 Bcf/d, it might go to 4 - 6 Bcf/d and asked if they saw any significant changes in costs with a higher throughput.

MR. BLAIR answered that he thought they would find that they would all go up in price accordingly.

SENATOR AUSTERMAN asked if there was any discussion of not doing the Mackenzie and just doing the Highway.

MR. ELLWOOD replied that there was a fair amount of discussion about which one might go first. People in the Mackenzie are very motivated. Everyone he has talked to thinks that gas will be needed from both basins in a very short period of time. "The price can be kept reasonable by adding new sources, but the demand will grow so rapidly that we will need both sources about as quickly as we can go."

CHAIRMAN TORGERSON asked what they were doing for in-state usage and getting gas to Cook Inlet or any other in-state processing.

MR. ELLWOOD answered that they saw no problem with providing in some way for in-state use of the gas. Clearly, it was going to go past Fairbanks and that could be the first place. They need to have a base and get started.

CHAIRMAN TORGERSON asked when he would have something to share with the committee.

MR. ELLWOOD replied that he is reluctant to commit more resources at this time, but he would do his best to get some information together and to the committee before the end of session.

CHAIRMAN TORGERSON asked if the LNG sponsor group would have numbers similar to theirs.

MR. ELLWOOD answered that he couldn't speak for the sponsor group, although Foothills was a member of it. They brought their pipeline expertise to the group and thought they would see similar thinking.

CHAIRMAN TORGERSON asked if Foothills could be ready for a permitted project by January 2002.

MR. ELLWOOD said they have a lot of the permits already, but the main piece missing is the state right-of-way and their application has been in abeyance for a number of years. They are talking with state officials about what it would take to reactivate it.

CHAIRMAN TORGERSON asked if the right-of-way had been permitted for the Mackenzie route.

MR. ELLWOOD answered that it wasn't; the only route that is permitted is the Alaska Highway project.

CHAIRMAN TORGERSON asked if although it's [Mackenzie] a shorter route, it would take longer.

MR. ELLWOOD replied that was right. Exploration and development in the Mackenzie Valley has been on hold for a number of years and it's just been started again. Quite a bit of work needs to be done.

CHAIRMAN TORGERSON asked if the Mackenzie route would be easier because it's all Canadian.

MR. ELLWOOD answered that he didn't know that having an international project added any significant difficulties.

REPRESENTATIVE GREEN asked when they are in the over $10 billion price, would Foothills want partners.

MR. ELLWOOD answered that they are always open to bringing in new partners who might "add something to the mix that we don't already bring ourselves."

CHAIRMAN TORGERSON asked what kind of debt to equity ratio they tried to keep.

MR. ELLWOOD answered that they try to keep about 30 percent equity and 70 percent debt.

SENATOR ELTON asked if Foothills would be interested in a spur to Anchorage or would they react to what someone else came to them with. He asked whom he meant when he said "we."

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MR. ELLWOOD replied that he meant "we" in the context of the industry.

SENATOR ELTON said he anticipated that Foothills would not be doing the Mackenzie Valley route; that someone else would do it and tie in. He asked if that was true.

MR. ELLWOOD said that was right. Their shareholders, TransCanada and West Coast, have a separate joint venture that is working on advancing the Mackenzie Valley route. Foothills Ltd. is the joint venture for the Alaska Highway.

SENATOR ELTON asked if they are looking at financing the cost of $12 million, minus the cost of the Mackenzie Valley.

MR. ELLWOOD responded that they are looking at $7.6 billion initially for the Alaska Highway project.

CHAIRMAN TORGERSON asked why they are studying the over-the-top route.

MR. ELLWOOD replied that they are finished with it.

CHAIRMAN TORGERSON thanked them for talking with the committee and adjourned the meeting at 5:05 p.m.