PART IX OVERALL EVALUATION OF THE PROJECT; PRICING OF ETHYLENE AND ETHANE

PART IX OVERALL EVALUATION OF THE PROJECT; PRICING OF ETHYLENE AND ETHANE

CHAPTER 1 METHOD FOR IMPROVING PROFITABILITY OF THE VCM PROJECT, AND ETHYLENE PRICING

In the following the study team presents its overall evaluation of the project, utilizing the results of financial evaluation given in Part VII and economic evaluation the results of which are reported in Part VIII, from the viewpoint of the pricing of ethylene and ethane.

As is evident from the discussion thus far, the ethylene project is financially and economically viable. Further, it is believed to have high profit potential and is feasible from all aspects and hence from the viewpoint of the Thai economy its early realization is highly desirable.

Financial analysis was performed on the basis of an ethylene sales price of US$800/t and a feedstock ethane supply price of US$350/t, which were obtained as a result of study of the market aspects in Part II and alternative plans in Part IV, and sensitivity test results indicate that even if the ethylene sales price is lower by 10% (US$720/t) the project is feasible.

Further, because the price of ethane in the natural gas can be evaluated at only US$190/t[1] if this ethylene project is not realized, the ethylene project has the potential for giving the ethane the high value of more than US$300/t.

Therefore, from the viewpoints of effective use of the natural gas (particularly, of its ethane fraction), and of maximizing value added, this ethylene project is of great importance, and its realization would make a great contribution to the Thai economy.

Regarding the VCM project, with feedstock ethylene priced at US$800/t, although the project is economically viable, it has very low profitability. The profitability is so low that it is not conceivable that a private investor would find it attractive.

It must be affirmed, however, that it was stipulated for this feasibility study that the ethylene project could not be realized unless downstream projects including the VCM plant are realized. In other words, an ethylene project alone is not sufficient to accomplish the effective use of the natural gas and improvement of its value added, so the realization of downstream projects is an indispensable requirement.

1) When the cost of separation at the gas processing plant is taken into account, US$240 is expected.

It is indispensable, to stimulate private sector interests to invest in downstream projects, and to participate in the formation of an integrated petrochemical complex organized around the ethylene plant being planned by the PTT, for the policy to be adopted of supplying ethylene to those projects at an attractive price.

From the basic understanding that the forced omission of any one of the gas processing (ethane separation) plant, ethylene plant or the downstream plants would prevent Thailand from establishing a petrochemical industry, it is necessary to establish a rational means of distributing profits and costs in a comprehensive manner among all participants in the petrochemical complex, by means of rational price setting of ethylene and ethane.

It was confirmed through the sensitivity analysis described in Part VII that even if the price of ethylene supplied to the VCM plant is set at US$700/t (in constant 1980 price) if the ethylene plant is supplied with ethane from the gas processing plant at US$300/t, it will result in a financial internal rate of return sufficiently exceeding 15%.

In such a case, from the viewpoint of the gas processing project, it will still be possible to evaluate the ethane at a suitably high level.[1] Further, the IRR of the VCM project would be improved from 10.1% to 13.1%,[2] making the project feasible, as is discussed in Part VII.

In the event that such measures are not taken, the profitability of the VCM project would be so low that private interests would not be able to justify investment in it. PTT therefore would have to utilize another means of implementing the project, as noted below.

(1) PTT itself undertakes VCM production, or
(2) The VCM project is abandoned, and the ethylene project is planned without taking into account the supply of ethylene to the VCM project.

As is evident from the study results presented thus far, there is more than adequate feasibility in the case of the ethylene project and the gas processing project (ethane price), so that if PTT were to undertake on its own not only the upstream projects but also the low-profitability VCM project, the projects as a whole would be feasible. It is therefore one possi-

1) Feedstock ethane price can be determined with relative flexibility as long as the assumption is made that both the ethylene project and the gas processing project are 100% under the justification of PTT. A difference in ethane price is simply a matter of how value added due to producing ethylene from ethane in the natural gas is allocated between the gas processing project and the ethylene project, and as long as there is overall feasibility, no matter what ethane price is adopted as long as the ethylene sales price is the same, there is no change in PTT's profits.

2) The IRR is not at the 15% level, and efforts by the private investor will be necessary, such as through reducing the plant investment cost at the stage of project implementation. It is noted in Part VII that a 10% reduction in plant cost will improve the IRR by 2.1%. Taking this into consideration, the IRR may be expected to reach the 15% level. It will also be necessary, nevertheless, for there to be exemption from import taxes levied on plant equipment, a prolonged tax holiday in regard to corporate tax, and other tax relief measures.

ble alternative that PTT itself undertakes VCM production in addition to ethylene production. In relation to the subject of marketing caustic soda which would be a co-product of salt electrolysis carried out to supply chlorine to the VCM plant, it would be necessary to obtain the participation[1] of one of the present Thai producers of caustic soda.

Further, if it is decided to use imported EDC, it would result in a reduction by half of the VCM plant's requirement of ethylene to be supplied from the ethylene plant (i.e., there would be a reduction of that demand by about 19,000 t/y at full utilization of VCM plant capacity).

The second alternative is simply to abandon the VCM project due to its low profitability. In such a case, the scale of the ethylene plant must be reduced from the level used in this feasibility study, by the amount of ethylene demand estimated for the VCM plant, or the utilization of ethylene plant capacity must be lowered. This would adversely influence the profitability of the ethylene plant in comparison to the conditions and results of this study or, in other words, it would force the reduction of the ethane price.

A relative decrease in the evaluated price for ethane, and a reduction in the quantity of ethane supplied for ethylene production, would serve to greatly decrease the income earned by the gas processing project from ethane separation, and would invite a great opportunity loss. Therefore, this alternative is not recommendable. It is, in final analysis, most desirable to solve this problem by setting the ethylene price at a level which enable the VCM project to be implemented.

1) Setting of the chlorine price would be accompanied by the same problem as noted above for setting of the ethylene price.

CHAPTER 2 FINANCIAL ANALYSIS OF ALTERNATIVE ETHYLENE PRICES

As stated above, it is understood from consideration of a natural gas-based Thai petrochemical industry combining upstream and downstream projects that it is desirable to adopt instead of the ethylene price of US$800/t used in the financial analysis (Part VII), the price of US$700 which will enable the VCM project to be implemented. Therefore the following conditions are adopted for calculation of production cost and for financial analysis of both the ethylene plant and the VCM plant.

	Ethylene plant	VCM plant
Feedstock :	Ethane US$300/t	Ethylene US$700/t
Product price :	Ethlene US$700/t	No change
Other conditions :	Identical to those of Part VII, Chapter 4	Identical to those of Part VII, Chapter 4

2-1 ETHYLENE PROJECT

For details, refer to Attachment IX-1.

(1) Ethylene production cost

Ethylene production cost and the shares of it accounted for by the major cost factors are shown in Table IX-1.

(2) Profitability and financial position

Results of financial analysis are provided in Attachment IX-1 of this part. The IRR is 17.3% and the project is adequately feasible. The income statements show a profit from the third year of commercial operation. The ratio of profit to paid-in capital is high, averaging 55.3% over the 15-year period. The debt service ratio is 1.40 at minimum and averages 2.96 during the period of loan replayment. This project is therefore judged to possess fully sufficient ability to repay its loans.

2-2 VCM PROJECT

For details, refer to Attachment IX-2.

Table IX–1 ETHYLENE PRODUCTION COST (CASE–B)

	1986: 142,700 t/y		1990: 189,400 t/y		1994: 230,000 t/y	
	$/t	%	$/t	%	$/t	%
Ethane	374.3	53.2	374.3	62.1	374.3	68.4
Cat. & Chem. Fuel Gas Raw Water Utilities Sale (to VCM, etc.)	5.1	0.7	6.4	1.0	11.5	2.1
Variable Cost	379.4	53.9	380.7	63.1	385.8	70.5
Labor Cost Plant Overhead Maintenance Insurance, etc.	71.9	10.2	54.2	9.0	44.6	8.1
Depreciation	149.6	21.2	112.7	18.7	92.8	17.0
Fixed Cost	221.5	31.4	166.9	27.7	137.4	25.1
Ex-factory Production Cost	600.9	85.3	547.6	90.8	523.2	95.6
Head Office Expenses and Interest Charges	103.3	14.7	55.6	9.2	24.1	4.4
Production Cost, Total	704.2	100.0	603.2	100.0	547.3	100.0

(1) Production cost of VCM and caustic soda

The production cost of VCM and caustic soda, and the shares in that cost of major cost items, are given in Table IX-2.

(2) Profitability and financial position

The results of financial analysis using US$700/t as the ethylene price are given in Attachment IX-2 of this part. In comparison to the IRR when the price is US$800, 10.1%, here it is improved, to 13.1%. The income statements show that a loss is expected only in the fourth year of operation and that the cumulative deficit is eliminated in the seventh year. The average ratio of profits to paid-in capital over the 15 years is 27.5%. The debt service ratio is, at the minimum, 1.19, and averages 2.03 during the period of loan repayment. Therefore, during the entire project life, there would be no capital shortages and hence no need for short-term loans, and no problem is expected in repaying the loan. Consequently the ethylene price of US$700/t, in comparison to US$800, results in a marked improvement of the financial position. The project therefore is feasible and it may be said that private investment in the VCM project is possible.

Table IX–2 PRODUCTION COST FOR VCM AND CAUSTIC SODA

Year	1986		1994	
VCM Production	62,800 t/y		80,000 t/y	
Caustic Soca Production	40,506 t/y		51,600 t/y	
Breakdown of Production Cost	US$/T	%	US$/T	%
Raw Salt	25			
Ethylene	332	31	332	38
Oxygen	20			
Cat. and Chem.	16			
Raw Materials Cost	(393)	(37)	(393)	(45)
Power	106	10	106	12
Other utilities	53			
Cost for Waste Water Treatment	5			
Utilities Cost	(164)	(16)	(164)	(19)
Variable Cost	557	53	557	64
Depreciation	215	20	169	19
Labor Cost	13	12	10	12
Maintenance	57		45	
Electrode & Ion Exchange Membrance	19		15	
Insurance, etc.	28		22	
Plant Overhead	13		10	
Fixed Cost	345	32	271	31
Ex-factory Production Cost	902	85	828	95
Head Office Expenses and Interest Charges	153	15	46	5
Production Cost, Total	1,055	100	874	100

CHAPTER 3 OVERALL EVALUATION

The following conclusions and recommendations are made as the overall evaluation of the project, based on the foregoing.

(1) The overall project essentially is feasible, and efforts should be made to realize it at the earliest possible time.

(2) Thought must be given to the ethylene project as a factor enabling realization of the VCM project. In other words, lowering of the sales price of ethylene makes the VCM project viable by improving its profitability, and rather than accept a reduction of ethylene demand it is economically advisable for the entire project (and for the gas processing project) to do so.

(3) To facilitate participation of private sector interests in realization of the VCM project will require that strategic considerations be given in regard to ethylene (at the minimum the price must be set below US$700/t). In addition, tax relief measures will be indispensable in order to obtain private sector participation.

(4) Participation by PTT in the VCM project ultimately will be decided by PTT, with due consideration given to availability of PTT's capital resources and technical staff, as well as PTT's marketing capability and other relevant point. It is the judgment of the feasibility study team that from the viewpoint of the future development of the petrochemical industry in Thailand it is desirable to obtain the strong participation of the private sector which can mobilize its abilities and experience for the successful implementation of the project.

ATTACHMENT IX–1

FINAL RESULTS OF THE FINANCIAL ANALYSIS OF THE ETHYLENE PROJECT

Ethane Price : $300/t

Ethylene Price : $700/t

Income Statements

Funds Flow Statements

Balance Sheet

Production and Sales Plan

Production Cost Statements

IRR Calculation

Profitability and Financial Indicators

*** FINANCIAL PROJECTIONS OF PTT ETHYLENE PLANT PROJECT ***
INCOME STATEMENTS (FOR YEARS ENDING DECEMBER 31)
(CASE-B : UTILITIES CENTER IS INTEGRATED) (US$ 1000)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
PRODUCTION AND SALES															
CAPACITY	230000.	230000.	230000.	230000.	230000.	230000.	230000.	230000.	230000.	230000.	230000.	230000.	230000.	230000.	230000.
CAPACITY UTILIZATION	0.307	0.620	0.651	0.742	0.794	0.823	0.867	0.898	0.932	1.000	1.000	1.000	1.000	1.000	1.000
PRODUCTION	70500.	142700.	149700.	170600.	182600.	189400.	199300.	206600.	214300.	230000.	230000.	230000.	230000.	230000.	230000.
INCREASE IN INVENTORIES	3500.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SALES VOLUME	67000.	142700.	149700.	170600.	182600.	189400.	199300.	206600.	214300.	230000.	230000.	230000.	230000.	230000.	230000.
SALES REVENUE	46900.	99890.	104790.	119420.	127820.	132580.	139510.	144620.	150010.	161000.	161000.	161000.	161000.	161000.	161000.
COST OF SALES	40364.	85756.	88240.	96389.	100921.	103706.	107760.	110750.	113903.	120333.	109656.	98979.	98979.	98979.	98979.
VARIABLE COST	26674.	54147.	54631.	64780.	65812.	72097.	76151.	79141.	82294.	88724.	88724.	88724.	88724.	88724.	88724.
DEPRECIATION & AMORTIZATION	10677.	21354.	21354.	21354.	21354.	21354.	21354.	21354.	21354.	21354.	10677.	0.	0.	0.	0.
OTHER FIXED COST	5128.	10255.	10255.	10255.	10255.	10255.	10255.	10255.	10255.	10255.	10255.	10255.	10255.	10255.	10255.
(INC) IN PRODUCT INVENTORIES	-2105.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GROSS PROFIT OR (LOSS) ON SALES	6531.	14134.	16550.	23031.	26899.	26874.	31750.	33870.	36107.	40667.	51344.	62021.	62021.	62021.	62021.
LESS. SALES EXPENSES	650.	1715.	1765.	1928.	2018.	2074.	2155.	2215.	2278.	2407.	2193.	1980.	1980.	1980.	1980.
OPERATING PROFIT OR (LOSS)	5881.	12418.	14785.	21103.	24881.	26800.	29594.	31655.	33828.	38260.	49151.	60041.	60041.	60041.	60041.
LESS. INTEREST															
ON LONG TERM DEBT	6638.	13019.	12265.	11115.	9787.	8460.	7132.	5804.	4477.	3149.	1822.	751.	177.	0.	0.
ON SHORT TERM DEBT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NET PROFIT OR (LOSS) BEFORE TAX	-957.	-600.	2520.	9988.	15093.	18340.	22462.	25851.	29352.	35111.	47329.	59290.	59864.	60041.	60041.
LESS. INCOME TAX	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NET PROFIT OR (LOSS) AFTER TAX	-957.	-600.	2520.	9988.	15093.	18340.	22462.	25851.	29352.	35111.	47329.	59290.	59864.	60041.	60041.

*** FINANCIAL PROJECTIONS OF PTI ETHYLENE PLANT PROJECT ***
FUNDS FLOW STATEMENTS (FOR YEARS ENDING DECEMBER 31)
(CASE-B : UTILITIES CENTER IS INTEGRATED) (US$ 1000)

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
SOURCES OF FUNDS	32087.	74869.	74869.	57557.	37481.	36474.	43557.	46846.	48530.	51496.	53612.	55608.	60482.	59827.	60041.	60041.	60041.	60041.
CASH GENERATED FROM OPERATION	0.	0.	0.	16358.	33772.	36139.	42457.	46234.	48154.	50948.	53009.	55182.	59614.	59827.	60041.	60041.	60041.	60041.
PROFIT BEFORE TAX, INTEREST	0.	0.	0.	5681.	12418.	14785.	21103.	24881.	26800.	29594.	31655.	33828.	38260.	49151.	60041.	60041.	60041.	60041.
DEPRECIATION & AMORTIZATION	0.	0.	0.	10677.	21354.	21354.	21354.	21354.	21354.	21354.	21354.	21354.	21354.	10677.	0.	0.	0.	0.
FINANCIAL RESOURCES	32087.	74869.	74869.	37598.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SHARE CAPITAL	8022.	18717.	18717.	8022.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
LONG TERM DEBT	24065.	56152.	56152.	29576.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SHORT TERM DEBT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INCREASE IN ACCT PAYABLE	0.	0.	0.	3601.	3709.	335.	1100.	612.	376.	547.	404.	426.	868.	0.	0.	0.	0.	0.
USES OF FUNDS	31972.	72578.	74306.	52008.	28882.	26630.	29883.	27630.	25761.	24756.	23158.	21872.	21377.	17213.	9324.	3135.	0.	0.
INVESTMENT IN FIXED ASSET	31972.	72578.	74306.	35055.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
LAND AND SITE IMPROVEMENT	373.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONSTRUCTED FACILITIES	27991.	65312.	65312.	27991.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PRE-INVEST. & START-UP EXP	864.	864.	2592.	4321.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INTEREST DURING CONSTRUCTN	2744.	6402.	6402.	2744.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INCREASE IN CURRENT ASSET OTHER THAN CASH	0.	0.	0.	9112.	7841.	728.	2174.	1248.	707.	1030.	759.	801.	1633.	0.	0.	0.	0.	0.
INCR(DECR) ACC'T RECEIVABLE	0.	0.	0.	6331.	7154.	662.	1975.	1134.	643.	936.	690.	728.	1484.	0.	0.	0.	0.	0.
INCR(DECR) IN INVENTORIES																		
PRODUCTS	0.	0.	0.	2109.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MATERIALS	0.	0.	0.	672.	688.	67.	199.	114.	65.	94.	70.	73.	150.	0.	0.	0.	0.	0.
DEBT SERVICES	0.	0.	0.	7841.	21041.	25902.	27709.	26382.	25054.	23726.	22399.	21071.	19744.	17213.	9324.	3135.	0.	0.
REPAYMENT OF LONG TERM DEBT	0.	0.	0.	1203.	8022.	13637.	16594.	16594.	16594.	16594.	16594.	16594.	16594.	15391.	8573.	2958.	0.	0.
REPAYMNT OF SHORT TERM DEBT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INTEREST ON LONG TERM DEBT	0.	0.	0.	6638.	13019.	12265.	11115.	9787.	8460.	7132.	5804.	4477.	3149.	1822.	751.	177.	0.	0.
INTEREST ON SHORT TERM DEBT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INCOME TAX PAYMENT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DIVIDENDS PAYMENT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CASH INCREASE OR (DECREASE)	115.	2291.	563.	5549.	8599.	9844.	13673.	19216.	22768.	26739.	30254.	33736.	39105.	42614.	50717.	56906.	60041.	60041.
BEGINNING CASH BALANCE	0.	115.	2406.	2968.	8517.	17116.	26960.	40634.	59850.	82618.	109358.	139612.	173347.	212452.	255067.	305784.	362690.	422731.
ENDING CASH BALANCE	115.	2406.	2968.	8517.	17116.	26960.	40634.	59850.	82618.	109358.	139612.	173347.	212452.	255067.	305784.	362690.	422731.	482772.

*** FINANCIAL PROJECTIONS OF PTT ETHYLENE PLANT PROJECT ***
BALANCE SHEET (FOR YEARS ENDING DECEMBER 31)
(CASE-B : UTILITIES CENTER IS INTEGRATED) (US$ 1000)

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
ASSETS	32087.	106955.	161824.	220863.	215950.	205169.	199662.	198773.	200895.	207310.	216970.	230153.	249537.	281475.	332152.	389098.	449139.	509180.
CURRENT ASSETS	115.	2406.	2968.	17629.	54070.	66642.	60490.	80954.	104430.	132199.	163212.	197749.	238487.	281102.	331819.	388725.	448766.	508807.
CASH	115.	2406.	2968.	8517.	17116.	26960.	40634.	59850.	82618.	109358.	139612.	173347.	212452.	255067.	305784.	362690.	422731.	482772.
ACCOUNTS RECEIVABLE	0.	0.	0.	6331.	13485.	14147.	16122.	17256.	17898.	18834.	19524.	20251.	21735.	21735.	21735.	21735.	21735.	21735.
INVENTORIES																		
PRODUCTS	0.	0.	0.	2109.	2109.	2109.	2109.	2109.	2109.	2109.	2109.	2109.	2109.	2109.	2109.	2109.	2109.	2109.
MATERIALS	0.	0.	0.	672.	1359.	1426.	1625.	1739.	1804.	1899.	1968.	2041.	2191.	2191.	2191.	2191.	2191.	2191.
NET FIXED ASSETS	31972.	104550.	178856.	203234.	181880.	160526.	139173.	117819.	96465.	75111.	53758.	32404.	11050.	373.	373.	373.	373.	373.
INVESTMENT	31972.	104550.	178856.	213911.	213911.	213911.	213911.	213911.	213911.	213911.	213911.	213911.	213911.	213911.	213911.	213911.	213911.	213911.
LAND & SITE IMPROVEMENT	373.	373.	373.	373.	373.	373.	373.	373.	373.	373.	373.	373.	373.	373.	373.	373.	373.	373.
CONSTRUCTED FACILITIES	27991.	93302.	158614.	186605.	186605.	186605.	186605.	186605.	186605.	186605.	186605.	186605.	186605.	186605.	186605.	186605.	186605.	186605.
PRE-INVEST. & START-UP EXP	864.	1728.	4321.	8641.	8641.	8641.	8641.	8641.	8641.	8641.	8641.	8641.	8641.	8641.	8641.	8641.	8641.	8641.
INTEREST DURING CONSTRUCTN	2744.	9146.	15548.	18292.	18292.	18292.	18292.	18292.	18292.	18292.	18292.	18292.	18292.	18292.	18292.	18292.	18292.	18292.
LESS.DEPRECIATN & AMORTIZTN	0.	0.	0.	10677.	32031.	53384.	74738.	96092.	117446.	138800.	160153.	181507.	202861.	213538.	213538.	213538.	213538.	213538.
LIABILITIES	24065.	80217.	136368.	168342.	164029.	150728.	135233.	119251.	103032.	86985.	70794.	54626.	38899.	23508.	14935.	11978.	11978.	11978.
CURRENT LIABILITIES	0.	0.	1203.	11623.	20947.	24240.	25340.	25952.	26328.	26875.	27278.	27704.	27369.	20551.	14935.	11978.	11978.	11978.
ACCOUNTS PAYABLE	0.	0.	0.	3601.	7310.	7645.	8745.	9357.	9733.	10280.	10684.	11110.	11978.	11978.	11978.	11978.	11978.	11978.
INCOME TAX PAYABLE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DIVIDENDS PAYABLE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CURRENT PORTION OF DEBT																		
LONG TERM DEBT	0.	0.	1203.	8022.	13637.	16594.	16594.	16594.	16594.	16594.	16594.	16594.	15391.	8573.	2958.	0.	0.	0.
SHORT TERM DEBT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
FIXED LIABILITIES	24065.	80217.	135165.	156719.	143083.	126488.	109894.	93299.	76705.	60110.	43516.	26922.	11530.	2958.	-0.	-0.	-0.	-0.
LONG TERM DEBT BALANCE	24065.	80217.	135165.	156719.	143083.	126488.	109894.	93299.	76705.	60110.	43516.	26922.	11530.	2958.	-0.	-0.	-0.	-0.
STOCK HOLDERS EQUITY	8022.	26739.	45456.	52521.	51921.	54441.	64429.	79522.	97863.	120325.	146176.	175527.	210638.	257966.	317250.	377120.	437161.	497202.
SHARE CAPITAL	8022.	26739.	45456.	53478.	53478.	53478.	53478.	53478.	53478.	53478.	53478.	53478.	53478.	53478.	53478.	53478.	53478.	53478.
RETAINED EARNINGS	0.	0.	0.	-957.	-1557.	963.	10951.	26044.	44385.	66847.	92698.	122049.	157160.	204489.	263772.	323642.	383683.	443724.

*** FINANCIAL PROJECTIONS OF PTT ETHYLENE PLANT PROJECT ***
PRODUCTION AND SALES PLAN
(CASE-B : UTILITIES CENTER IS INTEGRATED) (US$ 1000)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
CAPACITY	230000.	230000.	230000.	230000.	230000.	230000.	230000.	230000.	230000.	230000.	230000.	230000.	230000.	230000.	230000.
CAPACITY UTILIZATION	0.307	0.620	0.651	0.742	0.794	0.823	0.867	0.898	0.932	1.000	1.000	1.000	1.000	1.000	1.000
PRODUCTION	70500.	142700.	149700.	170600.	182600.	189400.	199300.	206600.	214300.	230000.	230000.	230000.	230000.	230000.	230000.
INCREASE IN INVENTORY	3500.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SALES VOLUME	67000.	142700.	149700.	170600.	182600.	189400.	199300.	206600.	214300.	230000.	230000.	230000.	230000.	230000.	230000.
UNIT PRICE	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000
SALES REVENUE	46900.	99890.	104790.	119420.	127820.	132580.	139510.	144620.	150010.	161000.	161000.	161000.	161000.	161000.	161000.
*** TOTAL SALES REVENUE ***	46900.	99890.	104790.	119420.	127820.	132580.	139510.	144620.	150010.	161000.	161000.	161000.	161000.	161000.	161000.
*** TOTAL SALES VOLUME ***	67000.	142700.	149700.	170600.	182600.	189400.	199300.	206600.	214300.	230000.	230000.	230000.	230000.	230000.	230000.
*** AVERAGE SALES PRICE ***	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000

*** FINANCIAL PROJECTIONS OF PTT ETHYLENE PLANT PROJECT ***
PRODUCTION COST STATEMENTS
(CASE-B : UTILITIES CENTER IS INTEGRATED) (US$ 1000)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
PRODUCTION	70500.	142700.	149700.	170600.	182600.	189400.	199300.	206600.	214300.	230000.	230000.	230000.	230000.	230000.	230000.
ETHANE	26389.	53414.	56034.	63857.	68349.	70894.	74600.	77332.	80215.	86091.	86091.	86091.	86091.	86091.	86091.
CATALYSTS & CHEMICALS	494.	999.	1048.	1194.	1278.	1326.	1395.	1446.	1500.	1610.	1610.	1610.	1610.	1610.	1610.
RAW MATERIAL COST	26882.	54413.	57082.	65051.	69627.	72220.	75995.	78779.	81715.	87701.	87701.	87701.	87701.	87701.	87701.
FUEL GAS (1)	1925.	3896.	4087.	4657.	4985.	5171.	5441.	5640.	5850.	6279.	6279.	6279.	6279.	6279.	6279.
FUEL GAS (2)	902.	1762.	1919.	2088.	2245.	2245.	2245.	2245.	2245.	2245.	2245.	2245.	2245.	2245.	2245.
RAW WATER (1)	66.	133.	139.	159.	170.	176.	185.	192.	199.	214.	214.	214.	214.	214.	214.
RAW WATER (2)	63.	122.	133.	145.	156.	156.	156.	156.	156.	156.	156.	156.	156.	156.	156.
UTILITIES SALE (TO VCM/HDPE)	-3164.	-6179.	-6730.	-7320.	-7871.	-7871.	-7871.	-7871.	-7871.	-7871.	-7871.	-7871.	-7871.	-7871.	-7871.
UTILITIES COST	-209.	-266.	-451.	-271.	-315.	-143.	156.	362.	580.	1023.	1023.	1023.	1023.	1023.	1023.
VARIABLE COST	26674.	54147.	56631.	64780.	69312.	72097.	76151.	79141.	82294.	88724.	88724.	88724.	88724.	88724.	88724.
DEPRECIATION (PROCESS PLANT)	9330.	18660.	18660.	18660.	18660.	18660.	18660.	18660.	18660.	18660.	9330.	0.	0.	0.	0.
DEPRECIATION (PRE-INVEST)	432.	864.	864.	864.	864.	864.	864.	864.	864.	864.	432.	0.	0.	0.	0.
DEPRECIATION (INTEREST DUR.)	915.	1829.	1829.	1829.	1829.	1829.	1829.	1829.	1829.	1829.	915.	0.	0.	0.	0.
DEPRECIATION	10677.	21354.	21354.	21354.	21354.	21354.	21354.	21354.	21354.	21354.	10677.	0.	0.	0.	0.
AMORTIZATION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEPRECIATION & AMORTIZATION	10677.	21354.	21354.	21354.	21354.	21354.	21354.	21354.	21354.	21354.	10677.	0.	0.	0.	0.
LABOR COST	465.	929.	929.	929.	929.	929.	929.	929.	929.	929.	929.	929.	929.	929.	929.
OVERHEAD	465.	929.	929.	929.	929.	929.	929.	929.	929.	929.	929.	929.	929.	929.	929.
EMPLOYMENT COST	929.	1858.	1858.	1858.	1858.	1858.	1858.	1858.	1858.	1858.	1858.	1858.	1858.	1858.	1858.
MAINTENANCE COST	2799.	5598.	5598.	5598.	5598.	5598.	5598.	5598.	5598.	5598.	5598.	5598.	5598.	5598.	5598.
TAX & INSURANCE	1400.	2799.	2799.	2799.	2799.	2799.	2799.	2799.	2799.	2799.	2799.	2799.	2799.	2799.	2799.
OTHER FIXED COST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DIRECT FIXED COST	5128.	10255.	10255.	10255.	10255.	10255.	10255.	10255.	10255.	10255.	10255.	10255.	10255.	10255.	10255.
EX-FACTORY PRODUCTION COST	42478.	85756.	88240.	96389.	100921.	103706.	107760.	110750.	113903.	120333.	109656.	98979.	98979.	98979.	98979.
UNIT DIRECT OPERATING COST	0.6025	0.6010	0.5894	0.5650	0.5527	0.5475	0.5407	0.5361	0.5315	0.5232	0.4768	0.4303	0.4303	0.4303	0.4303
HEAD OFFICE EXP.	850.	1715.	1765.	1928.	2018.	2074.	2155.	2215.	2278.	2407.	2193.	1980.	1980.	1980.	1980.
INTEREST ON LOAN NO.1	963.	1781.	1588.	1396.	1203.	1011.	818.	626.	433.	241.	48.	0.	0.	0.	0.
INTEREST ON LOAN NO.2	2246.	4380.	3931.	3481.	3032.	2583.	2134.	1685.	1235.	786.	337.	0.	0.	0.	0.
INTEREST ON LOAN NO.3	2246.	4492.	4380.	3931.	3481.	3032.	2583.	2134.	1685.	1235.	786.	337.	0.	0.	0.
INTEREST ON LOAN NO.4	963.	1925.	1925.	1877.	1685.	1492.	1300.	1107.	914.	722.	529.	337.	144.	0.	0.
INTEREST ON LOAN NO.5	220.	441.	441.	430.	386.	342.	298.	254.	209.	165.	121.	77.	33.	0.	0.
INTEREST ON LONG-TERM DEBT	6638.	13019.	12265.	11115.	9787.	8460.	7132.	5804.	4477.	3149.	1822.	751.	177.	0.	0.
INTEREST ON SHORT-TERM DEBT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOTAL PRODUCTION COST	49965.	100490.	102270.	109432.	112727.	114240.	117048.	118769.	120658.	125889.	113671.	101710.	101136.	100959.	100959.
UNIT PRODUCTION COST	0.7087	0.7042	0.6832	0.6415	0.6173	0.6032	0.5873	0.5749	0.5630	0.5473	0.4942	0.4422	0.4397	0.4390	0.4390

*** FINANCIAL PROJECTIONS OF PTT ETHYLENE PLANT PROJECT ***
IRR CALCULATION ON TOTAL INVESTMENT
(CASE-B : UTILITIES CENTER IS INTEGRATED) (US$ 1000)

YEAR	TOTAL INVESTMENT	PROFIT BEFORE TAX	DEPRECIATN	INTEREST ON L-T DEBT	RETURN BEFORE TAX	DISCOUNT FACTOR	(BEFORE TAX) PRESENT VALUE		(LESS) INCOME TAX	RETURN AFTER TAX	DISCOUNT FACTOR	(AFTER TAX) PRESENT VALUE	
							INVEST.	RETURN				INVEST.	RETURN
1982	29228.	0.	0.	0.	0.	1.0000	29228.	0.	0.	0.	1.0000	29228.	0.
1983	66176.	0.	0.	0.	0.	0.8522	56398.	0.	0.	0.	0.8522	56398.	0.
1984	67904.	0.	0.	0.	0.	0.7263	49320.	0.	0.	0.	0.7263	49320.	0.
1985	37822.	-957.	10677.	6638.	16358.	0.6190	23412.	10126.	0.	16358.	0.6190	23412.	10126.
1986	0.	-600.	21354.	13019.	33772.	0.5275	0.	17816.	0.	33772.	0.5275	0.	17816.
1987	0.	2520.	21354.	12265.	36139.	0.4496	0.	16248.	0.	36139.	0.4496	0.	16248.
1988	0.	9988.	21354.	11115.	42457.	0.3832	0.	16268.	0.	42457.	0.3832	0.	16268.
1989	0.	15093.	21354.	9787.	46234.	0.3265	0.	15098.	0.	46234.	0.3265	0.	15098.
1990	0.	18340.	21354.	8460.	48154.	0.2783	0.	13401.	0.	48154.	0.2783	0.	13401.
1991	0.	22462.	21354.	7132.	50948.	0.2372	0.	12084.	0.	50948.	0.2372	0.	12084.
1992	0.	25851.	21354.	5804.	53009.	0.2021	0.	10715.	0.	53009.	0.2021	0.	10715.
1993	0.	29352.	21354.	4477.	55182.	0.1723	0.	9506.	0.	55182.	0.1723	0.	9506.
1994	0.	35111.	21354.	3149.	59614.	0.1468	0.	8752.	0.	59614.	0.1468	0.	8752.
1995	0.	47329.	10677.	1822.	59827.	0.1251	0.	7486.	0.	59827.	0.1251	0.	7486.
1996	0.	59290.	0.	751.	60041.	0.1066	0.	6402.	0.	60041.	0.1066	0.	6402.
1997	0.	59864.	0.	177.	60041.	0.0909	0.	5456.	0.	60041.	0.0909	0.	5456.
1998	0.	60041.	0.	0.	60041.	0.0774	0.	4650.	0.	60041.	0.0774	0.	4650.
1999	-5884.	60041.	0.	0.	60041.	0.0660	-388.	3963.	0.	60041.	0.0660	-388.	3963.
TOTAL	195246.				741858.		157969.	157969.		741858.		157969.	157969.

***** INTERNAL RATE OF RETURN ***** 17.34 PER CENT (BEFORE TAX) 17.34 PER CENT (AFTER TAX)

***** PAY-OUT PERIOD ***** 5.92 YEAR (BEFORE TAX) 5.92 YEAR (AFTER TAX)
(THE YEAR WHEN THE TOTAL CAPITAL COST WILL BE PAID OUT BY ACCUMULATED TOTAL RETURN, FROM THE BEG. OF OPERATION)

CAPITAL REQUIREMENTS	
LAND COST	373.
PLANT COST	186605.
PRE-INVEST AND START-UP EXP.	8641.
INTEREST DURING CONSTRUCTION	18292.
TOTAL FIXED CAPITAL	213911.
INITIAL WORKING CAPITAL	5511.
TOTAL CAPITAL COST	219422.

SOURCE OF FUNDS	
OWN CAPITAL	53478.
LONG TERM DEBT	165944.
SHORT TERM DEBT	0.
FINANCIAL RESOURCES	219422.

*** FINANCIAL PROJECTIONS OF PTT ETHYLENE PLANT PROJECT ***
PROFITABILITY AND FINANCIAL INDICATORS
(CASE-B : UTILITIES CENTER IS INTEGRATED) (US$ 1000)

YEAR	(1) AFT TAX PROFIT -TO- SALES REV (PCT)	(2) AFT TAX PROFIT -TO- S/H EQUITY (PCT)	(3) BFR TAX PROFIT -TO- INVESTMNT (PCT)	(4) AFT TAX PROFIT -TO- S/CAPITAL (PCT)	(5) CURRENT RATIO	(6) QUICK RATIO	(7) DEBT SERVICE RATIO	(8) L/T DEBT -TO- S/H EQUITY	(9)* PROFIT B.E.P. CAPACITY UTILIZE (PCT)	(10)* CASH B.E.P. SALES PRICE (PRICE)	(11)* CASH B.E.P. CAPACITY UTILIZE (PCT)
1985	-2.0	-1.8	-0.4	-1.8	1.52	1.28	2.09	75./ 25.	31.5	604.4	18.2
1986	-0.6	-1.2	-0.3	-1.1	1.63	1.46	1.61	73./ 27.	62.9	610.8	44.1
1987	2.4	4.6	1.1	4.7	1.84	1.70	1.40	70./ 30.	61.6	631.6	50.7
1988	8.4	15.5	4.6	18.7	2.39	2.24	1.53	63./ 37.	60.1	613.6	53.4
1989	11.8	19.0	6.9	28.2	3.12	2.97	1.75	54./ 46.	58.2	591.3	51.5
1990	13.8	18.7	8.4	34.3	3.97	3.82	1.92	44./ 56.	56.5	578.0	49.8
1991	16.1	18.7	10.2	42.0	4.92	4.77	2.15	33./ 67.	54.8	563.4	48.1
1992	17.9	17.7	11.8	48.3	5.98	5.83	2.37	23./ 77.	53.1	551.8	46.4
1993	19.6	16.7	13.4	54.9	7.14	6.99	2.62	13./ 87.	51.4	540.8	44.6
1994	21.8	16.7	16.0	65.7	8.71	8.56	3.02	5./ 95.	49.7	526.7	42.9
1995	29.4	18.3	21.6	88.5	13.68	13.47	3.48	1./ 99.	32.5	514.7	39.2
1996	36.8	18.7	27.0	110.9	22.22	21.93	6.44	-0./100.	15.7	479.5	27.9
1997	37.2	15.9	27.3	111.9	32.45	32.09	19.15	-0./100.	14.8	452.6	19.0
1998	37.3	13.7	27.4	112.3	37.47	37.11**********		-0./100.	14.6	439.0	14.6
1999	37.3	12.1	27.4	112.3	42.48	42.12**********		-0./100.	14.6	439.0	14.6
AVERAGE1	19.1	13.6	13.5	55.3	12.63	12.42**********		30./ 70.	42.1	542.5	37.7
AVERAGE2	21.8	15.1	13.5	55.3	9.63	9.44	2.96	22./ 78.			

(AVERAGE1) : SUM OF ANNUAL FIGURES OF PERCENTAGE AND RATIO IS DIVIDED BY NO. OF YEARS(SIMPLE AVERAGE)
(AVERAGE2) : AVERAGE FIGURES ARE CALCULATED BY ACTUAL VALUES ACCUMULATED OVER THE PROJECT LIFE(WEIGHTED AVERAGE)
* NOTE FOR (9)(10)(11)
WHEN THERE ARE TWO OR MORE PRODUCTS, AND DURING THE YEARS WHEN ALL OF PRODUCTS ARE NOT PRODUCED AT THE SAME RATE OF CAPACITY UTILIZATION, ABOVE BREAK-EVEN-POINTS CANNOT GIVE CORRECT FIGURES.

ATTACHMENT IX–2

FINAL RESULTS OF THE FINANCIAL ANALYSIS OF THE VCM PROJECT

Ethylene Price : $700/t

Income Statement

Funds Flow Statements

Balance Sheet

Production and Sales Plan

Production Cost Statements

IRR Calculation

Profitability and Financial Indicators

*** THAI VCM PROJECT ***
INCOME STATEMENTS (FOR YEARS ENDING DECEMBER 31)
- BASE CASE (ETHYLENE US$ 700/T) (US$ 1000)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
SALES REVENUE	28102.	61277.	66741.	72596.	78060.	78060.	78060.	78060.	78060.	78060.	78060.	78060.	78060.	78060.	78060.
COST OF SALES	25756.	56675.	59799.	63145.	66269.	66269.	66269.	66269.	66269.	66269.	59523.	52777.	52777.	52777.	52777.
VARIABLE COST	17934.	35031.	38154.	41501.	44625.	44625.	44625.	44625.	44625.	44625.	44625.	44625.	44625.	44625.	44625.
DEPRECIATION & AMORTIZATION	6746.	13492.	13492.	13492.	13492.	13492.	13492.	13492.	13492.	13492.	6746.	0.	0.	0.	0.
OTHER FIXED COST	4076.	8152.	8152.	8152.	8152.	8152.	8152.	8152.	8152.	8152.	8152.	8152.	8152.	8152.	8152.
(INC) IN PRODUCT INVENTORIES	-3005.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GROSS PROFIT OR (LOSS) ON SALES	2345.	4602.	6943.	9450.	11791.	11791.	11791.	11791.	11791.	11791.	18537.	25283.	25283.	25283.	25283.
LESS. SALES EXPENSES	575.	1133.	1196.	1263.	1325.	1325.	1325.	1325.	1325.	1325.	1190.	1056.	1056.	1056.	1056.
OPERATING PROFIT OR (LOSS)	1770.	3469.	5747.	8187.	10465.	10465.	10465.	10465.	10465.	10465.	17346.	24227.	24227.	24227.	24227.
LESS. INTEREST															
ON LONG TERM DEBT	4234.	8418.	8073.	7374.	6526.	5678.	4830.	3982.	3135.	2287.	1439.	652.	149.	0.	0.
ON SHORT TERM DEBT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NET PROFIT OR (LOSS) BEFORE TAX	-2465.	-4949.	-2326.	813.	3939.	4787.	5635.	6483.	7331.	8179.	15907.	23575.	24078.	24227.	24227.
LESS. INCOME TAX	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
NET PROFIT OR (LOSS) AFTER TAX	-2465.	-4949.	-2326.	813.	3939.	4787.	5635.	6483.	7331.	8179.	15907.	23575.	24078.	24227.	24227.

*** THAI VCM PROJECT ***
FUNDS FLOW STATEMENTS (FOR YEARS ENDING DECEMBER 31)
- BASE CASE (ETHYLENE US$ 700/T) (US$ 1000)

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
SOURCES OF FUNDS	40585.	67642.	42516.	19268.	19600.	22138.	24379.	23957.	23957.	23957.	23957.	23957.	24092.	24227.	24227.	24227.	24227.
CASH GENERATED FROM OPERATION	0.	0.	8516.	16961.	19239.	21674.	23957.	23957.	23957.	23957.	23957.	23957.	24092.	24227.	24227.	24227.	24227.
PROFIT BEFORE TAX, INTEREST	0.	0.	1770.	3469.	5747.	8181.	10465.	10465.	10465.	10465.	10465.	10465.	17346.	24227.	24227.	24227.	24227.
DEPRECIATION & AMORTIZATION	0.	0.	6746.	13492.	13492.	13492.	13492.	13492.	13492.	13492.	13492.	13492.	6746.	0.	0.	0.	0.
FINANCIAL RESOURCES	40585.	67642.	31578.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SHARE CAPITAL	10146.	16911.	6764.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
LONG TERM DEBT	30439.	50732.	24814.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SHORT TERM DEBT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INCREASE IN ACCT PAYABLE	0.	0.	2422.	2307.	422.	452.	422.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
USES OF FUNDS	40163.	66103.	40201.	16078.	16953.	18790.	17887.	16277.	15429.	14581.	13733.	12885.	12037.	8200.	2630.	0.	0.
INVESTMENT IN FIXED ASSET	40163.	66103.	29018.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
LAND AND SITE IMPROVEMENT	366.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONSTRUCTED FACILITIES	35609.	59349.	23740.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PRE-INVEST. & START-UP EXP	1356.	2035.	3391.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INTEREST DURING CONSTRUCTN	2831.	4719.	1888.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INCREASE IN CURRENT ASSET OTHER THAN CASH	0.	0.	6943.	4617.	763.	817.	763.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
(INCREASE) ACCT RECEIVABLE	0.	0.	3794.	4479.	738.	790.	738.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
(INCREASE) IN INVENTORIES																	
PRODUCTS	0.	0.	3005.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MATERIALS	0.	0.	145.	138.	25.	27.	25.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEBT SERVICES	0.	0.	4239.	11462.	16190.	17972.	17125.	16277.	15429.	14581.	13733.	12885.	12037.	8200.	2630.	0.	0.
REPAYMENT OF LONG TERM DEBT	0.	0.	0.	3044.	8117.	10598.	10598.	10598.	10598.	10598.	10598.	10598.	10598.	7555.	2481.	0.	0.
REPAYMNT OF SHORT TERM DEBT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INTEREST ON LONG TERM DEBT	0.	0.	4239.	8418.	8073.	7374.	6526.	5678.	4830.	3982.	3135.	2287.	1439.	652.	149.	0.	0.
INTEREST ON SHORT TERM DEBT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INCOME TAX PAYMENT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DIVIDENDS PAYMENT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CASH INCREASE OR (DECREASE)	422.	1539.	2315.	3189.	2707.	3341.	6491.	7681.	8528.	9376.	10224.	11072.	12055.	16021.	21597.	24227.	24227.
BEGINNING CASH BALANCE	0.	422.	1961.	4276.	7466.	10173.	13515.	20006.	27687.	36215.	45591.	55814.	66888.	78942.	94963.	116560.	140787.
ENDING CASH BALANCE	422.	1961.	4276.	7466.	10173.	13515.	20006.	27687.	36215.	45591.	55814.	66888.	78942.	94963.	116560.	140787.	165014.

*** THAI VCM PROJECT ***
BALANCE SHEET (FOR YEARS ENDING DECEMBER 31)
- BASE CASE (ETHYLENE US$ 700/T) (US$ 1000)

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
ASSETS	40585.	108227.	139758.	136072.	124051.	114718.	108480.	102669.	97706.	93590.	90323.	87903.	95212.	109232.	130829.	155096.	179283.
CURRENT ASSETS	422.	1961.	11220.	19026.	22496.	26655.	33909.	41590.	50118.	59495.	69719.	80791.	92846.	108866.	130463.	154690.	178917.
CASH	422.	1961.	4276.	7466.	10173.	13515.	20306.	27667.	36215.	45591.	55816.	66888.	78942.	94963.	116560.	140787.	165014.
ACCOUNTS RECEIVABLE	0.	0.	3794.	8272.	9010.	9800.	10538.	10538.	10538.	10538.	10538.	10538.	10538.	10538.	10538.	10538.	10538.
INVENTORIES																	
PRODUCTS	0.	0.	3005.	3005.	3005.	3005.	3005.	3005.	3005.	3005.	3005.	3005.	3005.	3005.	3005.	3005.	3005.
MATERIALS	0.	0.	145.	283.	308.	335.	360.	360.	360.	360.	360.	360.	360.	360.	360.	360.	360.
NET FIXED ASSETS	40163.	106266.	128538.	117046.	101555.	88063.	74571.	61079.	47587.	34096.	20604.	7112.	366.	366.	366.	366.	366.
INVESTMENT	40163.	106266.	135284.	135284.	135284.	135284.	135284.	135284.	135284.	135284.	135284.	135284.	135284.	135284.	135284.	135284.	135284.
LAND & SITE IMPROVEMENT	366.	366.	366.	366.	366.	366.	366.	366.	366.	366.	366.	366.	366.	366.	366.	366.	366.
CONSTRUCTED FACILITIES	35604.	94958.	118698.	118698.	118698.	118698.	118698.	118698.	118698.	118698.	118698.	118698.	118698.	118698.	118698.	118698.	118698.
PRE-INVEST. & START-UP EXP	1356.	3391.	6782.	6782.	6782.	6782.	6782.	6782.	6782.	6782.	6782.	6782.	6782.	6782.	6782.	6782.	6782.
INTEREST DURING CONSTRUCTN	2831.	7550.	9438.	9438.	9438.	9438.	9438.	9438.	9438.	9438.	9438.	9438.	9438.	9438.	9438.	9438.	9438.
LESS:PRECIATN & AMORTIZTN	0.	0.	6746.	20238.	33729.	47221.	60713.	74205.	87697.	101188.	114680.	128172.	134918.	134918.	134918.	134918.	134918.
LIABILITIES	30439.	81170.	108406.	107670.	99975.	89828.	79651.	69053.	58454.	47856.	37257.	26659.	16060.	8506.	6024.	6024.	6024.
CURRENT LIABILITIES	0.	0.	5466.	14846.	15749.	16201.	16623.	16623.	16623.	16623.	16623.	16623.	13579.	8506.	6024.	6024.	6024.
ACCOUNTS PAYABLE	0.	0.	2422.	4729.	5151.	5603.	6024.	6024.	6024.	6024.	6024.	6024.	6024.	6024.	6024.	6024.	6024.
INCOME TAX PAYABLE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DIVIDENDS PAYABLE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CURRENT PORTION OF DEBT																	
LONG TERM DEBT	0.	0.	3044.	8117.	10598.	10598.	10598.	10598.	10598.	10598.	10598.	10598.	7555.	2481.	0.	0.	0.
SHORT TERM DEBT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
FIXED LIABILITIES	30439.	81170.	102941.	94824.	84225.	73627.	63028.	52430.	41831.	31233.	20634.	10036.	2481.	-0.	-0.	-0.	-0.
LONG TERM DEBT BALANCE	30439.	81170.	102941.	94824.	84225.	73627.	63028.	52430.	41831.	31233.	20634.	10036.	2481.	-0.	-0.	-0.	-0.
STOCK HOLDERS EQUITY	10146.	27057.	31352.	28402.	24076.	24890.	28829.	33616.	39251.	45734.	53065.	61244.	77151.	100727.	124805.	149032.	173259.
SHARE CAPITAL	10146.	27057.	33821.	33821.	33821.	33821.	33821.	33821.	33821.	33821.	33821.	33821.	33821.	33821.	33821.	33821.	33821.
RETAINED EARNINGS	0.	0.	-2469.	-7419.	-9745.	-8931.	-4992.	-205.	5430.	11913.	19244.	27423.	43330.	66906.	90984.	115211.	139438.

*** THAI VCM PROJECT ***
PRODUCTION AND SALES PLAN
- BASE CASE (ETHYLENE US$ 700/T)

(US$ 1000)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
CAPACITY (VCM)	80000.	80000.	80000.	80000.	80000.	80000.	80000.	80000.	80000.	80000.	80000.	80000.	80000.	80000.	80000.
CAPACITY UTILIZATION	0.402	0.785	0.855	0.930	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
PRODUCTION (VCM)	32160.	62800.	68400.	74400.	80000.	80000.	80000.	80000.	80000.	80000.	80000.	80000.	80000.	80000.	80000.
INCREASE IN INVENTORY	3360.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SALES VOLUME (VCM)	28800.	62800.	68400.	74400.	80000.	80000.	80000.	80000.	80000.	80000.	80000.	80000.	80000.	80000.	80000.
UNIT PRICE (VCM)	0.7500	0.7500	0.7500	0.7500	0.7500	0.7500	0.7500	0.7500	0.7500	0.7500	0.7500	0.7500	0.7500	0.7500	0.7500
SALES REVENUE	21600.	47100.	51300.	55800.	60000.	60000.	60000.	60000.	60000.	60000.	60000.	60000.	60000.	60000.	60000.
CAPACITY (SODA)	51600.	51600.	51600.	51600.	51600.	51600.	51600.	51600.	51600.	51600.	51600.	51600.	51600.	51600.	51600.
CAPACITY UTILIZATION	0.402	0.785	0.855	0.930	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
PRODUCTION (SODA)	20743.	40506.	44118.	47988.	51600.	51600.	51600.	51600.	51600.	51600.	51600.	51600.	51600.	51600.	51600.
INCREASE IN INVENTORY	2167.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SALES VOLUME (SODA)	18576.	40506.	44118.	47988.	51600.	51600.	51600.	51600.	51600.	51600.	51600.	51600.	51600.	51600.	51600.
UNIT PRICE (SODA)	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500	0.3500
SALES REVENUE	6502.	14177.	15441.	16796.	18060.	18060.	18060.	18060.	18060.	18060.	18060.	18060.	18060.	18060.	18060.
*** TOTAL SALES REVENUE ***	28102.	61277.	66741.	72596.	78060.	78060.	78060.	78060.	78060.	78060.	78060.	78060.	78060.	78060.	78060.
*** TOTAL SALES VOLUME ***	47376.	103306.	112518.	122388.	131600.	131600.	131600.	131600.	131600.	131600.	131600.	131600.	131600.	131600.	131600.
*** AVERAGE SALES PRICE ***	0.5932	0.5932	0.5932	0.5932	0.5932	0.5932	0.5932	0.5932	0.5932	0.5932	0.5932	0.5932	0.5932	0.5932	0.5932

*** THAI VCM PROJECT ***
PRODUCTION COST STATEMENTS
- BASE CASE (ETHYLENE US$ 700/T) (US$ 1000)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
PRODUCTION (VCM)	32160.	62800.	68400.	74400.	80000.	80000.	80000.	80000.	80000.	80000.	80000.	80000.	80000.	80000.	80000.
RAW SALT	805.	1572.	1712.	1862.	2002.	2002.	2002.	2002.	2002.	2002.	2002.	2002.	2002.	2002.	2002.
ETHYLENE	10693.	20881.	22743.	24738.	26600.	26600.	26600.	26600.	26600.	26600.	26600.	26600.	26600.	26600.	26600.
O2	642.	1253.	1365.	1484.	1596.	1596.	1596.	1596.	1596.	1596.	1596.	1596.	1596.	1596.	1596.
CHEMICALS	511.	998.	1087.	1182.	1271.	1271.	1271.	1271.	1271.	1271.	1271.	1271.	1271.	1271.	1271.
RAW MATERIAL COST	12651.	24703.	26906.	29266.	31469.	31469.	31469.	31469.	31469.	31469.	31469.	31469.	31469.	31469.	31469.
FUEL GAS	316.	617.	672.	731.	786.	786.	786.	786.	786.	786.	786.	786.	786.	786.	786.
POWER	3412.	6663.	7257.	7894.	8488.	8488.	8488.	8488.	8488.	8488.	8488.	8488.	8488.	8488.	8488.
STEAM (15K)	614.	1199.	1306.	1420.	1527.	1527.	1527.	1527.	1527.	1527.	1527.	1527.	1527.	1527.	1527.
STEAM (2K)	230.	448.	488.	531.	571.	571.	571.	571.	571.	571.	571.	571.	571.	571.	571.
FILTERED WATER	157.	307.	334.	364.	391.	391.	391.	391.	391.	391.	391.	391.	391.	391.	391.
DMW	83.	162.	177.	193.	207.	207.	207.	207.	207.	207.	207.	207.	207.	207.	207.
PORTABLE WATER	18.	35.	38.	42.	45.	45.	45.	45.	45.	45.	45.	45.	45.	45.	45.
INSTR/PLANT AIR	158.	308.	335.	365.	392.	392.	392.	392.	392.	392.	392.	392.	392.	392.	392.
N2	134.	262.	286.	311.	334.	334.	334.	334.	334.	334.	334.	334.	334.	334.	334.
UTILITIES COST	5122.	10002.	10894.	11849.	12741.	12741.	12741.	12741.	12741.	12741.	12741.	12741.	12741.	12741.	12741.
WASTE WATER TREATMENT	167.	326.	355.	386.	415.	415.	415.	415.	415.	415.	415.	415.	415.	415.	415.
VARIABLE COST	17939.	35031.	38154.	41501.	44625.	44625.	44625.	44625.	44625.	44625.	44625.	44625.	44625.	44625.	44625.
DEPRECIATION (PROCESS PLANT)	5935.	11870.	11870.	11870.	11870.	11870.	11870.	11870.	11870.	11870.	5935.	0.	0.	0.	0.
DEPRECIATION (PRE-INVEST)	339.	678.	678.	678.	678.	678.	678.	678.	678.	678.	339.	0.	0.	0.	0.
DEPRECIATION (INTEREST DUR.)	472.	944.	944.	944.	944.	944.	944.	944.	944.	944.	472.	0.	0.	0.	0.
DEPRECIATION	6746.	13492.	13492.	13492.	13492.	13492.	13492.	13492.	13492.	13492.	6746.	0.	0.	0.	0.
AMORTIZATION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEPRECIATION & AMORTIZATION	6746.	13492.	13492.	13492.	13492.	13492.	13492.	13492.	13492.	13492.	6746.	0.	0.	0.	0.
LABOUR COST	397.	794.	794.	794.	794.	794.	794.	794.	794.	794.	794.	794.	794.	794.	794.
OVERHEAD	397.	794.	794.	794.	794.	794.	794.	794.	794.	794.	794.	794.	794.	794.	794.
EMPLOYMENT COST	794.	1588.	1588.	1588.	1588.	1588.	1588.	1588.	1588.	1588.	1588.	1588.	1588.	1588.	1588.
MAINTENANCE COST	1780.	3561.	3561.	3561.	3561.	3561.	3561.	3561.	3561.	3561.	3561.	3561.	3561.	3561.	3561.
ELECTRODE & IEM	612.	1223.	1223.	1223.	1223.	1223.	1223.	1223.	1223.	1223.	1223.	1223.	1223.	1223.	1223.
TAX & INSURANCE	890.	1780.	1780.	1780.	1780.	1780.	1780.	1780.	1780.	1780.	1780.	1780.	1780.	1780.	1780.
DIRECT FIXED COST	4076.	8152.	8152.	8152.	8152.	8152.	8152.	8152.	8152.	8152.	8152.	8152.	8152.	8152.	8152.
EX-FACTORY PRODUCTION COST	28761.	56675.	59799.	63145.	66269.	66269.	66269.	66269.	66269.	66269.	59523.	52777.	52777.	52777.	52777.
UNIT DIRECT OPERATING COST	0.8943	0.9025	0.8742	0.8487	0.8284	0.8284	0.8284	0.8284	0.8284	0.8284	0.7440	0.6597	0.6597	0.6597	0.6597
ADMINISTRATIVE & SALES EXP.	575.	1133.	1196.	1263.	1325.	1325.	1325.	1325.	1325.	1325.	1190.	1056.	1056.	1056.	1056.
INTEREST ON LOAN NO.1	1218.	2374.	2131.	1887.	1644.	1400.	1157.	913.	670.	426.	183.	0.	0.	0.	0.
INTEREST ON LOAN NO.2	2029.	4059.	3957.	3551.	3145.	2740.	2334.	1928.	1522.	1116.	710.	304.	0.	0.	0.
INTEREST ON LOAN NO.3	812.	1623.	1623.	1583.	1420.	1258.	1096.	933.	771.	609.	446.	284.	122.	0.	0.
INTEREST ON LOAN NO.4	181.	362.	362.	353.	317.	280.	244.	208.	172.	136.	99.	63.	27.	0.	0.
INTEREST ON LONG-TERM DEBT	4239.	8418.	8073.	7374.	6526.	5678.	4830.	3982.	3135.	2287.	1439.	652.	149.	0.	0.
INTEREST ON SHORT-TERM DEBT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOTAL PRODUCTION COST	33576.	66226.	69067.	71782.	74121.	73273.	72425.	71577.	70729.	69881.	62153.	54485.	53982.	53833.	53833.
UNIT PRODUCTION COST	1.0440	1.0546	1.0098	0.9648	0.9265	0.9159	0.9053	0.8947	0.8841	0.8735	0.7769	0.6811	0.6748	0.6729	0.6729

*** THAI VCM PROJECT ***
IRR CALCULATION ON TOTAL INVESTMENT
- BASE CASE (ETHYLENE US$ 70C/T) (US$ 1000)

YEAR	TOTAL INVESTMENT	PROFIT BEFORE TAX	DEPRECIATN	INTEREST ON L-T DEBT	RETURN BEFORE TAX	DISCOUNT FACTOR	(BEFORE TAX) PRESENT VALUE INVEST.	(BEFORE TAX) PRESENT VALUE RETURN	(LESS) INCOME TAX	RETURN AFTER TAX	DISCOUNT FACTOR	(AFTER TAX) PRESENT VALUE INVEST.	(AFTER TAX) PRESENT VALUE RETURN
1983	37332.	0.	0.	0.	0.	1.0000	37332.	0.	0.	0.	1.0000	37332.	0.
1984	61384.	0.	0.	0.	0.	0.8845	54294.	0.	0.	0.	0.8845	54294.	0.
1985	31652.	-2469.	6746.	4239.	8516.	0.7823	24763.	6662.	0.	8516.	0.7823	24763.	6662.
1986	0.	-4949.	13492.	8418.	16961.	0.6920	0.	11737.	0.	16961.	0.6920	0.	11737.
1987	0.	-2326.	13492.	8073.	19239.	0.6121	0.	11775.	0.	19239.	0.6121	0.	11775.
1988	0.	813.	13492.	7374.	21679.	0.5414	0.	11737.	0.	21679.	0.5414	0.	11737.
1989	0.	3939.	13492.	6526.	23957.	0.4788	0.	11472.	0.	23957.	0.4788	0.	11472.
1990	0.	4787.	13492.	5678.	23957.	0.4235	0.	10147.	0.	23957.	0.4235	0.	10147.
1991	0.	5635.	13492.	4830.	23957.	0.3746	0.	8975.	0.	23957.	0.3746	0.	8975.
1992	0.	6483.	13492.	3982.	23957.	0.3314	0.	7938.	0.	23957.	0.3314	0.	7938.
1993	0.	7331.	13492.	3135.	23957.	0.2931	0.	7022.	0.	23957.	0.2931	0.	7022.
1994	0.	8179.	13492.	2287.	23957.	0.2592	0.	6211.	0.	23957.	0.2592	0.	6211.
1995	0.	15907.	6746.	1439.	24092.	0.2293	0.	5524.	0.	24092.	0.2293	0.	5524.
1996	0.	23575.	0.	652.	24227.	0.2028	0.	4914.	0.	24227.	0.2028	0.	4914.
1997	0.	24078.	0.	149.	24227.	0.1794	0.	4346.	0.	24227.	0.1794	0.	4346.
1998	0.	24227.	0.	0.	24227.	0.1587	0.	3844.	0.	24227.	0.1587	0.	3844.
1999	-4888.	24227.	0.	0.	24227.	0.1403	-686.	3400.	0.	24227.	0.1403	-686.	3400.
TOTAL	125480.				331138.		115703.	115703.		331138.		115703.	115703.

***** INTERNAL RATE OF RETURN ***** 13.06 PER CENT (BEFORE TAX) 13.06 PER CENT (AFTER TAX)

***** PAY-OUT PERIOD ***** 7.06 YEAR (BEFORE TAX) 7.06 YEAR (AFTER TAX)
(THE YEAR WHEN THE TOTAL CAPITAL COST WILL BE PAID OUT BY ACCUMULATED TOTAL RETURN, FROM THE BEG. OF OPERATION)

CAPITAL REQUIREMENTS	
LAND	366.
CONSTRUCTED FACILITIES	118698.
PRE-INVEST AND START-UP EXP	6782.
INTEREST DURING CONSTRUCTION	9438.
TOTAL FIXED CAPITAL	135284.
INITIAL WORKING CAPITAL	4522.
TOTAL CAPITAL COST	139806.

SOURCE OF FUNDS	
PAID-UP SHARE CAPITAL	33821.
LONG TERM DEBT	105985.
SHORT TERM DEBT	0.
FINANCIAL RESOURCES	139806.

*** THAI VCM PROJECT ***
PROFITABILITY AND FINANCIAL INDICATORS
- BASE CASE (ETHYLENE US$ 700/T) (US$ 1000)

YEAR	(1) AFT TAX PROFIT -TO- SALES REV (PCT)	(2) AFT TAX PROFIT -TO- S/H EQUITY (PCT)	(3) BFR TAX PROFIT -TO- INVESTMNT (PCT)	(4) AFT TAX PROFIT -TO- S/CAPITAL (PCT)	(5) CURRENT RATIO	(6) QUICK RATIO	(7) DEBT SERVICE RATIO	(8) L/T DEBT -TO- S/H EQUITY	(9)* PROFIT B.E.P. CAPACITY UTILIZE (PCT)	(10)* CASH B.E.P. SALES PRICE (PRICE)	(11)* CASH B.E.P. CAPACITY UTILIZE (PCT)
1985	-8.8	-7.9	-1.8	-7.3	2.05	1.48	2.01	77./ 23.	47.1	931.6	26.0
1986	-8.1	-18.7	-3.5	-14.6	1.48	1.23	1.48	78./ 22.	94.0	888.2	61.3
1987	-3.5	-9.7	-1.7	-6.9	1.43	1.22	1.19	78./ 22.	92.8	931.2	76.0
1988	1.1	3.3	0.6	2.4	1.65	1.44	1.21	75./ 25.	90.5	925.9	81.4
1989	5.0	13.7	2.8	11.6	2.04	1.84	1.40	69./ 31.	87.7	890.3	78.7
1990	6.1	14.2	3.4	14.2	2.50	2.30	1.47	61./ 39.	85.1	879.7	76.1
1991	7.2	14.4	4.0	16.7	3.02	2.81	1.55	52./ 48.	82.5	869.1	73.4
1992	8.3	14.2	4.6	19.2	3.58	3.38	1.64	41./ 59.	79.8	858.5	70.8
1993	9.4	13.8	5.2	21.7	4.19	3.99	1.74	28./ 72.	77.2	847.9	68.2
1994	10.5	13.4	5.9	24.2	4.86	4.66	1.86	14./ 86.	74.5	837.3	65.5
1995	20.4	20.6	11.4	47.0	6.84	6.59	2.00	3./ 97.	50.7	825.1	62.6
1996	30.2	23.4	16.9	69.7	12.80	12.40	2.95	-0./100.	27.2	775.5	50.5
1997	30.8	19.3	17.2	71.2	21.66	21.10	9.21	-0./100.	25.6	705.8	33.3
1998	31.0	16.3	17.3	71.6	25.68	25.12**********		-0./100.	25.2	672.9	25.2
1999	31.0	14.0	17.3	71.6	29.70	29.14**********		-0./100.	25.2	672.9	25.2
AVERAGE1	11.4	9.6	6.6	27.5	8.23	7.91**********		38./ 62.	64.3	834.1	58.3
AVERAGE2	12.8	14.0	6.6	27.5	5.68	5.42	2.03	37./ 63.			

(AVERAGE1) : SUM OF ANNUAL FIGURES OF PERCENTAGE AND RATIO IS DIVIDED BY NO. OF YEARS(SIMPLE AVERAGE)
(AVERAGE2) : AVERAGE FIGURES ARE CALCULATED BY ACTUAL VALUES ACCUMULATED OVER THE PROJECT LIFE(WEIGHTED AVERAGE)
* NOTE FOR (9)(10)(11)
WHEN THERE ARE TWO OR MORE PRODUCTS, AND DURING THE YEARS WHEN ALL OF PRODUCTS ARE NOT PRODUCED AT THE SAME RATE OF CAPACITY UTILIZATION, ABOVE BREAK-EVEN-POINTS CANNOT GIVE CORRECT FIGURES.

APPENDIX

APPENDIX

APPENDIX-1

MEMBERS LIST OF JAPANESE SURVEY TEAM

Name	Attached to	Function of the project
(1) Member of assigned experts		
Mr. Takeshi CHINO	UNICO International Corp.	Project Leader Market Analyst
Dr. Shigeo UEKI	Japan Consulting Institute	General Adviser
Mr. Ryuzo NAGAOKA	Toyo Engineering Corp.	Assistant Leader Technical Study
Mr. Kiko NAGASAWA	UNICO International Corp.	Market Study Financial and Economic Study
Mr. Yoshiaki NAKAMURA	UNICO International Corp.	Technical Study Financial and Economic Suty
Mr. Shigeru TANAKA	Toyo Engineering Corp.	Technical Study (Offsite and Infrastructure)
Mr. Masaaki AOKI	Toyo Engineering Corp.	Technical Study (Utilities)
Mr. Hiroshi KONDO	Toyo Engineering Corp.	Technical Study (Ethylene Process)
Mr. Ken WAKATSUKI	Toyo Engineering Corp.	Financial and Economic Study (Legal and Financial Condition)
Mr. Tanzo ZIZAIMARU	Asahi Glass Co., Ltd.	Technical Study (Salt Electrolysis Process)
Mr. Yoshimitsu OYAMADA	Mitsui Toatsu Chemicals Inc.	Technical Study (VCM Process)
Mr. Shin-ichi YAMAGUCHI	Japan Consulting Institute	Technical Study (Environment)

Name	Attached to
(2) Officer in charge of JICA	
Mr. Akihiro MITARAI	Head of Industry Division
Mr. Norio FUKUBAYASHI	Industry Division

APPENDIX–2

LIST OF COUNTERPARTS IN THAILAND

Petroleum Authority of Thailand (PTT)

Messrs.	Pratin Pathanaporn	Deputy Governor, Technical and Planning
	Sirin Nimmanakaeminda	Deputy Governor, Finance
	Pala Sookawesh	Director, Policy and Planning Department
	Patchara Pariwatvorn	Director, Research and Development Department
	Sahat Thongjen	Director, Engineering Division
	Adul Leelapatranuruk	Director, Project Planning Division
	Sirote Rhuwadhana	Director, Cooperation and Control Division
	Siri Jirapongphan	Assistant Director, Policy Division
	Vithaya Tivayanonda	Assistant Director, Oil and Gas Technology Division
	Pravith Veahongs	Project Planning Division
	Krittaya Chantarakka	Project Planning Division
	Pasook Puengbua	Project Planning Division
	Charoonrith Khampanya	Research and Development Department
	Kosol Pimthanothai	Research and Development Department
	Apisit Rujikeatkamjorn	Construction Manager

APPENDIX–3

LIST OF ORGANIZATIONS VISITED AND PERSONS INTERVIEWED

(1) List of organizations visited

- Department of Technical and Economic Cooperation
- Ministry of Industry
- The Board of Investment

- Embassy of Japan
- Japan International Cooperation Agency, Bangkok

- Royal Irrigation Department
- Industrial Estate Authority of Thailand
- National Environment Board
- Highway Department, Ministry of Communication
- Harbour Department, Ministry of Communication
- Bank of Thailand

- Electricity Generating Authority of Thailand
- Provincial Electricity Authority
- Express Transportation Organization of Thailand

- Japan External Trade Organization, Bangkok

- Fluor Ocean International Services Inc.
- Thai Plastic and Chemical Co., Ltd.
- Thai Asahi Caustic Soda Co., Ltd.
- Thai Petrochemical Industry Co., Ltd.
- Thai United Polymer Co., Ltd.
- Dow Chemical Thailand Co., Ltd.
- Thai Synthetic Fiber Manufacturers Association

- Universal Export-Import Co., Ltd.
- Bhasichason Cord Factory
- Century Plastic Factory
- Thai Kayan

- Metropolitan Plastic Industry Co., Ltd.
- Thai Pipe Industry Co., Ltd.
- Sieng Watana Ltd.

- Sino-Thai Engineering Co., Ltd.
- Thai Ohbayashi Corp.
- Thai Takenaka International Corp.
- N.Y.K. Transport Service (Thailand) Co., Ltd.

(2) Persons interviewed with the study team

Name	Title
Fluor Ocean International Services Inc. (FOSI)	
Messrs. Anon Tulyanon	Project Coordinator
On Piescott	Deputy Project Director
Electricity Generating Authority of Thailand (EGAT)	
Mr. Om Srid Aphaiphaminart	Director, Planning Department
Royal Irrigation Department	
Mr. Udom Rackhanya	Director of O&M Division
Industrial Estate Authority of Thailand (IEAT)	
Messrs. Wanchak Voradilok	Governor
Chavalt Chokratauachi	Acting Chief of Planning and Design Division
Ministry of Industry (MOI)	
Mr. Trakarn Chairt	Director, Office of the National Committee on Fertilizer and Pesticide Industry Development
National Environment Board (NEB)	
Messrs. Sirithan Boriboon	Industrial Impact Section Head
Mongkol Pwasarteeree	Technology of Environmental Management
Pichak Tanherwhongs	Water Quality Standard Section
Ratana Suthapong	Industrial Impact Section

Name	Title
Highway Department, Ministry of Communication	
Messrs. Panja Cooparat	Planning Division
Sajja Kamolvet	Programming Section
Harbour Department, Ministry of Communication	
Messrs. Surin Charoenvat	Director of Harbour Master Division
Pakit Sangkaprija Samboon	Harbour Master
Express Transportation Organization of Thailand (ETO)	
Messrs. Preecha Vichaikutka	Assistant Director, Transportation Department
Saneh Niyamaha	Interior Transport Center
Rurtai Charuchinta	International Freight Center
Domrong Kauhakamchiva	Chief International Division
Pradit Ruomthony	Chief of Commercial Division
Somkuan Chongdarakul	Chief of Domestic Transportation Division
Department of Technical and Economic Cooperation (DTEC)	
Mr. Pracha Chaowasilp	Chief of Colombo Plan Division
Bank of Thailand	
Messrs. Prateep Vachrongkura	
Kanitta Margaret Meesook	
Provincial Electricity Authority (PEA)	
Messrs. Pramual Kachataya	Assistant General Manager
Sakol Wongbuddher	Director of Planning and Civil Works Department
Sunthorn Tanthavorn	Chief of Project and Planning Division
Kitti Ting Panpong	Assistant Chief of General Construction Division
Kamol Pernpipat	Assistant Chief of Research Division
Sudchi Lophangse	Assistant Chief of Power Economic Division
Chakchi Chandrasupsang	Chief of Project Area No. 3 Section

APPENDIX–4

ON-THE-SPOT SURVEY SCHEDULE

October 7 (Tuesday)	Arrangements at the Embassy and JICA office Kick-off meeting at PTT
October 8 (Wednesday)	Sub-committee meeting
October 9 (Thursday)	Arrangements with EGAT, Royal Irrigation Dept., Thai Plastic & Chemical Co. and civil engineering firms Visit to JETRO office One member arrive Bangkok
October 10 (Friday)	Arrangements with Highway Dept. of MOC, IEAT, DTEC, Thai Asahi Caustic Soda Co. and Thai United Polymer Co. Ltd. Visit to MOI (Statistics Bureau)
October 11 (Saturday)	Arrangement with Thai Petrochemical Industry Co.
October 12 (Sunday)	All members move from Bangkok to Pattaya via Laem Chabang
October 13 (Monday)	On-the-spot survey: Dok Krai Reservoir, LDPE plant site, PTT LPG plant site, Sattahip port
October 14 (Tuesday)	On-the-spot survey: Arrangement at PTT plant site, Rayong city and fishing port Move to Bangkok
October 15 (Wednesday)	Arrangement with FOSI and MOI Visit to the Thai Plastic & Chemical Co. plant
October 16 (Thursday)	Arrangement with FOSI and Harbour Dept. of MOC Sub-committee meeting Visit to Thai Asahi Caustic Soda Co. plant

October 17 (Friday)	Arrangement with NEB, BOI, ETO, engineering company and plastic trading company
October 18 (Saturday)	Internal arrangements
October 19 (Sunday)	Five members leave Bangkok for home Two members move from Bangkok for Chiang Mai: local market survey
October 20 (Monday)	Local market survey (in Chiang Mai City) Visit to plastic processing company Sub-committee meeting Move from Chiang Mai to Bangkok
October 21 (Tuesday)	Sub-committee meeting One member leave Bangkok for home
October 22 (Wednesday)	Arrangement with Bank of Thailand, Thai Plastic and Chemical Co. Visit plastic processing company One member arrive Bangkok
October 23 (Thursday)	Visit Nakohn Pathom: Local market survey
October 24 (Friday)	Arrangement with Embassy and JICA office Visit to plastic processing companies
October 25 (Saturday)	Three members move from Bangkok to Pattaya: on-the-spot survey: Laem Chabang, Dok Krai Reservoir LDPE plant site, PTT LPG plant site Sattahip commercial port
October 26 (Sunday)	Move to Bangkok Internal Arrangement

October 27 (Monday)	Sub-committee meeting
	Visit to plastic processing company
October 28 (Tuesday)	Visit to plastic processing company
	Arrangement with PEA, Thai Synthetic Fiber Manufacturers Association
	One member arrive Bangkok
October 29 (Wednesday)	Internal arrangement
	Preparation of an interim report
October 30 (Thursday)	Plenary session
	Submit the interim report
October 31 (Friday)	Report the survey results to the Embassy and JICA office
November 1 (Saturday)	Internal arrangement
November 2 (Sunday)	Seven members leave Bangkok for home

APPENDIX–5

SCOPE OF WORK

FOR

FEASIBILITY STUDY FOR ETHYLENE AND VINYL CHLORIDE MONOMER PLANTS

IN

THE KINGDOM OF THAILAND

SCOPE OF WORK

FOR

FEASIBILITY STUDY FOR ETHYLENE AND VINYL CHLORIDE MONOMER PLANTS

IN

THE KINGDOM OF THAILAND

Agreed

Between

THE PETROLEUM AUTHORITY OF THAILAND

THE MINISTRY OF INDUSTRY

AND

JAPAN INTERNATIONAL COOPERATION AGENCY

Dated: July 25th, 1980

Dr. TONGCHAT HONGLADAROMP
Governor
Petroleum Authority of Thailand

Mr. AKIHIRO MITARAI
Team Leader
Preliminary Survey Team

in the presence of

for Mr. APILAS OSATANANDA
Director General
Department of Technical
and Economic Cooperation

Discussions were held on the scope of work for feasibility study of Ethylene and Vinyl Chloride Mononer Plants Project with the Thai authority concerned, between the Japanese preliminary survey team (the team), headed by Mr. Akihiro Mitarai, and counterpart personnel headed by Dr. Thongchat Hongladaromp, Governor of Petroleum Authority of Thailand (PTT), during the visit of the team to Thailand from July 20 to July 27, 1980. The discussions were conducted in a most friendly and cordial atmosphere.

The followings are the main point confirmed.

1) LPG Gas Plant

1.1 First unit of LPG plant will be commissioning by October 1983. Capacity of first unit of LPG plant is 350 MMSCFD.

1.2 Total capacity of LPG plant will be 2x350 MMSCFD.

1.3 Product mixtures are methane rich gas, ethane, LPG, and natural gasoline.

1.4 Availability of ethane based on the first unit of LPG plant at 350 MMSCFD capacity is 187,500 metric tons/year (55% recovery)

2) Ethane Price

Ethane price will be considered that PTT's produced ethylene price equivalent to competitive in world market.

3) Chlorine

Both parties recognized that the supplying methods of chlorine for the project is necessary to be studied.

4) Plant Site

The Thai party indicated that the project site for ethylene plant next to the LPG plant at Mabtaput in Rayong Province. The site for VCM plant will be recommended in the feasibility

study by considered the transportation cost of raw material and finished product including environmental effects. Concerning the environmental aspects, Thai party, PTT, will coordinate in supporting the information necessary to the study team.

The following is the overall scope of work confirmed by both parties.

I. INTRODUCTION

In response to a request by the Government of the Kingdom of Thailand, the Government of Japan has decided to conduct a Feasibility Study for Ethylene and Vinyl Chloride Monomer Plants, in accordance with the laws and regulations in force in Japan. The Japan Internaitonal Cooperation Agency (JICA), the official agency responsible for the implementation of the Technical Cooperation Programmes of the Government of Japan, will carry out the study in close cooperation with the Petroleum Authority of Thailand (PTT), and the authorities concerned of the Government of the Kingdom of Thailand.

II. BACKGROUND

The Petroleum Authority of Thailand (PTT) will start natural gas production by September, 1981, using the gas found in the Gulf of Thailand. This natural gas contains about 9 percent of ethane. The PTT is building an LPG Gas Processing Plant at Rayong which is expected to be completed by the middle of 1983. The plant includes an Ethane Recovery Unit, the product of which can be utilised as feed for ethylene production.

There are some projects in Thailand for the production of LDPE and HDPE, initiated by private sectors, and a plant to produce

PVC from imported Vinyl Chloride Monomer (VCM) has already been installed by the Thai Plastic & Chemical Co., Ltd. According to the Thai authorities concerned, the demand for ethylene by 1983 is estimated to be approximately 100,000 - 150,000 tons per year.

The PTT aims to supply ethylene and VCM to these industries to replace the imported materials. Therefore, the PTT will be likely to expedite the building work in order to be able to start production to meet the growing demands of ethylene and its derivatives, as soon as the LPG Gas Processing Plant is completed.

III. OBJECTIVES

The objectives of the Feasibility Study are:-

1) To confirm the demand for ethylene and its derivatives and thereby recommend a suitable scale of plants for this project.
2) To confirm technical, economic and financial feasibility.
3) To Provide information on the schedule and recommendable procedures for project execution.

IV. SCOPE OF THE STUDY

A) Ethylene and Vinyl Chloride Monomer Plants and Supplying methods of chlorine to be studied

The ethylene and Vinyl Chloride Monomer Plants examined in the study will ascertain the technical, economic and financial feasibility of a suitably scaled plant to produce Ethylene and VCM to meet the domestic petrochemical industries' requirements at the same time

to study the supplying methods of chlorine for VCM plant.

B) Activities of the Study

In order to achieve the objectives mentioned above, the Study will include the main activities listed below.

1). Raw Material Study

1. Availability of raw material (Ethane, Propane, Salt)

(1). Methods and conditions of supply

(2). Quantities available

(3). Composition

2. Raw material price

2) Market Survey (Reviews and forecasts in domestic market)

1. LDPE

2. HDPE

3. PVC/VCM

4. Caustic-soda (NaOH)

5. Chlorine

6. Other major ethylene derivatives such as Ethylene Oxide, (EO)/Ethylene Glycol (EG)

3). Technical Study (Ethylene , VCM Plants and Supplying methods of Chlorine.)

1. Decision on a suitable capacity

2. Outline of plants and manufacturing processes

3. Overall material and utility balance

4. Elaboration on the layout of plants and site

5. Organization and personnel

6. Storage and transportation systems for Ethylene, VCM and others

7. Environmental aspect

8. Applicable laws and regulations

9. Infrastructures and utilities

4). Economic and Financial Study

1. Estimate of investment and operating costs

2. Pricing & Revenue

3. Calculation of Internal Rate of Return (IRR)

4. Sensitivity analysis

5. Social cost benefit analysis

6. Financial analysis

5). Overall evaluation and recommendaitons

6). Recommendations for procedure of project execution

V. TIME SCHEDULE

The feasibility study team will be dispatched within three months of completion of the preliminary survey.

JICA will prepared and submit to the Petroleum Authority of Thailand the following reports in English:-

1. Reconnaissance Report to be submitted before the Study Team leaves Thailand for Tokyo.
2. Draft Final Report to be submitted within five months of completion of the field survey.
3. Final Report (50 copies) to be submitted within two months after the receipt of PTT's comments on the findings of the Draft Report.

VI. COUNTERPARTS

1). The PTT will assign a qualified counterpart to be responsible for liaison between the PTT and the sutudy team during the whole period of the study.

2). Provided that the Japanese Government receives a request from the Thai Government, two PTT senior engineers will visit Japan for one to two weeks under JICA's counterparts programme, subject to the approval of JICA, to review the interim results and also to discuss the presentation of the draft report with the study team.

VII. CONTRIBUTION OF THE GOVERNMENT OF THE KINGDOM OF THAILAND

1). The Government of Thailand and the authorities concerned will provide the study team with the necessary and available information and data.

2). The Government will make arrangements for visitting the authorities concerned.

3). The Government will make an effort to arrange the study team with an office and transportation means for the study and will also arrange suitable accommodation facilities in the vicinity of the plant site.

APPENDIX–6

MINUTES OF MEETING

ON

THE DRAFT REPORT OF FEASIBILITY STUDY

FOR ETHYLENE AND VINYLCHLORIDE MONOMER

PLANTS IN THE KINGDOM OF THAILAND

MINUTES OF MEETING

ON

THE DRAFT REPORT OF FEASIBILITY STUDY

FOR ETHYLENE AND VINYLCHLORIDE MONOMER

PLANTS IN THE KINGDOM OF THAILAND

BETWEEN

THE PETROLEUM AUTHORITY OF THAILAND

AND

JICA STUDY TEAM

DATED : MARCH 9,1981

Mr. Pratin Pathanaporn	Mr. Takeshi Chino
Deputy Governer	Team Leader
Petroleum Authority of Thailand (PTT)	JICA Study Team

1. Review meetings on the feasibility study for ethylene and vinylchloride monomer plants in the Kingdom of Thailand were held between the PTT headed by Mr.Pratin and the JICA study team headed by Mr.Chino in an unofficial discussion on Feb. 2-5, 1980 in Japan and a presentation on the 5th and 6th of March 1980 at PTT office in Bangkok. The presentation of the draft report was made to PTT and various government authorities.

2. In these meetings, both parties reviewed the draft feasibility report (hereinafter designated as case I) which was prepared by the JICA study team and submitted to the PTT on Jan. 31, 1981.

   This report contains:

   -- An ethylene plant whose capacity is 230,000 MTA based on 287,000 MTA of ethane which can be recovered from the first unit of the gas processing plant,

   -- A VCM plant of 80,000 MTA capacity, including a Chloro-Alkali plant to produce 48,000 MTA of chlorine and 51,600 MTA of caustic soda.

Conceptual design, and financial and economic analysis were carried out on the above project. It is concluded in this report that both ethylene and VCM projects are feasible and therefore, their early implementation is highly recommendable.

3. In addition to the above mentioned feasibility report, the JICA study team submitted to PTT on March 4, 1981 an additional report for a separate study with modification in assumptions on market conditions and larger ethylene capacities which has been prepared in accordance with the request made by PTT. (hereinafter designated as case II).

/This ...

This case II study was made for ethylene plants of which capacities are 300,000 MTA and 350,000 MTA respectively.

It is concluded that these larger sizes of ethylene plants are also feasible provided that the following conditions are satisfied:

-- Ethane will be recovered from more than one unit of 350 MMSCFD gas processing.

-- Potential domestic demand of ethylene can be effectuated by the timely implementation of all downstream plants (such as LDPE, HDPE, VCM/PVC, and EO/EG) without any delay in their construction on the condition that their plant will always have certain excess capacities compared with their demand,

-- Expected rate of substitution of polypropylene (PP) demand by polyethylene (PE) to be produced domestically would take place.

The followings are major points of discussions made between the two parties:

(a) PTT expressed that the trend of PE in 1978-1979 looks suspicious and should be checked with 1980 figure and that if it shows an increase over 1979 figure, then the correlation starting from 1975 including 1980 should be used.

The Japanese feasibility study team replied as follows:

According to the foreign trade statistics informed by the PTT's telex dated Feb.23,1981 , imports of PE and PP in 1980 are 40,238 and 39,585 tons respectively. On the other hand, the Japanese feasibility study team's demand projection for PE and PP in 1980 are 72,400 and 41,200 tons respectively.

The difference between the actual imports and forecasted demand was caused by an increase in inventory especially for PE during the year 1979. When this inventory is used up, the demand in 1980 is expected

/to...

to coincide to the study team's demand forecast. For the reason described above, the study team considers that the demand forecast shown in the draft report is reasonable and there is no need to change the model.

(b) PTT pointed out that the aggregate ethylene demand should include polystyrene(PS). The study team indicated that the consumption of PS is too small for a styrene monomer plant to be constructed in Thailand. At present the minimum economics size of styrene plant is about 100,000 MTA. In addition the production of styrene monomer requires benzene as main raw material and unit consumption of ethylene required for the production of styrene is rather small.. A possibility of construction of styrene monomer plant can be found only after the year 1995.

(c) PTT expressed its opinion that the capacity of EG plant should be 40,000 MTA and can be started in 1985.

The study team answered that this size of EG plant may be too small to be justified and it would be better to delay the construction of EG plant at the time when an economical size of the plant can be justified, because even a small reactor for the synthesis of EO is very expensive.

However, the study team mentioned that a 60,000 t/y plant in terms of EO will be taken into account in the finalization of the supplemental report based on the assumption that it will go on stream starting from 1985.

/(d) ...

(d) PTT requested the study team to make a separate analysis for LDPE and HDPE. The study team explained that in the Thai trade statistics imports figures for PE are not broken down into LDPE and HDPE. The trade statistics of export countries, for example, of Japan, do not have separate figures either until 1976. In order to analyze the historical trend in PE demand from 1970 to 1979, the study team can not help adopting statistical figures for total PE.

(e) PTT expressed its opinion that 50% of forecast figure for PP demand should be substituted by PE immediately after the initiation of the commercial operation of ethylene plant expected in 1985, and therefore PTT considers that the study team should take it into account in the demand forecast for ethylene based on which the size of ethylene plant should be determined. The study team considers that the 50% substitution of PP demand by PE from the year 1985 is unrealistic, because the imports of PP would continue at least up to 1985 and a gradual substitution will be expected from 1985 onwards and the 50% substitution may be assumed to be accomplished by 1990.

(f) PTT requested that the study team studies larger size of ethylene capacity taking into account the following conditions and assumptions:

(i) Ethane availability is not be limited to only one unit (350 MMSCFD) of the gas processing plant.

(ii) Potential demand of ethylene is considered as actual demand, and used in calculating IRR.

(iii) Capacity expansion of downstream plants is implemented as soon as there is excess demand and large enough to satisfy demand for at least 3 years.

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This additional study is almost completed and preliminary results were presented in the supplemental report as case II at the March meeting.

(g) PTT suggested that in the finalization of the additional study, the following conditions be taken into account:

(i) capital cost is based on 100% loan

(ii) cost of products

ethane	$300	(financial),	$240 (economic)
ethylene	$700	(financial)	$600 (economic)

(iii) relatively small capacity of ethylene plant is penalized for not satisfying domestic demand in the calculation of economic internal rate of return.

The study team expressed that the additional study would be continued based on these conditions.

(h) In reply to the question on the date of completion of final report, the study team expressed that the final report would be available by the middle of April 1981.

(i) PTT requests that analysis worldwide ethylene, LDPE, HDPE and PP supply demand balance should be included. The study team will comply with this request in a separate document.

(j) The final Report will consist of 3 volumes;

Volume 1	-	Executive summary and Recommendation
Volume 2	-	Main Report (Case I)
Volume 3	-	Supplementary Report (Case II)

The executive summary and recommendation should be an integrated discussion of the case I and Case II study.