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POSSIBLE PERMANENT FUND CAPITALIZATION OF AN ALTERNATE ENERGY TRANSPORT SYSTEM TO THE INTERIOR OF ALASKA

A CONTEMPORARY QUESTION !

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INTRODUCTION

This paper will seek to evaluate the financial viability, using a variation of the standard Benefit Cost Analysis (P.I.) method of an alternative pipeline for the transport of the State's (1/8) royalty share of Prudhoe Bay natural gas to the interior of Alaska. The view will be that of the State as a potential investor (Permanent Fund Use) in such a venture.

HISTORY

There are now three (3) competing routes for the delivery of natural gas from the North Slope to the lower 48 States:

1. Artic Gas
2. El Paso
3. Northwest Pipeline

Only the latter two (2) proposals would make available energy and feedstock to the State and primarily to the interior. The Artic Proposal if successful would necessitate an alternate delivery system similar to that proposed in this paper.

PROJECT POTENTIAL

This pipeline as with any similar system must have a use for the products it transports to be considered for potential investment. The interior of Alaska is in dire need of low to moderate cost energy. However, this in no way could justify the need for an alternate pipeline. Less than five (5) percent of our share of the reserves could be used for energy needs. The development of a petrochemical industry as a symbiotic partner would then follow. Since this would be the major customer an overview of its potential and costs is necessary. Using the estimated gas analysis provided by the producers, we arrive at the volumes of natural gas liquids shown in Exhibit B. As you will note, Alaska's royalty share of ethane alone is sufficient to support a 500 million pound per year ethylene plant, based on an 80% yield factor. If propane is included, Alaska by itself has almost enough royalty feedstock for a billion pound per year olefin facility. This would be comparable in size to the largest worldwide facilities now under construction. It is quite possible, however, that when a petrochemical project is developed in Alaska, that one or more of the oil companies who control the remaining LPG fractions at Prudhoe would be an active participant and would assign a share of its LPG to the venture.

LPG supplies to petrochemical plants in the lower 48 will continue to decline in rough proportion to the predictable decline in natural gas

production. Spokesmen for the petrochemical industry now flatly state that no new olefin plants based on LPG facilities will be constructed. All of the new] ', including several that are now under construction, will have to employ naphthas or gas oils as the feedstock. Olefin plants using the heavier feedstocks cost at least 50% more to construct than if ethane or propane were the raw material. Another disa..vantage for plants using naphtha or gas oil is that a very broad spectrum of products is produced, ranging from methane and ethylene all the way to heavy fuel oil. While the yield of ethylene from ethane is around 80%, it is only 25-30% for naphtha. Any company desiring to produce ethylene today would be most fortunate to have a secure, economical long term domestic supply of ethane and propane such as should be available in Alaska in the near future.

Let us consider the range of petrochemical projects based on natural gas and natural gas liquids that could be established in Alaska. There are only two major petrochemical candidates that are manufactured from natural gas or methane: (1) ammonia and its derivatives, and (2) methanol and its derivatives. Both products are high volume commodities. By 1980, consumption of ammonia in the U.S. will reach 21,000,000 tons of which 75% will be consumed as fertilizer nitrogen and 25% will be used to produce industrial chemicals. Worldwide consumption by 1980 will be close to 100,000,000 tons.

Unfortunately, ammonia does not appear to be a very good prospect for Alaska for the foreseeable future. The major problem seems to be

one of excessive production capacity combined with rather poor price prospects.

The situation for methanol is similar to ammonia. Without going into details at this time, I would also categorize methanol as an excellent future possibility.

This brings us to the LPG fractions; ethane, propane and butane. I believe that the most experienced venture development specialists would identify the establishment of a major olefin producing complex as a prime commercial opportunity for Alaska. The principle olefins, ethylene and propylene, have become the major building blocks in manufacturing a wide range of synthetic resins and/or organic chemicals. Ethylene would be produced by steam cracking of ethane; and propylene by cracking propane. Natural gas would be used for fuel.

Ethylene is the starting raw material for the two largest volume synthetic resins or plastics, as they are more commonly called, polyethylene and polyvinyl chloride. The latter is generally referred to as PVC. In 1976, approximately 750 mm. tons of polyethylene and 1200 mm tons of PVC were produced in the U.S. By 1980, these volumes are expected to reach 850 mm and 1300 mm tpy, respectively. The worldwide growth rate for polyethylene is established estimated at 10% annually. By 1986, 100 new high density polyethylene plants will be needed, along with an equal number of low density units.

The production of polyethylene in satellite plants appears to be the best

first choice for converting the ethylene into finished commercial products. The satellite plants could produce low density polyethylene which is used to produce pliable sheets and films and soft containers. These plants should be located in the Anchorage area to take advantage of the international traffic.

In rough round numbers, a 500 million pound per year ethylene-polyethylene complex such as I have just described would require an investment of at least $500 million; $250 million for the ethylene plant and $250 million for the satellite conversion plants. Such a complex would provide directly 300 to 400 high quality jobs including a high percentage of technical people -- possibly as many as a hundred. It is possible that a larger billion pound per year ethylene plant might prove to be economically feasible.

A second phase expansion program might logically involve a cracking plant to produce propylene from propane. Additional ethylene would be produced as a co-product. Satellite plants would include a polypropylene plant and possibly an ethylene oxide-ethylene glycol unit. Also, co-polymers and polyethylene and polypropylene could be produced, further broadening the product line. These facilities would probably cost an additional $500 million in 1976 dollars.

To provide feedstock for the petrochemical complex, it would be necessary to construct large, sophisticated extraction plants to remove ethane and propane from the pipeline gas. As the result, propane would be readily available to the public, to industry, and to agriculture in central Alaska and could be transported in the existing product pipeline to Haines. Universal availability of propane throughout Alaska would be helpful in improving living standards of the citizens.

Natural gas would be used as fuel in the ethane and propane cracking plants. We could conceivably be looking at an ultimate total investment of in the range of $2.0 billion and a product volume approaching one million tons of product per year. Total direct employment would be close to 1,000 of which about 200 could be from the engineering or chemistry professions.

These products do not sell by the ton. Rather they sell by the pound - currently close to 30 cents per pound for the products which I have described. The value added in Alaska will be substantial as shown in Exhibit D. The present value of ethane and propane from Prudhoe Bay is approximately 17 cents per gallon or about $79. per ton. Ethylene and propylene, the intermediate products, are worth about $240 per ton. Polyethylene and polypropylene, the finished products sell for $600 per ton and there is no reason that a portion of the polyethylene could not be further upgraded in Alaska. For example, a polyethylene and polypropylene pipe manufacturing plant could be established that would serve Alaska and the Pacific Coast states; or a polyethylene calendering plant could be built to manufacture various grades of films and sheets.

GENERAL PARAMETERS

In determining the cost of a transmission line and distribution system the following items were considered.

1. Approximately 400 miles of 24 inch pipeline from Prudhoe Bay to the North Star Borough area.

   $1,000,000/mi

2. Assume 10,000 residential hookups at $2500 each. Tie in for major(industrial)users and physical plant necessary for the distribution system computed at $25,000,000.

3. Interest rate for distribution system has been calculated using a most favorable municipal bond rate.

4. State royalty share (1/8) of calculated reserves in the Prudhoe Bay field. Approximately 3.5 trillion cu. ft. of natural gas. For the purposes of these calculations, we have estimated usage in the interior at 2 trillion cu. ft. over the 20 year period.

5. All major cost items were extrapolated from known arctic and sub-arctic construction costs.

COST BREAKDOWN TRANSMISSION LINE

A.	Capital Investment	$ 400,000,000.
B.	Interest (20 years) See computer printout	401,502,000.
C.	Operations and Profit	350,000,000.
		$ 1,151,502,000./20 years

COST BREAKDOWN OF GAS DISTRIBUTION SYSTEM

A.	Capital Investment	$ 50,000,000.
B.	Interest (20 years) See computer printout	37,739,000.
C.	Operation and Reserves	200,000,000.
		$ 287,739,000.

NOTE: This reserve figure allows for reinjection costs of surplus gas if necessary.

TOTAL PROJECT COSTS OVER 20 YEARS:	$ 1,439,241,000.
CONSUMPTION PER YEAR:	100 billion cu. ft.
ROYALTY TO STATE AT FPC new gas price $0.52/mcf	52,000,000/year or
	1,040,000,000 Total
COST PER mcf delivered to users in North Star Borough	$ 1.24/mcf

COST ANALYSIS

Energy Use: The cost of $1.24/mcf on a B.T.U. Basis is extremely competitive with heating oil in the Alaskan interior.

Natural Gas/million B.T.U.	$1.24
Fuel Oil/million B.T.U.	$3.00 to $4.80

Petrochemical Feedstock: The cost of $1.24/mcf is well below the $1.50/mcf now being paid on a short term contract for access to Intrastate gas in the lower 48. It also compares favorably with price changes by the Canadian government to petrochemical complexes in Alberta on new contracts.

GAS TRANSMISSION LINE

LOAN AMOUNT 400,000,000
INTEREST RATE (% PER YEAR) 8%
YEARS 20
MIN MONTHLY PAYMENT 345.77
ACTUAL MONTH PAYMENT 3,500,000
PAYMENTS START(MT,YR) Jan 1980
PRINT LINE EVERY ? PAYMENTS
PRINT MAX OF ? LINES

MORTGAGE REPAYMENT SCHEDULE (8.00%)
MONTHLY PAYMENTS $350.00

M-YR	INT PAY	PRIN PAY	TOT INT	BAL.		
0 0-80				400000.00		
12-80	2614.85	735.15	31692.55	391492.55		
12-81	2553.53	796.17	62678.99	382278.98		
12-82	2487.75	862.25	92900.70	372300.70		
12-83	2416.19	933.81	122294.22	361494.22		
12-84	2338.68	1011.32	150790.82	349790.81		
12-85	2254.74	1095.26	178316.03	337116.02		
12-86	2163.84	1186.16	204789.24	323389.24		
12-87	2065.38	1284.62	230123.14	308523.13		
12-88	1958.76	1391.24	254223.15	292423.14		
12-89	1843.29	1506.71	276986.88	274986.86		
12-90	1718.23	1631.77	298303.39	256103.38		
12-91	1582.80	1767.20	318052.60	235652.58		
12-92	1436.12	1913.88	336104.39	213504.38		
12-93	1277.27	2072.73	352317.89	189317.88		
12-94	1105.24	2244.76	366540.53	163540.52		
12-95	918.92	2431.08	378607.06	135407.05		
12-96	717.14	2632.86	388338.53	104938.52		
12-97	498.62	2851.38	395541.12	71941.11		
12-98	261.95	3088.05	400004.93	36204.94		
12-99	5.65	847.03	401502.68	0.	LAST PAYMENT	852.68

NOTE: multiply all results by 1000

GAS DISTRIBUTIO SYSTM

LOAN AMOUNT 50,000,000
INTEREST RATE (% PER YEAR) 6.5%
YEARS 20
MIN MONTHLY PAYMENT 372.79
ACTUAL MONTH PAYMENT 380,000
PAYMENTS START(MT,YR) Jan 1982
PRINT LINE EVERY ? PAYMENTS
PRINT MAX OF ? LINES

MORTGAGE REPAYMENT SCHEDULE (6.50%)
MONTHLY PAYMENTS 3380.00

M-YR	INT PAY	PRIN PAY	TOT INT	BAL.
0 0-82				50000.00
12-82	264.15	115.85	3210.26	48650.26
12-83	256.39	123.61	6330.12	47210.13
12-84	248.11	131.89	9353.54	45673.54
12-85	239.28	140.72	12274.05	44034.05
12-86	229.86	150.14	15084.76	42234.76
12-87	219.80	160.20	17778.31	40418.31
12-88	209.07	170.93	20346.87	38426.87
12-89	197.62	182.38	22782.06	36302.06
12-90	185.41	194.59	25074.94	34034.94
12-91	172.38	207.62	27215.99	31615.99
12-92	158.47	221.53	29195.04	29035.04
12-93	143.64	236.36	31001.24	26281.24
12-94	127.81	252.19	32623.01	23343.01
12-95	110.92	269.08	34048.00	20208.09
12-96	92.90	287.10	35263.03	16363.03
12-97	73.67	306.33	36254.05	13294.05
12-98	53.15	326.85	37006.04	9456.04
12-99	31.26	348.74	37503.01	5423.01
12-00	7.91	372.09	37727.86	1087.86
3-01	1.83	337.62	37739.45	0. LAST PAYMENT 339.45

NOTE: multiply all results by 1000

SUMMARY

A great volume of data has been compiled in order to answer the question is a return to the State of eight (8) percent on an investment of $400,000,000.: (1) equitable, and (2) justified.

Equitability in this case whould be viewed as a comparison of opportunity costs. The lender (State) will be viewing its options in this light. Long term guaranteed yield from 5-1/2 to 7% can be expected in non venture investments. Therefore a return to the state of eight (8) percent from long term contracts is a definite plus.

Justification: Mr. John C. Whitehead partner in Goldman, Sachs & Co., New York investment bankers, recently wrote that "Project Financing Techniques" are necessary in viewing new captial expenditures in this industry. Investment capital has relied too heavily on the debt capacity on the sponsor rather than the merit of an individual project. Using the techniques of drawing in the debt capacity of the customer (Petrochemical Complex) the justification for heavy (up to 100%) debt financing is justified.

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Dempsey, R.H. — Cost Estimate of Gas Transmission Report to the North Star Borough, 1975

EXHIBIT B

PETROCHEMICAL RAW MATERIALS IN PRUDHOE BAY SALES GAS

(BASED ON 1,600,000 B/D OF CRUDE OIL - 2.0 BCF/D OF SALES GAS)

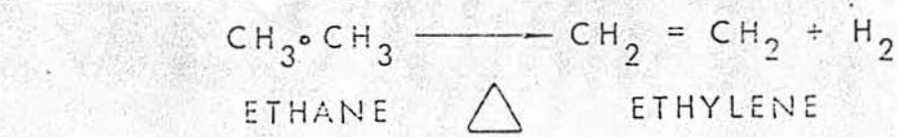
LPG CONTENT OF SALES GAS

	(BARRELS/DAY)		(TON/YEAR)	
	TOTAL LPG	ALASKA SHARE	TOTAL LPG	ALASKA SHARE
ETHANE (C-2's)	103,000	13,000	2,338,000	292,000
PROPANE (C-3's)	55,000	7,000	1,780,000	223,000
BUTANES (C-4's)	20,000	2,500	736,000	92,000
PENTANES+ (C-5's)	4,000	500	178,000	22,000
TOTAL	182,000	23,000	5,032,000	629,000

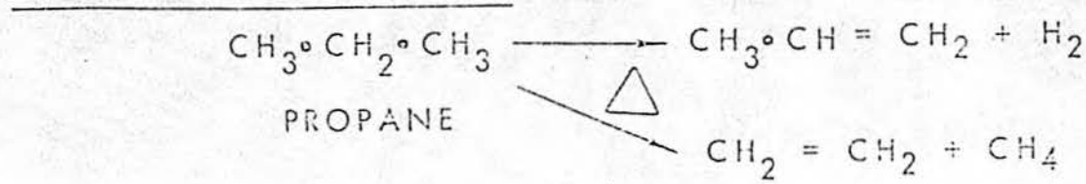
EXHIBIT C

PRODUCTION OF OLEFINS FROM LPG FRACTIONS

ETHANE TO ETHYLENE



PROPANE TO PROPYLENE



BUTANE TO BUTYLENE

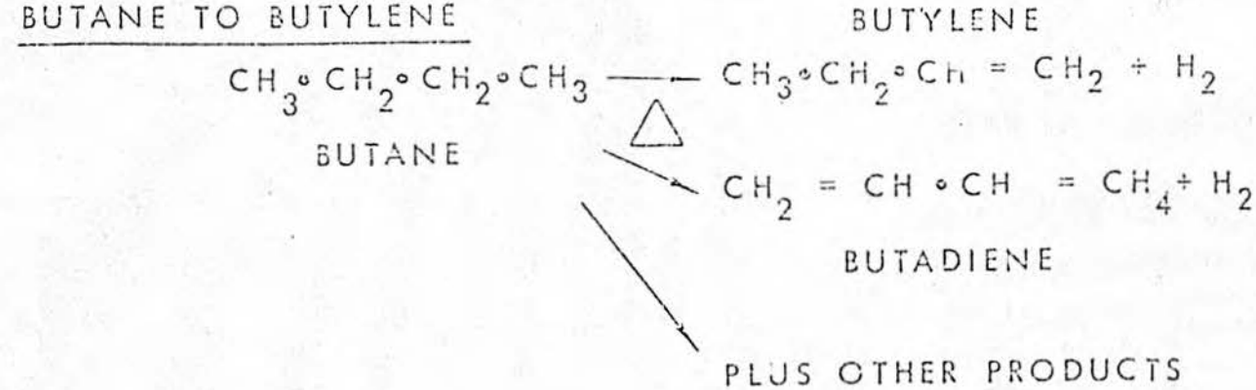


EXHIBIT D

ALASKA PETROCHEMICALS VALVE ADDED

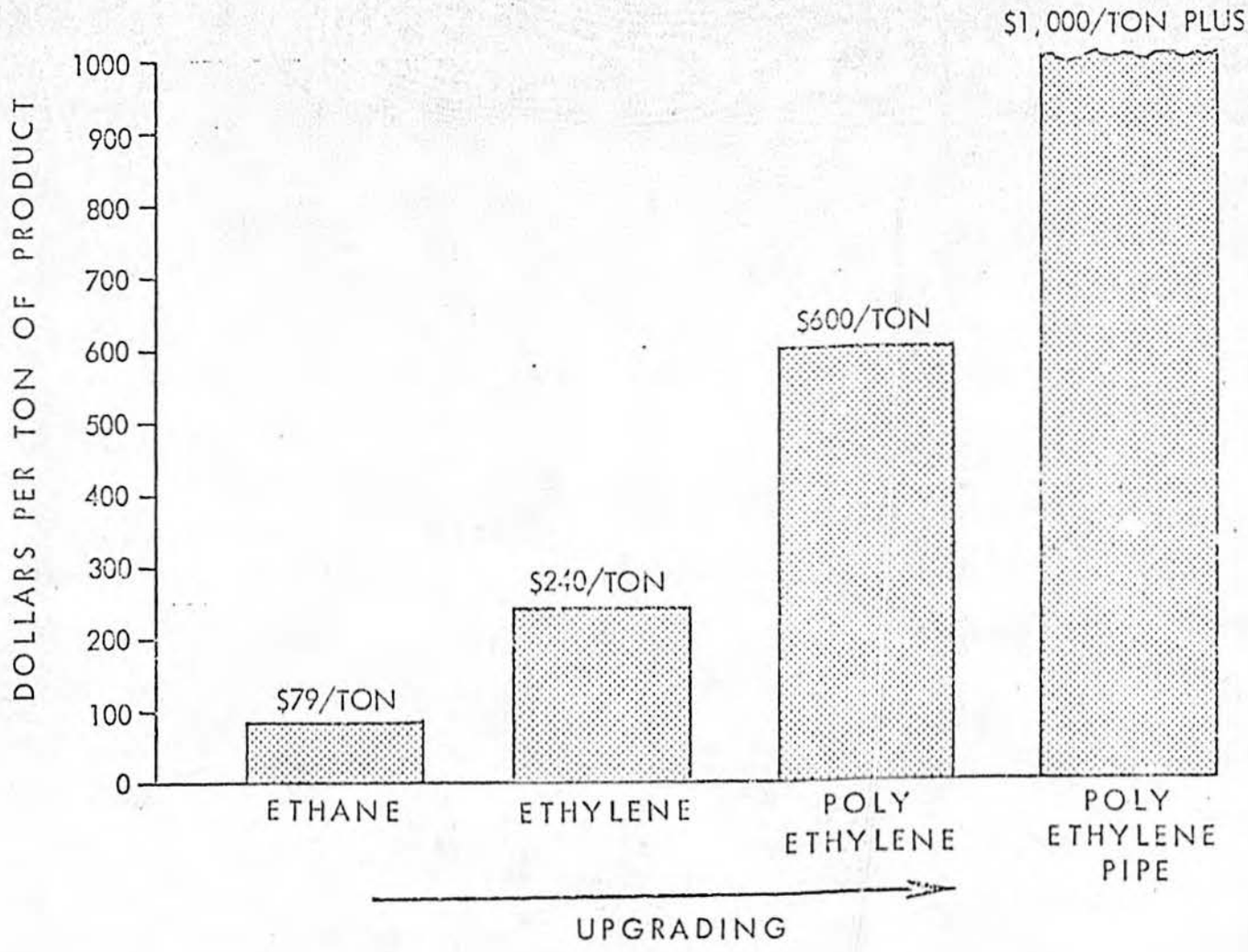


EXHIBIT E

ALBERTA PETROCHEMICAL RUNDOWN ON NEW PLANTS

NATURAL GAS BASED

3 WORLD SIZED AMMONIA PLANTS
2 WORLD SIZED UREA PLANTS
1 WORLD SIZED AMMONIUM NITRATE PLANT
3 WORLD SIZED METHANOL PLANTS
1 WORLD SIZED ACETIC ACID PLANT

NATURAL GAS LIQUIDS BASED

1 WORLD SIZED ETHYLENE PLANT
1 ETHYLENE OXIDE - ETHYLENE GLYCOL PLANT
1 VINYL CHLORIDE PLANT

CONDENSATE BASED (PENTANES PLUS)

1 BENZENE - GASOLINE PLANT

VALVE - WELL OVER $1 BILLION