Folder Title:	IPD - Chron File - (From: 1976 to 1977) - Mr. Rischard
Folder ID:	30017808
Series:	Project officer, Industrial Projects Department (NDP/IPD/IND) chronological correspondence files
Dates:	03/12/1976 - 12/07/1977
Sub-Fonds:	Jean-Francois Rischard files
Fonds:	Records of Individual Staff Members
ISAD Reference Code:	WB IBRD/IDA STAFF-28-01
Digitized:	02/17/2022

Chron - 1976 - 1977 Mr. Jean Francois Rischard

December 7, 1977

Mr. T. Singh, Manager
Development & Engineering
ZUARI AGRO CHEMCIALS LTD.
Jai Kisaan Bhawan
Zuarinagar 403726 GOA
India

Re: IDA Credit No. 598-IN

Dear Mr. Singh:

This is to acknowledge receipt of and thank you for your letter of October 11, 1977 and the attached progress report for the month of September 1977.

Sincerely yours,

Harinder S. Kohli
Acting Chief of Division II
Industrial Projects Department

JFRischard:cmb

Chron Rischard

October 28, 1977

Mr. Clement Gavrilescu
Deputy Director
Banca de Investitii
Strada Doamnei, 4
Bucharest, Romania

Dear Mr. Gavrilescu:

Re: Bacau Fertilizer
Loan #1020-RO
Activity Report

This will acknowledge receipt of your activity report of Bacau Fertilizer Project for the month May-June and the second quarter 1977.

Thank you very much.

Sincerely,

Anthony R. Perram
Chief of Division II
Industrial Projects Department

cc: Messrs. Rischard, Tortorelli, Soncini
des

Rischard Chron

October 28. 1977

Mr. Clement Gavrilescu
Deputy Director
Banca De Investitii
Strada Doamnei, 4
Bucharest
ROMANIA

Dear Mr. Gavrilescu:

ROMANIA - Bacau Fertilizer Project

This is to acknowledge receipt and thank you for your activity reports for the months May-June and the second quarter, 1977 for Bacau Chemical Plant Project.

Sincerely yours,

Jean-Francois Rischard
Industrial Projects II

cc: Messrs. Perram/Kohli, Tortorelli, Brown, Loos

/yvw

FORM NO. 27-OCR (5-77)

WORLD BANK OUTGOING MESSAGE FORM (Telegram, Cable, Telex)

IMPORTANT (PLEASE READ INSTRUCTIONS BELOW BEFORE TYPING FORM.)

Class of Service: TELEX

Date: OCTOBER 27, 1977

Telex No.: 019 275 ZUARI

Originators Ext: 6802

START HERE

TO: ZUARI AGRO CHEMICALS LIMITED

CITY/COUNTRY: ZUARINAGAR, GOA, INDIA

MESSAGE NO.: (TSE-22A REFERENCE) TELEX NO. 019 275 ZUARI

FOR T. SINGH REURLET TSE 22A OF OCTOBER 1977, WE HAVE NO OBJECTION TO REVISED VENDORS LIST FOR PURGE GAS RECOVERY UNIT. REGARDS,

RISCHARD

END OF TEXT

NOT TO BE TRANSMITTED

SUBJECT: India-Fertilizer VII

DRAFTED BY: JF Rischard

CLEARANCES AND COPY DISTRIBUTION:
cc: Messrs. Perram/Kohli
Venkataraman/Shetty, Ms. Espiritu

AUTHORIZED BY (Name and Signature): T. Perram

DEPARTMENT: (305-20) Industrial Projects II

SECTION BELOW FOR USE OF CABLE SECTION

CHECKED FOR DISPATCH

DISTRIBUTION: WHITE — File Copy WHITE — Transmittal Copy CANARY — Bill Copy BLUE — Originator to Keep

FORM NO. 27-OCR (5-77)

WORLD BANK OUTGOING MESSAGE FORM (Telegram, Cable, Telex)

IMPORTANT (PLEASE READ INSTRUCTIONS BELOW BEFORE TYPING FORM.)

Class of Service: TELEX   Date: NOVEMBER 18, 1977

Telex No.: 001238   Originators Ext: 6802

File Bacau

START HERE TO: BANCA DE INVESTITI

CITY/COUNTRY: BUCAREST, ROMANIA

MESSAGE NO.:

FOR MR. CLEMENT GAVRILESCU. MR. J.F. RISCHARD OF THE INDUSTRIAL PROJECTS DEPARTMENT PROPOSES TO VISIT ROMANIA FROM DECEMBER 18 TO 23 ON HIS WAY BACK FROM BANGLADESH FOR SUPERVISION OF BACAU PROJECT. TOPICS FOR DISCUSSION INCLUDE PRIMARILY REVISED CAPITAL COST ESTIMATES AND IMPLEMENTATION SCHEDULE, TIMING AND AMOUNT OF COMMITMENTS AND DISBURSEMENTS ON IBRD LOAN, AND UPDATE ON MARKET SITUATION. FOR THIS PURPOSE IT WOULD BE USEFUL TO REVISE ANNEXES 4-4 AND 5-1, AS WELL AS TABLES 28 TO 30 OF ANNEX 3-3 OF APPRAISAL REPORT, AND TO PREPARE A TABLE SHOWING PROJECTED COMMITMENTS AND DISBURSEMENTS ON IBRD LOAN FOR EACH OF THE FIVE ALLOCATION CATEGORIES. WHILE IN ROMANIA, MR. RISCHARD WOULD ALSO BRIEFLY DISCUSS DATA NEEDED FOR PROJECT SELECTION, IN PREPARATION OF SPRING 1978 CHEMICAL SECTOR PROJECT IDENTIFICATION MISSION. PLEASE ADVISE IF TIMING OF MISSION IS ACCEPTABLE TO YOU. BEST REGARDS, STEEL

END OF TEXT

NOT TO BE TRANSMITTED

SUBJECT: ROMANIA - Bacau

DRAFTED BY: JFRischard/yvw

CLEARANCES AND COPY DISTRIBUTION:

cc: Messrs. Fuchs/Dewey, Perram/ Kohli, Tortorelli, Loos, Brown Rischard

AUTHORIZED BY (Name and Signature): William S. Humphrey, Div. Chief

DEPARTMENT: Industrial Projects/CPD 1D, EMENA

SECTION BELOW FOR USE OF CABLE SECTION

CHECKED FOR DISPATCH

DISTRIBUTION: WHITE — File Copy   WHITE — Transmittal Copy   CANARY — Bill Copy   BLUE — Originator to Keep

November 18, 1977

Banca De Investitii
4 Strada Doamnei
Bucharest, Romania

Attention: Mr. Clement Cavrilescu

Gentlemen:

Re: Bacau Chemical Plant Project
Activity Report, Q. III, 1977

This is to acknowledge receipt and thank you for the Quarterly Activity Report for the 3rd quarter, 1977.

Sincerely yours,

Anthony R. Perram
Chief, Division II
Industrial Projects Department

cc: Mr. David Steel

JFR/dw

CABLE

November 3, 1977
3578

MR. VINEET NAYYAR, G-82 SUJAN SINGH PARK, HUMAYUN ROAD,
NEW DELHI, INDIA

RE POSSIBLE MISSION IN BURMA. MISSION HAS BEEN POSTPONED AND IS UNLIKELY TO TAKE PLACE BEFORE YOUR ARRIVAL IN WASHINGTON. HOPE TO HAVE UP TO DATE INFORMATION NEXT WEEK. WILL ADVISE ACCORDINGLY. REGARDS, BOURCIER, INTBAFRAD

P. Bourcier:nc

cc: P. Peters, J-f. Rischard (IPD)

~~EWT~~ P. Bourcier

EWT

October 31, 1977

Mr. Clement Gavrilescu
Deputy Director
Banca de Investitii
Strada Doamnei, 4
Bucharest, Romania

Dear Mr. Gavrilescu:

Re: Bacau Fertilizer
Loan #1020-RO
Activity Report

This will acknowledge receipt of your activity report of Bacau Fertilizer Project for the month of July-August 1977.

Thank you very much.

Sincerely,

Anthony R. Perram
Chief of Division II
Industrial Projects Department

JFRischard:des
cc: Perram, Tortorelli, Loos
Dossani, Espiritu

October 31, 1977

Mr. S. Chander
Chief Engineer for Project Coordination
The Fertilizer Corporation of India, Ltd.
C.I.F.T. Buildings
P. O. Sindri Pin 828122
Dist. DHANBAD (BIHAR), India

Dear Mr. Chander:

Re: IDA Credit No. 598-IN(Rourkela)
Activity Report on Additional
Synthesis Gas Generation Facilities
for Rourkela Fertilizer Plants

This will acknowledge receipt of your activity report for the month of September 1977 with reference to the Rourkela Fertilizer Plants.

Thank you very much.

Sincerely,

Anthony R. Perram
Chief of Division II
Industrial Projects Department

JFRischard:dam
cc: Rischard, Perram, Shetty, Dossani

October 31, 1977

Mr. T.R. Visvanathan
Technical Services Superintendent
Madras Fertilizers Limited
Post Bag No. 2
Manali, Madras - 600 068
INDIA

INDIA: Fertilizer VII

Dear Mr. Visvanathan:

This is to acknowledge receipt and thank you for your monthly report for September 1977 in respect of each of the four schemes under the World Bank sectoral loan.

Sincerely yours,

Jean-Francois Rischard
Industrial Projects II

cc: Messrs. Perram/Kohli
Venkataraman
Shetty
Petry

/yvw

October 31, 1977

Mr. Lashkar Singh
Project Manager
Gujarat State Fertilizers Co. Ltd.,
Fertilizer Nagar - 391750
Baroda
INDIA

INDIA: Fertilizer VII Project

Dear Mr. Singh:

This is to acknowledge receipt and thank you for your progress reports from August 20, 1977 to September 30, 1977 regarding the Purge Gas Recovery Project and Phosphoric Acid Debottlenecking Project.

Sincerely yours,

Jean-Francois Rischard
Industrial Projects II

cc: Messrs. Perram/Kohli
Venkataraman
Shetty
Petry

/yvw

Record Removal Notice

The World Bank Group
Archives
& Records Management

File Title	**Barcode No.**
IPD - Chron File - (From: 1976 to 1977) - Mr. Rischard	30017808

Document Date	**Document Type**
27 October, 1977	Form

Correspondents / Participants

Subject / Title
Performance Evaluation of Consultant - Fred J. Bastl

Exception(s)
Personal Information

Additional Comments

The item(s) identified above has/have been removed in accordance with The World Bank Policy on Access to Information or other disclosure policies of the World Bank Group.

Withdrawn by	**Date**
Sherrine M. Thompson	August 22, 2019

chron

Anthony Perram

October 20, 1977

Jean-Francois Rischard & David Caplin

Craiova Chemical Project
Revised Techno-Economic Study

1. We have briefly reviewed the revised techno-economic study submitted by the Investment Bank for the above mentioned project. Although this document is more detailed than is usual, it suffers from any ambiguities and errors. In any case, it is difficult to determine from the indications contained in that document whether the units whose viability had been questioned by the Preparation Mission will actually not be built or have simply been formally taken out of the project submitted to the Bank for financing (in which case we would not be able to consider the project further). It would, therefore, seem desirable to have one member of the original project preparation team briefly visit Romania to settle the questions.

2. We have also done some calculations assuming that the design now presented to the Bank reflects the decision actually not to build the above mentioned units. The economic return of the new project would now approach 13%. The likely loan amount would be lower than the figures contemplated before, due (i) to the absence of these units and (ii) the exclusion of the acetic acid plant, due to advance contracting and retroactive financing problems. Depending on which assumptions are made regarding indirect foreign exchange items packageable for procurement under Bank guidelines the amount would range from US $27 million to about US $34 million. Possible advance contracting and retroactive financing problems with the CO plant could further reduce these amounts by US $2-3 million.

cc: Messrs. Humphrey, Noon, Tortorelli

Rischard:des

Chron

Tel.
216-494-2816

Collier-Travel
X-3928

September 7, 1977

Mr. Fred Bastl
910 Wise Avenue, S.E.
North Canton, Ohio 44720

Dear Mr. Bastl:

BRAZIL-COPESUL Petrochemical Project
Preparation Mission
Back-to-Office and Full Report

Enclosed you will find a copy of my full report as of August 19, 1977 on the BRAZIL-COPESUL Petrochemical Project as above-referenced.

Please feel free to telephone Mr. H. Kohli for any questions you might have during my absence on mission to Brazil.

Sincerely,

Jean-Francois Rischard
Industrial Projects
Department

J-FR:des

enclosure

Record Removal Notice

The World Bank Group Archives & Records Management

File Title	Barcode No.
IPD - Chron File - (From: 1976 to 1977) - Mr. Rischard	30017808

Document Date	Document Type
26 October, 1977	Form

Correspondents / Participants

Subject / Title
Operational Travel Request
Request for Consultant - Ferdinand J. Bastl

Exception(s)
Personal Information

Corporate Administrative Matters

Additional Comments

The item(s) identified above has/have been removed in accordance with The World Bank Policy on Access to Information or other disclosure policies of the World Bank Group.

Withdrawn by	Date
Sherrine M. Thompson	August 22, 2019

WORLD BANK / INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Mr. Anthony A. Perram, IPD

DATE: October 21, 1977

FROM: Irwin Baskind, LCPID

SUBJECT: Participation in Argentine Industrial Mission
Scope of work for consultant in petrochemical industries

1. I attach a copy of the overall terms of reference of the Argentine Industrial Sector Mission and a background note explaining its objective and composition. While the mission will be in the field for 4 weeks, the consultant is expected to participate from November 6 to 19.

2. Within the overall terms of reference the consultant will undertake a review of the petrochemical industries. The consultant should, in particular, assess its overall capacity and current level of utilization, international price competitiveness and factors affecting efficiency, in particular, scale of output and price and quality of inputs. The consultant will review the expansion program formulated by the Government in the light of expected demand and cost/price relationships. The consultant's analysis should take into account the impact of measures recently taken by the Government to rationalize industry and the consultant should make recommendations concerning any possible modifications or new measures which may be required to achieve the desired objectives.

3. Upon completion of his field work the consultant is expected to prepare a brief report summarizing the situation in these industries.

IBaskind:mt

cc.: Messrs. Wogart, LC2
Ross/Jaspersen, LC2
Knotter, LCPID

WORLD BANK / INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Mr. Irwin Baskind

DATE: October 19, 1977

FROM: Paul F. Knotter, Acting Chief, LCPID

SUBJECT: Argentine Industrial Sector Mission
General Terms of Reference

1. On or about October 24, 1977 you will proceed to Buenos Aires to lead a mission to review current performance of and prospects for the Argentine industrial sector. The mission will be in the field for approximately four weeks, although as is indicated below, some participants may be required for shorter periods of time.

2. The principal objective of the mission is to prepare an analysis and assessment of the current structure of manufacturing industry, focussing on the major factors affecting its efficiency and taking into account the measures which the Government has recently adopted to promote rationalization of the sector. In this context, consideration should be given to additional measures which may be required to achieve the Government's objectives. The analysis will be based on a review of both the overall performance of the sector as well as on performance of a selected sample of major industrial branches chosen on the basis of their importance, both actual and potential, to the economy. In addition, the mission will review specific areas within the sector where Bank operations may be designed.

3. The following represents a brief and general description of the assignments to be undertaken by mission staff. More detailed terms of reference for participants will be supplied prior to mission departure.

(a) As mission chief, you will be responsible for coordination of all inputs and for the chapter on major sectoral issues.

(b) Mr. Wogart will be deputy mission chief and will be responsible for analyses of effective protection, and of industrial organization.

(c) Mr. Castañeda (Consultant) will assist in the review of the industrial incentive laws, and also in the review of the performance of the traditional export industries.

(d) Mr. Santistevan (Consultant) will undertake a review of the financial sector.

(e) Ms. Cortes (DPS) will undertake the analysis of the experience of Argentina in developing and exporting certain industrial items (agricultural equipment and machine tools) to determine to what extent these represent indigenous intermediate technologies.

(f) Two sub-sectoral specialists from NDP will review the steel-making industries and the pulp and paper industries. These staff will join the mission during the second half of its stay in Argentina.

(g) Mr. Knepell (UNIDO) will review the metal-mechanical sub-sector with close coordination with Ms. Cortes.

(h) A consultant for the petro-chemical industries will review the performance of this sub-sector; he will also join the mission during the second half of stay.

(i) Mr. Wolffelt (CPS) will review output trends and prospects, in particular export possibilities, of the traditional food processing industries, primarily fruits, vegetables and dairy products. Because of other commitments, Mr. Wolffelt will undertake his field work after the mission has returned to Washington; upon his return, he will provide a summary of his principal findings for inclusion in the yellow-cover draft.

(j) Mr. Goderez (IDFD) will review the small industry sector, in particular analyzing policies and institutional measures affecting that sector.

4. Within two weeks of your return, you should prepare a brief back-to-office report highlighting the principal issues which are to be treated in the final report. All inputs of mission staff (other than that of Mr. Wolffelt) are to be submitted by the end of December 1977 and a yellow cover draft should be prepared by February 28, 1978.

IBaskind/PFKnotter:mt

Cleared and cc.: Messrs. Glaessner, LCP
Ross, LC2

cc.: Messrs. van der Meer, LCP
Lerdau, LC2
Holsen, LCNVP
Jasperson, LC2
Scherer, LC2
Goderez, IDFD
Wolffelt, CPS
Wogart, LC2
Ms. Cortes, DPS
Messrs. Oberdorfer, IPD
Knepell (UNIDO)
Castañeda, Consultant
Santistevan, Consultant
Ms. Velarde, LCPID

Messrs. van der Tak, PAS (3)
Gordon, IDF (3) (o/r)
Chanmugam, IDF
Walstedt, IPD
Nayar, IPD
Perram, IPD
Cash, IPD

Record Removal Notice

The World Bank Group Archives & Records Management

File Title	Barcode No.
IPD - Chron File - (From: 1976 to 1977) - Mr. Rischard	30017808

Document Date	Document Type
21 October, 1977	Form

Correspondents / Participants

Subject / Title
Request for Consultant - Ferdinand J. Bastl

Exception(s)
Personal Information

Corporate Administrative Matters

Additional Comments

The item(s) identified above has/have been removed in accordance with The World Bank Policy on Access to Information or other disclosure policies of the World Bank Group.

Withdrawn by	Date
Sherrine M. Thompson	August 22, 2019

Archives 01 (March 2017)

WORLD BANK / INTERNATIONAL FINANCE CORPORATION

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IBaskind/PFKnotter:mt

Cleared and cc.: Messrs. Glaessner, LCP
Ross, LC2

cc.: Messrs. van der Meer, LCP
Lerdau, LC2
Holsen, LCNVP
Jasperson, LC2
Scherer, LC2
Goderez, IDFD
Wolffelt, CPS
Wogart, LC2
Ms. Cortes, DPS
Messrs. Oberdorfer, IPD
Knepell (UNIDO)
Castañeda, Consultant
Santistevan, Consultant
Ms. Velarde, LCPID

Messrs. van der Tak, PAS (3)
Gordon, IDF (3) (o/r)
Chanmugam, IDF
Walstedt, IPD
Nayar, IPD
Perram, IPD
Cash, IPD

Richard Chown

October 20, 1977

Mr. M. M. Rao
Coromandel Fertilisers, Ltd.
Jeevan Deep
10 Parliament Street
New Delhi-110 001
INDIA

Re: Fert. VII Credit No. 598-IN

Dear Mr. Rao:

This is to acknowledge with thanks receipt of your letter of September 27, 1977 reporting on the progress of:

(i) 5 MW Power Plant
(ii) Argon-Ammonia Recovery
(iii) Aluminium Flouride

Yours sincerely,

Anthony R. Perram
Chief of Division II
Industrial Projects Department

JRischard:des

cc: Venkataraman

WORLD BANK / INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Anthony R. Perram

DATE: 17 October 77

FROM: Jean-Francois Rischard

SUBJECT: Need for Petrochemical Information Support

1. As we become more deeply involved in complex petrochemical projects (Craiova in Romania, COPESUL in Brazil, Mexico, Saudi-Arabia) or in projects using petrochemical intermediates as raw materials (tires and polyester in Romania), we need an increasingly large amount of information on (i) the demand and supply situation and prospects for a large spectrum of petrochemical raw materials, intermediates and derivatives and (ii) the economic prices to be assigned to them in the economic analyses. The petrochemical sector is characterized by frequent process changes or innovations, complex by-product situations, a high capital intensity and hence a tendency towards periodic over-capacity problems, a high sensitivity to feedstock prices, rapidly shifting market conditions and product obsolescence, and complex inter-product competition.

2. It is, therefore, difficult and expensive to obtain the market and production cost information needed on a case-by-case basis. For instance, to obtain the market and production cost information needed to place economic prices on three out of seven products in the preliminary analysis of the Craiova project, we had to spend US$3,000 and to incur a one-week delay in the completion of the analysis. For COPESUL, the bill is likely to be much higher, as well as for the Shell project (S.A.) evaluation. Finally, since we need to build up our evaluation capabilities in the petrochemical field, we would need a more integrated approach, the first step being a general data base.

Stanford Research Institute Services

3. I have, therefore, requested several consulting firms to propose subscription services covering a large range of petrochemicals. Among them, Stanford Research International (SRI) would seem to provide the services best adapted to our needs. SRI's main advantage over the two other major firms contacted (Chem Systems and Pace Company) is that it is the only firm to (i) provide a world-wide country-by-country demand and supply data base (ii) cover almost all petrochemical products up to such downstream products as synthetic fibers and (iii) give process economics not only on a US Gulf Coast basis, but also for Europe and Japan with different location factors and input/output price assumptions.

4. The services offered by SRI and of interest to us are (i) the World Hydrocarbon Program (WHP) and (ii) the Process Economics Yearbook (PEY).

World Hydrocarbon Program

5. The WHP contains detailed demand and supply data for petrochemicals by region and by country. The most important features of the Program are the annual reports on producers and consumers of petrochemicals and the annual supply and demand reviews. The reports provide continously updated information on plant locations, plant capacities, expansion plans, and raw material requirements. (See sample attached as Annex 1). The reviews are the newest service of the Program. These studies summarize the most important supply data contained in the reports and provide additional information on production, foreign trade, consumption, end uses and five-year demand forecasts, (sample attached as Annex 2). In addition, all participants have inquiry and consulting privileges and receive supplements; and direct computer access by terminal is being studied. The Program is available for the following product segments:

- ethylene and ethylene-based derivatives
- propylene and propylene-based derivatives
- benzene, toluene and xylene, and derivatives
- C_4 hydrocarbons and derivatives

Process Economics Yearbook

6. The PEY is a compilation of up-to-date production ratios and economics of most chemicals and polymers analyzed by SRI in its Progress Economic Program (PEP). This list includes 180 products by about 200 processes. The prices of the basic raw materials are derived from energy costs and data from computer-simulated refining operations. The cost-plus-return values estimated for the intermediates are carried forward to downstream processes and all co-products are valued and credited. The estimated investment, consumption of raw materials and utilities, and a brief description of the operations are given for each process. All of these data are given for several plant scales located (i) at the U.S. Gulf Coast (ii) in West Germany and (iii) in Japan, thus providing a good basis for economic price calculations. A list of the products included in the PEY and a sample is given in Annex 3.

Cost and Beneficiaries

7. Annual participation fees for the WHP are as follows:

Program participation	Initial Fee	Renewal
Total Program	$ 11,600	$ 8,600
Three Segments	9,000	6,750
Two Segments	6,200	4,700
One Segment	3,200	2,450

If we elect to join any portion of the program before year-end, SRI will deduct US $1,000 from the subscription cost, reflecting the price of an assignment given to the WHP people for the Brazil COPESUL project in August this year.

8. Normally, the PEY is offered for US$4,000 only to clients of the more detailed PEP which costs in itself US $13,500 a year. Since contrary to engineering companies or chemical companies we do not need the entire PEP program, I have asked SRI to work out a proposal taking account of our specific needs and limited budget.

9. SRI proposes to sell us a package including the four WHP segments and the PEY for US $18,000, while waiving the condition of joining the entire PEP program (in which case the total cost of our subscription would have amounted to US $29,100). As mentioned above, we could credit US$1,000 against the US$18,000, thus bringing down subscription costs for calendar 1978 to US $17,000. Furthermore, they agreed to send us specific material on request before calendar 1978 to meet our needs for projects presently under appraisal (e.g. COPESUL).

10. Compared with what we would have to spend on a case by case basis it is felt that this is an attractive package. The costs of the program could be shared by Division II and for a small part by Division III inasmuch as nylon and polyester fibers as well as synthetic rubber are part of the products covered by the SRI programs. PEY also contains up-to-date production economics for such items as ammonia, urea and phosphoric acid, of interest to the Fertilizer Unit.

cc: MM. Fuchs/Dewey, Nayar/Iskander, Pratt, Evans, Tortorelli, Tarnawiecki, Caplin, Soncini, Ms. Wolf (IFC).

ANNEX I

Sample of a WHP Report

(product: phenol)

PHENOL REPORT

TABLE OF CONTENTS

PRODUCERS/CONSUMERS

(Continued)

TABLE OF CONTENTS (Continued)

PHENOL

PRODUCERS/CONSUMERS
(tabular data in 1000 metric tons per year)

CANADA

Ashland Oil Canada Limited (Resins & Chemicals Division)
[owned 83% by Ashland Oil, Inc.]

- **Mississauga (near Toronto), Ontario**

DATE	DERIVATIVES PRODUCT	CAPACITY	INPUT REQ.	COMMENTS
Current	PF Resins	20	15	Purchased phenol

Phenol is supplied by Gulf Oil Canada Limited (Chemicals Department), at Montreal East.

Bakelite Thermosets Limited

- **Belleville, Ontario**

DATE	DERIVATIVES PRODUCT	CAPACITY	INPUT REQ.	COMMENTS
Current	PF Resins	7	5	Purchased phenol

The company recently purchased this plant from Union Carbide Canada Limited. Liquid, solid, and powdered phenolic resins are produced. It is assumed that Gulf Oil Canada Limited (Chemicals Department) at Montreal East, Quebec, will continue to supply phenol.

The Borden Chemical Company (Canada) Limited
[subsidiary of Borden Co. Ltd. (Canada)]

- **Laval, Quebec**

DATE	DERIVATIVES PRODUCT	CAPACITY	INPUT REQ.	COMMENTS
Current	PF Resins	na	na	Purchased phenol

Captive formaldehyde and phenol purchased from Gulf Oil Canada Limited (Chemicals Department) at Montreal East are used in manufacturing phenolic resins.

- **North Bay, Ontario**

DATE	DERIVATIVES PRODUCT	CAPACITY	INPUT REQ.	COMMENTS
Current	PF Resins	na	na	Purchased phenol

Captive formaldehyde and phenol purchased from Gulf Oil Canada Limited (Chemicals Department) at Montreal East are used in manufacturing phenolic resins.

Borden Chemical (Western) Limited
[owned 100% by Borden Co. Ltd. (Canada)]

- **Edmonton, Alberta**

DATE	DERIVATIVES PRODUCT	CAPACITY	INPUT REQ.	COMMENTS
Current	PF Resins	2	1	Purchased phenol

Phenol is purchased from Dow Chemical of Canada, Limited, at Ladner, British Columbia.

PHENOL

PRODUCERS/CONSUMERS
(tabular data in 1000 metric tons per year)

CANADA (continued)

Borden Chemical (Western) Limited (continued)

- **New Westminster, British Columbia**

DERIVATIVES				COMMENTS
DATE	PRODUCT	CAPACITY	INPUT REQ.	
Current	PF Resins	34	25	Purchased phenol

Phenol is purchased from Dow Chemical of Canada, Limited, at Ladner, British Columbia.

- **Vancouver, British Columbia**

DERIVATIVES				COMMENTS
DATE	PRODUCT	CAPACITY	INPUT REQ.	
Current	PF Resins	45	33	Purchased phenol

Phenol is purchased from Dow Chemical of Canada, Limited, at Ladner, British Columbia.

Canadian General Electric Company Limited
[owned 100% by General Electric Company]

- **Toronto, Ontario**

DERIVATIVES				COMMENTS
DATE	PRODUCT	CAPACITY	INPUT REQ.	
Current	PF Resins	neg	neg	Purchased phenol

Phenol is supplied by Dow Chemical of Canada, Limited, at Ladner, British Columbia. Phenolic resins are used captively.

Cyanamid of Canada Limited
[owned 100% by American Cyanamid Company]

- **Saint Jean, Quebec**

DERIVATIVES				COMMENTS
DATE	PRODUCT	CAPACITY	INPUT REQ.	
Current	PF Resins	na	na	Purchased phenol

Phenol is supplied by Gulf Oil Canada Limited (Chemicals Department) at Montreal East. Phenolic resins are used captively for the manufacture of decorative laminates.

Domtar Construction Materials Ltd.
[affiliated with Domtar Limited]

- **La Salle, Quebec**

DERIVATIVES				COMMENTS
DATE	PRODUCT	CAPACITY	INPUT REQ.	
Current	PF Resins	7	5	Purchased phenol

Phenol is supplied by Gulf Oil Canada Limited (Chemicals Department) at Montreal East. Phenolic resins are used captively for high-pressure decorative and industrial laminates.

PHENOL

PRODUCERS/CONSUMERS
(tabular data in 1000 metric tons per year)

CANADA (continued)

Dow Chemical of Canada, Limited
[wholly-owned subsidiary of The Dow Chemical Company]

- **Ladner, British Columbia**

DATE	PHENOL CAPACITY	CAPTIVE USE	RAW MATERIAL	COMMENTS
Current	23	0 (0%)	Toluene	Purchased toluene
1977(Mid)	34	0 (0%)	Toluene	

Most of the phenol produced is sold for use in manufacturing adhesives for British Columbia's plywood industry, e.g., to Reichhold Chemicals, Inc., at Kamloops and Port Moody.

Phenol is also reportedly supplied to Borden Chemical (Western) Limited at Edmonton, Alberta, and at Vancouver and New Westminster, both in British Columbia. Phenol is manufactured via benzoic acid.

Fiberglas Canada Limited

- **Sarnia, Ontario**

DATE	DERIVATIVES PRODUCT	CAPACITY	INPUT REQ.	COMMENTS
Current	PF Resins	1	1	Purchased phenol

Phenol is supplied by Gulf Oil Canada Limited (Chemicals Department) at Montreal East.

Gulf Oil Canada Limited (Chemicals Department)
[owned 68% by Gulf Oil Corporation]

- **Montreal East, Quebec**

DATE	PHENOL CAPACITY	CAPTIVE USE	RAW MATERIAL	COMMENTS
Current	27	4 (16%)	Cumene	Captive cumene

DATE	DERIVATIVES PRODUCT	CAPACITY	INPUT REQ.
Current	Bisphenol A	5	4

In addition to its captive use, phenol is supplied to Ashland Oil Canada Limited (Resins & Chemicals Division) at Mississauga, Ontario; to The Borden Chemical Company (Canada) Limited at Laval, Quebec, and North Bay, Ontario; to Cyanamid of Canada Limited at Saint Jean, Quebec; to Domtar Construction Materials Ltd. at La Salle Quebec; to Fiberglas Canada Limited at Sarnia, Ontario; to Hooker Chemicals (Nanaimo) Ltd. at Fort Erie, Ontario; to Reichhold Chemicals Limited at North Bay, Ontario, and at Ste. Therese de Blainville, Quebec; and, presumably, to Bakelite Thermosets Limited at Belleville, Ontario.

Hooker Chemicals (Nanaimo) Ltd.
[wholly-owned subsidiary of Canadian Occidental Petroleum Ltd.]

- **Fort Erie, Ontario**

DATE	DERIVATIVES PRODUCT	CAPACITY	INPUT REQ.	COMMENTS
Current	PF Resins	10	8	Purchased phenol

(continued)

PHENOL

PRODUCERS/CONSUMERS
(tabular data in 1000 metric tons per year)

CANADA (continued)

Hooker Chemicals (Nanaimo) Ltd. (continued)

- **Fort Erie, Ontario** (continued)

Phenol is supplied by Gulf Oil Canada Limited (Chemicals Department) at Montreal East. Some phenolic resins are captively consumed in the manufacture of molding compounds (capacity is 4,500 mt/y).

Reichhold Chemicals Limited
[owned 29% by Reichhold Chemicals, Inc.]

- **Kamloops, British Columbia**

DATE	DERIVATIVES PRODUCT	CAPACITY	INPUT REQ.	COMMENTS
Current	PF Resins	9	7	Purchased phenol

Phenol is purchased from Dow Chemical of Canada, Limited, at Ladner.

- **North Bay, Ontario**

DATE	DERIVATIVES PRODUCT	CAPACITY	INPUT REQ.	COMMENTS
Current	PF Resins	9	7	Purchased phenol

Phenol is supplied by Gulf Oil Canada Limited (Chemicals Department) at Montreal East.

- **Port Moody, British Colombia**

DATE	DERIVATIVES PRODUCT	CAPACITY	INPUT REQ.	COMMENTS
Current	PF Resins	11	8	Purchased phenol

Phenol is purchased from Dow Chemical of Canada, Limited, at Ladner.

- **Ste. Therese de Blainville, Quebec**

DATE	DERIVATIVES PRODUCT	CAPACITY	INPUT REQ.	COMMENTS
Current	PF Resins	11	8	Purchased phenol

Phenol is supplied by Gulf Oil Canada Limited (Chemicals Department) at Montreal East.

Schenectady Chemicals Canada Limited

- **Scarborough, Ontario**

DATE	DERIVATIVES PRODUCT	CAPACITY	INPUT REQ.	COMMENTS
Current	PF Resins	na	na	Purchased phenol

Union Carbide Canada Limited
[owned 75% by Union Carbide Corporation and 25% by private investors]

- **Belleville, Ontario**

Bakelite Thermosets Limited recently purchased Union Carbide Canada Limited's phenolics resins business.

PHENOL

PRODUCERS/CONSUMERS
(tabular data in 1000 metric tons per year)

MEXICO

Aditivos Mexicanos, SA

- **Tlalnepantla, Mexico**

DERIVATIVES				COMMENTS
DATE	PRODUCT	CAPACITY	INPUT REQ.	
Current	Dodecylphenol	1	neg	Purchased raw material
Future	Dodecylphenol	1	neg	Planning stage

Phenol is supplied by Fenoquimia, SA.

Canamex, SA

- **Cholula, Puebla**

DERIVATIVES				COMMENTS
DATE	PRODUCT	CAPACITY	INPUT REQ.	
Current	Alkylphenols	3	1	Purchased phenol

Capacity includes that for nonylphenol and octylphenol. Phenol is supplied by Fenoquimia, SA.

Esquim SA

- **Cuernavaca, Morelos**

DERIVATIVES				COMMENTS
DATE	PRODUCT	CAPACITY	INPUT REQ.	
Current	Bisphenol A	3	2	
Current	p-Tert-Butyl Phenol	1	neg	
Current	TOTAL		2	

Phenol is supplied by Fenoquimia, SA, at Cosoleacaque.

Fenoquimia, SA
[owned 50% by Industrias Resistol, SA; and 50% by Celanese Mexicana, SA]

- **Cosoleacaque (near Minatitlan), Veracruz**

PHENOL				COMMENTS
DATE	CAPACITY	CAPTIVE USE	RAW MATERIAL	
Current	25	0 (0%)	Cumene	Imported cumene

Cumene is currently imported, but will be supplied by Petroleos Mexicanos (PEMEX) when its cumene plant at La Cangrejera comes on stream. Sufficient phenol is available to satisfy 100% of the domestic market.

PHENOL

PRODUCERS/CONSUMERS
(tabular data in 1000 metric tons per year)

MEXICO (continued)

Industrias Quimicas Formex, SA de CV

- **San Nicolas de los Garza, Nuevo Leon**

DERIVATIVES				COMMENTS
DATE	PRODUCT	CAPACITY	INPUT REQ.	
Current	PF Resins	3	2	Purchased phenol

Phenol is supplied by Fenoquimia, SA, at Cosoleacaque. The capacity includes that for the Xalostoc facility.

- **Xalostoc, Mexico State**

DERIVATIVES				COMMENTS
DATE	PRODUCT	CAPACITY	INPUT REQ.	
Current	PF Resins	na	0	See note

Phenol is supplied by Fenoquimia, SA, at Cosoleacaque. Data are included in the table at the San Nicolas de los Garza location.

Industrias Quimicas Synres, SA
[owned by Dutch and Mexican investors]

- **Toluca, Mexico State**

DERIVATIVES				COMMENTS
DATE	PRODUCT	CAPACITY	INPUT REQ.	
Current	PF Resins	2	1	Purchased phenol

Phenol is supplied by Fenoquimia, SA, at Cosoleacaque. All phenolic resins are sold.

Industrias Resistol, SA
[owned 34% by Desarrollo Economico, SC (DESC), 39% by Monsanto Company, and 27% by the owners of the former Resistol SA and other private investors]

- **Toluca, Mexico, D.F.**

DERIVATIVES				COMMENTS
DATE	PRODUCT	CAPACITY	INPUT REQ.	
Current	PF Resins	na	na	Purchased phenol

Phenol-formaldehyde resins are produced in a 17,000 mt/y multipurpose facility: the phenol requirement is variable. Phenol is supplied by Fenoquimia, SA, at Cosoleacaque. Most phenolic resins are captively consumed for adhesives and industrial laminates.

PHENOL

PRODUCERS/CONSUMERS
(tabular data in 1000 metric tons per year)

MEXICO (continued)

Ingsam SA

- **Lerma, Mexico State**

DATE	PRODUCT	CAPACITY	INPUT REQ.	COMMENTS
	DERIVATIVES			
Current	Nonylphenol	neg	neg	Purchased phenol
Current	Octylphenol	neg	neg	
Current	TOTAL		neg	

Phenol is supplied by Fenoquimia, SA, at Cosoleacaque. Capacity for the manufacture of octylphenol and nonylphenol is 500 mt/y: phenol input requirement for this capacity amounts to 225 mt/y. Octylphenol and nonylphenol are captively consumed in the manufacture of non-ionic detergents.

Materiales Moldeables SA de CV

- **Atizapan de Zaragoza, Mexico State**

DATE	PRODUCT	CAPACITY	INPUT REQ.	COMMENTS
	DERIVATIVES			
Current	PF Resins	1	neg	Purchased phenol

Phenol is supplied by Fenoquimia, SA, at Cosoleacaque.

Polaquimia, SA

- **Xalostoc, Mexico**

DATE	PRODUCT	CAPACITY	INPUT REQ.	COMMENTS
	DERIVATIVES			
Current	Alkylphenols	1	neg	Purchased phenol

Poliresinas, SA
[owned by private investors]

- **Xalostoc, Mexico State**

DATE	PRODUCT	CAPACITY	INPUT REQ.	COMMENTS
	DERIVATIVES			
Current	PF Resins	3	1	Purchased phenol

Phenol is supplied by Fenoquimia, SA, at Cosoleacaque.

PHENOL

PRODUCERS/CONSUMERS
(tabular data in 1000 metric tons per year)

MEXICO (continued)

Compania Quimica Ameyal, SA

- **Tultitlan, Mexico**

DATE	PRODUCT	CAPACITY	INPUT REQ.	COMMENTS
	DERIVATIVES			
Current	p-Tert-Butyl Phenol	neg	neg	Purchased phenol
Current	Nonylphenol	neg	neg	
Current	Octylphenol	neg	neg	
Current	TOTAL		neg	

Phenol is supplied by Fenoquimia, SA, at Cosoleacaque.

Quimica Retzloff Interamericana SA

- **Matamoros, Tamaulipas**

DATE	PRODUCT	CAPACITY	INPUT REQ.	COMMENTS
	DERIVATIVES			
Current	Dodecylphenol	neg	neg	Used captively
Current	Nonylphenol	neg	neg	Used captively
Current	TOTAL		neg	

Phenol is supplied by Fenoquimia, SA, at Cosoleacaque. Total capacity for the manufacture of dodecylphenol and nonylphenol is 350 mt/y.

Reichhold Quimica de Mexico SA
[a subsidiary of Reichhold Chemicals, Inc.]

- **Mexico City, Mexico, D.F.**

DATE	PRODUCT	CAPACITY	INPUT REQ.	COMMENTS
	DERIVATIVES			
Current	PF Resins	1	1	Purchased phenol

This company manufactures synthetic resins and plasticizers, including phenolic and modified phenolic resins. Total plant capacity amounts to 12,000 mt/y. Most of the output is sold, but some is captively consumed. Phenol is supplied by Fenoquimia, SA, at Cosoleacaque.

Union Carbide Mexicana SA
[owned 60% by Union Carbide Corporation and 40% by Mexican investors]

- **Tecamac, Mexico State**

DATE	PRODUCT	CAPACITY	INPUT REQ.	COMMENTS
	DERIVATIVES			
Current	PF Resins	5	4	Purchased phenol

Phenol is supplied by Fenoquimia, SA, at Cosoleacaque.

ANNEX II

Sample of a WHP Annual Review

CYCLOHEXANE

Cyclohexane is the basic starting material for nylon fibers and resins, since these are the main end uses for adipic acid, caprolactam, and 1, 6-hexamethylenediamine. Of these three derivatives, adipic acid and caprolactam account for close to 90 percent of worldwide cyclohexane consumption. Cyclohexane is also used as a solvent in paint removers, as a solvent for the Phillips HDPE process, and as a starting material for cyclohexanol and cyclohexanone.

Cyclohexane is produced commercially by hydrogenating benzene and by recovering naturally-occurring cyclohexane from hydrocarbon streams. Since high purity cyclohexane is required for oxidation to adipic acid, the benzene-derived material is far more important. Purity as high as 99.97 percent is obtainable with some commercial processes. Although straight-run gasoline usually contains 5-15 percent cyclohexane, complete separation is difficult due to the presence of hydrocarbons with similar boiling points. As a result, purity is usually on the order of 85 percent.

- **Summary of World and Regional Capacity**

Region/Country	Annual Capacities (thousand metric tons) As of Year-end 1976		Announced Expansions	
North America				
Canada	70		--	
Mexico	85		--	
United States	1326		55	
		1481		55
Latin America				
Argentina	45		13	
Brazil	--		44	
Others	20		--	
		65		57
Western Europe				
EEC				
Belgium	100		--	
Netherlands	120		--	
Denmark	--		--	
France	80		--	
West Germany	100		100	
Ireland	--		--	
Italy	45		--	
United Kingdom	413		--	
	858		100	
Others				
Austria	--		--	
Finland	--		--	
Greece	--		--	
Norway	--		--	
Portugal	--		--	
Spain	40		40	
Sweden	--		--	
Switzerland	--		--	
	40		40	
Total Western Europe		898		140
Eastern Europe		>113		--
Middle East/Africa		31		220
Far East				
Japan	602		--	
Other Far East	173		110	
		775		110
Oceania		--		--
Total World		3363		582

Producing companies, plant locations, and capacities are listed in Chapter III of this report and in Volume III of the World Hydrocarbons report, **Benzene-Toluene-Xylenes and Derivatives.**

- **Supply and Demand, 1975 (thousand metric tons):**

Country	Capacity (Year-end)	Production	Imports	Exports	Apparent Consumption	Actual Consumption
North America						
Canada	70	56	7	--	63	63
Mexico	85	34½	4	--	38½	40
United States	1245	786	--	128	658	735
Latin America						
Argentina	45	20	--	19	1	--
Brazil	--	--	neg	--	neg	neg
Andean Countries	20	12	--	--	12	12
Western Europe						
EEC						
Belgium, Netherlands	220	130	net import	57	187	187
Denmark	--	--	neg	--	neg	neg
France	80	45	net import	69	114	114
West Germany	100	55	net import	145	200	200
Ireland	--	--	neg	--	neg	neg
Italy	40	25	net export	10	15	15
United Kingdom	413	280	net export	70	210	210
Others						
Austria	--	--	1	--	1	1
Finland	--	--	neg	--	neg	neg
Greece	--	--	neg	--	neg	neg
Norway	--	--	neg	--	neg	neg
Portugal	--	--	neg	--	neg	neg
Spain	40	33	net export	3	30	30
Sweden	--	--	1	--	1	1
Switzerland	--	--	2	--	2	2
Far East						
Japan	602	498	6	--	504	514
South Korea	36	31	neg	3	28	28
Taiwan	60	--	--	--	--	--
Southeast Asia	--	--	--	--	--	--
Oceania						
Australia	--	--	--	--	--	--

- **Regional Summary of Supply and Demand, 1975 (thousand metric tons):**

Region	*Capacity (Year-end)*	*Production*	**Net** *Trade Balance Imports*	*Exports*	*Apparent Consumption*	*Actual Consumption*
North America	1400	876½		117	759½	838
Latin America	65	32		19	13	12
Western Europe	893	568	192		760	760
EEC	853	535	191		726	726
Others	40	33	1		34	34
Far East	698	529	3		532	542
Oceania	--	--			--	--

- **Uses**

United States

The pattern of cyclohexane consumption in the United States in 1975 was as follows:

Adipic acid	61%
Caprolactam	29
HMDA	5
Others	5
	100%

Western Europe

The applicational breakdown of cyclohexane consumption in Western Europe in 1974 was as follows:

Adipic acid	48
Caprolactam	44
Others	8
	100%

Japan

The pattern of cyclohexane usage in Japan in 1975 was as follows:

Caprolactam	95%
Adipic acid	4
Others	1
	100%

- **Development and Growth**

United States

Because 95 percent of the market for cyclohexane in the United States is based on its use as an intermediate in the manufacture of nylon 6 and 66, demand closely follows that of nylon fibers and plastics. Usage of cyclohexane in 1974 was only slightly (2%) below that of 1973, but declined almost 13 percent between 1974 and 1975. Full recovery to the level of consumption attained in 1974 appears likely in 1976. During the period, 1976-1980, cyclohexane demand should increase 8 percent per year with consumption reaching one million metric tons by 1980.

Western Europe

The demand for cyclohexane declined almost 24 percent between 1974 and 1975 as Europe experienced the effects of the worldwide recession. Although some recovery to pre-recession levels was seen in 1976, cyclohexane demand will not equal that of 1974 until 1977. Thereafter, growth should occur at a rate of about 4 percent annually. By 1980, consumption should reach 1.1 million metric tons. Based on an anticipated production of one million metric tons in 1980, Western Europe will continue to be a net importer of cyclohexane.

Japan

In 1975, the consumption of cyclohexane increased 15 percent from 1974. This gain was primarily the result of a corresponding increase in the demand for caprolactam. However, demand was expected to decline slightly in 1976 (about 3%) because of an anticipated decrease in caprolactam exports. Starting in 1977, demand should grow at an average rate of about 5 percent per year. By 1980, consumption of cyclohexane should amount to 610 thousand metric tons.

- **Summary**

The demand (in thousand metric tons) for cyclohexane in 1974, 1975 and 1980 is shown in the following table.

Country	*1974*	*1975*	*1980*
North America			
Canada	68	63	100
Mexico	38	40	97
United States	762	735	1040
Latin America			
Argentina	--	--	--
Brazil	½	neg	44
Andean Countries	11	12	57
Western Europe			
EEC			
Belgium } Netherlands }	210	187	230
Denmark	neg	neg	1
France	154	114	160
West Germany	307	200	320
Ireland	neg	neg	1
Italy	20	15	25
United Kingdom	248	210	275
Others			
Austria	2	1	2
Finland	neg	neg	1
Greece	neg	neg	1
Norway	neg	neg	1
Portugal	neg	neg	1
Spain	45	30	80
Sweden	2	1	3
Switzerland	3	2	5
Far East			
Japan	447	514	610
South Korea	17	28	106
Taiwan	--	--	105
Southeast Asia	--	--	--
Oceania			
Australia	--	--	--

WESTERN EUROPE: OTHERS
SWITZERLAND

Although well diversified in other chemical areas (pharmaceuticals, agrochemicals, dyestuffs), the Swiss have not developed a significant petrochemical industry.

No aromatics are produced in Switzerland and those derivatives that are needed by the chemical and pharmaceutical industries are imported.

BENZENE

- **Producing Companies, Plant Locations, and Capacities (as of Year-end 1976):**

Total number of plants: 0
Total annual capacity: 0
Additional announced capacity: 0

No producers or announced plans.

- **Supply and Demand (thousand metric tons):**

Year	Capacity (Year-end)	Production	Imports	Exports	Apparent Consumption	Actual Consumption
1974	--	--	neg	--	neg	neg
1975	--	--	neg	--	neg	neg

- **Uses**

There was a negligible amount of benzene used for chemical applications in 1974 and 1975.

- **Development and Growth**

Because there are no announced plans to produce benzene, it is unlikely that any significant demand for benzene will develop in the period, 1977-1980. Consumption in 1980 is not expected to exceed 1,000 metric tons.

ETHYLBENZENE

- **Producing Companies, Plant Locations, and Capacities (as of Year-end 1976):**

Total number of plants: 0
Total annual capacity: 0
Additional announced capacity: 0

No producers or announced plans.

- **Supply and Demand (thousand metric tons):**

Year	Capacity (Year-end)	Production	Imports	Exports	Apparent Consumption	Actual Consumption
1974	--	--	--	--	--	--
1975	--	--	--	--	--	--

- **Uses**

There was no direct consumption of ethylbenzene in 1974 and 1975.

- **Development and Growth**

There are no announced plans to produce or consume ethylbenzene within the next several years.

STYRENE

- **Producing Companies, Plant Locations, and Capacities (as of Year-end 1976):**

Total number of plants: 0
Total annual capacity: 0
Additional announced capacity: 0

No producers or announced plans.

- **Supply and Demand (thousand metric tons):**

Year	Capacity (Year-end)	Production	Imports	Exports	Apparent Consumption	Actual Consumption
1974	--	--	3	--	3	3
1975	--	--	4	--	4	4

- **Uses**

Most of the styrene goes into the production of polystyrene.

- **Development and Growth**

The increase in demand for styrene will parallel polystyrene production. Estimated consumption of styrene in 1980 is approximately 5,000 metric tons.

POLYSTYRENE

- **Producing Companies, Plant Locations, and Capacities (as of Year-end 1976):**

Producer	Location	Capacity (thousand metric tons)
Luxit	Chatel-St. Denis	2

Total number of plants: 1
Total annual capacity: 2 thousand metric tons
Additional announced capacity: 0

- **Supply and Demand (thousand metric tons):**

Year	Capacity (Year-end)	Production	Imports	Exports	Apparent Consumption	Actual Consumption
1974	2	2	28	--	30	30
1975	2	1	24	--	25	27

"Actual consumption" is measured as polymer, delivered to processors, which may not as yet have been "consumed" in a conversion operation.

The breakdown between GP/HI and expandable polystyrene consumption in 1974 and 1975 was as follows:

	1974	1975	
GP/HI polystyrene	24	22	thousand metric tons
Expandable polystyrene	6	5	
Total	30	27	

- **Uses**

The market breakdown for general-purpose and high-impact polystyrene in 1974 was as follows:

Packaging/containers	47%
Appliances	24
Electrical/electronics	8
Others	21
	100%

Approximately 35 percent of expandable polystyrene went to packaging and 65 percent went to building/refrigeration.

- **Development and Growth**

Following the drop in consumption in 1975 which continued into 1976, growth of GP/HI polystyrene is expected to resume in 1977 at a rate of 6 to 7 percent annually. Growth of expandable polystyrene is expected to be sustained above 10 percent per year after 1977. Estimates of demand in 1980 are 30,000 metric tons of GP/HI polystyrene and 9,000 metric tons of expandable polystyrene.

ABS RESINS

- **Producing Companies, Plant Locations, and Capacities (as of Year-end 1976):**

Total number of plants: 0
Total annual capacity: 0
Additional announced capacity: 0

No producers or announced plans.

- **Supply and Demand (thousand metric tons):**

Year	*Capacity (Year-end)*	*Production*	*Imports*	*Exports*	*Apparent Consumption*	*Actual Consumption*
1974	--	--	1½	--	1½	1½
1975	--	--	4	--	4	4

"Actual consumption" is measured as polymer, delivered to processors, which may not as yet have been "consumed" in a conversion operation.

- **Uses**

ABS is used primarily as a specialty plastic in appliances and for other technical applications. However, a new toy factory opened in 1975 and began using significant amounts of ABS resin. This application now accounts for the majority of consumption.

- **Development and Growth**

ABS will continue to be used as a specialty plastic, with growth between 10 and 15 percent annually. Consumption in 1980 may reach 6,000 metric tons.

SBR ELASTOMER

- **Producing Companies, Plant Locations, and Capacities (as of Year-end 1976):**

Total number of plants: 0
Total annual capacity: 0
Additional announced capacity: 0

No producers or announced plans.

- **Supply and Demand (thousand metric tons):**

Year	*Capacity (Year-end)*	*Production*	*Imports*	*Exports*	*Apparent Consumption*	*Actual Consumption*
1974	--	--	12	--	12	12
1975	--	--	8	--	8	8

An additional 2,000 to 3,000 metric tons of SBR latices were consumed in 1974.

- **Uses**

Consumption in tires is estimated at 60 percent, with the remaining 40 percent for specialty and other uses.

- **Development and Growth**

In 1975, some stagnation in demand was observed and this is expected to continue through 1976. Thereafter, growth is anticipated at 4 to 5 percent annually. Consumption of SBR elastomer in 1980 is estimated at approximately 14,000 metric tons.

CUMENE

- **Producing Companies, Plant Locations, and Capacities (as of Year-end 1976):**

Total number of plants: 0
Total annual capacity: 0
Additional announced capacity: 0

No producers or announced plans.

- **Supply and Demand (thousand metric tons):**

Year	*Capacity (Year-end)*	*Production*	*Imports*	*Exports*	*Apparent Consumption*	*Actual Consumption*
1974	--	--	--	--	--	--
1975	--	--	--	--	--	--

- **Uses**

There is no direct use of cumene.

- **Development and Growth**

There are no announced plans to produce or consume cumene in the next five years.

PHENOL

- **Producing Companies, Plant Locations, and Capacities (as of Year-end 1976):**

Total number of plants: 0
Total annual capacity: 0
Additional announced capacity: 0

No producers or announced plans.

- **Supply and Demand (thousand metric tons):**

Year	*Capacity (Year-end)*	*Production*	*Imports*	*Exports*	*Apparent Consumption*	*Actual Consumption*
1974	--	--	7	--	7	7
1975	--	--	4	--	4	4

- **Uses**

Phenol is used for phenolic resins (50%) and as an intermediate in the pharmaceutical and specialty chemicals markets (50%).

- **Development and Growth**

The use of phenol should increase about 6 percent annually, reaching 9,000 metric tons in 1980.

ACETONE

- **Producing Companies, Plant Locations, and Capacities (as of Year-end 1976):**

Total number of plants: 0
Total annual capacity: 0
Additional announced capacity: 0

No producers or announced plans.

- **Supply and Demand (thousand metric tons):**

Year	Capacity (Year-end)	Production	Imports	Exports	Apparent Consumption	Actual Consumption
1974	--	--	15	--	15	15
1975	--	--	12	--	12	12

- **Uses**

Essentially all of the acetone is used for solvent applications, primarily in the chemical and pharmaceutical markets.

- **Development and Growth**

After recovering from the recession in 1976, the market for acetone should increase at an annual rate of 6 to 7 percent. Consumption in 1980 should reach 18,000 metric tons.

CYCLOHEXANE

- **Producing Companies, Plant Locations, and Capacities (as of Year-end 1976):**

Total number of plants: 0
Total annual capacity: 0
Additional announced capacity: 0

No producers or announced plans.

- **Supply and Demand (thousand metric tons):**

Year	Capacity (Year-end)	Production	Imports	Exports	Apparent Consumption	Actual Consumption
1974	--	--	3	--	3	3
1975	--	--	2	--	2	2

- **Uses**

Cyclohexane is used for solvent applications.

- **Development and Growth**

Cyclohexane is expected to make further inroads into markets held by other solvents. Future growth should increase at a steady rate, with consumption reaching 5,000 metric tons by 1980.

CAPROLACTAM

- **Producing Companies, Plant Locations, and Capacities (as of Year-end 1976):**

Producer	Location	Capacity (thousand metric tons)
Emserwerke	Domat/Ems	20

Total number of plants: 1
Total annual capacity: 20 thousand metric tons
Additional announced capacity: 0

- **Supply and Demand (thousand metric tons):**

Year	Capacity (Year-end)	Production	Imports	Exports	Apparent Consumption	Actual Consumption
1974	20	--	22	--	22	22
1975	20	--	18	--	18	18

Although still available for the production of caprolactam, the Emserwerke plant is currently being used for other purposes.

- **Uses**

About 95 percent of the caprolactam imported is used in the manufacture of nylon 6 fibers.

- **Development and Growth**

Caprolactam demand is expected to increase at an annual rate of 5 percent, with consumption amounting to 30,000 metric tons in 1980.

TOLUENE

- **Producing Companies, Plant Locations, and Capacities (as of Year-end 1976):**

Total number of plants: 0
Total annual capacity: 0
Additional announced capacity: 0

No producers or announced plans.

- **Supply and Demand (thousand metric tons):**

Year	Capacity (Year-end)	Production	Imports	Exports	Apparent Consumption	Actual Consumption
1974	--	--	8	--	8	8
1975	--	--	6	--	6	6

- **Uses**

Toluene is used for a variety of solvent and specialty chemical applications.

- **Development and Growth**

Toluene demand is expected to grow at an annual rate of 6 percent through 1980. By then, consumption should reach 10,000 metric tons.

TOLUENE DIISOCYANATE

- **Producing Companies, Plant Locations, and Capacities (as of Year-end 1976):**

Total number of plants: 0
Total annual capacity: 0
Additional announced capacity: 0

No producers or announced plans.

- **Supply and Demand (thousand metric tons):**

Year	Capacity (Year-end)	Production	Imports	Exports	Apparent Consumption	Actual Consumption
1974	--	--	2	--	2	2
1975	--	--	3	--	3	3

- **Uses**

Almost all of the TDI consumed in Switzerland is used in the manufacture of flexible polyurethane foams. About 5 to 10 percent is consumed in coatings and specialty applications.

- **Development and Growth**

TDI demand is expected to increase at an annual rate of 8 percent through 1980. By then, consumption should amount to 4,000 metric tons.

MIXED XYLENES

There are no producers and no announced plans to produce mixed xylenes in Switzerland. Mixed xylenes were imported in 1974 and 1975 and used in a variety of solvent applications.

	1974	1975	
Solvent applications	10	9	thousand metric tons

The demand for mixed xylenes is expected to increase at a modest rate. Consumption in 1980 should amount to 11,500 metric tons.

p-XYLENE

- **Producing Companies, Plant Locations, and Capacities (as of Year-end 1976):**

Total number of plants: 0
Total annual capacity: 0
Additional announced capacity: 0

No producers or announced plans.

- **Supply and Demand (thousand metric tons):**

Year	Capacity (Year-end)	Production	Imports	Exports	Apparent Consumption	Actual Consumption
1974	--	--	--	--	--	--
1975	--	--	--	--	--	--

- **Uses**

There was no direct use of p-xylene in either 1974 or 1975.

- **Development and Growth**

There are no plans to produce or consume p-xylene in Switzerland during the next five years.

o-XYLENE

- **Producing Companies, Plant Locations, and Capacities (as of Year-end 1976):**

Total number of plants: 0
Total annual capacity: 0
Additional announced capacity: 0

No producers or announced plans.

- **Supply and Demand (thousand metric tons):**

Year	Capacity (Year-end)	Production	Imports	Exports	Apparent Consumption	Actual Consumption
1974	--	--	4	--	4	4
1975	--	--	4	--	4	4

- **Uses**

o-Xylene is used in the production of phthalic anhydride.

- **Development and Growth**

The demand for o-xylene is expected to increase at an annual rate of about 8 percent. By 1980, consumption should amount to 6,000 metric tons.

DMT/TPA

- **Producing Companies, Plant Locations, and Capacities (as of Year-end 1976):**

Total number of plants: 0
Total annual capacity: 0
Additional announced capacity: 0

No producers or announced plans.

- **Supply and Demand (thousand metric tons):**

Year	Capacity (Year-end)	Production	Imports	Exports	Apparent Consumption	Actual Consumption
1974	--	--	35	--	35	35
1975	--	--	36	--	36	36

Production and consumption data as well as the capacities of all TPA plants have been converted to DMT equivalents.

The breakdown of DMT and TPA imports in 1974 and 1975 was as follows:

	1974	1975	
DMT	22	22	thousand metric tons
TPA	11	12	

- **Uses**

Almost all of the DMT/TPA was used in the production of polyester fibers in 1974 and 1975. The only other use was the manufacture of polyester film. An estimated 1,000 metric tons of DMT is used in this application.

- **Development and Growth**

The demand for DMT/TPA is expected to grow at a moderate rate—about 6 percent per year—for the next several years. By 1980, consumption is expected to reach 48,000 metric tons. Of this amount, DMT usage should amount to 30,000 metric tons.

POLYESTER FIBERS

- **Producing Companies, Plant Locations, and Capacities (as of Year-end 1976):**

Producer	*Location*	*Capacity (thousand metric tons)*
Emserwerke	Domat/Ems	20
Viscousuisse	Widnau	31

Total number of plants: 2
Total annual capacity: 51 thousand metric tons
Additional announced capacity: 0

- **Supply and Demand (thousand metric tons):**

Year	Capacity (Year-end)	Production	Imports	Exports	Apparent Consumption	Actual Consumption
1974	44	32	15	30	17	16
1975	51	33	9	30	12	12

The polyester fiber industry in Europe is highly concentrated with several major firms (Enka, Hoechst, ICI, Montefibre and Rhone-Poulenc) dominating the market. In addition to imports and exports of fiber, there is also considerable movement of semi-finished goods between production and processing centers.

The breakdown between filament yarn and staple fiber consumption in 1974 and 1975 was as follows:

		1974		*1975*	
Filament yarn		6		4½	thousand metric tons
Textile	5		4		
Industrial	1		½		
Staple fiber		10		7½	
Total		16		12	

Throughout Western Europe, production of polyester fibers in 1975 was lower than in 1974 due to a decrease in demand and high inventories remaining from 1974. Much of this excess was worked off during 1975.

- **Uses**

The breakdown of uses in apparel, home furnishings and industrial applications is not available for 1974 and 1975.

- **Development and Growth**

The demand for polyester fibers is forecast to grow between 8 and 10 percent during the period, 1976-1980. By 1980, consumption could reach 25,000 metric tons.

PHTHALIC ANHYDRIDE

- **Producing Companies, Plant Locations, and Capacities (as of Year-end 1976):**

Producer	*Location*	*Capacity (thousand metric tons)*
Reichhold Chemie	Hausen	4*
Sintesi Organiche	Grono	6

*Naphthalene-based capacity.

Total number of plants: 2
Total annual capacity: 10 thousand metric tons
Additional announced capacity: 0

- **Supply and Demand (thousand metric tons):**

Year	*Capacity (Year-end)*	*Production*	*Imports*	*Exports*	*Apparent Consumption*	*Actual Consumption*
1974	10	4	net import 4		8	8
1975	10	4	net import 2		6	6

- **Uses**

The use pattern for phthalic anhydride in Switzerland in 1974 was as follows:

Phthlate esters	62%
Alkyd resins	25
Unsaturated polyester resins	13
	100%

- **Development and Growth**

The demand for phthalic anhydride is expected to grow at a rate of 5 percent per year between 1976 and 1980, with consumption reaching 10,000 metric tons.

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ANNEX III

PEY Sample and Prospectus

PROCESS
ECONOMICS
PROGRAM

PEP YEARBOOK INTERNATIONAL

PROSPECTUS

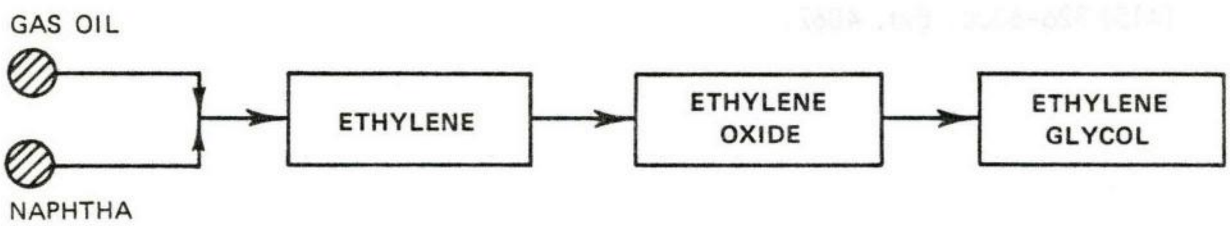
JUNE 1977

STANFORD RESEARCH INSTITUTE · Menlo Park, California 94025 · U.S.A.

PEP YEARBOOK INTERNATIONAL

The Process Economics Program at Stanford Research Institute is expanding the scope of its Yearbook to include the economics of chemical production in Europe (West Germany) and Japan, as well as the United States (Gulf Coast). As did its predecessor, the PEP Yearbook International will contain up-to-date economics of all the major chemicals and polymers covered by the Process Economics Program since its beginning. The products and processes that PEP intends to include in the 1977 edition of the Yearbook International, which will be issued in September 1977, are listed in Exhibit A. All in all, over 115 compounds and nearly 190 processes are scheduled for this edition. Compounds and processes added since 1976 are marked with an asterisk on Exhibit A.

The production economics will be updated on a systematic basis, as illustrated by the process chain leading to the manufacture of ethylene glycol.



The prices of the basic raw materials--in this case, gas oil and naphtha--will be derived from energy forecasts and refinery simulations. Then, the value of ethylene will be estimated by calculating its production cost and adding the equivalent of a 25%/yr before-tax return on fixed capital. The ethylene value so determined will be used to estimate the value of ethylene oxide, and so forth. In cases where the particular product can be made from different raw materials and/or different processes, the value carried forward in the process chain will be based on the dominant process.

The plant capacities will be representative of "world-size" units. The production cost of each process will be given for two additional capacities to show the effect of scale. A brief description of each process will also be included.

The estimates will be based on an overnight plant construction in the third quarter of 1977. Investments for plants in Europe or Japan will be estimated on the basis of location factors currently being established by PEP.

The economics will be expressed in U.S. cents per either metric or English units of measure (client's option). The applicable exchange rates will be indicated. The format of the Yearbook is illustrated in the sample printouts shown in Exhibit B.

The Yearbook International will be generated by PEP's proprietary computer model. Purchasers will have the option to test their own scenarios on the model. The use of the program will be offered only at SRI's Menlo Park facilities under separate arrangements. Clients may use SRI personnel for this purpose or they may send their own representatives to SRI to operate the program.

For further information concerning the PEP Yearbook International, please contact J. E. Dingler, SRI Process Economics Program, Menlo Park, California, (415) 326-6200, Ext. 4867.

Exhibit A

PEP YEARBOOK INTERNATIONAL, 1977
LIST OF COMPOUNDS AND PROCESSES

ABS Resins	By Emulsion/Emulsion Polymerization
Acetaldehyde	By One-Step Ethylene Oxidation
	By Two-Step Ethylene Oxidation
Acetal Resins	From Trioxane and Ethylene Oxide
Acetic Acid	By Low Pressure Carbonylation of Methanol
	By Oxidation of Acetaldehyde with Air
Acetic Anhydride	By Direct Oxidation of Acetaldehyde
	Via Ketene Produced from Acetic Acid
	Via Ketene Produced from Acetone
Acetone	By Vapor-phase Dehydrogenation of Isopropanol
Acetylene	From Natural Gas by Partial Oxidation
	From Residual Oil by Submerged Flame Process
Acrylamide	By Catalytic Hydration of Acrylonitrile
Acrylic Acid	By Two-Stage Vapor-phase Oxidation of Propylene
	By Catalytic Acetylene Process
Acrylonitrile	By Ammoxidation of Propylene

Adipic Acid	From Cyclohexane by Air Oxidation Followed by Nitric Acid Oxidation of the Intermediates
*Allyl Alcohol	From Propylene Oxide
*Allyl Chloride	By Chlorination of Propylene
Ammonia	By Steam Reforming Natural Gas
	*From Naphtha
Aniline	By Vapor-phase Reduction of Mononitrobenzene
Barrier Resins	Acrylic Multipolymer
	Acrylonitrile-Based
Bisphenol A	From Phenol and Acetone
Butadiene	From n-Butane by Catalytic and Oxidative Dehydrogenation
	From n-Butylenes by Oxidative Dehydrogenation
	* Recovery by Acetonitrile Extractive Distillation
Butanediol	From Acetylene and Formaldehyde
	*From Butadiene
	*From Maleic Anhydride
	*From Propylene
n-Butanol	From Propylene by Conventional Oxo
	*By Cobalt-Phosphine Catalyst
	*By Rhodium Catalyst
Butyl Acrylate	By Esterification of Acrylic Acid
*Butyrolactam	From Maleic Anhydride via Butyrolactone

Caprolactam	Via Hexahydrobenzoic Acid
	By Hydroxylammonium Phosphate Route
	By Nitric Oxide Reduction Process
	By Phenol Process
	By Photonitrosation of Cyclohexane
Carbon Monoxide	From Natural Gas by Catalytic Steam Reforming
	*From Naphtha
*Chlorinated PVC	
Chlorine	By Electrolysis of Sodium Chloride in Diaphragm Cells
*Chlorine Dioxide	From Sodium Chlorate, Sulfuric Acid Process
*Chloroprene	From Butadiene
Cumene	From Benzene and Propylene
Cyclohexane	By Hydrogenation of Benzene
Di(2-ethylhexyl) Phthalate	By Esterification of Phthalic Anhydride
Dimethyl Terephthalate	From p-Xylene by Successive Oxidation and Esterification
Dinitrotoluene	By Nitration of Toluene
*Dodecanedioic Acid	From Butadiene Trimer
*Epichlorohydrin	By Chlorohydrination of Allyl Chloride
Ethanol	By the Catalytic Hydration of Ethylene
Ethyl Acrylate	By Esterification of Acrylic Acid
Ethylbenzene	By Aluminum Chloride-Catalyzed Alkylation of Benzene
	By Zeolite-Catalyzed Alkylation of Benzene

Ethylene	From Ethane/Propane
	From Atmospheric Gas Oil
	From Naphtha
Ethylene Glycol	From Ethylene Oxide
	From Ethylene via Glycol Ester
Ethylene Oxide	By Air Oxidation of Ethylene
	By Oxygen Oxidation of Ethylene
Ethylene/Vinyl Acetate Copolymers	By Emulsion Polymerization
2-Ethylhexanol	From Propylene by the Oxo Process
*Flame Retardant Polyols	Tetrabromophthalic Anhydride Polyol
	Trichlorobutylene Oxide Polyol
	Trischloroethylphosphate Polyol
Formaldehyde	By Ferric Molybdate-Catalyzed Oxidation of Methanol
*Glycerin	By Hydrolysis of Epichlorohydrin
Hexamethylenediamine	By Electrolytic Dimerization of Acrylonitrile
	From Adipic Acid
	By Hydrocyanation of Butadiene
Hydrogen	By Steam Reforming of Methane
	*By Steam Reforming of Naphtha
Hydrogen Cyanide	From Methane and Ammonia, Andrussow Process
*Hydrogen Fluoride	From Fluorspar
Hydrogen Peroxide	By Anthraquinone Process
	By Autoxidation of Isopropanol
*Hydrogenated SBS Block Copolymer	

*Hydroquinone	From Aniline From Diisopropylbenzene
*Hypochlorite, Calcium	
*Hypochlorite, Sodium	
Isopropanol	By Hydration of Propylene
*Lauryllactam	From Butadiene Trimer
*Malathion	
Maleic Anhydride	By Oxidation of Benzene By Oxidation of n-Butane
Methanol	From Methane, High Pressure Process From Methane, Intermediate Pressure Process From Methane, Low Pressure Process *From Naphtha, Intermediate Pressure Process
Methyl Acrylate	By Esterification of Acrylic Acid
Methyl Methacrylate	By Acetone Cyanohydrin Process From Isobutylene via Methacrylic Acid
*Methyl Parathion	
Methylene Diphenylene Diisocyanate (MDI) and Its Polymeric Form (PMPPI)	From Aniline and Formaldehyde
Mononitrobenzene	By Nitration of Benzene
Nitric Acid	95%, by Uhde Type Process 60%, by Grande Paroisse Type Process
Nylon 6	Chips, from Caprolactam Melt, from Caprolactam

Nylon 6,6	Chips, from Adipic Acid and Hexamethylenediamine
Peracetic Acid	By Acid-Catalyzed Liquid-phase Oxidation of Acetaldehyde
	Two-Stage Liquid-phase Oxidation of Acetaldehyde
Phenol-Formaldehyde Resin	Novolac Molding Compound
	Resol Syrup
Phenol	From Cumene
Phosgene	From Carbon Monoxide and Chlorine
*Phosphoric Acid	By the Wet Process
Phthalic Anhydride	By Air Oxidation of o-Xylene
Polyacrylamide, Anionic	By Simultaneous Polymerization and Hydrolysis of the Polymer
Polyacrylate Latex	By Emulsion Polymerization
Polyacrylate Molding Powder	By Suspension Polymerization
Polybutadiene	By Cobalt-Catalyzed Polymerization
	By Lithium-Catalyzed Polymerization
Polybutylene Terephthalate	From Dimethyl Terephthalate and Butanediol
Polycarbonates	By Continuous Solution Phosgenation
	By Interfacial Phosgenation Continuous Process
	Flame Resistant Grade

Polyethylene, High Density	*Gas Phase Process
	BASF Technology
	Union Carbide Technology
	Particle Form Process
	Ziegler Catalyst
	*Hoechst Technology
	Montedison Technology
	*Solvay Technology
	*Stamicarbon Technology
Polyethylene, Low Density	By Autoclave Reactor Process
	By Tubular Reactor Process
Polyethylene Terephthalate	From Dimethyl Terephthalate and Ethylene Glycol
	From Terephthalic Acid and Ethylene Glycol
Polymethacrylate Sheet	By Continuous Casting
Polyols	Glycerin-Based Triol
	Sorbitol-Based Hexol
Polyphenylene Oxide	From Phenol and Methanol
Polyphenylene Oxide, Modified	From Polyphenylene Oxide and Polystyrene
Polypropylene	Liquid-phase Process (Dart Technology)
	Vapor-phase Process (BASF Technology)
*Polypropylene Glycol	
Polystyrene, Crystal Grade	By Bulk Polymerization
Polystyrene, Impact Grade	By Bulk and Suspension Polymerizations
Polyurethane Flexible Foam Slabstock	

Polyurethane Rigid Foam Sheet	
Polyvinyl Acetate	By Emulsion Polymerization
	By Solution Polymerization
	By Suspension Polymerization
Polyvinyl Alcohol	From Vinyl Acetate
Polyvinyl Chloride	By Bulk Polymerization
	By Emulsion Polymerization
	By Suspension Polymerization
Propylene Glycol	By Hydration of Propylene Oxide
Propylene Oxide	By Chlorohydrin Process
	By the Ethylbenzene Process
	By the Isobutane Process
* SBS Block Copolymer	
*Sodium Chlorate	By Electrolysis of Sodium Chloride
*Sodium Chlorite	
Styrene-Butadiene Rubber	By Emulsion Polymerization
	By Solution Polymerization
Styrene	By Dehydrogenation of Ethylbenzene
	*By Hydroperoxide Process
*Sulfuric Acid	By the Double Absorption Process
Terephthalic Acid	From p-Xylene by Bromine-Promoted Air Oxidation
Terephthalic Acid (Medium Purity)	By Oxidation of p-Xylene, Modified Process
Tetrabromobisphenol A	By Bromination of Bisphenol A

*Thermoplastic Elastomer	Blends
	Copolyester
Toluenediamine	By Reduction of Dinitrotoluene
Toluene Diisocyanate (TDI)	By Phosgenation of Toluenediamine
Unsaturated Polyesters	From Propylene Glycol and Phthalic and Maleic Anhydrides
	From Propylene Oxide and Phthalic and Maleic Anhydrides
Urea	By Stamicarbon Process
	By Total Recycle Process
Urea-Formaldehyde Resin Syrup	
Urea-Formaldehyde Molding Compound	
Vinyl Acetate	From Acetic Acid and Ethylene, Vapor-phase Process
	From Acetylene
Vinyl Chloride	By Balanced Chlorination and Oxychlorination of Ethylene
Vinyl Chloride/Vinyl Acetate Copolymers	By Suspension Polymerization
*Vinylidene Chloride	From Vinyl Chloride
	By Caustic Dehydrochlorination of 1,1,2-Trichloroethane

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* The list of compounds and processes is being expanded for the 1977 issue of the PEP Yearbook to include the entries marked with an asterisk.

Exhibit B

EXAMPLE OF PEP YEARBOOK INTERNATIONAL FORMAT

Economics are presented for the production of ethylene, ethylene oxide, and ethylene glycol in the United States (Gulf Coast), followed by economics for Europe (West Germany) and Japan.

The examples are given in English units. A metric version of the Yearbook will also be published.

ETHYLENE
FROM ATMOSPHERIC GAS OIL

LOCATION: U.S. GULF COAST

RAW MATERIAL AND UTILITY COST, US C/LB

	UNIT COST	CONSUMPTION/LB	C/LB
RAW MATERIALS			
GAS OIL	4.6C/LB	3.86 LB	17.76
GROSS RAW MATERIAL COST			17.76
BY-PRODUCT CREDITS			
PROPYLENE POLYMER GRADE	10.2C/LB	0.58 LB	5.94
BUTADIENE	19C/LB	0.18 LB	3.42
BUTYLENES	5.49C/LB	0.19 LB	1.04
BENZENE	10.9C/LB	0.33 LB	3.60
XYLENES	8.61C/LB	0.084 LB	0.72
PYROLYSIS GASOLINE	6C/LB	0.28 LB	1.68
FUEL OIL (1.5 PCT S)	3.5C/LB	0.69 LB	2.41
TOTAL CREDITS			18.81
UTILITIES			
COOLING WATER	3C/1,000 GAL	65.3 GAL	0.20
STEAM	$ 2.75/1,000 LB	4.2 LB	1.15
ELECTRICITY	1.75C/KWH	0.097 KWH	0.17
NATURAL GAS	$ 2.00/MM BTU	0.0028 MM BTU	0.56
TOTAL UTILITIES			2.08

PROCESS DESCRIPTION:

THE ECONOMICS COVER THE COSTS OF AN INTEGRATED COMPLEX FEEDING LIGHT ATMOSPHERIC GAS OIL CONTAINING 0.45 PCT S. BESIDES ETHYLENE, VARIOUS BY-PRODUCTS ARE SEGREGATED AND UPGRADED INTO MARKETABLE MATERIALS. THE COMPLEX INCLUDES STEAM CRACKING, QUENCH, CRACKED PRODUCT FRACTIONATION, BUTADIENE EXTRACTION, SEPARATION OF H2 AND CH4, HYDROGENATION OF GASOLINE FRACTION, BTX EXTRACTION FROM A SEGREGATED C6-8 CUT AND TOLUENE DEALKYLATION. ETHANE IS RECYCLED TO THE CRACKING STEP.

REFERENCE: PEP REPORT 29B (IN PREPARATION) (JJLM,HWS)

ETHYLENE
FROM ATMOSPHERIC GAS OIL

LOCATION: U.S. GULF COAST
PEP COST INDEX: 280

	ETHYLENE MILLION LB/YR		
	500	1,000	1,500
INVESTMENT, US$MILLION			
BATTERY LIMITS	109.5	186.8	260.5
OFF-SITES	59.5	97.5	132.7
TOTAL FIXED CAPITAL	169.0	284.3	393.2
SCALING EXPONENTS		0.75	0.80
PRODUCTION COSTS, US C/LB			
RAW MATERIALS	17.76	17.76	17.76
BY-PRODUCT CREDITS	-18.81	-18.81	-18.81
UTILITIES	2.08	2.08	2.08
MAINTENANCE MATERIALS	0.44	0.37	0.35
OPERATING SUPPLIES	0.04	0.02	0.01
VARIABLE COSTS	1.51	1.42	1.39
OPERATING LABOR (21/SHIFT)	0.38	0.21	0.17
MAINTENANCE LABOR	0.44	0.37	0.35
CONTROL LABORATORY	0.08	0.04	0.03
TOTAL DIRECT COSTS	2.41	2.04	1.94
PLANT OVERHEAD	0.71	0.50	0.44
TAXES AND INSURANCE	0.68	0.57	0.52
DEPRECIATION	3.38	2.84	2.62
PLANT GATE COST	7.18	5.95	5.52
G + A, SALES, RES., 5.0 PCT	1.81	1.68	1.63
NET PRODUCTION COST	8.99	7.63	7.15
25 PERCENT/YR ROI	8.45	7.11	6.55
PRODUCT VALUE	17.44	14.74 S	13.70

ETHYLENE OXIDE
BY OXYGEN PROCESS

LOCATION: U.S. GULF COAST

RAW MATERIAL AND UTILITY COST, US C/LB

	UNIT COST	CONSUMPTION/LB	C/LB
RAW MATERIALS			
ETHYLENE	14.7C/LB	0.884 LB	13.03
OXYGEN	1.75C/LB	1.152 LB	2.02
SILVER CATALYST, EO	$ 4.00/LB	0.00062 LB	0.25
GROSS RAW MATERIAL COST			15.30
UTILITIES			
COOLING WATER	3C/1,000 GAL	34.1 GAL	0.10
STEAM	$ 2.75/1,000 LB	-2.5 LB	-0.70
ELECTRICITY	1.75C/KWH	0.318 KWH	0.56
TOTAL UTILITIES			-0.04

PROCESS DESCRIPTION:

ETHYLENE IS OXIDIZED WITH OXYGEN AT ABOUT 490 F (254 C) AND 300 PSIG (21 ATM) OVER A SUPPORTED SILVER CATALYST PACKED IN TUBES OF THE REACTOR. THE PER PASS CONVERSION OF ETHYLENE IS 10 PCT, WITH 76 PCT SELECTIVITY; REACTION SECTION YIELD IS 72.7 PCT. THE PRINCIPAL BY-PRODUCT IS CARBON DIOXIDE. THE HEAT OF REACTION IS REMOVED BY SIMULTANEOUS GENERATION OF STEAM.

THE ETHYLENE OXIDE IS ABSORBED IN WATER AND RECOVERED BY DISTILLATION. UNREACTED ETHYLENE IS RECYCLED TO THE REACTOR ALONG WITH THE OXYGEN AFTER CARBON DIOXIDE HAS BEEN REMOVED BY ABSORPTION. ETHYLENE GLYCOL FORMED DURING THE RECOVERY OPERATION IS SENT TO WASTE, BUT COULD BE RECOVERED FOR SALE.

REFERENCE: PEP REPORT 2B, P. 50-56; PEP REVIEWS, PEP 75-2-4 (YCY)

ETHYLENE OXIDE
BY OXYGEN PROCESS

LOCATION: U.S. GULF COAST
PEP COST INDEX: 280

	ETHYLENE OXIDE MILLION LB/YR				
	150		300		600
INVESTMENT, US$MILLION					
BATTERY LIMITS	20.2		35.1		63.3
OFF-SITES	7.8		14.0		25.9
TOTAL FIXED CAPITAL	28.0		49.1		89.2
SCALING EXPONENTS		0.81		0.86	
PRODUCTION COSTS, US C/LB					
RAW MATERIALS	15.30		15.30		15.30
UTILITIES	-0.04		-0.04		-0.04
MAINTENANCE MATERIALS	0.44		0.37		0.33
OPERATING SUPPLIES	0.03		0.01		0.01
VARIABLE COSTS	15.73		15.64		15.60
OPERATING LABOR (4/SHIFT)	0.20		0.13		0.12
MAINTENANCE LABOR	0.44		0.37		0.33
CONTROL LABORATORY	0.04		0.03		0.02
TOTAL DIRECT COSTS	16.41		16.17		16.07
PLANT OVERHEAD	0.54		0.42		0.38
TAXES AND INSURANCE	0.37		0.33		0.30
DEPRECIATION	1.87		1.64		1.49
PLANT GATE COST	19.19		18.56		18.24
G + A, SALES, RES., 5.0 PCT	1.25		1.19		1.15
NET PRODUCTION COST	20.44		19.75		19.39
25 PERCENT/YR ROI	4.67		4.09		3.71
PRODUCT VALUE	25.11		23.84 S		23.10

ETHYLENE GLYCOL
FROM ETHYLENE OXIDE

LOCATION: U.S. GULF COAST

RAW MATERIAL AND UTILITY COST, US C/LB

	UNIT COST	CONSUMPTION/LB	C/LB
RAW MATERIALS			
ETHYLENE OXIDE	23.8C/LB	0.872 LB	20.79
GROSS RAW MATERIAL COST			20.79
BY-PRODUCT CREDITS			
DIETHYLENE GLYCOL	20.5C/LB	0.107 LB	2.19
TRIETHYLENE GLYCOL	30C/LB	0.028 LB	0.84
TOTAL CREDITS			3.03
UTILITIES			
COOLING WATER	3C/1,000 GAL	13.7 GAL	0.04
STEAM	$ 2.75/1,000 LB	5.35 LB	1.47
PROCESS WATER	40C/1,000 GAL	0.28 GAL	0.01
ELECTRICITY	1.75C/KWH	0.013 KWH	0.02
TOTAL UTILITIES			1.54

PROCESS DESCRIPTION:

ETHYLENE GLYCOL IS PRODUCED BY THE NONCATALYTIC LIQUID PHASE HYDRATION OF ETHYLENE OXIDE AT 392 F (200 C) AND 215 PSIA (15 ATM). THE CONVERSION OF ETHYLENE OXIDE IS PRACTICALLY COMPLETE. THE REACTOR EFFLUENT CONSISTS OF MONO-, DI-, AND TRIGLYCOLS, THE RATIO OF WHICH DEPENDS ON THE RATIO OF WATER TO ETHYLENE OXIDE IN THE FEED. WITH AN 8:1 WEIGHT RATIO, APPROXIMATELY 88 WT PCT OF THE GLYCOL FRACTION IS MONOGLYCOL.

THE GLYCOLS ARE RECOVERED FROM THE REACTOR EFFLUENT BY FIRST EVAPORATING MOST OF THE WATER IN A MULTIPLE-EFFECT EVAPORATOR AND THEN SEPARATING THE REMAINING WATER, MONO-, DI-, AND TRIGLYCOLS IN A SERIES OF VACUUM DISTILLATIONS.

REFERENCE: PEP REPORTS 70, 70A (HWS)

ETHYLENE GLYCOL
FROM ETHYLENE OXIDE

LOCATION: U.S. GULF COAST
PEP COST INDEX: 280

	ETHYLENE GLYCOL MILLION LB/YR		
	200	400	800
INVESTMENT, US$MILLION			
BATTERY LIMITS	6.1	10.0	17.6
OFF-SITES	6.6	11.4	20.4
TOTAL FIXED CAPITAL	12.7	21.4	38.0
SCALING EXPONENTS	0.75	0.83	
PRODUCTION COSTS, US C/LB			
RAW MATERIALS	20.79	20.79	20.79
BY-PRODUCT CREDITS	-3.03	-3.03	-3.03
UTILITIES	1.54	1.54	1.54
MAINTENANCE MATERIALS	0.09	0.08	0.07
OPERATING SUPPLIES	0.02	0.01	NEGL
VARIABLE COSTS	19.41	19.39	19.37
OPERATING LABOR (4/SHIFT)	0.20	0.10	0.07
MAINTENANCE LABOR	0.09	0.08	0.07
CONTROL LABORATORY	0.04	0.02	0.01
TOTAL DIRECT COSTS	19.74	19.59	19.52
PLANT OVERHEAD	0.26	0.16	0.12
TAXES AND INSURANCE	0.13	0.11	0.09
DEPRECIATION	0.64	0.53	0.47
PLANT GATE COST	20.77	20.39	20.20
G + A, SALES, RES., 5.0 PCT	1.34	1.30	1.29
NET PRODUCTION COST	22.11	21.69	21.49
25 PERCENT/YR ROI	1.59	1.34	1.19
PRODUCT VALUE	23.70	23.03	22.68

ETHYLENE
FROM FULL RANGE NAPHTHA

LOCATION: WEST GERMANY
(US$1 = DM2.40)

RAW MATERIAL AND UTILITY COST, US C/LB

	UNIT COST	CONSUMPTION/LB	C/LB
RAW MATERIALS			
NAPHTHA (C5-400F)	6.09C/LB	2.97 LB	18.09
GROSS RAW MATERIAL COST			18.09
BY-PRODUCT CREDITS			
PROPYLENE POLYMER GRADE	10C/LB	0.43 LB	4.30
BUTADIENE	17C/LB	0.15 LB	2.55
BUTYLENES	4.54C/LB	0.13 LB	0.59
BENZENE	11.8C/LB	0.29 LB	3.42
XYLENES	8.39C/LB	0.074 LB	0.62
PYROLYSIS GASOLINE	6.8C/LB	0.22 LB	1.50
FUEL OIL (1.5 PCT S)	3.4C/LB	0.12 LB	0.41
TOTAL CREDITS			13.39
UTILITIES			
COOLING WATER	3C/1,000 GAL	60.8 GAL	0.18
STEAM	$ 2.82/1,000 LB	5 LB	1.41
ELECTRICITY	2.11C/KWH	0.054 KWH	0.11
TOTAL UTILITIES			1.70

PROCESS DESCRIPTION:

THE ECONOMICS COVER THE COSTS OF AN INTEGRATED COMPLEX, IN WHICH, BESIDES ETHYLENE, VARIOUS BY-PRODUCTS ARE SEGREGATED AND UPGRADED INTO MARKETABLE MATERIALS. THE COMPLEX INCLUDES STEAM CRACKING, QUENCH, CRACKED PRODUCT FRACTIONATION, BUTADIENE EXTRACTION, SEPARATION OF H2 AND CH4, HYDROGENATION OF GASOLINE FRACTION, BTX EXTRACTION FROM A SEGREGATED C6-8 CUT, AND TOLUENE DEALKYLATION. ETHANE IS RECYCLED TO THE CRACKING STEP.

REFERENCE: PEP REVIEWS, PEP 75-3-1 (KEL)

ETHYLENE
FROM FULL RANGE NAPHTHA

LOCATION: WEST GERMANY
(US$1 = DM2.40)
PEP COST INDEX: 280 - LOCATION FACTOR: 0.83

	ETHYLENE MILLION LB/YR		
	500	1,000	1,500
INVESTMENT, US$MILLION			
BATTERY LIMITS	82.7	141.0	196.6
OFF-SITES	46.4	76.1	103.7
TOTAL FIXED CAPITAL	129.1	217.1	300.3
SCALING EXPONENTS	0.75	0.80	
PRODUCTION COSTS, US C/LB			
RAW MATERIALS	18.09	18.09	18.09
BY-PRODUCT CREDITS	-13.39	-13.39	-13.39
UTILITIES	1.70	1.70	1.70
MAINTENANCE MATERIALS	0.33	0.28	0.26
OPERATING SUPPLIES	0.03	0.02	0.01
VARIABLE COSTS	6.76	6.70	6.67
OPERATING LABOR (20/SHIFT)	0.28	0.16	0.12
MAINTENANCE LABOR	0.33	0.28	0.26
CONTROL LABORATORY	0.06	0.03	0.02
TOTAL DIRECT COSTS	7.43	7.17	7.07
PLANT OVERHEAD	0.53	0.37	0.33
TAXES AND INSURANCE	0.52	0.43	0.40
DEPRECIATION	2.21	1.86	1.71
PLANT GATE COST	10.69	9.83	9.51
G + A, SALES, RES., 5.0 PCT	1.61	1.51	1.47
NET PRODUCTION COST	12.30	11.34	10.98
25 PERCENT/YR ROI	6.45	5.43	5.00
PRODUCT VALUE	18.75	16.77 S	15.98

ETHYLENE OXIDE
BY OXYGEN PROCESS

LOCATION: WEST GERMANY
(US$1 = DM2.40)

RAW MATERIAL AND UTILITY COST, US C/LB

	UNIT COST	CONSUMPTION/LB	C/LB
RAW MATERIALS			
ETHYLENE	16.8C/LB	0.884 LB	14.82
OXYGEN	1.5C/LB	1.152 LB	1.73
SILVER CATALYST, EO	$ 4.00/LB	0.00062 LB	0.25
GROSS RAW MATERIAL COST			16.80
UTILITIES			
COOLING WATER	3C/1,000 GAL	34.1 GAL	0.10
STEAM	$ 2.82/1,000 LB	-2.5 LB	-0.71
ELECTRICITY	2.11C/KWH	0.318 KWH	0.67
TOTAL UTILITIES			0.06

PROCESS DESCRIPTION:

ETHYLENE IS OXIDIZED WITH OXYGEN AT ABOUT 490 F (254 C) AND 300 PSIG (21 ATM) OVER A SUPPORTED SILVER CATALYST PACKED IN TUBES OF THE REACTOR. THE PER PASS CONVERSION OF ETHYLENE IS 10 PCT, WITH 76 PCT SELECTIVITY; REACTION SECTION YIELD IS 72.7 PCT. THE PRINCIPAL BY-PRODUCT IS CARBON DIOXIDE. THE HEAT OF REACTION IS REMOVED BY SIMULTANEOUS GENERATION OF STEAM.

THE ETHYLENE OXIDE IS ABSORBED IN WATER AND RECOVERED BY DISTILLATION. UNREACTED ETHYLENE IS RECYCLED TO THE REACTOR ALONG WITH THE OXYGEN AFTER CARBON DIOXIDE HAS BEEN REMOVED BY ABSORPTION. ETHYLENE GLYCOL FORMED DURING THE RECOVERY OPERATION IS SENT TO WASTE, BUT COULD BE RECOVERED FOR SALE.

REFERENCE: PEP REPORT 2B, P. 50-56; PEP REVIEWS, PEP 75-2-4 (YCY)

ETHYLENE OXIDE
BY OXYGEN PROCESS

LOCATION: WEST GERMANY
(US$1 = DM2.40)
PEP COST INDEX: 280 - LOCATION FACTOR: 0.83

	ETHYLENE OXIDE MILLION LB/YR		
	150	300	600
INVESTMENT, US$MILLION			
BATTERY LIMITS	16.7	29.1	52.5
OFF-SITES	6.6	11.7	21.5
TOTAL FIXED CAPITAL	23.3	40.8	74.0
SCALING EXPONENTS	0.81	0.86	
PRODUCTION COSTS, US C/LB			
RAW MATERIALS	16.80	16.80	16.80
UTILITIES	0.06	0.06	0.06
MAINTENANCE MATERIALS	0.36	0.30	0.28
OPERATING SUPPLIES	0.02	0.01	0.01
VARIABLE COSTS	17.24	17.17	17.15
OPERATING LABOR (4/SHIFT)	0.16	0.10	0.09
MAINTENANCE LABOR	0.36	0.30	0.28
CONTROL LABORATORY	0.03	0.02	0.02
TOTAL DIRECT COSTS	17.79	17.59	17.54
PLANT OVERHEAD	0.44	0.34	0.31
TAXES AND INSURANCE	0.31	0.27	0.25
DEPRECIATION	1.33	1.16	1.05
PLANT GATE COST	19.87	19.36	19.15
G + A, SALES, RES., 5.0 PCT	1.25	1.20	1.17
NET PRODUCTION COST	21.12	20.56	20.32
25 PERCENT/YR ROI	3.88	3.40	3.08
PRODUCT VALUE	25.00	23.96 S	23.40

ETHYLENE GLYCOL
FROM ETHYLENE OXIDE

LOCATION: WEST GERMANY
(US$1 = DM2.40)

RAW MATERIAL AND UTILITY COST, US C/LB

	UNIT COST	CONSUMPTION/LB	C/LB
RAW MATERIALS			
ETHYLENE OXIDE	24C/LB	0.872 LB	20.89
GROSS RAW MATERIAL COST			20.89
BY-PRODUCT CREDITS			
DIETHYLENE GLYCOL	19C/LB	0.107 LB	2.03
TRIETHYLENE GLYCOL	34C/LB	0.028 LB	0.95
TOTAL CREDITS			2.98
UTILITIES			
COOLING WATER	3C/1,000 GAL	13.7 GAL	0.04
STEAM	$ 2.82/1,000 LB	5.35 LB	1.51
PROCESS WATER	40C/1,000 GAL	0.28 GAL	0.01
ELECTRICITY	2.11C/KWH	0.013 KWH	0.03
TOTAL UTILITIES			1.59

PROCESS DESCRIPTION:

ETHYLENE GLYCOL IS PRODUCED BY THE NONCATALYTIC LIQUID PHASE HYDRATION OF ETHYLENE OXIDE AT 392 F (200 C) AND 215 PSIA (15 ATM). THE CONVERSION OF ETHYLENE OXIDE IS PRACTICALLY COMPLETE. THE REACTOR EFFLUENT CONSISTS OF MONO-, DI-, AND TRIGLYCOLS, THE RATIO OF WHICH DEPENDS ON THE RATIO OF WATER TO ETHYLENE OXIDE IN THE FEED. WITH AN 8:1 WEIGHT RATIO, APPROXIMATELY 88 WT PCT OF THE GLYCOL FRACTION IS MONOGLYCOL.

THE GLYCOLS ARE RECOVERED FROM THE REACTOR EFFLUENT BY FIRST EVAPORATING MOST OF THE WATER IN A MULTIPLE-EFFECT EVAPORATOR AND THEN SEPARATING THE REMAINING WATER, MONO-, DI-, AND TRIGLYCOLS IN A SERIES OF VACUUM DISTILLATIONS.

REFERENCE: PEP REPORTS 70, 70A (HWS)

ETHYLENE GLYCOL
FROM ETHYLENE OXIDE

LOCATION: WEST GERMANY
(US$1 = DM2.40)
PEP COST INDEX: 280 - LOCATION FACTOR: 0.83

	ETHYLENE GLYCOL MILLION LB/YR				
	200		400		800
INVESTMENT, US$MILLION					
BATTERY LIMITS	5.0		8.3		14.6
OFF-SITES	5.5		9.4		16.9
TOTAL FIXED CAPITAL	10.5		17.7		31.5
SCALING EXPONENTS		0.75		0.83	
PRODUCTION COSTS, US C/LB					
RAW MATERIALS	20.89		20.89		20.89
BY-PRODUCT CREDITS	-2.98		-2.98		-2.98
UTILITIES	1.59		1.59		1.59
MAINTENANCE MATERIALS	0.08		0.06		0.05
OPERATING SUPPLIES	0.02		0.01		NEGL
VARIABLE COSTS	19.60		19.57		19.55
OPERATING LABOR (4/SHIFT)	0.16		0.08		0.06
MAINTENANCE LABOR	0.08		0.06		0.05
CONTROL LABORATORY	0.03		0.02		0.01
TOTAL DIRECT COSTS	19.87		19.73		19.67
PLANT OVERHEAD	0.21		0.12		0.10
TAXES AND INSURANCE	0.11		0.09		0.08
DEPRECIATION	0.45		0.38		0.34
PLANT GATE COST	20.64		20.32		20.19
G + A, SALES, RES., 5.0 PCT	1.31		1.28		1.27
NET PRODUCTION COST	21.95		21.60		21.46
25 PERCENT/YR ROI	1.32		1.11		0.99
PRODUCT VALUE	23.27		22.71		22.45

ETHYLENE
FROM FULL RANGE NAPHTHA

LOCATION: JAPAN
(US$1 = Y280)

RAW MATERIAL AND UTILITY COST, US C/LB

	UNIT COST	CONSUMPTION/LB	C/LB
RAW MATERIALS			
NAPHTHA (C5-400F)	6.8C/LB	2.97 LB	20.20
GROSS RAW MATERIAL COST			20.20
BY-PRODUCT CREDITS			
PROPYLENE POLYMER GRADE	12.1C/LB	0.43 LB	5.21
BUTADIENE	15.2C/LB	0.15 LB	2.28
BUTYLENES	5.81C/LB	0.13 LB	0.76
BENZENE	13.3C/LB	0.29 LB	3.86
XYLENES	11.8C/LB	0.074 LB	0.87
PYROLYSIS GASOLINE	7.12C/LB	0.22 LB	1.57
FUEL OIL (1.5 PCT S)	4.85C/LB	0.12 LB	0.58
TOTAL CREDITS			15.13
UTILITIES			
COOLING WATER	4.1C/1,000 GAL	60.8 GAL	0.25
STEAM	$ 3.28/1,000 LB	5 LB	1.64
ELECTRICITY	3.45C/KWH	0.054 KWH	0.19
TOTAL UTILITIES			2.08

PROCESS DESCRIPTION:

THE ECONOMICS COVER THE COSTS OF AN INTEGRATED COMPLEX, IN WHICH, BESIDES ETHYLENE, VARIOUS BY-PRODUCTS ARE SEGREGATED AND UPGRADED INTO MARKETABLE MATERIALS. THE COMPLEX INCLUDES STEAM CRACKING, QUENCH, CRACKED PRODUCT FRACTIONATION, BUTADIENE EXTRACTION, SEPARATION OF H2 AND CH4, HYDROGENATION OF GASOLINE FRACTION, BTX EXTRACTION FROM A SEGREGATED C6-8 CUT, AND TOLUENE DEALKYLATION. ETHANE IS RECYCLED TO THE CRACKING STEP.

REFERENCE: PEP REVIEWS, PEP 75-3-1 (KEL)

ETHYLENE
FROM FULL RANGE NAPHTHA

LOCATION: JAPAN
(US$1 = Y280)
PEP COST INDEX: 280 - LOCATION FACTOR: 0.77

	ETHYLENE MILLION LB/YR				
	500		1,000		1,500
INVESTMENT, US$MILLION					
BATTERY LIMITS	76.7		130.8		182.4
OFF-SITES	43.0		70.6		96.1
TOTAL FIXED CAPITAL	119.7		201.4		278.5
SCALING EXPONENTS		0.75		0.80	
PRODUCTION COSTS, US C/LB					
RAW MATERIALS	20.20		20.20		20.20
BY-PRODUCT CREDITS	-15.13		-15.13		-15.13
UTILITIES	2.08		2.08		2.08
MAINTENANCE MATERIALS	0.31		0.26		0.24
OPERATING SUPPLIES	0.03		0.01		0.01
VARIABLE COSTS	7.49		7.42		7.40
OPERATING LABOR (20/SHIFT)	0.26		0.14		0.12
MAINTENANCE LABOR	0.31		0.26		0.24
CONTROL LABORATORY	0.05		0.03		0.02
TOTAL DIRECT COSTS	8.11		7.85		7.78
PLANT OVERHEAD	0.37		0.26		0.23
TAXES AND INSURANCE	0.36		0.30		0.28
DEPRECIATION	2.63		2.22		2.04
PLANT GATE COST	11.47		10.63		10.33
G + A, SALES, RES., 5.0 PCT	1.71		1.62		1.58
NET PRODUCTION COST	13.18		12.25		11.91
25 PERCENT/YR ROI	5.99		5.03		4.64
PRODUCT VALUE	19.17		17.28 S		16.55

ETHYLENE OXIDE
BY OXYGEN PROCESS

LOCATION: JAPAN
(US$1 = Y280)

RAW MATERIAL AND UTILITY COST, US C/LB

	UNIT COST	CONSUMPTION/LB	C/LB
RAW MATERIALS			
ETHYLENE	17.3C/LB	0.884 LB	15.28
OXYGEN	1.7C/LB	1.152 LB	1.96
SILVER CATALYST, EO	$ 4.00/LB	0.00062 LB	0.25
GROSS RAW MATERIAL COST			17.49
UTILITIES			
COOLING WATER	4.1C/1,000 GAL	34.1 GAL	0.14
STEAM	$ 3.28/1,000 LB	-2.5 LB	-0.83
ELECTRICITY	3.45C/KWH	0.318 KWH	1.10
TOTAL UTILITIES			0.41

PROCESS DESCRIPTION:

ETHYLENE IS OXIDIZED WITH OXYGEN AT ABOUT 490 F (254 C) AND 300 PSIG (21 ATM) OVER A SUPPORTED SILVER CATALYST PACKED IN TUBES OF THE REACTOR. THE PER PASS CONVERSION OF ETHYLENE IS 10 PCT, WITH 76 PCT SELECTIVITY; REACTION SECTION YIELD IS 72.7 PCT. THE PRINCIPAL BY-PRODUCT IS CARBON DIOXIDE. THE HEAT OF REACTION IS REMOVED BY SIMULTANEOUS GENERATION OF STEAM.

THE ETHYLENE OXIDE IS ABSORBED IN WATER AND RECOVERED BY DISTILLATION. UNREACTED ETHYLENE IS RECYCLED TO THE REACTOR ALONG WITH THE OXYGEN AFTER CARBON DIOXIDE HAS BEEN REMOVED BY ABSORPTION. ETHYLENE GLYCOL FORMED DURING THE RECOVERY OPERATION IS SENT TO WASTE, BUT COULD BE RECOVERED FOR SALE.

REFERENCE: PEP REPORT 2B, P. 50-56; PEP REVIEWS, PEP 75-2-4 (YCY)

ETHYLENE OXIDE
BY OXYGEN PROCESS

LOCATION: JAPAN
(US$1 = Y280)
PEP COST INDEX: 280 - LOCATION FACTOR: 0.77

	ETHYLENE OXIDE MILLION LB/YR		
	150	300	600
INVESTMENT, US$MILLION			
BATTERY LIMITS	15.5	27.0	48.7
OFF-SITES	6.1	10.8	19.9
TOTAL FIXED CAPITAL	21.6	37.8	68.6
SCALING EXPONENTS	0.81		0.86
PRODUCTION COSTS, US C/LB			
RAW MATERIALS	17.49	17.49	17.49
UTILITIES	0.41	0.41	0.41
MAINTENANCE MATERIALS	0.34	0.28	0.26
OPERATING SUPPLIES	0.02	0.01	NEGL
VARIABLE COSTS	18.26	18.19	18.16
OPERATING LABOR (4/SHIFT)	0.14	0.10	0.08
MAINTENANCE LABOR	0.34	0.28	0.26
CONTROL LABORATORY	0.03	0.02	0.02
TOTAL DIRECT COSTS	18.77	18.59	18.52
PLANT OVERHEAD	0.30	0.24	0.21
TAXES AND INSURANCE	0.22	0.19	0.17
DEPRECIATION	1.58	1.39	1.26
PLANT GATE COST	20.87	20.41	20.16
G + A, SALES, RES., 5.0 PCT	1.29	1.24	1.21
NET PRODUCTION COST	22.16	21.65	21.37
25 PERCENT/YR ROI	3.60	3.15	2.86
PRODUCT VALUE	25.76	24.80 S	24.23

ETHYLENE GLYCOL
FROM ETHYLENE OXIDE

LOCATION: JAPAN
(US$1 = Y280)

RAW MATERIAL AND UTILITY COST, US C/LB

	UNIT COST	CONSUMPTION/LB	C/LB
RAW MATERIALS			
ETHYLENE OXIDE	24.8C/LB	0.872 LB	21.63
GROSS RAW MATERIAL COST			21.63
BY-PRODUCT CREDITS			
DIETHYLENE GLYCOL	19.4C/LB	0.107 LB	2.08
TRIETHYLENE GLYCOL	28.8C/LB	0.028 LB	0.81
TOTAL CREDITS			2.89
UTILITIES			
COOLING WATER	4.1C/1,000 GAL	13.7 GAL	0.06
STEAM	$ 3.28/1,000 LB	5.35 LB	1.75
PROCESS WATER	31C/1,000 GAL	0.28 GAL	0.01
ELECTRICITY	3.45C/KWH	0.013 KWH	0.04
TOTAL UTILITIES			1.86

PROCESS DESCRIPTION:

ETHYLENE GLYCOL IS PRODUCED BY THE NONCATALYTIC LIQUID PHASE HYDRATION OF ETHYLENE OXIDE AT 392 F (200 C) AND 215 PSIA (15 ATM). THE CONVERSION OF ETHYLENE OXIDE IS PRACTICALLY COMPLETE. THE REACTOR EFFLUENT CONSISTS OF MONO-, DI-, AND TRIGLYCOLS, THE RATIO OF WHICH DEPENDS ON THE RATIO OF WATER TO ETHYLENE OXIDE IN THE FEED. WITH AN 8:1 WEIGHT RATIO, APPROXIMATELY 88 WT PCT OF THE GLYCOL FRACTION IS MONOGLYCOL.

THE GLYCOLS ARE RECOVERED FROM THE REACTOR EFFLUENT BY FIRST EVAPORATING MOST OF THE WATER IN A MULTIPLE-EFFECT EVAPORATOR AND THEN SEPARATING THE REMAINING WATER, MONO-, DI-, AND TRIGLYCOLS IN A SERIES OF VACUUM DISTILLATIONS.

REFERENCE: PEP REPORTS 70, 70A (HWS)

ETHYLENE GLYCOL
FROM ETHYLENE OXIDE

LOCATION: JAPAN
(US$1 = Y280)
PEP COST INDEX: 280 - LOCATION FACTOR: 0.77

	ETHYLENE GLYCOL MILLION LB/YR				
	200		**400**		**800**
INVESTMENT, US$MILLION					
BATTERY LIMITS	4.7		7.7		13.5
OFF-SITES	5.1		8.8		15.7
TOTAL FIXED CAPITAL	9.8		16.5		29.2
SCALING EXPONENTS		0.75		0.82	
PRODUCTION COSTS, US C/LB					
RAW MATERIALS	21.63		21.63		21.63
BY-PRODUCT CREDITS	-2.89		-2.89		-2.89
UTILITIES	1.86		1.86		1.86
MAINTENANCE MATERIALS	0.07		0.06		0.05
OPERATING SUPPLIES	0.01		0.01		NEGL
VARIABLE COSTS	20.68		20.67		20.65
OPERATING LABOR (4/SHIFT)	0.14		0.07		0.05
MAINTENANCE LABOR	0.07		0.06		0.05
CONTROL LABORATORY	0.03		0.01		0.01
TOTAL DIRECT COSTS	20.92		20.81		20.76
PLANT OVERHEAD	0.15		0.09		0.07
TAXES AND INSURANCE	0.07		0.06		0.05
DEPRECIATION	0.54		0.45		0.40
PLANT GATE COST	21.68		21.41		21.28
G + A, SALES, RES., 5.0 PCT	1.36		1.33		1.32
NET PRODUCTION COST	**23.04**		**22.74**		**22.60**
25 PERCENT/YR ROI	1.22		1.03		0.91
PRODUCT VALUE	**24.26**		**23.77**		**23.51**

WORLD BANK / INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Mr. Anthony R. Perram, Chief, IPDD2 DATE: October 11, 1977

FROM: Don Brown, Jean-François Rischard and Ramon Beteta

SUBJECT: BRAZIL: COPESUL Petrochemical Project Issues Paper

1. The appraisal mission for the COPESUL Project visited Brazil September 12-30, 1977. The findings of the mission are summarized in the following two parts. Part A gives some background information on the Project, summarizing and complementing the information given in the Project Preparation Report (August 19, 1977). Part B discusses the issues which are outstanding and contains the mission's recommendations. A list of the organizations visited and persons met is attached as Annex 1.

A. PROJECT BACKGROUND

Objectives, Scope and Location

2. The COPESUL Project will form the core of the Country's third petrochemical complex, to be located in Rio Grande do Sul. It is in line with the Government's policy of decentralizing industry away from the congested Sao Paulo area while promoting regional development, and of improving the Country's long-term balance of payment prospects. Brazil is likely to attain self-sufficiency in a large number of petrochemicals with the commissioning of the Third Complex and net foreign exchange savings and earnings are expected to exceed US$550 million (1977 prices) at full capacity operation.

3. Starting from naphtha feedstock, the COPESUL Project will supply basic raw materials such as ethylene, propylene, butadiene and benzene for supply to at least seven downstream (or second generation) units with the following capacities for plastics and synthetic rubber:

	Tons per Year (TPY)
Low-density polyethylene (LDPE) I	100,000
Low-density polyethylene (LDPE) II	115,000
High-density polyethylene (HDPE)	60,000
Polyvinyl chloride (PVC)	240,000
Polypropylene (PP)	50,000
Styrene/Polystyrene (PS)	100,000/80,000
Styrene Butadiene Rubber (SBR)	80,000

Government approval for six of these seven units has been granted and the approval for the seventh is due within a month. Three other smaller projects are under development, and others will undoubtedly be added over time. The COPESUL plant has the flexibility of changing the mix of materials produced by modifying the cracking conditions (or severity); the output of the main material, ethylene, can accordingly vary between 420,000 and more than 470,000 tpy, with little change in total operating costs.

4. The Project will include large utility generating facilities to serve all the downstream units in addition to its own needs. COPESUL will also fulfill a number of complex-wide coordination functions and provide some infrastructure and services on the same basis.

5. Location will be a large, new industrial estate about 30km from Porto Alegre, with good access to road, rail and river transportation. Naphtha will be supplied via pipeline from a nearby PETROBRAS refinery, whose expansion has already reached the early stages of implementation. Arrangements for supply of coal are under study and no major problems are foreseen in that respect. A well-developed manpower training program is already underway, under the joint sponsorship of PETROBRAS, COPESUL and the Rio Grande do Sul State.

Project Status

6. COPESUL is now incorporated in its final form and its capital was raised to Cr.$800 million. Its staff currently numbers 170 people, most of whom have been involved in the implementation of the second petrochemical complex in Bahia. The engineering contract with Technip/KTI of France became effective in May 1977 and project implementation is underway. Work has begun on the site and procurement arrrangements for time-critical items has now started (para. 24).

Project Cost

7. Total financing required for the project, including the ethylene plant and the utility center for the complex, amounts to US$825 million, including US$76 million in interest during construction, US$50 million in working capital, and US$108 million in price escalation. Details are shown in Annex 2. Capital costs have been conservatively estimated based on detailed data from the second complex now nearing completion in Bahia, from Technip and on quotes from Brazilian equipment manufacturers. The estimates are satisfactory and conceivably 5 to 10% on the high side in constant dollars. Escalation is believed to have been adequately taken into account. For construction costs, which usually increase faster than average inflation in Brazil, COPESUL has added extra contingencies.

8. Total foreign exchange financing required for the project amounts to US$275 million, including US$42 million in interest during construction and US$60 million in indirect foreign exchange. This estimate is based on a 50/50 equipment and materials split between local reserve and ICB, to which the Government has agreed (para. 31).

Sponsors Ownership and Financing

9. The project will be sponsored by PETROBRAS through is subsidiary PETROQUISA (51% of COPESUL equity) and by BNDE (National Development Bank) both directly through a large local currency loan, and indirectly through its affiliate FIBASE which will subscribe to 49% of COPESUL's equity.

FIBASE plans to sell its shares at a later stage to the private companies which will sponsor the downstream units surrounding the COPESUL plant. Foreign exchange financing would be provided through the proposed World Bank loan, a loan from IDB supplementing an earlier IDB loan covering COPESUL's foreign engineering expenditures, a credit line extended by French banks tied to purchases from France, and other commercial (Euro-currency) loans. The financing plan is relatively complex and constitutes one of the major issues (paras. 15 to 22).

Financial and Economic Analysis

10. COPESUL's projected financial return, based on prices currently charged by the raw materials plant of the Sao Paulo Complex, is between 10% and 13% according to the product mix and degree of cracking severity chosen (para. 3). The project is expected to break even at about 40% of its capacity. COPESUL's financial prospects are satisfactory. Present Government policy is to allow price levels assuring a 16% after tax return on investment at 80% capacity utilization to all chemical producers. This would improve the estimated financial profitability of COPESUL, but might affect market development (para. 37).

11. The project's preliminary economic return has been estimated at between 13% and 14% based on a set of reasonable economic transfer prices for the major outputs. Relevant economic prices are nevertheless difficult to determine for the main products such as ethylene and propylene since they are not commonly traded (due to large shipping costs) but rather used captively. The economic analysis of a project such as COPESUL has therefore to be done on a complex-wide basis, starting from naphtha all the way to the products of the downstream units. This analysis will be included in the appraisal report and is expected to show a somewhat higher return for COPESUL and the Complex as a whole than the preliminary return calculated for COPESUL alone based on assumed transfer prices.

Market and Sector Background

12. The success of the Third Complex depends on the domestic petrochemical market; only a small portion of its output is expected to be temporarily for export. We have now completed an econometric projection exercise for the Brazilian petrochemical market, based on post-oil crisis petrochemical consumption data in about 40 countries covering a large range of development levels. This forecast is believed to be more up-to-date than earlier forecasts produced by the Brazilians. Preliminary results show that the Bank forecast, while being considerably more conservative, still indicates that the timing of the Complex is adequate.

13. We have also received and reviewed the survey of the plastic and rubber transformation industries and end-uses in Brazil prepared by our consultant, which concludes that the market prospects for the products to be produced by the Complex are good, especially in the South where a large range of plastic and rubber end-use products have a strong potential mainly

in the agriculture, industry and construction sectors. The degree to which the market actually develops depends, however, on the pricing philosophy applied after Brazil moves from a situation where one single petrochemical complex enjoys a quasi-monopoly in a protected sellers' market, to one where several complexes will have to compete within more balanced demand and supply conditions. This issue is discussed below (para. 37).

B. ISSUES AND RECOMMENDATIONS

14. A number of issues have been identified and are discussed below:

(i) Financing plan for COPESUL
(ii) Financing of downstream units
(iii) Procurement, allocation, terms and amount of World Bank loan
(iv) Reserve List
(v) Infrastructure and environmental control
(vi) Offtake and pricing arrangements
(vii) Market potential and pricing of petrochemicals.

Financing Plan for COPESUL

15. The financing plan for COPESUL, shown in Annex 3, is complex and presents several problems.

16. IDB has already extended a loan to cover foreign engineering costs up to an amount of US$18 million, and expects to be able to provide another US$80 million (a figure apparently limited by its lending program) to finance preallocated items (related to the utilities plant, and procured under ICB -- see para. 31). Terms will be approximately the same as those proposed for the IBRD loan. IDB intends to describe in rather specific terms what items it will finance. For the interest of the project, the Bank should collaborate with IDB in defining equipment lists in a flexible manner so as to allow for items to be shifted from one Bank's allocation list to the other's.

17. A syndicate of French banks led by the Credit Lyonnais has agreed to provide up to US$80 million equivalent as a credit line tied to purchases from France. COPESUL plans to make use of this credit line, which finances 85% of each contract with a French supplier, after ICB. We estimate that about US$30 million of this credit line corresponding to US$37 million in orders to French suppliers could thus be used efficiently without significant price and/or performance penalties. We recommend that this figure be used in determining the amount of the IBRD loan.

18. Commercial, untied loans would also be needed, mainly to finance interest during construction on the foreign loans. Such financing, the amount of which partly depends on the IBRD loan amount, is likely to be available, but since the terms would be relatively short, it should be minimized to improve COPESUL's debt servicing ability in the early operating years. Since such financing will not be needed in significant

amounts through 1978, we do not propose to make arrangements for these loans a condition to the IBRD loan. Rather, we propose to rely on adequate assurances from COPESUL and the Government that all necessary funds be made available (para. 22 below).

19. BNDE, the major lender, will provide about US$230 million equivalent (at 1977 constant prices in local)currency. The loan agreement was signed in December 1976 and provides for a comparatively short 10 year repayment period including 4-1/2 years of grace, and a 6% annual interest charge plus monetary correction. Application of an existing Government program which covers loan agreements signed before January 1, 1977 could, however, limit the monetary correction to 20% per year, if approved by the Government in the case of COPESUL. Any difference between actual monetary correction and these 20% would be paid to BNDE from federal sources. We recommend accepting the relatively short repayment terms on the BNDE loan provided the maximum monetary correction of 20% is granted. If not, the BNDE repayment terms would likely have to be increased to give COPESUL a satisfactory debt service coverage.

20. The grace period on the BNDE loan starts running at its effective date on December 1976. We have requested COPESUL to renegotiate the starting date of the grace period to December 1977 to avoid repayments in 1981. This is only a minor problem and should not constitute an issue.

21. Equity (40% of project financing) will be provided by PETROQUISA (51%) and by FIBASE (49%). FIBASE's only resources for the coming years are from BNDE. PETROQUISA's investment program in the coming years exceeds its cash-generating potential and hence it will depend on PETROBRAS for additional funds.

22. The project's success depends greatly on the timely and adequate provision of funds. Delays for COPESUL are likely to delay the entire Complex and could therefore carry a high cost to the economy, mainly by postponing the realization of the large foreign exchange saving expected (para. 2). We recommend therefore that shareholders' agreements be obtained from FIBASE and PETROQUISA assuring efficient implementation of the project including an adequate and timely flow of funds. In addition, we propose that the timely and adequate provision of BNDE funds and, in general, of all financing required for the project be assured by the Government.

Financing of Downstream Units

23. BNDE's role, and to a lesser degree FIBASE's and PETROQUISA's, in financing the downstream companies is also critical. In most cases final arrangements for financing of the already identified and approved downstream projects will not be completed until the second half of 1978; the implementation of these units can in most instances start somewhat later than COPESUL due to shorter construction periods. Therefore, we do not propose to make shareholders' and loan agreements for the currently

identified downstream units a condition to the proposed Bank loan to COPESUL, but instead rely on assurances from the Government, similar to those mentioned under para. 22, that adequate and timely funds will be made available to BNDE, FIBASE and PETROQUISA, to enable them to provide necessary financing for all downstream units. Since the entire complex has reportedly been given priority by the Government and will have received all required Government approvals prior to loan negotiations, this general covenant should be adequate. The Government is aware of the large economic and financial petalties in case of significant delays. Financing for the required infrastructure is mentioned below (para. 33).

Procurement, Allocation, Terms and Amount of Bank Loan

24. The project is already underway with Technip's contract effective in May 1977 (para. 6). Arrangements for procurement are now being made in accordance with procedures satisfactory to both IBRD and IDB. To avoid delaying the project, some advance contracting prior to presentation of the proposed loan to the Executive Directors will likely be required (COPESUL and the Government have been informed that any procurement decisions prior to Board approval are at their own risk). We recommend that advance contracting up to 25% of the proposed Bank loan be agreed. We also propose retroactive financing up to 5% of the proposed Bank Loan be agreed to cover downpayments on advance contracts. Although we will minimize advance contracting and retroactive financing wherever possible by allocating early procurement (comprising time critical items) to other financing sources some provision on the Bank's part is desirable to avoid a costly 2 to 4 month delay (para. 22).

25. To make the maximum efficient use of the French tied credit, COPESUL proposes to follow the World Bank's ICB procedures and then post-allocate any items won by French suppliers to the French credit. This procedure is actually the only practical way to use the French credit. CACEX, the Brazilian import authority for capital goods, has only agreed to a 50% national reserve list (para. 31) if most of the balance was purchased under ICB following Bank-style procedures. Full use of the French Credit would have probably resulted in a 70-80% national reserve list. Use of both tied and non-competitive procurement sources would have been prohibitively costly for COPESUL.

26. The Credit Lyonnais has agreed to postallocation , and we recommend that post-allocation be agreed to in principle, with the understanding that COPESUL can, at any time, elect to allocate bid packages to the French credit as long as significant price penalties are not incurred. This will insure maximum flexibility and the efficient use of the French credit. Such flexibility is particularly needed as IDB has expressed a strong preference for preallocation and COPESUL and we have agreed.

27. The French credit would only disburse against 85% of the amount of purchase orders placed in France and COPESUL has requested that IBRD finance the 15% balance. We recommend covering these partial payments through the Bank loan provided that the above-mentioned post-allocation procedure after ICB has been followed and that no taxes or uneligible charges are included. A similar procedure was agreed to in another industrial project in the case of a Japanese tied credit to facilitate the use of such credit (Pakistan/Fauji-Agrico Fertilizer Project).

28. We recommend a direct loan to COPESUL at a 10% annual interest (the prevailing Bank lending rate plus the guarantee fee payable to the Government) with fifteen years of repayment including four years of grace. These lending terms are identical with those of recent industrial loans to Brazil.

29. We propose a Bank loan of US$75 million as in the current lending program for Brazil[1/]. However, up to US$87 million could be justified on project grounds and to simplify financial arrangements for COPESUL, by including interest during construction of US$12 million. COPESUL, as a newly formed company, will have to rely on external funds until commercial operation is attained in 1982. Alternatively, interest during construction would have to be provided by the shareholders or through relatively shorter term commercial loans (para. 18). Since total interest during construction on foreign loans is estimated at about US$40 million, the provision of funds by the Bank to cover interest during construction on its own lown (as well as by IDB for its own loan) is desirable. In any case, we recommend that interest during construction be included in the IBRD loan allocation, irrespective of the agreed loan amount.

30. Finally, COPESUL has requested that IBRD agree to establish a US$5 million revolving fund account to expedite disbursements for orders and downpayments under US$50,000. A similar procedure was successfully applied in the Indonesia Pusri III Fertilizer Project, and we recommend that the provision of a revolving fund be agreed.

Reserve List

31. The Government has agreed to a 50/50 equipment and materials split between local reserve and ICB (para. 8). Normal Brazilian procurement policies would have resulted in an overall 70-80% national reserve list. This 50/50 split will actually be achieved by sub-dividing the project into two parts (i) the boilers for the utility center, to be procured on a 100% ICB basis (allocated to IDB for financing), and (ii) the petrochemical raw materials plant with a 67/33% split between locally reserved and ICB-procured items. Our preference would be for a 50-55% reserve list on the raw materials plant. We estimate that the price penalty for following a 67% rather than a 55% reserve list is

1/ US$75 million is also the maximum amount the Bank could disburse against in the equipment and materials category, assuming US$30 million are financed through the French Credit line and US$80 million by IDB.

approximately US$15 million, or about 2% of total project cost, and therefore acceptable. Technical quality and delivery should not be a problem. We therefore believe that the higher reserve list is a reasonable compromise and we recommend its acceptance. If we shadow-priced the currency and were to measure the total impact on the local capital goods industry, the overall effect on the Brazilian economy could very well be positive.

Infrastructure and Environmental Control

32. A specially created agency of the Rio Grande do Sul State Government, CONPETRO, is responsible for coordinating a number of required infrastructure projects including water and sewerage, roads, rails and jetties, that will be implemented by several different State and Federal organizations. Financing for a large part of the infrastructure requirements, mainly water and sewerage, will be available through established programs from the National Housing Bank (BNH/PLANASA). Sufficient funds are likely to be available, but CONPETRO and the other local agencies appear to be administratively weak. COPESUL has agreed to supervise closely all infrastructure projects and will take on the responsibility for the implementation of the sub-projects if local authorities do not act in a timely fashion (a contract to that effect has been concluded between COPESUL and CONPETRO). Although infrastructure requirements are critical to the overall success of the petrochemical complex, we believe that COPESUL's already agreed involvement is sufficient and we only propose that we seek assurances (or confirmation) to that effect.

33. One weakness of the local authorities has been (so far) the inability to set specific environmental standards that apply to the project. COPESUL has taken the lead, and prepared water and air standards that it proposes to use (based on the COPENE project in Bahia and relevant standards in US and Europe). We are reviewing COPESUL's standards and its management has agreed to reassess them if we believe tighter standards should apply. We should seek adequate assurance from the Government that reasonable and sound environmental standards will be established in sufficient time to permit project design and execution to proceed efficiently and that adequate funds will be provided to install facilities as required by these standards.

Offtake and Pricing Arrangements

34. The major raw materials to be produced by COPESUL, ethylene and propylene, are gases which are not usable as such and cannot be transported over a long distance unless at a high cost. The downstream units are thus essential to the success of the COPESUL projects; inversely, though, the downstream units cannot be supplied with their major raw materials from outside the Complex. Because of the early stage and later schedule of most downstream projects (para. 23), and because of the difficulty of determining long-range prices at this stage, it would nevertheless seem unreasonable to expect that offtake and pricing agreements could or should be concluded between COPESUL and those downstream units which are already approved until sometime before the beginning of commercial operations by early 1982.

35. It would thus appear important to obtain assurances regarding the effective and timely implementation of the downstream units. In this respect, COPESUL has drafted an agreement between itself, the already downstream units, BNDE, FIBASE, PETROQUISA, PETROBRAS and the authorities in charge of coordinating and financing the infrastructure, which confirms each entity's role and commitment to the successful and timely implementation of the Complex. We recommend that the signing of this document be made a condition to the World Bank loan. COPESUL's ability to supervise the effective and efficient implementation and coordination of the mostly privately sponsored downstream units is however limited. As a common -- albeit minority -- shareholder in most downstream companies, PETROQUISA would seem to be in a much better position to perform that role effectively, and we propose that the Government be asked to formally acknowledge PETROQUISA's responsibilities in that respect.

36. The current return estimates for the downstream units are attractive to private investors. In view of the pending revision of the pricing policies in the petrochemical sector (para. 37), and so as to obtain all possible guarantees regarding the effective and timely implementation of all the units included in the Complex, we should, however, insist that the Government give assurances that a satisfactory level of profitability will be maintained not only for COPESUL, but also for the downstream units.

Market Potential for Petrochemicals and Pricing Policy

37. As mentioned above (para. 34), the Bank's econometric market forecast, based on conservative assumptions, shows a potential demand for petrochemicals large enough to justify the scope and timing of the COPESUL Project and in general the Third Complex. However, the degree to which any such forecast is likely to materialize depends critically on the future prices of petrochemicals compared to those of such competing products as glass, paper, steel, lumber, aluminum, etc. The present pricing policy of having each petrochemical unit's prices based on its actual cost structure (even if this entails different prices between different producers) as implemented by the Ministry of Finance's CIP (Price Council), is adequate in the present situation where basically only one petrochemical complex is in operation, and where demand by far outstrips the domestic supply capabilities. With the commissioning of the Bahia Complex in mid-1978 and later of Third Complex, both of which have costs much higher than the existing Sao Paulo Complex, the entire petrochemical pricing philosophy will have to be rethought. A task force is planned to start working on this in October and the Government is aware of the complexity and urgency of the problem. We propose that the Bank be kept informed of the progress of the task-force's work on pricing, and that we be consulted on the scope and terms-of-reference of such studies. In particular, we recommend that we reach agreement with the Government to include the issue of market development in the terms of reference of the task force and that agreement be obtained as to the completion of the work by December 1979.

DEBrown/JFRischard:ki

cc: Messrs. van der Tak (8), Chittleburgh, Gordon (IDF), Fuchs, Dewey, Nayar/Iskander, Cash, Jaffe, Soncini, Evans
van der Meer, Glaessner, Lerdau, Wyss, Skillings, Mirza (2), Mole, Buhler, Ruisanchez (IFC), Dehejia (IFC)

LIST OF THE ORGANIZATIONS VISITED AND PERSONS MET

- BNDE (National Development Bank) (RIO)

  Mr. Jose Tostes (Accountant)
  Mr. Roberto Carripos (Planning)

- CIP (Interminesterial Pricing Commission) (RIO)

  Mr. Jose Scrivano (General Coordinator of the Petrochemical Sector)

- COPESUL (RIO)

  Mr. Juan Jose Molinos (Technical Director)
  Mr. Carlos Guttmann (Financial Director)
  Mr. Paulo Tessarolo (Planning)
  Mr. Jose Obirajara Nogueira Bezerra (Financial Analyst)
  Mr. Tomaso (Planning)
  Mr. Xavier (Purchasing)
  Mr. Percy de Abreu (Director Superintendent), (Porto Alegre)

- PETROPAR (RIO) (MVC/PVC & PP)

  Mr. Arthur Candal (Financial Director)
  Mr. Flavio Canali Ferreira (Project Manager)

- PETROQUISA (RIO)

  Mr. Wagner Clemente (Planning Director)
  Mr. Jose da Polonia Batalheiro (Assistant to the General Director)
  Mr. Jose Angrisani (General Director)

- OXITENO (SAO PAULO) (S/PS)

  Mr. Jose Saguas Presas (General Director)

- PETROFLEX (RIO) (SBR)

  Mr. Milton Fontenelle M. Filho (General Coordinator)
  Mr. Idalvo dos Santos Cunha (Engineer)

- POLIOLEFINAS (SAO PAULO) (LDPE)

  Mr. David A. Wicker (Director - Superintendent)
  Mr. Fernando Xavier Soares (Industrial Director)
  Mr. Teuracy Jose Leitao Bastos (Financial Director)

- POLISUL (RIO) (HDPE)

  Mr. Federico Knauer (General Director)

- IPIRANGA (RIO) (HDPE)

    Mr. Sergio S. Saraiva (General Director)

- POLITENO (RIO) (LDPE)

    Mr. Mauro Guia (Financial Director)

- FIBASE (RIO)

    Mr. Jose Clemente de Oliveira (Financial Director)

- GOVERNMENT (BRASILIA)

    Mr. Valter Gurgel de Alencar (SUBIN)
    Mrs. Maria de Lourdes Marques (SUBIN)
    Mrs. Maria Regeria Bastos Le Oliveira (SUBIN)
    Mr. Jose Carlos Oliveira (Adviser, Ministry of Finance)
    Representative of Ministry of Energy

- CONPETRO (Porto Algre)

    Mr. Maier Avruch, (Coordinator of the Third Complex)
    Representatives of various CONPETRO divisions and of a number of State Agencies.

- REFAP REFINERY (CANOAS)

    General Manager
    Expansion Project Manager

- COPELMI (Coal Company in Rio Grande Loful)

    Director

BRAZIL-COPESUL Petrochemical Project, Revised Capital Cost Estimate in US $ Million and at mid-1977 prices a/

	Direct Foreign Exchange Costs	Indirect For. Exch. Costs f/	Local Currency Costs	TOTAL COSTS
Project Preparation	-	-	0.1	0.1
Incorporation and Administration	-	-	32.3	32.3
Land and Site Improvements	-	-	20.3	20.3
Civil Works and Buildings	-	7.9	44.8	52.7
Licenses & Know-How	2.9	-	-	2.9
Engineering				
Basic	6.2	-	-	6.2
Detail	10.0	-	17.3	27.3
Equipment & Materials				
Reserved to Braz.Suppliers b/	-	26.1	110.4	136.5
Open for ICB	104.5	5.2	22.0	131.7
Out of Which:				
Likely to be Won by Loc.suppl.	(-)	(5.2)	(22.0)	(27.2)
" " " " by For.suppliers	(104.5)	(-)	(-)	(104.5)
Insurance & Freight c/	5.3	1.6	13.0	19.9
Tools and Supplies	-	-	4.6	4.6
Erection	-	-	89.4	89.4
Pre-operating Costs	4.3	-	9.9	14.2
Basic Cost Estimate (BCE)	133.2	46.0	358.9	538.1
Physical Contingencies d/	13.3	4.6	35.9	53.8
Price Contingencies e/	26.7	9.2	71.8	107.7
Installed Costs	173.2	59.8	466.6	699.6
Working Capital, with contingencies	-	-	50.1	50.1
Total Project Cost	173.2	59.8	516.7	749.7
Interest During Construction	42.4	-	33.6	76.0
Total Financing Required	215.6	59.8	550.3	825.7

a/ July 1977 exchange rate of Cr. $14.35
b/ Based on 50/50 reserve/ICB split currently considered
c/ 5% of FOB price for locally procured items and 10% for foreign purchases
_/ 10% on all except land and site improvements
e/ 8% for 1977/78, 7.5% for 1978/79 and 7% thereafter. Excess of local inflation over general foreign inflation deemed offset by changes in the exchange rate.
f/ based on an estimated average indirect foreign exchange content of 20% for equipment and materials and 10% for civil works

BRAZIL-COPESUL Petrochemical Project

Financing Plan

	Current $	Constant 1977 $ Amount
EQUITY (40%)		
PETROQUISA	168	
FIBASE	162	
Subtotal, Equity	330	
DEBT (60%)		
Foreign Exchange		
IDB I (signed)	18	
IDB II (tentative)	80	
IBRD (tentative)	75	
French Credit Line (signed)	30	
Eurocurrency Loans	20	
Local Currency		
BNDE (signed)	272	230
Subtotal, Debt	495	
TOTAL FINANCING REQUIRED	825	

COPESUL PETROCHEMICAL PROJECT

SUMMARY OF TERMS AND AMOUNTS OF DIFFERENT FINANCING SOURCES

1. BNDE (Signed December 1976)
   - U$230,000,000 equivalent in local currency
   - 6% interest
   - 20% maximum monetary correction can possibly be granted
   - Repayments starting 06/15/1981
   - 22 quarterly installments

2. FRENCH CREDIT LINE
   (Negotiations completed, signing awaits shareholders' agreement)
   - Up to US$ 80 million equivalent
   - Syndicate led by Credit Lyonnais, includes BNP, Paribas, Worms, BFCE
   - Interest 7.5% (official interest rate for long-term export credits by France; can change over implementation period, with a consequent change in the average interest rate of the credit line; change is unlikely, though)
   - Guarantee fee to COFACE of 5.4% flat (amounts to an additional 1.1% a year)
   - 0.3% per annum commitment fee
   - 0.3% flat management fee
   - 12 years repayment including 4 years of grace if orders to French industry amount to US$ 20 million equivalent; 14 years including 4 years of grace if orders total US$ 40 million or more. Even contracts simply admissible, but not actually financed by the credit line, are taken into account to determine the "orders to French industry"
   - covers only 85% of equipment cost; 15% down payment is required
   - can cover equipment and materials subcontracted by French suppliers from other countries up to 5% of each order

3. EUROCURRENCY LOAN (Offer under consideration)
   - Same syndicate as for credit line
   - Up to US$ 18 million equivalent, or 20% of the orders to the French industry, with a minimum of US$ 5 million
   - Interest: 2.25% above LIBOR payable twice a year
   - 0.75% per annum commitment fee
   - 1.125% flat management fee
   - 8.5 years repayment including 3.5 years of grace

NOTA: Other offer was made by Citybank with a somewhat longer repayment schedule

4. IDB/FINEP (Approved by IDB Board, should be signed soon)
   - US$ 18 million earmarked for foreign engineering costs at 8% interest plus 1% on-lending premium to FINEP; 20 years repayment including 4.5 years of grace
   - Standby of US$ 5 million at 8.6% interest and 0.5% on-lending charge to be cancelled at signing of above loan

5. IDB (Appraisal mission should be in the field early November)
   - terms and amount to be determined

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DRAFT:RSCHARD:des
October 5, 1977

TO: Mr. Anthony R. Perram, Chief, Div. II, IPD

FROM: Donald Brown, Jean-Francois Rischard and Ramon Beteta

SUBJECT: BRAZIL-COPESUL Petrochemical Project
Issues Paper

1. The appraisal mission for the COPESUL Project visited Brazil September 12-30, 1977. The findings of the mission are summarized in the following two parts. Part A gives some background information on the Project, summarizing and complementing the information given in the Project Preparation Report (August 19, 1977). Part B discusses the seven issues which are outstanding and contains the mission's recommendations. A list of the organizations visited and persons met is attached as Annex 1.

A. PROJECT BACKGROUND

Objectives, Scope and Location

2. The COPESUL project will form the core of the Country's third petrochemical complex, to be located in Rio Grande do Sul. It is in line with the Government's policy of decentralizaing industry away from the congested Sao-Paulo area while promoting regional development, and of improving the Country's long-term balance of payment prospects. Brazil is likely to attain self-sufficiency in petrochemicals with the commissioning of the Third Complex and net foreign exchange savings are expected to exceed US$500 million (1977 prices) at full capacity operation.

3. Starting from naphtha feedstock, the COPESUL project will supply basic raw materials such as ehtylene, propylene, butadiene and benzene for supply to at least seven downstream (or second generation) units with the following capacities for plastics and synthetic rubber:

	TPY
Low-density polyethylene (LDPE) I	100,000
Low-density polyethylene (LDPE) II	115,000
High-density polyethylene (HDPE)	60,000
Polyvinyl chloride (PUC)	240,000
Polyproylene (PP)	50,000
Styrene/Polystyrene PS)	100,000/80,000
Styrene Butadiene Rubber (SBR)	80,000

Government approval for six of these seven units has been granted. Three other projects are known to the mission, and others will undoubtedly be added over time. The COPESUL plant has the flexibility of being able to change the mix of raw materials produced by modifying the cracking conditions (or severity); the output of the main building block, ethylene, can accordingly vary between 420,000 and more than 470,000 tpy, with little change in total operating costs.

4. The project will include large utility generating facilities to serve all the downstream units beyond its own needs. COPESUL will also assure a number of complex-wide coordination functions and provide some infrastructure and services on the same basis.

5. Location will be a large, new industrial estate about 25 Km from Porto Alegre, with an excellent access to road, rail and river transportation. Naphtha will be supplied via pipeline from a nearby PETROBRAS refinery, whose expansion has already reached the early stages of implementation. Arrangements for supply of coal are under study and no

major problems are foreseen in that respect. A well-thought manpower training program is already underway, under the joint sponsorship of PETROBRAS, COPESUL and the Rio Grande do Sul State.

Project Status

6. COPESUL is now a Sociedade Anonima and its capital was raised to Cr.$800 million. Its staff currently counts 170 people. most of whom have been involved in the implementation of COPESUL's sister project COPENE in Bahia. The engineering contract with Technip/KT1 of France has become effective in May 1977 and project implementation is underway. Work has begun on the site and procurement for time-critical items has now started .

Project delays would be unusually costly, since they are liable to affect the entire complex; some advance contracting might therefore be necessary (para.24).

Project Cost.

7. Total financing required for the project, including the ethylene cracker and the utility center for the complex, amounts to US$825 million, including US$76 million in interest during construction, US$50 million in working capital, and US$ 108 million in price escalation. Details are shown in Annex 2. Capital costs have been constructively estimated based on detailed data from the Second Complex now nearing completion in Bahia, from Technip/KT , the selected French engineering firm, and on quotes from Brazilian suppliers. The estimates are satisfacotry and conceivably 5 to 10% on the high side in constant dollars. Escalation is believed to be adequately taken into account; for construction costs, which usually incrase faster than average inflation in Brazil, COPESUL has added special contingencies.

8. Total foreign exchange financing required for the project amounts to US$275 million, including US$42 milliion in interest during construction and US$69 million in indirect foreign exchange. This estimate is based on a 50/50 equipment and materials split between local reserve and ICB, to which the Government has agreed (para. 31).

Sponsors and Financing

9. The project will be sponsored by PETROBRAS through is subsidiary PETROQUISA, (51% of COPESUL equity) and by BNDE (National Development Bank) both directly through a large local currency loan, and indirectly through its IFC-like affiliate FIBASE which will subscribe to 49% of COPESUL's equity, with plans for selling its shares at a later stage to the private companies which will sponsor the downstream units surrounding the COPESUL plant. Foreign exchange financing would be provided through the proposed World Bank loan, a loan from IDB supplementing an earlier IDB loan covering COPESUL's foreign engineering expenditures, a credit line extended by French banks solely for purchases from France, and other commercial (Euro-currency) loans. The financing plan is hence complex and constitutes one of the major issues (paras. 15 to 22).

Financial and Economic Analysis

10. COPESUL's projected financial return, based on prices currently charged by the raw materials plant of the Sao Paulo Complex, is between 10% and 13% according to the product mix and degree of cracking severity chosen (para 3). The project is expected to break even at about 40% of its capacity. COPESUL's financial prospects are deemed satisfactory.

Present Government policy is to allow price levels assuring a 16% return at 80% capacity utilization to all chemical producers. This would improve the estimated financial profitability of COPESUL, but might affect market development (para).

11. The project's preliminary economic return has been estimated at between 13% and 14% based on a set of reasonable economic transfer prices for the major outputs. As mentioned in an earlier report, relevant economic prices are nevertheless difficult to determine for the main products such as ethylene and propylene since they are not commonly traded (due to large shipping costs) but rather used captively or sold over a pipeline grid. The economic analysis of a project like COPESUL has therefore to be done on a complex-wide basis, starting from naphtha all the way to the products of the downstream units. This analysis will be ready for inclusion in the appraisal report and is expected to show a somewhat higher return for COPESUL and the Complex as a whole than the preliminary return calculated for COPESUL alone based on assumed transfer prices.

Market and Sector Background.

12. The success of the Third Complex depends on the domestic petrochemical market development, and only a small portion of its output is expected to be temporarily for export. The Bank is at the present time completing an econometric projection exerise for the Brazilian petrochemical market, based on post-oil crisis petrochemical consumption data in about 40 countries covering a large range of development levels. This forecast is believed to be more up-to-date than earlier forecasts produced by the Brazilians. Preliminary results show that the Bank forecast, while being more conservative, still indicates that the timing of the Complex is adequate.

13. We have now received the report on the plastic and rubber transformation industries and end-uses in Brazil and will be able to include in the appraisal report its main findings, which tend to firm up our view that the market prospects for the products to be produced by the Complex are good, especially in the South where a large range of plastic and rubber end-use products seem to have a good potential in the agriculture industry and to a lesser extent consumer sectors. The degree to which the market actually develops depends, however, on which pricing philosophy is applied after Brazil moves from a situation where one single petrochemical complex enjoying a monopoly in a well-protected sellers' market, to one where several complexes will have to compete within more balanced demand and supply conditions. This issue is developed below.

B. ISSUES AND RECOMMENDATIONS

14. Seven issues have been identified and are discussed below:

(i) Financing plan for COPESUL

(ii) financing of Downstream Units

(iii) procurement, allocation and amount of World Bank loan

(iv) reserve list

(v) infrastructure and environmental control

(vi) marketing arrangements

(vii) market ppotential and pricing of petrochemicals.

Financing Plan for COPESUL

15. The financing plan for COPESUL, shown in Annex 3, is complex and presents several problems.

16. IDB has already extended a loan to cover foreign engineering costs up to an amount of US $18 million, and expects to be able to provide another US$ 80 million (a figure apparently limited by its lending program) to finance preallocated items (related to the utilities plant, and procured under ICB - see para.). Terms will be approximately the same as those proposed for the IBRD loan. IDB intends to describe in rather specific terms what items it will finance. For the interest of the project, the Bank should collaborate with IDB in defining equipment lists in a way flexible enough to allow for marginal switches of items from one Bank to the other.

17. A syndicate of French banks led by the Credit Lyonnais is ready to provide up to US$ 80 million equivalent as a credit line tied to purchases from France. COPESUL plans to make use of this credit line, which finances 85% of each contract with a French supplier, after ICB; we estimate that about US$30 million of this credit line corresponding to about &S$37 million in orders to French suppliers could thus be used efficiently without significant price and/or performance penalties. We recommend that this figure be used in determining the amount of the IBRD loan.

18. Commercial, untied loans, most likely in Euro-currencies would also be needed, mainly to finance interest during construction on the foreign loans. Such financing, which amount partly depends on the IBRD loan amount is likely to be available, but since their terms would be relatively short, they should be minimized to improve COPESUL's servicing ability in the early operating years, Since such financing will not be needed in significant amounts through 1978, we do not propose to make arrangements for these loans a condition to the IBRD loan. Rather, we propose to rely on adequate assurances from COPESUL and the Government that all necessary funds be made available (para below).

19. BNDE, the major lender, will provide about US$230 million equivalent (at 1977 constant prices in local currency. The corresponding agreement

was signed in December 1976 and provides for a comparatively short 10 year repayment period including 4 1/2 years of grace, and a 6% annual interest charge plus monetary correction. Application of a now defunct Government program which covers loan agreements signed before January 1, 1977 could, however, limit the monetary correction to 20% per year, if approved by the Government in the case of COPESUL. Any difference between the future actual monetary correction and these 20% would be paid to BNDE from federal sources. We recommend accepting the relatively short repayment terms on the BNDE loan provided the maximum monetary correction of 20% is granted. If not, the BNDE repayment terms would likely have to be increased to give COPESUL a satisfactory debt service coverage.

20. The grace period on the BNDE loan starts running at its effectiveness date in December 1977.

We have requested COPESUL to renegotiate the starting date of the grace period to December 1977 to avoid repayments in 1981. This is only a minor problem and should not constitute an issue.

21. Equity (40% of project financing) will be provided by PETROQUISA (51%) and by FIBASE (49%). FIBASE's only resources come from BNDE. PETROQUISA's investment program in the coming years exceeds its cash-generating potential and hence it will depend on PETROBRAS for additional funds.

22. The project's success depends greatly on the timely and adequate provision of funds. Delays for COPESUL are likely to delay the entire Complex and could therefore carry a high cost to the economy, mainly in balance-of-payments terms. We recommend therefore that shareholders agreements be obtained from FIBASE and PETROQUISA assuring efficient implementation of the project including an adequate and timely flow of funds. In addition, we propose that the provision of BNDE funds and in general of all local financing required for the project be assured by the Government.

Financing of Downstream Units

23. BNDE's role, and to a lesser degree FIBASE and PETROQUISA, in financing the downstream units is also critical. In most cases final arrangements for financing of the already identified and approved Downstream units will **not** be completed until the second half of 1978; these units can in most instances start somewhat later than COPESUL due to shorter implementation periods. Therefore, we do not propose to make shareholders' and loan agreements for the currently identified units a condition to the proposed Bank loan to COPESUL, but instead rely on assurances from the government, similar to those mentioned under para 23, that adequate and timely funds will be made available to BNDE, FIBASE and PETROQUISA, to enable them to provide necessary financing for all downstream units. Since the entire complex has reportedly been given

priority by the Government and will have received all required Government approvals prior to loan negotiations, this general covenant should be adequate. The Government is aware of the large economic and financial penalties in case of significant delays. Financing for the required infrastructure is mentioned below.

Procurement, Allocation, Terms and Amount of Bank Loan

24. The project is already underway with Technip's contract effective in May 1977 (para 6). Arrangements for procurement are now being made in accordance with procedures of IBRD and IDB. To avoid delaying the project, some advance contracting prior to presentation of the proposed loan to the Board might be required (COPESUL and the Government have been informed that any procurement decisions prior to Board approval are at their own risk). We recommend that advance contracting up to 25% of the proposed Bank loan be agreed. We also propose retroactive financing up to 5% of the proposed Bank Loan be agreed to cover downpayments on advance contracts. Although we will minimize advance contracting and retroactive financing wherever possible by allocating certain time critical items to other financial sources, some provisions on the Bank's part necessary to avoid a costly 2 to 4 month delay.

25. To make the maximum efficient use of the French tied credit, COPESUL proposes to follow the Bank's ICB procedures in all cases and then post-allocate any items won by French suppliers to the French credit. This procedure is actually the only practical way to use the

French credit. CACEX, the Brazilian import authority has only agreed to a 50% national reserve list (para) if most of the balance was tied under ICB via Bank-style procedures. Full use of the French Credit would have probably resulted in a 70-75% national reserve list which, combined with non-competitive procurement, would have been prohibitively costly for COPESUL.

26. The Credit Lyonnais has agreed to postallocation, and we recommend that post-allocation be agreed in principle, with the understanding that COPESUL can, at any time, elect to allocate bid packages to the French credit as long as a significant price penalty is not incurred. This will insure maximum flexibility and the efficient use of the French credit. Such feasibility is the more needed as IDB has expressed a strong preference for preallocation and we have agreed with it.

27. The French credit would only disburse against 85% of the amount of purchase orders placed in France and COPESUL has requested that IBRD finance the 15% balance. We recommend covering these partial payments through the Bank loan provided that the abovementioned postallocation procedure after ICB has been followed and that no taxes or uneligible charges are included. A similar procedure was agreed in

another industrial project in the case of a Japanese tied credit to facilitate the use of such credit (Pakistan/Fauji-Agrico Fertilizer Project).

28. We recommend a direct loan to COPESUL at a 10% annual interest (the prevailing Bank lending rate plus the guarantee fee payable to the Government) with fifteen years of repayment including four years of grace. These lending terms are identical with those of recent industrial loans to Brazil.

29. We propose a Bank loan of US$75 million as in the current lending program for Brazil.[1/] However, up to US$85 million could be justified on project grounds and to simplify financial arrangements for COPESUL, by including interest during construction of US$10 million COPESUL, as a newly formed company, will have to rely on external funds until commercial operation is attained in 1982. Alternatively, interest during construction (IDC) would have to be provided by the share-holders or through relatively shorter term commercial loans. Since total IDC is estimated at about US$40 million, the provision of funds by the Bank to cover IDC on its own loan (as well as by IDB for its own loan) is desirable.

1/ US$75 million is the maximum amount the Bank could disburse against in the equipment and materials category, assuming US$30 million are financed through the French Credit line and US$80 million by IDB.

30. Finally, COPESUL has requested that IBRD agree to establish a US $5 million revolving fund account to handle orders and downpayments under US$50,000. A similar procedure was usefully applied in the Indonesia Pusri III Fertilizer Project, and we recommend that the revolving fund be agreed to.

Reserve List

31. The Government has agreed to a 50/50 equipment and materials split between local reserve and ICB (para 8). Normal Brazilian procurement policies would have reslted in an overall 70-80% national reserve list. This 50/50 split will actually be achieved by sub-dividing the project in two parts (i) the boilers for the utility center, to be procured on a 100% ICB basis, allocated to IDB for financing and (ii) the raw materials plant with a 33/67 split between locally reserved and ICB-procured items. Our preference would be for a 50% reserve list on the raw materials plant. We estimate that the price penalty for following a 65% rather than a 50% reserve list is approximately of US $15-20 million, or 2-3% of total project cost. Technical quality and delivery should not be a problem. We therefore believe that the higher reserve list is a reasonable compromise and we recommend its acceptance. If we shadow-priced the currency and were to measure the total impact on the local capital goods industry, the overall effect on the Brazilian economy could very well be positive.

Infrastructure and Environmental Control.

32. An agent of the Rio Grande do Sul State Government, CONPETRO, is responsible for coordinating a number of required infrastructure projects including water and sewerage, roads, rails and jetties, that will be implemented by several different State and Federal organizations. Financing for most infrastructure requirements, mainly water and sewerage, will be available through established programs from the National Housing Bank (BNH).

Sufficient funds are likely to be available, but CONPETRO and the other local agencies appear to be administratively weak. Copesul has agreed to liaise closely with all infrastructure projects and will assure responsibility for the implementation of the sub-projects if local authorities do not act in sufficient time. Although infrastructure requirements are critical to the overall success of the petrochemical complex, we believe that Copesul's already agreed involvement is sufficient and we only propose that we seek assurances (or confirmation) to that effect.

33. One weakness of the local authorities has been (so far) the inability to set specific environmental standards that apply to the project. Copesul has taken the lead, and prepared water and air standards that it proposes to use (based on the COPENE project in Bahia and relevant standards in US and Europe). We are reviewing COPESUL's standard and they have agreed to reassure their criteria if we believe tighter standards should apply.

We should seek adequate assurance from the Government that reasonable and sound environmental standards will be established in sufficient time to permit project design and execution to proceed efficiently and that adequate funds will be provided to install facilities as required by these standards

Marketing Arrangements

34. The downstream units to be established are the same site as COPESUL's are the sole markets for its products. The major raw materials produced, ethylene and propylene, are gases and are not usable as such. Transporation is extremely costly unless through a pipeline grid. Thus the downstream units are essential to the success of the COPESUL project. Ideally, offtake agreements between COPESUL and the seven already approved Downstream units would be required. Because of the difficulty of defining long-range prices in Brazil, and because of the early stage and later schedule of most Downstream projects (para)

it would seem unreasonable to expect that off-take contracts could

and should be finalized until sometime b efore the beginning of commercial operations by early 1982. An informal agreement between COPESUL, the already approved downstream companies, BNDE, PETROQUISA, PETROBRAS, FIBASE and the authorities in charge of infrastructure has been drafted by COPESUL and is due for signing. It details each entity's role and commitment to the successful and timely implementation of the Complex. PETROQUISA, as a common shareholder in COPESUL and

and directly or indirectly in the downstream companies, will also play an appreciable role in monitoring the respective project schedules and assuring timely and adequate contracual arrangements between them. Finally, the good profitability expected for the already approved downstream units and the number of groups competing for Government approval (four or average per approved unit) seems to assure that the respective downstream projects will materialize; since these projects cannot be supplied with ethylene or propylene from outside the Complex, the likelihood of COPESUL experiencing difficulties in disposing of its output is limited. We do not propose, therefore, to make the completion of formal off-take contracts between COPESUL and those downstream units which are already approved a condition to the World Bank loan, but rather to rely on the general Government assurances regarding the timely provision of funds to all the projects included in the Complex (mentioned under para _____).

Market for Petrochemicals and Pricing

35. As mentioned above (para), the Bank's econometric market forecast,based on conservative assumptions,show a potential demand for petrochemicals sufficient to justify the scope and timing of the COPESUL project and in general the Third Complex. However, the degree to which any such forecast is likely to materialize depends critically on the future prices of petrochemicals compared to

such competing products as glass, paper, steel, lumber, aluminium, etc. The present pricing policy of having each petrochemical unit's prices based on its actual cost structure (even if this entails different prices between different producers) as implemented by the Ministry of Finance's CIP (Price Council), is adequate in the present situation where basically only one petrochemical complex is in operation, and where demand by far outstrips the domestic supply capabilities. With the commissioning of the Balia Complex in mid-1978 and later of Third Complex, both of which have costs much higher than the existing Sao Paulo Complex, the entire petrochemical pricing philosophy will have to be rethought. A task force is planned to start working on this in October and the Government is aware of the complex and urgency of the problem. We propose that the Bank be kept informed, possibly through the Ministry of Finance of the progress of the task-force's work on pricing, that we be consulted on the scope and terms-of-reference of such studies. In particular, we recommend that we reach agreement with the Government to include the initial issues of market development in the terms of reference of the task force and that agreement be obtained as to the completion of the work by December 1979.

Don Brown, Jean-Francois Rischard and Ramon Beteta September 2, 1977

Harinder S. Kohli, Acting Chief, IPD2

BRAZIL-COPESUL Petrochemical Project
Appraisal Mission
Terms-of-Reference

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1. On or about September 12, 1977, you will arrive in Brazil to complete the appraisal of the COPESUL Petrochemical Project. The mission is expected to take about two weeks.

2. Mr. Brown will be the mission chief and will also be responsible for the technical, procurement and organizational aspects of the project. Mr. Rischard will be responsible for all other aspects. He will be assisted in this task by Mr. Beteta.

3. The mission should critically review all aspects of the project to complete the appraisal. In particular you should:

(a) review the project scope and costs and the revised financing plan with COPESUL

(b) determine the maximum efficient use of the available French credit line, the amount of financing likely to be required from IDB for the boiler system, and then ascertain the amount of the financing suitable for Bank consideration and ICB procurement

(c) clarify all procurement procedures to be used for ICB with particular emphasis on early procurement action for several long delivery items, so as to facilitate efficient project implementation

(d) review the equipment list to determine local supply capabilities for the items reserved for local procurement

(e) determine the pricing system to be used for sales of the products to the several downstream plants. Since actual prices may not be determined for some time yet, you should review the pricing arrangements made for COPESUL's sister project COPENE nearing completion in Bahia

(f) prepare financial projections for COPESUL and complete the financial and economic return calculations

(g) review the status of all the downstream plants to determine their costs, schedule and financing plans. Subject to sufficient cost data being available, you should make an economic analysis of the entire petrochemical complex.

(h) review future commercial arrangements between COPESUL and the downstream companies

(i) discuss with BNDE the financing requirements for the several companies involved in the complex, to determine if overall financing for the complex will be timely available

(j) meet with government officials to determine the status of, and financing arrangements for the required infrastructure projects, including ports and sewage treatment facilities

(k) review all organization, management and training arrangements for both implementation and operation of the project

4. Upon your return to Washington you should prepare the issues paper, which will be followed by the draft appraisal report.

cc and cleared with: Messrs. Mirza and Nayar

cc: Messrs. van der Tak (5), Fuchs, Dewey, Walstedt, Perram, Cash, Kohli, Soncini
van der Meer, Glaessner, Skillings, (Region)
Buhler/Rigo (Legal)
Mole (Controllers)
Gordon (DFC)
McClure, Plan, Andrews, Azevedo, Ruisanchez (IFC)
Brown, Evans, Pratt, Tortorelli, Tarnawiecki

J-F Rischard:des

Chrono

Mr. Harinder S. Kohli | August 31, 1977

Jean Francois Rischard

Brazil-COPESUL Petrochemical Prãject
<u>Summary of Conclusions Reached During the August 23-25 Meetings Between COPESUL, IDB and IBRD</u>

1. This memo briefly records major understandings and conclusions reached during August 23-25 meetings between COPESUL, IDB AND IBRD. The meetings were attended by Messrs. Guttmann and Molinos (COPESUL: Stempel, Montez, Newberg, Sanchez and Valencia (IDB); and Mirza, Brown, Kohli and Rischard (IBRD). The COPESUL delegation also met with Mr. Dewey on the last day of the meetings.

Revised Financing Plan

2. Based on revised capital cost estimates worked out during the meetings (Annex 1) and related foreign exchange needs of US $275 million equivalent, the foreign exchange gap, which COPESUL would like IBRD AND IDB to finance, is now estimated at between US $210 to 230 million depending on how much of the credit line extended by the French is used (Annex 2).

3. Total disbursement possibilities for IBRD and IDB correspondingly vary between US $175 and 195 million assuming both can finance interest during construction (Annex 3). Since OOPESUL is a newly established company, depending entirely on outside sources of financing until it starts operations by 1982, and since foreign exchange constraints could cause extremely costly delays both for the project itself and the entire complex which depends on it, it would appear desirable to pick up interest during construction on the Bank loan. A decision in this regard will be obtained by LAC II. IDB has informed us that it plans to finance interest during construction on its loan.

Parallel Financing Arrangements

4. IDB informed COPESUL and the Bank that it wishes to focus its financing on the coal boilers of COPESUL's steam generation plant. On this basis, the IDB loan would probably amount to about US $90-100 million including interest during construction. The boilers have a long delivery time and involve substantial advance contracting. Since retroactive financing of such items does not present a problem to IDB, this approach was considered satisfactory by all those concernedd

5. IBRD would consider financing the ethylene plant's process equipment and materials open for ICB and possibly parts of the boiler systems not financed by IDB, e.g. the electrostatic filters costing US $10-13 million. Assuming a loan amount of US $95 million for IDB, and based on the range of

figures mentioned under paragraph 3 above, the IBRD loan would amount to between US $80 and 100 million, depending on the amount withdrawn on the French credit line. In determining the final loan amount, IBRD will take into consideration the desirability of making maximum use of the French credit line provided no unduly high penalties in terms of equipment cost and/or performance result. The appraisal mission will review this issue accordingly.

Further Timetable and Recommendation

6. An appraisal mission is scheduled for September 12, 1977 after COPESUL has agreed that all information needed by the mission will be available at that time. For this purpose, we reviewed the status of, and expanded the content of a detailed list of information needs already submitted to COPESUL earlier this month. Because of staff constraints IDB will not be able to participate in this mission, but will try to have a member of its Rio office to join the IBRD team in the field.

7. It is recommended that the Bank launch the appraisal mission as agreed and thereafter proceed as rapidly as possible with the processing of the project to avoid creating problems of advance contracting and retroactive financing on items considered for Bank financing. We should aim at Board presentation by March/April 1978.

cc and cleared with: Mr. Mirza

cc: Messrs. van der Tak (5), Fuchs, Dewey, Walstedt, Perram, Cash, Nayar, Kohli, Soncini
van der Meer, Glaessner, Skillings, (Region)
Buhler/Rigo (Legal)
Mole (Controllers)
Gordon (DFC)
McClure, Plant, Andrews, Azevedo, Ruisanchez (IFC)
Brown, Evans, Pratt, Tortorelli, Tarnawiecki

J-F Rischard:des

FORM NO. 27-OCR (5-77) WORLD BANK OUTGOING MESSAGE FORM (Telegram, Cable, Telex)

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Telex No.: Originators Ext. 6802 RISCHARD

START HERE TO: MR MIHAI DIAMANDOPOL, PRESIDENT

CITY/COUNTRY: BANCA DE INVESTITII, 4, STRADA DOAMNEI

MESSAGE NO.: BUCHAREST, ROMANIA

ALPHA: WE THANK YOU FOR YOUR TELEX OF AUGUST 19 AND ARE PARTICULARLY PLEASED TO NOTE THAT OUR SUGGESTIONS FOR IMPROVING THE ECONOMIC RETURN TO ROMANIA OF THE CRAIOVA PROJECT HAVE BEEN CAREFULLY REVIEWED AND TAKEN INTO ACCOUNT. BETA: TO FACILITATE FURTHER BANK CONSIDERATION OF THE PROJECT, WE WOULD APPRECIATE SOME CLARIFICATIONS ON THE FOLLOWING POINTS MENTIONED IN YOUR TELEX: AAA: CAPITAL COSTS. INDEPENDENTLY OF THE PROPOSED CHANGES IN PROJECT DESIGN, THE PROJECT'S CAPITAL COST ESTIMATE HAS BEEN REDUCED BY 400 MILLION LEI. HOW AND IN WHICH CATEGORIES OF INVESTMENT COSTS IS THIS REDUCTION LIKELY TO BE ACHIEVED? BBB: CHANGES IN PROJECT PROFILE. WITH REGARD TO THE POLYVINYL ALCOHOL AND BUTYL ACETATE PLANTS, PLEASE ADVISE IF THESE PLANTS HAVE ONLY BEEN TAKEN OUT OF THE PROJECT TO BE FINANCED BY THE BANK, OR IF THEY HAVE BEEN DROPPED TOTALLY FROM PLANS OF MINISTRY OF CHEMICAL INDUSTRIES. WE WOULD ALSO LIKE TO DRAW YOUR ATTENTION TO FOOTNOTE ONE ON PAGE FOUR OF THE ECONOMIC ANALYSIS REPORT COMMUNICATED TO YOU ON JULY 14 WHICH INDICATES THAT THE BUTYL

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DRAFTED BY: Jean-Francois Rischard

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Telex No.: — Originators Ext. 6802 RISCHARD

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MR MIHAI DIAMANDOPOL, PRESIDENT
BANCA DE INVESTITII, 4, STRADA DOAMNEI
BUCHAREST, ROMANIA

ALPHA: WE THANK YOU FOR YOUR TELEX OF AUGUST 19 AND ARE PARTICULARLY PLEASED TO NOTE THAT OUR SUGGESTIONS FOR IMPROVING THE ECONOMIC RETURN TO ROMANIA OF THE CRAIOVA PROJECT HAVE BEEN CAREFULLY REVIEWED AND TAKEN INTO ACCOUNT. BETA: TO FACILITATE FURTHER BANK CONSIDERATION OF THE PROJECT, WE WOULD APPRECIATE SOME CLARIFICATIONS ON THE FOLLOWING POINTS MENTIONED IN YOUR TELEX: AAA: CAPITAL COSTS. INDEPENDENTLY OF THE PROPOSED CHANGES IN PROJECT DESIGN, THE PROJECT'S CAPITAL COST ESTIMATE HAS BEEN REDUCED BY 400 MILLION LEI. HOW AND IN WHICH CATEGORIES OF INVESTMENT COSTS IS THIS REDUCTION LIKELY TO BE ACHIEVED? BBB: CHANGES IN PROJECT PROFILE. WITH REGARD TO THE POLYVINYL ALCOHOL AND BUTYL ACETATE PLANTS, PLEASE ADVISE IF THESE PLANTS HAVE ONLY BEEN TAKEN OUT OF THE PROJECT TO BE FINANCED BY THE BANK, OR IF THEY HAVE BEEN DROPPED TOTALLY FROM PLANS OF MINISTRY OF CHEMICAL INDUSTRIES. WE WOULD ALSO LIKE TO DRAW YOUR ATTENTION TO FOOTNOTE ONE ON PAGE FOUR OF THE ECONOMIC ANALYSIS REPORT COMMUNICATED TO YOU ON JULY 14, WHICH INDICATES THAT THE BUTYL

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Withdrawn by	Date
Sherrine M. Thompson	August 22, 2019

WORLD BANK / INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Mr. Harinder S. Kohli, Acting Chief, IPDD2 DATE: August 19, 1977

FROM: Jean-Francois Rischard, IPDD2

SUBJECT: BRAZIL: COPESUL Petrochemical Project
Preparation Mission
Back-to-Office and Full Report

A. INTRODUCTION

1. Following terms-of-reference dated July 15, 1977, I visited Brazil from July 18 to August 10 to (i) review the market prospects for the products of the proposed Third Petrochemical Complex, of which the COPESUL raw material and utilities center will form the core, and (ii) to discuss several outstanding issues with the COPESUL staff and prepare the project's appraisal tentatively planned for September/October.

2. In connection with the market review, I accompanied Mr. Bastl, a Bank consultant, for about a dozen plant visits in the three Southern States of Rio Grande do Sul (which will host the Complex), Parana and St. Catharina. While in the South, I also contacted the authorities responsible for the investments in the infrastructure related to the Complex. I spent the remainder of my time with COPESUL management in Rio to discuss project-related issues, as well as talking to a number of plastic manufacturers there. A list of persons met is given in Annex 1. Annex 2 contains a list of acronyms and a short description of entities involved in Brazil's petrochemical industry.

B. MARKET REVIEW

Preliminary Findings of the Mission

3. Following recommendations made by the Identification Mission in February of this year, it was decided that the Bank's market review would aim primarily at (i) analyzing the pattern and future trends of end-uses for the types of plastics and rubber 1/ to be produced by the seven downstream (second generation) units of the Complex; and (ii) assessing the ability of the plastic and rubber transformation (or third generation) industries to develop their activities around these second generation units. This review involved a large number of field interviews with third generation transformation industries and existing second generation producers in the south as well as in Rio and Sao Paulo. The Bank's consultant has returned from the field this week and will submit a full report by mid-September; only the mission's preliminary impressions are summarized below.

4. The Brazilian petrochemical (and primarily plastic) transformation industries are currently in a state of weakness, with capacity utilization ranging from 30 to 70%, with an average of 50-60%. This is partly due, as in many other industries, to temporary conditions of depressed demand following deflationary measures taken by the Government. More important, though, is the chronic repressed demand effect which afflicts the industry due to constant shortages in the domestic

---

1/ low-density and high-density polyethylene (LDPE and HDPE); polyvinyl chloride (PVC); polystyrene (PS); polypropylene (PP); and styrene-butadiene rubber (SBR) supply of plastics. Because of these shortages, the full demand could only be met by processing more imported plastics, but the import penalties, including taxes and a costly import deposit, are such (up to 150-200% for certain plastics)[1] that low capacity utilization emerges as the financially least damageable alternative, leaving a large element of latent demand unsatisfied. In a qualitative sense, this also implies that the demand for plastic products in many potential uses has not been as effectively developed in the recent past as would appear possible. However, with the commissioning of the Second Complex in Bahia in 1978/79 and the resulting temporary elimination of the shortage of domestic supply of plastic, the margins of the existing transformers will be leveraged up from their present depressed levels to levels which are likely to revive the industry's prospects and restore its cash generating potential in time for it to meet new investment requirements in connection with the commissioning of the Third Complex in 1981/82. In parallel, the restored ability of the industry to develop demand in a variety of uses is also likely to bear fruit around this time.

5. Besides these general considerations, there are a variety of specific points which lead the mission to a rather optimistic view with regard to the ability of the transformation industry to provide a market for the products of the Third Complex. Briefly, the major ones are that (i) a large part of the growth in demand for plastics should be expected to originate in the agriculturally well endowed South, mainly in such uses as LDPE and PP heavy duty and general purpose bags for agricultural and agro-industry uses and in certain high-potential areas such as mulching film and canal linings (ii) transformers located in the South will benefit - particularly compared with those around the Bahia Complex - from the closeness of the Center-South market[2] as well as of foreign markets in Argentina, Paraguay and Uruguay (iii) entrepeneurship and capital appear to be more readily available in the South; furthermore, the Rio Grande do Sul State has already initiated a sound skilled manpower training program, and (iv) the definite commitment of a Taiwanese group to relocate part of its transformation activities to Brazil, around the Complex, while investing in the PVC and PP downstream units, insures the off-take, and local processing, of at least two of the major products; a number of existing major transformation industries have also made plans for expansion and product line development in the South.

Market Forecast and Timing of the Project

6. Since the Identification Mission issued its report, IDB has prepared a revised statistical forecast of the ethylene demand in Brazil in connection with a "technology transfer project" which in effect will finance COPESUL's foreign engineering costs. This forecast is based on Brazilian time series data rather than international cross-sectional data for per capita income and plastics consumption, as had been used in the Brazilian Petroleum Institute forecast reviewed by the Identification Mission.

1/ Not to mention the frequent unavailability-at any price- of funds to finance the import deposits

2/ IDB has performed an interesting analysis of the economics of locating the Complex in the South, showing that the project's handicap in terms of added transportation costs is minimal, while avoiding additional congestion and pollution in the Sao Paulo area. See also February Identification Mission Report.

The IDB forecast comes out more conservative than the latter but still shows that the timing of COPESUL and of the Complex is adequate, assuming commissioning in 1981. Since the mission believes, after discussions with COPESUL, that the project's schedule will be extended by one year so as to be commissioned only around early 1982, the questions raised by the Identification Mission with respect to market timing can be considered as satisfactorily resolved.

7. Both of the above mentioned forecasts share the common feature of applying a curve (linking the per capita consumption of the thermoplastics to per capita income) to Brazil's projected average per capita income. Since there appears to be a strong differentiation among Brazil's unequally developed regions with respect to plastics consumption patterns and growth prospects, it might be worthwhile to prepare a final market forecast based on applying an international cross-section curve to per capita income projections by region. We will attempt to develop such a forecast during the coming month, if time and resources permit; this forecast is expected to confirm earlier findings by IDB, while also providing us with a better picture with regard to potential demand in the Southern Region. This analysis ought to be available in time for incorporation in the appraisal report.

C. PROJECT RELATED ISSUES

Project Scope and Capital Costs

8. COPESUL has now worked out with the selected engineering firm, Technip of France, the new capacity specifications for the raw materials plant. They compare as follows with the originally envisaged capacity, in tons per year (TYP):

	ORIGINAL DESIGN		PRESENT DESIGN			
			Medium Severity		High Severity	
Outputs:	TYP	%	TYP	%	TPY	%
Ethylene	350,000	38	420,000	33	471,640	38
Propylene	120,000	13	120,000	10	120,000	10
Butadiene	45,210	5	66,470	5	67,920	6
Benzene	107,440	11	115,440	9	150,420	12
Xylenes	32,150	3	25,400	2	28,470	2
Toluene	-		18,640	2	22,310	2
Residue	72,450	8	51,020	4	83,890	7
LPG	88,570	9	210,960	17	130,740	11
Pyrolysis Gasoline	123,810	13	231,090	18	148,030	12
Sub-total	939,630	100	1,259,020	100	1,223,420	100
Inputs:						
Naphtha	1,050,500		1,499,840		1,499,840	
Refinery Gas	67,000		-		-	
LPG	62,000		-		-	

To achieve higher capacity and flexibility, two furnaces and one compressor were added to the original design. Under the new design, the ethylene capacity can vary from 420,000 to 470,000 TPY according to the degree of cracking severity with little change in operating costs, and a reduction in the output of lower value products such as LPG and pyrolysis gasoline as the degree of severity increases. The seven downstream units are designed to absorb only about 400,000 TPY of ethylene at full capacity operations; additional ethylene could be shipped by cryogenic vessels loaded on barges to the Sao Paulo area which is likely to experience shortages of this basic raw material in the 1980's. This design flexibility appears reasonable.

9. The steam generating capacity of COPESUL's utility center, which will also supply the downstream units, has not been changed, but the Government has instructed COPESUL to switch from oil boilers to coal boilers. Coal is available from a nearby mine, the galleries of which reach under the site; a shaft could be opened in the future on the site. This coal has a low sulphur content but has a 50% ash content which renders its shipping over large distances uneconomical. The coal boilers, (three 280 TPH units) will cost

about US$40 million more than the originally envisaged oil boilers but the mission's preliminary analysis shows that this is likely to be largely offset by savings in fuel costs.[1/] The total cost of the boiler system including coal preparation facilities, estimated by COPESUL at US$84 million, is high and warrants further analysis.[2/]

10. Revised capital costs and foreign exchange needs are shown in the following table:

BRAZIL-COPESUL Petrochemical Project, Revised Capital Cost Estimate in US $ Million and at mid-1977 prices a/

	Direct Foreign Exchange Costs	Indirect For. Exch.Costs	Local Curr. Costs	TOTAL COSTS
Project Preparation	-	-	0.1	0.1
Incorporation & Administration	-	-	32.3	32.3
Land and Site Improvements	-	-	20.3	20.3
Civil Works and Buildings	-	-	52.7	52.7
Licenses & Know-How	2.9	-	-	2.9
Engineering				
Basic	6.2	-	-	6.2
Detail	10.0	-	17.3	27.3
Equipment & Materials				
Reserved to Braz.Suppliers b/	-	19.6	116.9	136.5
Open for ICB	109.5	3.9	23.3	131.7
Out of which:				
Likely to be Won by Loc.suppl.	(-)	(3.9)	(23.3)	(27.2)
" " " " by For.suppliers	(104.5)	(-)	(-)	(104.5)
Insurance & Freight c/	5.3	1.2	13.4	19.9
Tools and Supplies	-	-	4.6	4.6
Erection	-	-	89.4	89.4
Pre-operating Costs	4.3	-	9.9	14.2
Basic Cost Estimate (BCE)	133.2	24.7	380.2	538.1
Physical Contingencies d/	13.3	2.5	36.0	51.8
Price Contingencies e/	26.7	5.0	75.7	107.4
Installed Costs	173.2	32.2	491.9	697.3
Working Capital, with contingencies	-	-	50.1	50.1
Total Project Cost	173.2	32.2	542.0	747.4
Interest During Construction	42.4	-	33.6	76.0
Total Financing Required	215.6	32.2	575.6	823.4

a/ July 1977 exchange rate of Cr.$14.35 = US$1.0 was used
b / Based on 50/50 reserve/ICB split currently considered
c/ 5% of FOB price for locally procured items and 10% for foreign purchases
d/ 10% on all except land and site improvements
e/ 8% for 1977/78, 7.5% for 1978/79 and 7% thereafter. Excess of local inflation over general foreign inflation deemed offset b y changes in the exchange rate.

1/ The indifference point is reached at $10 per ton of coal; the price charged to COPESUL is $8 per ton.

2/ Early bidding should also be considered for this and other reasons mentioned under paragraph 19.

11. Total financing required amount to about US$820 million, out of which about US$250 million equivalent is in foreign exchange. Previous estimates prepared by the Identification Mission in February were of US$640 million and US$150 million respectively. A very approximative explanation of the variance of US $180 million in total financing is given below:

	US $ million
Change in scope/design	
Two additional furnaces	+ 7
Change from one to two compressors	+ 7
Coal Boilers Instead of Oil Boilers	+40
Cryogenic Facilities in Port	+ 6
Sub-total	+60
Additional Interest during Construction (IDC) Due to Extension of Project Schedule from 4 to 5 years and Higher Financing Needs	+35
Other, Including Escalation due to Later Start of Construction and Revision of Estimates Based on Technip Work (Net)	+85
Total Variance	+180

12. The revised estimate for foreign exchange needs of about US $250 million is based on a 50/50 split for equipment and materials between equipment reserved to local suppliers and equipment open to ICB (paras. 21-22) and on the additional assumptions (i) that the Brazilians would win about 20% of ICB and (ii) that indirect foreign exchange needs will amount to 15% of the cost of local equipment. The latter percentage was worked out with COPESUL but would seem low compared with other projects in Brazil. If a higher percentage were used, e.g. 25%, total foreign exchange needs would increase by about US$20 million. Escalation on imported items has been assumed at 8, 7.5 and 7 percent for 1977/78, 1978/79 and 1979/80 and thereafter respectively.

13. It is recommended that the Bank review with COPESUL staff (possibly already at the meeting proposed under para 20) the cost estimates for the major project components in order to get a better view on the accuracy of these estimates. Further analysis is also required to refine the estimate of indirect foreign exchange needs, and clarifications should be sought from Bank management so as to determine whether indirect foreign exchange needs for reserved items are to be considered in determining the size of the IBRD loan.

Financing Needs and Sources

14. A summary of the amounts and terms of the major sources of financing is contained in Annex 3. Local currency financing, available from BNDE for US $200 million equivalent based on a December 1976 contract, does not appear to be sufficient, nor are the loan's short terms (9.5 years of repayment including 4 years of grace) satisfactory. COPESUL staff assured that these terms would be renegotiated since they had been concluded before the possibility of IBRD/IDB financing had been known.

15. Foreign exchange needs can be covered by (i) a credit line of up to US $80 million equivalent extended by a syndicate of French Banks led by Credit Lyonnais (ii) a Eurocurrency loan of up to US $18 million equivalent (iii) IDB financing of about US $18 million for engineering only, earmarked from an earlier project (para 6); (iv) IBRD and additional IDB financing and (v) purchase of foreign exchange from the Central Bank to cover interest during construction on the French credit line, the Eurocurrency loan, and the part of such interests on IBRD/IDB financing not picked up by those agencies themselves.

16. Based on total foreign exchange needs of about US $250 million (para 12), the following breakdown among financing sources could be envisaged, depending on how much of the French credit line and of the concommitant Eurocurrency loan is used (for the latter, it was assumed below that an amount equivalent to 15% of the amount of the credit line used would be withdrawn, which amounts to using it to finance downpayments on items financed through the credit line):

Alternative Foreign Exchange Financing Schemes

(in US $ Million)

	Case 1	Case 2	Case 3	Case 4
Foreign Exchange Needs (from table under Paragraph 10-figures rounded.)				
Direct Foreign Exchange	173	173	173	173
Indirect Foreign Exchange	32	32	32	32
Interest During Construction	42	42	42	42
	248	248	248	248
Foreign Exchange Sources				
IDB Technology Transfer Project (earmarked for foreign engineering costs)	18	18	18	18
Line of Credit from French Banks	22[a]	40	60	80
Deduct: COFACE guarantee fee of 5.4%	(1)	(2)	(3)	(4)
Eurocurrency Financing from French Banks[b]	5	6	9	12
Financing of IDC through Purchases of Foreign Exchange from Central Bank	42	42	42	42
IBRD/IDB (residual)	162	144	122	100
Disbursement Possibilities				
Financing Theoretically Available from External Sources Based on Above Data (Excluding Resources Earmarked for Engineering and IDC)	188	188	188	188
Less: Equipment and Materials open to ICB[c]	177	177	177	177
Shortfall of Disbursement Possibilities Under ICB for Equipment and Materials Against External Financing Theoretically Available	11	11	11	11

a / US $22 million is the minimum amount which should be used in order to secure the best possible payment terms; see Annex 3.

b / Minimum amount is US $5 million equivalent

c/ From table under paragraph 10 and including relevant physical and price contingencies and foreign component of freight on imported items

17. No matter what situation applies with regard to the French line of credit, it appears that the total foreign exchange financing theoretically available from external sources would exceed disbursement possibilities by about US $11 million. Two ways are open to deal with this problem: (i) the Brazilians could choose not to use the Eurocurrency loan - whose terms are the least favorable among the available financing sources - to finance downpayments on items financed by the French credit line, asking IBRD/IDB to consider financing these (ii) IBRD/IDB could pick up all or part of the interests during construction on the amount financed by them, or possibly part of the local engineering costs.

18. As for the amount to be financed by IBRD/IDB, it would vary between US $100 and 162 million according to how much of the French credit line is used, or between US $112 and 167 million, if the Eurocurrency loan is not used. It is in the country's interest to maximize the use of the line of credit whose terms are relatively favorable (8.6% interest including guarantee fee, maximum of 14 years of repayment including 4 years of grace) provided this does not entail unduly high penalties in terms of increased equipment prices and/or lower performance. How this is to be achieved remains to be discussed. COPESUL staff is of the opinion that the French might win US $40 million worth of equipment and materials under ICB; but this sort of forecast is surrounded by a large degree of uncertainty, mainly considering the large size of certain packages (para 19). This would leave US $142 million for IBRD/IDB financing but would imply that items won by French suppliers under ICB be postallocated to the credit line.[1/]

Reportedly, IDB would have some difficulty in accepting the possibility of postallocation on its own loan on the grounds that this would force COPESUL to pay a commitment fee on an amount larger than the actual amount withdrawn in the end. (On the other hand, IDB has similar misgivings as IBRD about not using available buyers' credit assuming it is available under favorable terms and without any major equipment cost or performance penalties.) If IDB does not accept postallocating, and if IBRD is prepared to do so, parallel financing would become necessary, which in any case is considered the preferred method of co-financing by the Department.

19. However, whatever the solution adopted in principle with regard to the various questions - post-allocation, joint or parallel financing between IBRD and IDB - there is an important practical complicating factor in the unusually large size and lumpiness of certain items in principle destined for procurement under ICB. The three identical coal boiler systems for instance, are worth a total of about US $75 million.[2/] The size of this sort of package, which is impractical to break up, could make post-allocation very difficult, even more so if IBRD were to be the only agency to accept post-allocation. It might be desirable to discuss the alternative of early bids on the boilers to resolve this crucial factor of uncertainty. This approach is technically feasible and would give the Bank and IDB an opportunity

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1/ Which finances 85% of the equipment cost; as mentioned above, IBRD/IDB might consider the possibility of picking up the 15% downpayments.

2 / This is for the ICB package(s); an additional US $8 million is reserved.

to know the results of this ICB before negotiations; however, this might also entail possible advance contracting.

20. In view of the complexity of these questions and the need to avoid further costly delays for COPESUL, it is suggested that a meeting be held in Washington between IDB, IBRD and COPESUL Staff. August 23rd has been suggested as the date for the start of the meeting, and two COPESUL directors have accepted to come to Washington for that date.

Status of Local Reserve List Decision

21. A 50/50 local reserve/ICB list has been prepared by COPESUL and submitted to the Bank. The cable sent by SUBIN to the Bank confirming the Government's decision to aim at a 50/50 split had not yet been conveyed by the Ministry of Finance to CACEX when I left Brazil. I was told that the Ministry waited for Mr. Skilling's visit to Brazil before doing so. Apparently, the concept of a 50/50 list was cleared by Mr. Belotti, PETROQUISA'S president, with four Ministers (Finance, Planning, Energy, Industry and Commerce). The acceptability of a 50/50 split to the Brazilian manufacturers' associations has not yet been tested, however. It is reported that some manufacturers have recently commissioned significant capacity additions. COPESUL staff has started consultations with CACEX and the National Manufacturers' Association and should have the first reactions before coming to the meeting in Washington.

22. In order to maximize the chances for securing a final decision on the 50/50 split without too much opposition from manufacturers, we discussed a fallback position during the mission, which consists in distinguishing within the COPESUL project between two major components: (i) the raw materials plant and (ii) the utility center, which also produces steam for the downstream units.[1/] The raw materials plant project could be presented to CACEX under a 67/33 local reserve/ICB split, which should be acceptable to the manufacturers. The utility center project would not follow the usual CACEX procedure (involving the manufacturers' opinion on the split) but could be placed under Portaria #6, which extends the same advantages to COPESUL in terms of tax exemptions and incentives under the following conditions: (i) financing is available with at least a 15 years repayment period (ii) all the equipment and materials under the project are procured through ICB. The manufacturers' opinion is not required under the procedure. The above distinction between the raw materials and utility plants would only apply internally but would not affect the Bank's ability of viewing the COPESUL project as a single project with a 50/50 local reserve/ICB split. We propose to further discuss this issue at the August 23d meeting with COPESUL.

1/ The raw materials plant component would represent 56% and the utility center 44% of the total equipment and materials costs.

Status and Timing of COPESUL and Downstream Units

23. COPESUL became a Sociedade Anonima during July and its capital was increased for the first time from Cr $10 million to Cr $800 million. Technip's contract was signed in April and it has started the engineering work but needs to know in the near future the final specifications of some time-critical items such as the compressors. It is therefore suggested that an agreement on accelerated procurement procedures to be followed for these items be sought between IBRD and IDB during the above mentioned meeting.

24. The project schedule now envisages commissioning at the end of 1981 or early in 1982. The downstream units are on a somewhat later schedule, due to their shorter construction time, and two out of the seven have not yet been formally awarded by CDI (the PS and PP units, although the decision for the latter has informally been taken.[1/])

25. COPESUL does not intend to conclude off-take contracts with the downstream units before several years. It appears, however, that these units are committed through the CDI certificate to implement their respective projects under a deadline. COPESUL's management has drafted an informal agreement between all the parties involved in the Complex (COPESUL, the seven downstream units, BNDE, PETROBRAS, PETROQUISA, CONPETRO, CDI, FIBASE) and is seeking their participation in that agreement, designed to further formalize the commitment of each entity and assure full coordination.

26. The Bank should consider whether the above agreements and the CDI certificate, which do not specify penalties or recourses in case a downstream unit does not live up to its obligations, provide sufficient assurances for a timely off-take of the project's production, or whether special covenants should be considered. It should be kept in mind that assured off-take would however only lower the degree of risk surrounding COPESUL's financial return and debt servicing ability, while increasing it for the downstream units; the risk surrounding the economic return of the Complex as a whole would basically remain the same.

1 / The expected capacities for the seven downstream units are now as follows:

	Tons per Year
LDPE	
Plant I	100,000
Plant II	115,000
HDPE	60,000
MVG/PVC	240,000
Styrene/PS	100,000/80,000 or possibly 10% more
SBR	80,000

Economic Analysis

27. Although the increase in total financing required appears considerable, much of this increase does not really affect the economic return calculation, since part of the change is due to a difference in the price basis, and additional interest during construction. Furthermore, the benefits of increased capacity and of switching to cheaper coal fuel offset to a large extent, although not entirely, the remaining part of the increase as shown by the revised - but still preliminary - economic returns, which compare as follows to the Identification Mission's prior estimate (details in Annex 4)

	Economic Return (Percentage)
Identification Mission Estimate	15.0%
Revised Estimate	
Medium Severity	12.9%
High Severity	14.2%

28. Revised economic prices were used for most of the outputs based on long-range prices forecasts from a major consulting firm and other sources. As mentioned by the Identification Mission, relevant economic prices are nevertheless difficult to determine for the main products such as ethylene and propylene since they are not commonly traded (due to high shipping costs) but rather used captively or sold over a pipeline grid. Ideally, one should therefore derive their relevant economic prices from an economic analysis of the entire complex, reaching up to the products of the downstream units. As it appears now, revised capital and operating cost estimates will not yet have been prepared for all the downstream units (which are on a somewhat later shcedule than COPESUL) by the time the appraisal mission visits Brazil; hence, we will not be able to perform this complex-wide calculation.

29. The mission does not feel, however, that this should constitute an obstacle to further consideration, provided we obtain more detailed information from one of the major consulting firms on the basis for their projections of transfer prices, so as to determine whether there is any reason to adjust these to reflect some factors specific to the Third Complex.

D. INFRASTRUCTURAL NEEDS FOR THE COMPLEX

30. CONPETRO in Porto Alegre is the entity in charge of organizing the financing and implementation of the investments in infrastructure for the Complex and the surrounding industrial zone of 13,000 ha, which include the following major items:

	US $ million[1/] (at 1977 prices)
Expropriations	30.8
Roads	34.9
Railways	7.3
Conduits to protect rainwater from contamination	7.3
Research Center	9.8
Sewerage	5.2
Sewerage treatment	104.5
Port facilities	34.8
Other	6.9
	241.5

31. The Secretary of Planning of the Rio Grande do Sul State assured that financing was available for roads, railways and expropriations and that most of the expenditures for sewerage could be financed through BNH (Brazil's Bank for Housing and Construction). Additional financing will have to be sought, mainly for the port facilities. It is suggested that the Bank investigate whether this could be an area of interest for a separate project. The appraisal mission would, of course, have to review in detail the timely availability of necessary infrastructure for the Complex.

E. SUMMARY OF RECOMMENDATIONS AND FURTHER TIMETABLE

32. The following recommendations are made in this report:

(i) The major components of capital costs should be discussed with COPESUL to get a firmer view on the accuracy of present estimates; questions surrounding the amount of indirect foreign exchange needs, and their relevance in determining the amount of the loan will also have to be addressed (para 13)

(ii) A meeting should be held in Washington between IDB, IBRD, and COPESUL to solve the various questions raised with regard to co-financing and procurement (para 20). August 23 has been tentatively agreed as a date for that meeting.

(iii) The questions pertaining to the reserve list should also be addressed during that meeting, in the light of the first reactions obtained

1/ translated at July 1977 exchange rate of Cr. $14.35 = US $1.0

by COPESUL from CACEX (para 22)

(iv) The appropriateness of off-take agreements between COPESUL and the downstream units should be further reviewed by the Bank, along with the desirability and nature of possible covenants in that respect(para 26).

(v) The question of accelerated procurement procedures for time-critical items, and the boiler package, whose award will crucially affect the financing plan, should be discussed during the August 23rd meeting. (paras 19 and 23)

(vi) Detailed information should be obtained preferably by mid-September from a major consulting company to firm up our assessment of economic transfer prices for the project's outputs (para 29)

(vii) The Bank should consider whether it would have any interest in the financing of some of the infrastructure required for the large industrial zone to be established around the Complex, under a separate project (para 31)

33. Provided most of the above recommendations can be satisfactorily addressed during the suggested meeting and provided COPESUL is able to respect its deadline of September 15 for completing the revision of the feasibility study, which is already well advanced, the appraisal mission could be planned for mid-September.

cc: Messrs. van der Tak (5), Fuchs, Dewey, Walstedt, Perram, Cash, Nayar
Kohli, Soncini
van der Meer, Glaessner, Skillings, Mirza (Region)
Buhler/Rigo (Legal)
Mole (Controllers)
Gordon (DFC)
McClure, Plant, Andrews, Azevedo, Ruisanchez (IFC)
Brown, Evans, Pratt, Tortorelli, Tarnawiecki

J-FRischard:des

COPESUL PETROCHEMICAL PROJECT

LIST OF PERSONS MET BY THE MISSION

COPESUL (Rio)

Mr. Carlos Guttmann, Financial Director
Mr. Jose Molinos, Technical Director
Mr. Percy de Abreu, General Manager
Mr. Paulo Gomide, Assistant Financial Director
Mr. Paulo Tessarolo, Planning
Mr. Manuel Lopez, Organization and Methods
Mr. Francisco Melo (Porto Alegre)

PETROQUISA (Rio)

Mr. Clemente Wagner, Head of Planning Department
Mr. Helio Camarotta, Assistant Director
Mr. Helio Cardoso, Assistant, Plannig

CONPERTO (Porto Alegre)

Mr. Maier Avruch, General Coordinator for the Third Complex
Mr. Edison Deffenti, Coordinator, Transformation Industries
Mr. Joao Feijo, Technical Assistant, Transformation Industries

POLITENO (Rio)

Mr. Paulo Lontra, General Manager
Mr. Mauro Guia, Financial Director

BNH (Rio)

Mr. Pinto de Oliveira, Head of Research
Mr. Nico Saceanu. Assistant

SUPERINTENDENCIA DA BORRACHA (RIO)

Mr. da Costa, Superintendent

PLASTIC TRANSFORMERS (Rio Grande Do Sul, Parana, St. Catharina)

FITESA (Mr. Liu)
PLASTISUL (Mr. Zabka)
USIPLA (Mr. Raul Wertheimer)
BRASHOLANDA (Mr. Arantes)
INPLASP (Mr. A. de Campos)
PLASTICOS DO PARANA (Mr. R. de Oliveira)
JAEGER & VENTORINI CIA (Mr. Ventorini)
SALTOS SCHMIDT (Mr. Arno Schmidt)
PROVIDENCIA (Mrs. Milan)
HANSEN (Mr. Muller)
TUPINIQUIM

SECRETARY OF PLANNING OF RIO GRANDE DO SUL

Mr. Miller, Secretary of Planning

SECRETARY OF AGRICULTURE OF RIO GRANDE DO SUL

Mr. Isaac Magrisso, General Coordinator

Industrial Projects Department
August 15, 1977

COPESUL PETROCHEMICAL PROJECT

LIST OF ORGANIZATIONS ASSOCIATED WITH THE BRAZILIAN PETROCHEMICAL INDUSTRY

CDI — CONSELHO de DESENVOLVIMENTO INDUSTRIAL
Council for Industrial Development
Established under Ministry of Industry and Commerce in 1964 by Decree 53989.

CNP — CONSELHO NATIONAL de PETROLEO
National Council of Petroleum

GEIQUIM — GRUPO EXECUTIVO da INDUSTRIA QUIMICA
Executive Group for the Chemical Industry
Created in 1964 by Decree No. 53975/64 to act along with CDI to plan and develop the chemical, petrochemical, pharmaceutical and fertilizer industries.

PETROBRAS — PETROLEO BRASILIERO S.A.
Brazilian Petroleum Corporation
Created by Law No. 2004/53.

COPEB — CONJUNTO PETROQUIMICO da BAHIA
Petrochemical Complex of Bahia
An ammonia/urea petrochemical works established in the mid-60s at Camacari by PETROBRAS using the natural gas reserves of Reconcavo Baiano.

PUSA — PETROQUIMICA UNIAO S.A.
A company established to build a basic petrochemical works at Sao Paulo owned by Refinaria Uniao, Moreira Sales, Ultra and Petroquisa (75%).

EBT — EMPRESA BRASILIERO de TETRAMERO
A company established to produce cumene and propylene tetramer within the Sao Paulo petrochemical center.

COPAMO — CONSORCIO PAULISTA de MONOMEROS
A company established to produce VCM within the Sao Paulo petrochemical center.

SUDENE — SUPERINTENDENCIA do DESENVOLVIMENTO do NORDESTE
Northeast Development Authority
A regional development agency established by the Federal Government under Decree No. 3692/59.

BNB — BANCO do NORDESTE do BRASIL
Created under Law No. 1049/52. Only able to make loans for projects referred by SUDENE as in interest of development of the Northeast.

BNDE	BANCO NATIONAL de DESENVOLVIMENTO ECONOMICO The National Bank for Economic Development
FIBASE	INSUMOS BASICOS S/A FINANCIAMENTO e PARTICIPACOES An affiliate of BNDE which takes participation in Brazilian company with the objective of selling later to private investors.
FAFER	FABRICA de FERTILIZANTES de CUBATAO Fertilizer Factory of Cubatao Ammonia/nitric acid/nitrocalcium works established in 1958 by PETROBRAS using residual gases from RPBC as feedstock.
CBE	COMPANHIA BRASILIERO de ESTIRENO Brazilian Styrene Company Established in 1958 to produce styrene from benzene and ethylene supplied by RPBC.
RHODIA	(Rhone-Poulenc Group) Company established in 1960 to produce isopropyl alcohol and acetone from propylene supplied by RPBC.
QUIMBRASL	QUIMICA INDUSTRIAL BRASILIERA (Brazilian Chemical Industry) Company established in early 60s at Cubatao to produce phenol.
REDUC	REFINERY DUQUE de CAXIAS The Duke of Caxias Refinery Refinery established in the early 60s.
FABOR	FABRICA de BORRACHA SINTETICA Synthetic Rubber Factory Works established by PETROBRAS in mid-60s which from 1972 produced synthetic rubber from styrene supplied by CBE.
PETROQUISA	PETROBRAS QUIMICA S.A. A wholly owned subsidiary of PETROBRAS established in 1968 under Decree No. 61981/67 to take over PETROBRAS' interests in the petrochemical industry and to undertake further investments inclusive of joint ventures with Brazilian and/or foreign interests.
IBP	INSTITUTO BRASILEIRO DE PETROLEO The Brazilian Institute of Petroleum
ESPIN	CONSULTORIA e ASSESSORIA Ltda "Consulting and Advising Limited" A consulting firm commissioned by IBP to draw up a plan for the development of the Brazilian petrochemical industry.

CPIBP COMISSAO PETROQUIMICA do IBP
Petrochemical Subcommittee of the Brasilia Institute of Petroleum

RPBC REFINARIA PRESIDENTE BERNARDES
President Bernades Refinery
Refinery constructed in the mid-50s at Cubatao in the State of Sao Paulo which supplied raw materials (ethylene extracted from refinery gas, aromatics, etc.) to earliest Brazilian petrochemical companies.

COPENE COMPANHIA PETROQUIMICA do NORDESTE LTDA
Northeast Petrochemical Company
A company established in 1972 as a wholly owned subsidiary of PETROQUISA to implement the Northeast Petrochemical Complex's raw materials center. Became public company in 1974, but 50% ownership remained with PETROQUISA.

RLAM REFINARIA LANDULPHO ALVES
Landulpho Alves Refinery
Refinery located 30 km from Camacari supplying naphtha, gas oil, fuel oil to Northeast Petrochemical Complex.

PETROFERTIL PETROBRAS FERTILIZANTES
A wholly owned subsidiary of PETROBRAS producing ammonia and urea within the Northeast Petrochemical Complex at Camacari.

ULTRAFERTIL Nitrogenous fertilizer plant set up as part of Sao Paulo petrochemical center.

IPEA INSTITUTO de PESQUISAS ECONOMICAS CAPLICADAS
The Institute of Economic and Applied Research
The Institute has studied future demand for petrochemicals in Brazil (early 80s).

II. PND II. PLANO NACIONAL de DESENVOLVIMENTO
Second National Development Plan published in September 1974.

REFAP REFINARIA de ALBERTO PASQUALINI
Alberto Pasqualini Refinery
The refinery supplying hydrocarbon feedstock to the Southern Petrochemical Center.

COPESUL COMPANHIA PETROQUIMICA do SUL Ltda
Southern Petrochemical Company Ltd
A company 51% owned by PETROQUISA and 49% by FIBASE established to implement the raw materials center forming the basis of the Southern Petrochemical Center.

COPESUL PETROCHEMICAL PROJECT

SUMMARY OF TERMS AND AMOUNTS OF DIFFERENT FINANCING SOURCES

1. BNDE (Signed December 1976)
   - U$200,000,000 equivalent in local currency
   - 6% interest
   - 20% maximum monetary correction
   - Repayments starting 06/15/1981
   - 22 quarterly installments

2. FRENCH CREDIT LINE
   (Negotiations completed, signing awaits shareholders' agreement)
   - Up to US$ 80 million equivalent
   - Syndicate led by Credit Lyonnais, includes BNP, Paribas, Worms, BFCE
   - Interest 7.5% (official interest rate for long-term export credits by France; can change over implementation period, with a consequent change in the average interest rate of the credit line; change is unlikely, though)
   - Guarantee fee to COFACE of 5.4% flat (amounts to an additional 1.1% a year)
   - 0.3% per annum commitment fee
   - 0.3% flat management fee
   - 12 years repayment including 4 years of grace if orders to French industry amount to US$ 20 million equivalent; 14 years including 4 years of grace if orders total US$ 40 million or more. Even contracts simply admissible, but not actually financed by the credit line, are taken into account to determine the "orders to French industry"
   - covers only 85% of equipment cost; 15% down payment is required
   - can cover equipment and materials subcontracted by French suppliers from other countries up to 5% of each order

3. EUROCURRENCY LOAN (Offer under consideration)
   - Same syndicate as for credit line
   - Up to US$ 18 million equivalent, or 20% of the orders to the French industry, with a minimum of US$ 5 million
   - Interest: 2.25% above LIBOR payable twice a year
   - 0.75% per annum commitment fee
   - 1.125% flat management fee
   - 8.5 years repayment including 3.5 years of grace

NOTA: Other offer was made by Citybank with a somewhat longer repayment schedule

BRAZIL - COPESUL PETROCHEMICAL PROJECT
FIXED CAPITAL EXPENDITURES FOR ECONOMIC ANALYSIS

(in US $ million and at mid-1977 prices)

	1977	1978	1979	1980	1981	TOTAL
Disbursement Percentage	2.8%	15.1%	27.4%	29.8%	24.9%	100%
Fixed Capital Expenditures Excl. Price Contingencies & Before Shadow-Pricing of Local Components	16.6	89.0	161.6	175.8	146.9	589.9
Out of which:						
Foreign Exchange	(4.9)	(26.2)	(47.6)	(51.7)	(43.3)	173.7
Local Currency	(11.7)	(62.8)	(114.0)	(124.1)	(103.6)	416.2
Same as above after Applying 1.25 Foreign Exchange Shadow Factor to local Currency Costs	14.3	76.4	138.8	151.0	126.2	506.7
Same after addtional Adjustment to Reflect Escalation on Capital Costs over and above General Inflation of 7%	14.3	77.1	140.8	153.1	128.0	513.3

BRAZIL - COPESUL PETROCHEMICAL PROJECT

ECONOMIC REVENUES AND OPERATING COSTS AT 100% CAPACITY UTILIZATION

(U.S. $million and at mid-1977 prices)

	Medium Severity Case				High Severity Case		
	Units	Quantity	Price (US $)	Value	Quantity	Price (US $)	Value
REVENUES							
Ethylene	ton	420,000	380	159.6	471,642		179.2
Propylene	ton	120,000	250	30.0	120,000		30.0
Butadiene	ton	66,468	395	26.3	67,921		26.8
Benzene	ton	115,443	250	28.9	150,424		37.6
Toluene	ton	18,644	200	3.7	22,306		4.5
Xylenes	ton	25,398	200	5.1	28,474		5.7
Residue	ton	51,015	60	3.1	83,888		5.0
LPG	ton	210,956	125	26.4	130,743		16.3
Pyrolysis Gasoline	ton	231,088	150	34.7	148,031		22.2
High Pressure Steam	ton	408,000	9	3.7	408,000		3.7
Medium Pressure Steam	ton	1,632,000	8	13.1	[illegible]		[illegible]
Low Pressure Steam	ton	326,400	6	2.0	[illegible]		[illegible]
Filtered Water	1,000 M^3	16,034	60	1.0	16,034		1.0
[illegible]	[illegible]	1,485	350	0.5	1,485		0.5
[illegible]	[illegible]	124	[illegible]	[illegible]	124		--
Nitrogen	1,000 M^3	17,014	30	0.5	17,014		0.5
Total				338.6			348.1
OPERATING COSTS							
Naphtha	ton	1,499,836	120	180.0			
Catalysts	M^3	45	various	0.4			
Inhibitors - Anti-Oxidants	ton	110	"	0.4			
Absorbents	ton	145	"	0.2			
Solvents	ton	51	"	0.1			
Soda Ash	ton	505	710	0.1			
MEA	ton	197	1,580	0.2			
Other Chemicals	ton	55	various	0.1			
Chemicals, Water Treatment	ton	1,790	"	0.5			
Power (Variable Rate Component)	1,000 KWH	48,960	14	0.7			
Fuel Oil	ton	36,100	70	2.5			
Coal	ton	1,205,000	8	9.6			
Sub-Total Variable Costs				194.8			
Labor							
Level I	Man-Month	11,124	720	8.0			
Level II	Man-Month	3,253	1,360	4.4			
Level III	Man-Month	1,475	2,540	3.7			
Level IV	Man-Month	252	2,960	0.1			
Sub-total				16.2			
Power (Fixed Rate Component)	MW-month	8	53,520	0.4			
Maintenance and Repairs	n.a.			7.0			
Insurance	n.a			2.3			
Overhead	n.a			1.6			
Sub-Total Fixed Costs				27.5			
OPERATIONS CASH-FLOW				116.3			

BRAZIL-COPENE PETROCHEMICAL PROJECT

CASH-FLOW PROJECTIONS FOR ECONOMIC ANALYSIS - MEDIUM AND HIGH SEVERITY CASE

(in US $ million and at mid-1977 prices)

	1977	1978	1979	1980	1981	1982	1983	1984	1985-92	1993	
Capital Resources Required For the Project											
Fixed Capital	(14.3)	(77.1)	(140.8)	(153.1)	(128.0)	-	-	-	-	-	
Working Capital	-	-	-	-	(38.6)	(6.9)	(4.6)	-	-	50.1	
Sub-Total	(14.3)	(77.1)	(140.8)	(153.1)	(166.6)	(6.9)	(4.6)	-	-	50.1	
Economic Value of Production						254.0	304.7	338.6	338.6	338.6	
Cash Operating Costs											
Variable Costs						(146.1)	(175.3)	(194.8)	(194.8)	(194.8)	
Fixed Costs						(27.5)	(27.5)	(27.5)	(27.5)	(27.5)	
Sub-Total						(173.6)	(202.8)	(222.3)	(222.3)	(222.3)	
Economic Cash-Flow from Operations						80.4	101.9	116.3	116.3	116.3	
Net Economic Cash-Flow Due to the Project in Medium Severity Case	(14.3)	(77.1)	(140.8)	(153.1)	(166.6)	73.5	97.3	116.3	116.3	166.4	ERR for Medium Severity Case: 12.9%
Additional Revenues in High Severity Case						7.1	8.6	9.5	9.5	9.5	
Net Economic Cash-Flow Due to the Project in High Severity Case	(14.3)	(77.1)	(140.8)	(153.1)	(166.6)	80.6	105.9	125.8	125.8	175.9	ERR for High Severity Case 14.2%

x

SEMADCO
CAIRO

EGYPT

JULY 19, 1977

6803

TELEX: 2609
SMADCO UN

FOR MUNIR SIDKY

IDA ACKNOWLEDGES AND HAS NO OBJECTION TO THE DOCUMENTS SENT TO US

AAA ON JUNE 30, 1977, PERTAINING TO SEMADCO/FWI NEW AGREEMENTS;

BBB ON JUNE 16 REGARDING AWARD OF ANALYZERS TO HARTMAN ON BASIS OF ONLY ACCEPTABLE BIDDER;

CCC ON JUNE 6 FOR AWARD OF MANIFOLD TO TECNOMATIC.

REGARDS

PRATT

EGYPT - Talkha II

Pratt:siv

Mr. C. J. Pratt

Industrial Projects

cc: Messrs. Fuchs/Dewey, Perram/Kohli, Sandig, Brown, Nayar, Kaps, Ms. Espiritu

Mr. Jean-Francois Rischard, IPD, Division II July 15, 1977

Anthony R. Perram, Chief, Division II, IPD

BRAZIL - COPESUL Petrochemical Project
Terms of Reference

1. You will arrive in Rio de Janeiro on July 18, 1977, for a mission expected to last about three weeks, during which you will also visit Sao-Paulo, Porto Alegre and other locations if required. You will supervise the work of Mr. Bastl (consultant), whose terms of reference for a study of the market prospects for the Rio Grande do Sul Petrochemical Complex have been issued separately, and join him whenever possible.

2. While in Rio, you will seek to obtain revised data on capital and operating costs, product slate and prices for the COPESUL project so as to firm up the assessment of the project's economic viability and foreign exchange financing needs. You will also seek to obtain clarifications on the status of the Government's decision regarding the local/foreign equipment split and on the nature and terms of the tentative financing arrangements for the project, mainly with regard to the credit line extended by the French. While in Porto Alegre, you will enquire about the investment program in infrastructure and the corresponding financing needs in connection with the Rio Grande do Sul Petrochemical Complex with the view to identify areas of possible interest to the Bank.

3. Upon your return in Washington, you will prepare a brief Back-to-Office Report on your main findings.

J-FRischard:siv

Cleared with and cc: Mr. Mirza

cc: Messrs. van der Tak (5), Fuchs/Dewey, Walstedt, Cash, Nayar, Kohli, Soncini, McClure, Glaessner, Skillings, Evans, Brown

July 14, 1977

Mrs. Beldeanu
Banca de Investitii
4, Strada Doamnei
Bucharest
ROMANIA

Dear Mrs. Beldeanu:

Re: CRAIOVA Chemical Project
Preliminary Economic Analysis

Further to Mr. Fuchs' telex of July 1 to Mr. Diamandopol, please find attached a summary of our preliminary economic evaluation of the Craiova Chemical Project which we had agreed to communicate to you during our last mission. We would like to emphasize that many of our assumptions are still tentative, although we have firmed up the major ones regarding the economic cost of methane and the long-run economic prices of major products such as methanol, acetic acid and vinyl/polyvinyl acetate. In general, wherever a choice between assumptions had to be made, we intentionally chose the one most favorable to the project economics; more refined assumptions would therefore most likely lead to a somewhat lower return for the project.

As indicated in Mr. Fuchs' telex, we have also attempted to analyze the project on a plant-by-plant basis in order to determine possibilities of improving the economic return of the proposed project to Romania. Preliminary results of this analysis are also included in the attachment. However, substantial further detailed work in this regard would have to be done before any final recommendations can be made about the possible optimum project formulation.

You would recollect that before we left Bucharest, we had discussed with you our first rough economic return calculations for the project which showed a 3 to 4% return. The revised calculations herewith submitted show an 8 to 9% return; these calculations are still preliminary and are based on somewhat optimistic assumptions in some key areas as indicated above. But, they clearly indicate that the project as presented to our mission does not have an acceptable economic return to Romania.

We believe it might be useful to explain the main differences in assumptions which have led to the above-mentioned change in economic return since our discussions in Bucharest. This change is the net result of (a) changes in assumptions (compared to those made at the end of our mission) which have improved the return and (b) changes in assumptions which have reduced the return. The two groups are as follows:

(a) Major changes in assumptions which have improved the return

(i) Latest information obtained by us on prices for fuel oil in the Mediterranean area indicate current price of about \$70 per ton, thus enabling us to lower the current cost of methane from the figure of \$80 per thousand cubic meters to \$65. The long-run price of fuel oil is actually likely to be somewhat higher than the current price after the present situation of oversupply in Europe is resolved. We feel that \$65 is the minimum economic cost of methane (i.e. the value of methane in its best alternative use) that can be defended on country grounds.

(ii) Based on a study which we have commissioned for that purpose from specialized consultants, we have tentatively increased the price of methanol, the project's most important product, from \$110 to \$130 per ton (in 1977 constant dollars). Here again, this is the highest long-run price which we think can be justified; in any further refinements, a somewhat lower price may have to be used.

(iii) Overall methane consumption has now been reduced to 391.5 million m^3 according to IITPIC's revised estimates.

(b) Major changes in assumptions which have deteriorated the return

(i) Price of polyvinyl alcohol was lowered from \$2,000 to \$1,500, the latter being the present US and European price for top grade (compare with the internal Romanian price of \$3,300!). We consider this to be an optimistic price when applied to the project, considering the difficulty of marketing this product and the lack of experience of Danubiana in this respect.

(ii) A major error in our previous calculations was discovered (the quantity of purge gas from the CO separation unit had been erroneously set at 264.0 million m^3 in Annex 13 of the TES summary submitted to us, while it should have read 26.4 million m^3).

(iii) Based on the study prepared by our consultants, we have lowered the vinyl acetate/PVA prices somewhat, but this has had only a marginal effect. Again, prices used here seem to be the highest which could possibly be justified.

As you can see, the effect of the changes under group (a) have more than offset those of the changes under (b). The return remains nevertheless below 10%-- at least for the project in its present form.

We hope that this information will be useful. If there are any questions, please communicate them to us. In the meantime, we are awaiting the decisions of the competent authorities pursuant to Mr. Fuchs' telex.

Yours faithfully,

Jean-Francois Rischard David Caplin
Industrial Projects Department

J-FRischard:siv

cc: Messrs. Fuchs/Dewey
Perram/Kohli

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Withdrawn by	Date
Sherrine M. Thompson	August 22, 2019

July 13, 1977

The Pace Company Consultants
& Engineers, Inc.
5251 Westheimer
P. O. Box 53473
Houston, Texas 77052

Gentlemen:

Attention: Mr. Matson

This is to acknowledge receipt and thank you for the preliminary market and plant economics analyses of methanol, acetic acid, and vinyl acetate for the World Bank.

Sincerely yours,

Anthony R. Perram
Chief, Division II
Industrial Projects Department

cc: Messrs. Rischard, Caplin, Tortorelli, Kohli

ARPerram:siv

Mr. Fred Bastl, Consultant July 11, 1977

Anthony R. Perram, Chief, Division II, IPD

BRAZIL - COPESUL Petrochemical Project
Terms of Reference for Market and Marketing Review

1. Your mission is expected to start on July 18, 1977, and to last about three weeks. You will visit Rio, Sao Paulo, Porto Allegre, as well as other locations if required. Mr. Rischard will join you from July 18 to August 5. You will report to him and inform him about the progress of your work.

2. The object of the mission is to investigate the markets and marketing needs for the main products to be produced by the Rio Grande do Sul (RGS) Complex, namely, LDPE, HDPE, PVC, Styrene/PS, SBR and PP. In that respect, you will gather information and write a final report on the following:

(i) Historical demand and supply, including import and export data for the above products. Description of existing manufacturing capacities, firms or groups involved, and ties, if any, to companies expected to participate in the RGS Complex. Analysis of demand breakdown between various thermoplastics and comparison with patterns and trends in other countries. Factors which will affect this breakdown in Brazil in the future. Factors which will affect demand for SBR.

(ii) Description of end-uses for above products by sectors (agriculture, industry, construction, consumer sectors) and main subsectors wherever possible and useful (e.g. automobile subsector). Comparison with end-use patterns elsewhere. Factors which will affect this pattern in the future.

(iii) Analysis of the transformation industries involved in the processing of above products for their end-uses. This includes the following data by product or group of products:

- General description of transformation industries, stages, methods of processing (extrusion, blow-molding, etc.).

- Size and location of firms involved at various stages. Sponsors and affiliations.

- General description of customer relationships with manufacturers described under (i), channels of distribution, types of contracts, frequency of supply.

- Could these industries import the products for processing and have they done it? At what prices and under what penalties? Where did imports, if any, come from?

- Is domestic availability of products critical for establishment of new transformation industries?

- Experience in that regard in Sao Paulo and Bahia. Key factors involved.

- Prospects in that respect for RGS, including capital costs and sources of financing, enterpreneurship, timing aspects regarding regional demand, exports to other countries, etc.

- Employment creation in various transformation industries (e.g. per ton of product input).

(iv) Regional demand breakdown in Brazil and factors affecting future pattern.

3. You will determine with Mr. Rischard how the information required for this review is to be collected, based on contacts to be provided and coordinated by COPESUL and the Secretary of Planning. The format of your report, which is expected to be ready two to three weeks upon return of the mission, will be worked out between you and Mr. Rischard at the beginning of the mission and amended subsequently if the need arises.

J-FRischard:siv

cc: Messrs. van der Tak (5), Fuchs/Dewey, Walstedt, Cash, Nayar, Kohli, Soncini, McClure, Glaessner, Evans, Brown, Rischard, Mirza, Skillings

Files   July 7, 1977

Jean-Francois Rischard

BRAZIL - COPESUL Petrochemical Project
Financing Arrangements

1. A meeting was held on June 29, 1977, between Messrs. Skillings and Mirza (LC2) and Messrs. Dewey, Evans and Rischard (IPD) to discuss issues raised during a meeting with the IPD Director with regard to the financing arrangements for the above project. In both these meetings, the basis for discussion was the June 15 Back-to-Office Report prepared by Messrs. Brown and Evans following their visit to Brazil at the beginning of June (report attached for reference).

Background

2. Total foreign exchange requirements for the COPESUL project are expected to amount roughly to US$150 million in the case of a 70% local/30% foreign split for equipment supply and only to US$200 million if a 50/50 split were to be adopted. A French bank is reported to have made US$80 million available in the form of a line of credit.1/ About US$10 million are available through a previous IDB loan to meet the foreign engineering costs. BNDE is expected to cover downpayments for items financed through the French credit, and interests during construction for a total of US$20 million. The remaining financial requirements could possibly be financed by IBRD and/or IDB, with the latter apparently willing to put up US$50 million or more.

Description of the Problem

3. Two variables are most important in determining the nature and extent of the possible participation by the Bank in the financing of the COPESUL project, namely, the local/foreign equipment split and the degree of utilization of the line of credit extended by the French. The problem was sketched out as follows by Mr. Evans:

(i) If the equipment split is 50/50 and if only half the French credit were to be used, there would be room for a sizeable Bank loan.

(ii) If the equipment split is 70/30 and if the credit line were to be fully utilized, there would not be any room for a significant Bank loan to COPESUL as such; a wider-based loan could then be envisaged, channelled most likely through BNDE to COPESUL as well as to two or three designated downstream units, following BNDE's own procurement procedures.

1/ There are indications that several bilateral agencies might also be interested in the project.

(iii) If a situation evolved which would be in between the two described above, there would be room for a comparatively smaller Bank loan to COPESUL, besides the alternative of a wider-based project.

Subsequent discussions focused on the questions of the equipment split, the line of credit extended by the French and the possibility of a modified project.

Equipment Split

4. Based on the discussions which they had in Brasilia, Messrs. Skillings and Mirza expressed their conviction that the principle of a 50/50 split had been accepted by the Government, and that it also had the support of the president of PETROQUISA (COPESUL's majority shareholder). According to Mr. Evans, the COPESUL people were also in favor of a 50/50 split, both for technical and financial reasons; they had indicated their willingness to prepare an equipment list based on such a split for early submission to CACEX once the Government would have confirmed to COPESUL its decision to aim at a 50/50 split, which had not yet been done at the time of the IPD mission. Mr. Evans expressed nevertheless some doubts about the acceptability to the equipment manufacturers of a 50/50 split in this project, when a 70/30 split had been used for COPENE (COPESUL's sister company in the Bahia Complex). As there still remained some confusion as to the agreed split, Mr. Skillings stated that he would request the Brazilian Government to confirm its decision concerning this issue to the Bank by telex.

French Line of Credit

5. With the possibility of a 50/50 split, the degree of utilization of the line of credit offered by the French deserves increased attention.1/ Mr. Dewey expressed at the outset of the discussion the view that if a commercial line of credit is extended at favorable terms and is tied to the project so as to be otherwise unavailable to the Country, there would seem to be little reason for the Bank, which can make its funds available to a variety of projects, to insist on participating in the project when this would crowd out the line of credit. This was particularly true if it could be determined that the project would not be unduly penalized in terms of equipment cost or technical quality by using the tied funds. He mentioned questions asked by the Board in that respect in the case of projects in other countries to stress this point. Mr. Skillings argued in reply that he had never interpreted the idea of the Bank being a lender of last resort to imply that the Bank had no role when sufficient amounts of credit were available from supplying countries.

1/ As do the credits which could possibly be offered by several bilateral agencies. In the absence of further information, this topic was not discussed in detail during the meeting.

6. Since this question hinges on the definition of what one should call "favorable terms" the nature and conditions of the line of credit were discussed in more detail. Mr. Evans stated that the line carried a low 7.5% interest rate, with 15 years maturity. According to Mr. Skillings, one had to add some guarantee fee levied by COFACE to the interest rate charged by the French bank involved (reportedly the Credit Lyonnais), and furthermore, the maturity was probably slightly shorter than indicated to the IPD mission. Mr. Dewey wondered whether part of the line of credit could be used to finance non-French procured items as had been the case in similar situations known to him.[1]

7. Regarding the question of how and to what extent this line of credit would be used, Mr. Evans stated that the concept of postallocating items won under ICB by French suppliers to the French line of credit was preferred by the Brazilians and also reportedly acceptable to the French. The issue here is that IDB would not readily accept such a possibility in regard to their own loan. Therefore, with the IDB loan amount fixed through preallocation, the Bank loan would have to shrink as items are awarded to French suppliers and postallocated to the line of credit. Mr. Skillings admitted that this could pose some problems.

8. The discussants agreed that the problems mentioned above (paras 5 and 7) could be more easily dealt with if the line of credit were open, not merely to COPESUL, but to the entire complex, with its considerable financing requirements. Although Mr. Skillings thought that this could presumable be the case, he did not know with certainty whether the agreement with the French provided for this possibility.

9. In view of the uncertainty surrounding the nature and terms of the line of credit, it was agreed that LC2 would as soon as possible obtain additional information on the various questions raised regarding the French credit. With this information, it was agreed that it would be desirable to inform management about the existence and details of the line of credit, and seek guidance on the posture of the Bank with regard to the apparent disinclination of the Brazilians to use such credit, preferring Bank financing.

Modified Project Concept

10. With regard to the alternatives open to the Bank assuming that there would not be any room for a sizeable loan to COPESUL, Mr. Skillings ruled out the alternative of a smaller loan on the grounds that he envisaged the role of the Bank in this project only as the main lender or as one of the main lenders. Mr. Dewey saw, however, no reason why a smaller loan than envisaged, essentially to close the financing gap, could not be

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1/ Where purchases of items procured outside of France had been financed to the extent that these items were part of complete packages to be supplied by the main French contractors.

considered by the Bank. As far as the possibility of a wider-based project was concerned, Mr. Skillings made two remarks. First, he would have similar misgivings about directing only a relatively smaller volume of funds to COPESUL through that channel. With respect to the downstream units, he felt that the later start of their construction schedules (i.e. about 1-2 years after COPESUL's) would make the alternative of a wider-based loan worth considering as a FY 79 or even FY 80 project, possibly as a second stage project following the COPESUL project.

J-FRischard:siv

Attachment

cc: Messrs. Fuchs, Dewey, Ferram, Kohli, Skillings, Mirza, Evans, Brown

OFFICE MEMORANDUM

TO: Mr. Anthony D. Perram, Chief, Division II, NDP

DATE: June 15, 1977

FROM: Don Brown and Geoffrey Evans

SUBJECT: BRAZIL - COPESUL Petrochemical Project
Back-to-Office Report

1. We met with COPESUL staff in Rio during May 31 - June 3 to discuss the financing and procurement arrangements for the COPESUL ethylene project. IDB staff (Messrs. Stempel and Montez) also attended most meetings, along with Mr. Humayun Mirza.

2. Little progress had been made in defining capital costs more accurately than in the previous mission, since the contractor Technip has only just started working and COPESUL has no clear direction from the Government on the split between foreign and local supply for the project. Their previous ethylene project, COPENE in Bahia, was executed on a 70% local/30% foreign split. On this basis, COPESUL estimated about $120 million in direct foreign project costs (in 1976 values). We estimated that this would increase to about $160 million direct costs in 1977 prices, assuming a 50/50 split in procurement sources, and this number was used for subsequent discussion. This would correspond to about $200 million total foreign exchange financing requirements.

3. On this basis foreign exchange financing could develop along the following very approximate levels:

Source	Amount $ million	Allocation
IBRD	80	ICB equipment (Post-allocated)
IDB	60*	engineering plus preselected ICB items
French Credit	40	post-allocated equipment after ICB
BNDE	20	down payment on French-financed items plus interest during construction
	200	

4. However, we should not preclude the possibility of different decisions of the Brazilians (and IDB) that could eliminate the need for either further IDB or IBRD participation. Maximum use of French credits, a 70/30 equipment split, and higher IDB financing (a distinct possibility) could lead to the following approximate breakdown, in million of foreign exchange requirements.

IDB or IBRD	70 - 90
French Credit	60 - 80
BNDE	10 - 20
Total required	160

* includes $11 million for engineering as part of a "technology transfer and engineering project"

5. COPESUL has available an $80 million French (tied) buyer's credit at favorable terms (about 7.5% interest with 15 year maturity). They will probably proceed with using this credit and we estimate that French suppliers could win as much as $40 million under ICB procurement. COPESUL would like to post-allocate items to the French credit after following ICB. IDB indicated they would not do this and would prefer preallocation of a list of goods to IDB for financing in parallel. We indicated that IBRD has used post allocation previously and we would likely consider it in this instance. Preallocation to IDB (who would use ICB) does not present a problem in itself but possibly makes it more difficult to use the French credit efficiently. Preallocation to the French credit is possible but likely to add to the cost of the project (since there would be virtually no competition under that arrangement).

6. BNDE would have to make a relatively small contribution, to cover down payments for items financed from the French credits plus interest during construction on the IBRD loan (we presumed that this would likely not be financed by IBRD) and French credit. (The BNDE part could be substituted by a commercial credit but there was no need to discuss it at this stage.) Thus, although foreign costs (and financing) are not firmly known at this stage, there appears to be a need for both IDB and IBRD to participate in the project at approximately the levels previously contemplated, assuming a relatively low reserve list is agreed.

Financing Constraint

7. Financing availability for the overall complex may be a problem. Total investment would be about $1,500 million equivalent. Although COPESUL would appear to be in good shape vis-a-vis foreign exchange availability, shortage of local funds for COPESUL and for all funds for the downstream plants may cause delays. The financing requirement on BNDE appears to be large, and considering the overall Brazilian fiscal constraints, BNDE may not be able to provide all funds in a timely manner.

8. For COPESUL, BNDE (plus its subsidiary FIBASE) will probably have to provide about $300-400 million during 1977-1981. The downstream units apparently also intend to rely on BNDE for both loan and equity (as preferred shares) for large portions of finance, in the order of $500 million, during 1978-81. PETROQUISA, a significant source of finance for the complex, may also have funding problems; depending largely on revenue to be generated by COPENE starting only in 1978.

Downstream Units

9. Considering this possible constraint we began reviewing the need or desirability of IBRD participation in one of the downstream units. PVC, being the largest, would be the most probable choice. We briefly discussed the PVC project with one of its selected owners* with regard to scope, schedule and their views on financing. In general, the downstream units, all with majority private sector ownership, should be able to attract some financing. IFC has expressed interest in participating in one or more of the units (IFC has several investments in Brazilian petrochemical projects). But it is unlikely that they all can attract sufficient funds.

* "PETROPAR", a venture formed for two Brazilian groups, OLIVEIRA and PEIXOTO. PETROQUISA and FORMOSA PLASTICS (Taiwan) are also project sponsors.

10. COPESUL asked both IBRD and IDB if an "umbrella" loan could be considered for the several downstream plants. IDB, which did this in the COPENE project through BNDE, rejected the approach. We did not offer any encouragement about the possibility of IBRD using this approach.

11. While an "umbrella" loan would be cumbersome and not recommended, direct IBRD participation, when other funds are not readily forthcoming, may improve overall project implementation. During appraisal we should coordinate closely with IFC and other prospective lenders in this regard.

Procurement

12. We also discussed procurement procedures in great detail. We suggested that COPESUL seek Government concurrence on reaching agreement with CACEX on a 50% maximum local reserve list. (We attempted not to qualify this level indicating that our criteria are not based on a given level but rather on an analysis of effect on project cost and technical reliability of whatever level is chosen.)

13. We encouraged COPESUL to develop a system with three lists (similar to the Valefertil project):

(1) local supply, consisting of items that clearly can be supplied competitively from local sources. (Local Reserve)

(2) foreign supply, consisting of those items where no local supplies exist.

(3) unallocated list where local supply is possible but price competitiveness and technical experience is questionable.

14. The last category would be included in ICB with local participation in bidding with the normal 15% preference. Such a system could avoid most of the difficulties in reaching agreement with CACEX.

15. We also gave COPESUL copies of procurement instructions as used in the Valefertil project, as well as discussed advertising procedures, plus the minor differences in procurement procedures between IBRD and IDB.

16. Depending in part on how quickly we are able to proceed, advance contracting may be a problem. Engineering work started in mid-May, financed under an IDB engineering credit. COPESUL claims a CACEX agreement, a necessary condition of any procurement decision, could be attained by September. Even allowing for some delays on the Brazilian side and adding the advertising requirements of IDB/IBRD, some orders could be placed for critical equipment late in 1977. Therefore, COPESUL would need to firm up its financing plan (as well as procurement procedures) relatively soon. If possible, we should schedule appraisal by August/September, to enable procurement activity to proceed efficiently in parallel with our internal processing of the appraisal.

Marketing

17. The marketing mission scheduled for July is acceptable to COPESUL. This mission should be able to proceed relatively quickly, based on IDB's appraisal report (for the engineering loan) plus other market analysis information available with IDB and COPESUL.

cc: Messrs. van der Tak (5), Fuchs, Dewey, Cash, Nayar, Soncini,
Rischard, van der Meer, Skillings, Mirza, Aguirre,
McClure (IFC), Plant (IFC), Ruisanchez (IFC)

DBrown:ki

Mr. Harinder S. Kohli, Acting Chief, Division II, IPD June 27, 1977

Eustachio Tortorelli, David Caplin and Jean-Francois Rischard

ROMANIA - Craiova Chemical Project
Project Preparation Mission
Back-to-Office and Full Report

I. INTRODUCTION

1. A Project Preparation Mission visited Romania from May 29 to June 10, 1977 to undertake a preliminary review of the main technical, financial and economic aspects of the Craiova Chemical Project and tentatively prepare it for appraisal by September 1977. The project had been submitted to the Bank in early 1976, although under a different form, along with nine other chemical sector projects and retained as one of the possible candidates for FY 1978 by a Project Identification Mission which visited Romania in May 1976. The present mission was a follow-up on recommendations made at that time and on preferences expressed by the Government in April 1977. A list of persons met by the mission is contained in Annex 1.

2. The project, which consists of the expansion of the Craiova Chemical Complex located near Craiova in the judet (district) of Dolj, will mainly produce a variety of organic chemicals using methane gas as the primary feedstock. The concept and priority of the project are in line with the Government's policy of maximizing the chemical uses of the Country's significant, but limited oil and natural gas resources while replacing them with coal and lignite as primary energy sources.

3. The project does not, however, appear to be economically viable under its present form. There seems to be room for improving its economic return by redesigning the project and in particular by eliminating certain plants and products. This would nevertheless take some time, and other problems would in any case have to be dealt with, notably with respect to markets and marketing, and financing arrangements; these various issues are discussed in paras 38 to 44. Provided that redesigning the project is acceptable to the Romanians and that the major issues are solved, the project, which from the Country's point of view has some important, though not readily quantifiable benefits, ought to be suitable for further consideration by the Bank as a possible FY 79 project.

II. INDUSTRY BACKGROUND

Chemical Sector Background

4. The chemical industry has been one of Romania's most dynamic sectors. Since 1950, it has attained an average growth rate of 21% a year, and ranks now in third place, with a share of about 11% of total industrial

output, behind the machine building and metal working industries (31%) and the food industries (13%). It absorbed about 15% of total industrial investment and employed 7% of the industrial labor force in 1975.

5. The development strategy for the chemical industry has been largely designed so as to increase the value added to the Country's petroleum and methane gas resources. Accordingly, the fastest growth has occurred in fertilizers, plastics and synthetic rubber and fibers. Long-term plans continue to attribute a high priority to petrochemicals, which are expected to account for three-fourths of the chemical industry output by 1990, against about one-half today. Romania's main competitive advantages in the chemical field reside in the local availability of valuable hydrocarbon resources (its methane gas, for instance, is one of the world's purest), considerable experience in chemical engineering, research and development, and the excellence of its manpower development efforts in that area. The Country's ambitious industrial development plans in the chemical sector, aiming at self-sufficiency and at covering a large variety of activities, face however severe constraints in the relatively limited size of the domestic market, in the obsolescence of many facilities, in the rapid stretching of its know-how resources, and in the serious inadequacy of its pricing system when it comes to making the specific investment decisions which are required to implement these plans.

Production and Consumption of Methane Gas

6. Romania possesses significant reserves of associated gas (i.e., found in oil wells) and non-associated natural gas. Present production levels run at about 33 billion cubic meters per year, out of which about 27 are non-associated gas. The latter is high-quality gas, almost pure methane. About 70% of the methane fields are located in the Transylvanian Basin within the Carpathian arc. Production increased at a rapid pace after 1960 and by 1965, methane gas became the largest single energy source in Romania, replacing oil in that role, while the proportion used for feedstock remained under 10% until 1975.

Production and Consumption of Methane in Romania
(in million cubic meters)

	Production	Consumption as Fuel 1/	Consumption as Feedstock
1960	6,710	6,250	460
1965	13,040	12,150	890
1970	19,970	17,950	2,020
1975	27,000	24,300	2,700
1977	27,500(p)	24,200(p)	3,300(p)

p = projected

1/ Includes small amounts of net exports until 1975 of the order of 200 million cubic meters in that year.

7. The Government does not publish any data on hydrocarbon reserves. It is thus difficult to make any estimation of gas reserves but Plan targets, showing a peak in production in 1977, and thereafter a stable level at about 27 billion cubic meters, would tend to show some kind of resource constraint. Also, it is reported that Romania has now begun importing gas from the USSR. As a working hypothesis, the figure of 500 billion cubic meters has been proposed,1/ including both associated and non-associated natural gas reserves. Within this context of limited reserves and with the added stimulus of the world oil crisis, the Government designed in 1973 a new energy strategy involving, as far as gas is concerned, the restriction of new connections solely to the chemical industry and a major program of converting utilities and industries from the use of gas as primary fuel to that of coal and lignite, the exploitation of which is to be developed in parallel.

8. Among the major chemical uses of methane, ammonia production for fertilizers has been the earliest2/ and by far the most important one in Romania. It has expanded rapidly during the last decade as the Government implemented a vast program to develop fertilizer production for home use and for export.3/

Breakdown of Chemical
Uses of Methane Gas in Romania
(in percentages)

	1969	1975
Ammonia	58.5	68.4
Acetylene	14.8	9.3
Methanol	5.5	11.3
Carbon Black	20.7	6.1
Other Uses	0.5	4.9
	100.0	100.0

Methanol is made at Victoria and is used mainly to produce formaldehyde, and dimethyl-terephthalate (DMT), a polyester fiber intermediate. 20,000 tons per year (tpy) of acetylene are produced in Borzesti for the production of polyvinyl chloride (PVC). The major acetylene producer is nevertheless the Craiova Chemical Complex, with a present capacity of 49,000 tpy of acetylene, of which 33,000 tpy are produced using methane feedstock.4/

1/ Economic Report on Romania, to be issued.

2/ The first plant in Europe producing hydrogen out of methane gas for the manufacture of ammonia is claimed to have been opened in Tirnaveni in 1936.

3/ Details on these developments can be found in the Bacau Fertilizer Project Appraisal Report, No. 459-RO.

4/ Acetylene was produced in Savinesti to manufacture acrylonitrile for synthetic fibers, but this process is now replaced by a more economical one (from propylene and ammonia) in Pitesti.

III. THE CRAIOVA CHEMICAL COMPLEX

9. The Craiova Chemical Complex is located near the village of Isalnita, about six miles west of Craiova, at the confluence of the Jiu and Amarandia rivers. The platform hosts facilities for the production of nitrogenous (270,000 nutrient tons capacity) and complex fertilizers as well as for the production of acetylene and a range of acetylene-based organic chemicals.

10. A background note on acetylene production, and products based on this intermediate, is given in Annex 2. The organic chemicals section of the complex developed around a small (16,000 tpy) acetylene unit opened in the early sixties and using carbide as feedstock. In 1964 a second acetylene plant (33,000 tpy) was put on stream, based on the partial oxidation of methane brought from Transylvania by pipeline. Products made from acetylene in the complex include acetaldehyde, acetic acid, n-butanol, nicotinic acid and derivatives, butyl acetate, vinyl acetate and polyvinyl acetate (PVA). A semi-commercial scale unit for the manufacture of polyvinyl alcohol is also in operation. These products are mostly used as raw materials by the fiber, plastic, paints and coatings industries, as well as being used as intermediates for the production of more complex organic chemicals. Annex 3 shows the capacities existing at the complex for the production of organic chemicals.

11. The Craiova Chemical Complex is part of the Craiova Fertilizer Central, (one of the nine coordinating agencies organized under the Ministry of Chemical Industry), which plans, supervises and coordinates the various activities of the Country's fertilizer plants, as well as exercising the same responsibilities with regard to the organic chemicals section of the Craiova Complex. The Craiova Central is known to the Bank through its involvement with the Bacau Fertilizer Project also under the Central's jurisdiction. Its technical staff also acts in similar functions in the Craiova Complex. Historical financial statements for the Complex are summarized in Annex 4, showing a high level of profitability, due largely to the exceedingly low price of methane feedstock in Romania.

IV. THE PROJECT

Rationale and Objectives

12. The project, which consists of the expansion and modernization of the Craiova Chemical Complex, is intended to address the following development objectives or constraints:

(i) The project would divert about 390 million cubic meters of methane gas from fuel to chemical feedstock uses, thus increasing the amount of gas processed into chemicals by about 12 percent. The project has been very ingeniously designed so as to achieve this objective to the fullest. About half of the methane stream would be directed to a new acetylene unit; one-third of the carbon contained in this stream of gas would thus be transformed into acetylene and from there into a variety of high value organic chemicals. The remaining two-thirds would be transferred in the form of offgases to other units, and mainly to the existing ammonia/urea facilities, the composition of the offgas permitting direct use by the ammonia reactor, in replacement of pure methane gas (which would have had to incur the costs of preparation in the synthesis gas unit). The other half of the original methane stream would be used for the production of methanol, one-fifth of which would be also used for the synthesis of the above-mentioned acetylene-based organic chemicals.

(ii) The project's location and design concept addresses the need to make the best possible use of pre-existing investments on the platform. The gas pipeline and many intrastructural facilities would be shared by the new units, which would be closely integrated with existing process streams. Spare capacity in some existing units would also be absorbed. Duplication of plants is to take place wherever possible so as to maximize the benefits of existing expertise in building and operating similar units.

(iii) The transfer of new technologies would be sought for two major plant units and local machinery and equipment suppliers would be involved as much as possible to facilitate such transfers. At the same time, the acetylene from carbide unit would be phased out and replaced by a more modern partial oxidation unit using methane.

Description and Scope

13. The project's quite complex design is described in some detail in Annex 5 (flow chart) and Annex 6. It comprises the following major elements:

(i) The core of the project lies in the installation of a 30,000 tpy acetylene unit using methane feedstock which will

- replace the production of the old 16,000 tpy acetylene from carbide unit
- provide additional acetylene intermediate to new or expanded downstream units (see below) and
- deliver offgases for use in the existing ammonia reactor and in part in the new acetic acid plant.

(ii) The capacities of the existing vinyl acetate and PVA units will be expanded and the acetaldehyde unit will now be fully utilized.

(iii) New acetic acid, acetic anhydride, methanol, ethyl acetate, butyl acetate and polyvinyl alcohol units will be built and included into the complex. In the case of the two first products, new technologies will be adopted and acquired abroad.

(iv) A new cryogenic plant for the separation of carbon monoxide (CO) will provide CO to the new acetic acid plant and hydrogen to the existing butanol plant.

14. Most of the production processes are highly integrated and maximum use is made of by-products. The capacities of the new units are shown below:

Product	Capacity
Acetylene	30,000 tpy
Oxygen	15,000 m^3/hr
Carbon Monoxide	5,000 m^3/hr
Methanol	210,000 tpy
Acetic Acid	60,000 tpy
Acetic Anhydride	10,000 tpy
Vinyl Acetate	20,000 tpy
Polyvinyl Acetate	13,000 tpy
Polyvinyl Alcohol	5,000 tpy
Butyl Acetate	10,000 tpy
Ethyl Acetate	7,500 tpy

These figures represent gross capacities. Several of these products are used as intermediates in the production of other products in the system; shortages of raw materials have in the past prevented capacity utilization of some downstream plants. The net incremental tonnages of products available for sale differ therefore from these capacities. The net effect of the project on quantity available for sale or transfer to existing units is shown in Annex 3 and summarized here:

Product	Production Capacity For Sale or Transfer
Acetylene	13,430 tpy (transferred)
Methanol	167,580 tpy
Acetic Acid	31,946 tpy
Acetic Anhydride	10,000 tpy
Vinyl Acetate	8,325 tpy
Polyvinyl Acetate	13,000 tpy
Polyvinyl Alcohol	4,503 tpy
Butyl Acetate	10,000 tpy
Ethyl Acetate	7,950 tpy
Offgases	
Offgas from Acetylene Unit	119.0 million m^3/year (transferred)
Purge Gas from CO Separation Unit	26.4 million m^3/year (transferred)
Purge Gas from Acetic Acid Unit	14.4 million m^3/year (transferred)
Hydrogen	100.0 million m^3/year (transferred)

Location and Availability of Inputs

15. There is sufficient room on the Craiova platform to accommodate the facilities to be built under the project. Some storage facilities will be moved closer to the railway at the outskirts of the plant, but this had to be done any case. Water is available from the nearby Jiu river and chemically impure water will be processed through a biological treatment unit. The plant units (mainly the methanol unit) will generate part of the steam required for the project and residual needs will be filled by existing facilities. Power is available from the national grid as well as from the platform network. Methane is readily available through the pipeline connecting the platform to the Transylvanian fields.

16. The number of existing administrative staff does not need to be expanded for the project. Total technical personnel requirements amount to a total of 1,460 people, out of which 820 are operators, 550 are auxiliary workers and 90 are engineers and technicians. The latter will be found among graduates of chemistry schools (which work in close collaboration with the chemical industry) and/or trained in the complex. Semi-skilled manpower is available in the judet of Dolj.

Environmental and Safety Hazards

17. No major problems are expected with regard to pollution levels as a result of the project, but further investigation would be warranted once the Bank chooses to proceed with the project's evaluation. The same applies to safety measures, which are of particular importance with respect to the air separation and acetylene plants.

Project Management and Implementation

18. The project will be implemented under the supervision of the management of the Craiova Chemical Complex. The project management team includes staff from the complex, from the Ministry of Chemical Industry's engineering institute IITPIC, and from ROMCHIM, the procurement agency organized under the same ministry. IITPIC and ROMCHIM are known to the Bank through the Bacau Fertilizer Project and the Cimpulung Polyester Project. The organizational arrangements for the projects are somewhat cumbersome, but have worked satisfactorily in these other projects.

Project Status and Timing

19. The Techno-Economic Study (TES) for the Craiova Project has been completed and is being processed for the Council of Minister's approval by June 1977. Site preparation is reportedly underway and civil works could start this year if the original schedule is followed. Some preliminary process design has been completed. The commissioning dates determined

in the TES for the various units are spread over a period of two years, from October 1979 to June 1981. The CO separation unit and the acetic acid plant would be the first to be constructed and commissioned, and ROMCHIM has already contacted potential suppliers of know-how and equipment for these two plants.

20. For the acetic acid plant, technical discussions with the two leading licensors, BASF (West Germany) and Monsanto (USA), are well advanced and a contract could be signed before the end of 1977. In addition orders for long delivery items for the methanol unit may also have to be placed early.

Project Costs and Financing Plan

21. Capital cost estimates, based on TES data worked out by IITPIC and ROMCHIM are detailed in Annex 7 and summarized below. The total financing requirements amount to US$190 million, out of which US$76 million is convertible and about US$15 million is non-convertible foreign exchange.

Capital Cost Summary
(in US$ million)

	Convertible F. Exchange Costs	Local Cy. Costs 1/	Total Costs	Breakdown
	---US$ million---			---%---
Land and Site Improvements		0.2	0.2	0.1
Equipment, Materials and Spares	48.8	53.4	102.2	65.5
Freight and Insurance	0.9	1.0	1.9	1.2
Erection	0.2	7.4	7.6	4.9
Duties and Other Expenses	1.4	2.3	3.7	2.4
Buildings & Civil Works	0.8	28.1	28.9	18.5
Engineering, Licenses and Technical Assistance	2.4	4.1	6.5	4.2
Training	-	1.3	1.3	0.8
Administration and Pre-Operating Expenses	-	3.7	3.7	2.4
Basic Cost Estimate (BCE)	54.5	101.5	156.0	100.0
Physical Contingencies (4.2% of BCE)	2.3	4.2	6.5	
Price Escalation (5.2% of BCE + phys. cont.)	8.5	-	8.5	
Total Installed Costs	65.3	105.7	171.0	
Working Capital	3.0	7.0	10.0	
Expected Project Cost	68.3	112.7	181.0	
Interest During Construction	7.8	1.6	9.4	
Total Financing Required	76.1	114.3	190.4	
Breakdown of BCE (in %)	34.9	65.1	100.0	

1/ Includes US$14.5 million in non-convertible foreign exchange costs.

22. No foreign exchange financing arrangements have yet been made. The possibility of attracting co-financing funds deserves careful consideration. Suppliers' credit could be arranged in the case of certain plant units. The issues concerning financing arrangements in the case of Bank participation are discussed in para 44.

V. MARKET AND MARKETING

Domestic Consumption and Export Forecasts

23. It has so far not proven possible to obtain reliable estimates of the expected future growth of the Romanian market for the products under review. Annex 8 shows the tentative estimates prepared by the mission, from the little information available, on projected future growth of the domestic market and the amounts of project output which will have to be disposed of by exports. A summary is given below, showing only the proportion of production presumed to be exported:

Product	Percentage of Economic Revenues of the Project at 100% Cap. Utilization 1/	Percentage of Production for Export During First Three Years of Plant Operations	Percentage of Production for Export in 1985
Acetic Acid	15	51	17
Methanol	25	79	-
Acetic Anhydride	5	84	80
Vinyl Acetate	5	-	-
Polyvinyl Acetate	8	-	-
Ethyl Acetate	5	23	12
Butyl Acetate	6	19	-
Polyvinyl Alcohol	8	60	51

1/ Total does not add up to 100% of revenues, since part of these are due to transferred offgases and acetylene (see below).

24. Acetic acid is mainly used for the production of cellulose acetate fiber and vinyl acetate in the fiber and coatings industries. It is estimated that by 1982, domestic consumption will have risen to the point where there will be a production deficit of about 15,500 tons. Since the incremental quantities available for sale after the expansion are about 32,000 tpy, some 16,500 tpy will have to be exported in that year. Romania plans to double its output of artificial fibers in the next 10 years. This expansion is equivalent to an annual growth rate of 7.2%. This rate was also used to project the future growth of the domestic acetic acid market. By 1986, all the output from the new unit will be absorbed in the home market. The

quantity temporarily directed to export markets represents only a small proportion of total world demand. However, it is believed that the EEC is a potential exporter of acetic acid, and there may be problems in disposing of this material in commercial markets in Europe although other areas of the world and in particular the US will be short of acetic acid.

25. Acetic anhydride is also used in the manufacture of cellulose acetate for artificial fibers; a small tonnage is also used for the manufacture of aspirin. Consumption in Romania is estimated at about 1,000 tpy until the early eighties. The mission has assumed that the domestic demand will rise in proportion to that for cellulose acetate; the remainder of the project's output will be exported. While adequate world capacity for acetic anhydride seems to exist, a projected shortage of acetic acid, a least in the US, should make it possible to find export markets for the anhydride. US producers prefer to use the acid for vinyl acetate or terephthalic acid production.

26. Vinyl acetate and PVA have become of major importance in the last 15 years as the basic constituents of water based paints which have made tremendous inroads into the markets formerly held by lacquers. The use of PVA in coatings and adhesives is also significant. For this project, virtually all of the extra production of these products will go to the POLICOLOR plants which manufacture a range of coatings, paints, and resins. POLICOLOR is bringing new capacity on stream in 1979/80 (Timisoara in W. Romania) to produce resins, varnishes, and printing inks and is expanding its PVA utilization capacity in Bucharest by 50% at the same time. About 30% of POLICOLOR coatings are exported mainly to the Middle East and Africa. The increased demand for products used in the building industry as an aftermath of the earthquake is expected to continue for several years. It is, therefore, assumed that the entire output of these two products will be absorbed by the domestic market.

27. Estimates of growth of the home demand for methanol, as estimated in the TES, have been tentatively accepted by the mission for this analysis. Until 1985, there will be about 120,000 tpy available for export; in 1985, Romania is planning to bring on stream a number of plants which will be large users of methanol, e.g. single cell protein, urea/formaldehyde slow release fertilizers, polysaccharides. The use of methanol as a blend component in motor gasoline (or as a raw material for methyl tetrabutyl ether which has a high octane rating) is also forecast to grow. At least eight major methanol units will have to come on stream in the period 1980-85 to meet projected increases in world demand, and it may well prove possible to find export markets for methanol without too much difficulty. This issue requires nevertheless further investigation.

28. Ethyl and butyl acetates are used as solvents and thinners in lacquers. They are being increasingly preferred over the cheaper MEK and MIBK solvents as the latter are causing serious pollution problems. Romania is currently importing 3-4,000 tons per year of butyl acetate, and a considerable increase in paint or lacquer capacity is scheduled for 1980.

The forecasted growth of domestic demand for these products has been based on estimated future growth of the paints and varnishes industry. On that basis, all the output of the new units should be absorbed in the domestic market by 1985. Europe imports considerable quantities from the US, and no difficulty should be experienced in finding export markets.

29. Polyvinyl alcohol is used as an emulsifier, as a textile warp size, and in the manufacture of grease proof and other papers. In Japan, it is also being used as a synthetic fiber with good heat insulation properties. Little is known about European manufacture and demand. Both Japan and the US are major producers (the latter producing 60,000 tpy). It would appear that reliable technical service to customers will have to be provided if Romania is to place this material in export markets. Although 1980 domestic demand is estimated at only 1,000 tpy, the close coordination of the chemical industry with the coatings and textile industries should lead to a quite rapid build up of domestic utilization of this product. It has been claimed that there are some possibilities of sales to COMECON countries.

Export Marketing Arrangements

30. Good rail communication exists with Constanta on the Black Sea, where bulk storage for liquids has already been installed. Besides normal ship-loading facilities, they will have facilities for pipeline loading of barges of 500-3,000 tons, which are then loaded onto ships for movement to Western Europe and the US. Because of berth limitations, the maximum ship size is 5-6,000 tons today, but extensions are being made to receive ships up to 10,000 tons. Export marketing will be carried out by DANUBIANA, a Foreign Trade Enterprise under the Ministry of Chemical Industry, which is currently trading in fertilizers, explosives, tires, plastics, rubber, and fibers. DANUBIANA becomes the formal owner of the goods which are transferred to it from the individual enterprises and undertakes to sell all the materials of which it takes possession. Some technical service is provided by the individual enterprises via DANUBIANA to customers. Although preliminary contacts have been made with potential customers abroad, no firm commitments can yet be entered into because start up dates are still too far off in the future. DANUBIANA appears to have little experience in the export of those products (e.g. polyvinyl alcohol) where customer technical service can be an essential factor in the marketing process. Its general access to information on export markets and prices also seems limited.

VI. ECONOMIC ANALYSIS

31. Due to the complex nature of the project, an unusually large number of assumptions and calculations had to be made, the details of which are given in Annex 9. Wherever simplifying assumptions had to be made, they were intentionally made in the way most favorable to the project. Only the most important assumptions, pertaining to feedstock and product prices, are discussed here.

Feedstock Costs

32. Methane gas accounts for about half of the recurrent operating costs in the economic analysis (Annex 9, Table 9); its unit cost is therefore a key element in determining the project's economic return. The Romanian prices for methane are US$3 for methane used as chemical feedstock and US$10 for methane used as fuel. These prices are entirely out of line with the economic (opportunity) value of methane to the economy. The major alternative uses for the methane gas to be used by the project are the following: (i) use as feedstock for ammonia, (ii) exports or lesser imports of the gas, and (iii) use of methane in power stations instead of coal, lignite or fuel oil. Romania has reached levels of nitrogenous fertilizer production which would imply severely diminished returns to additional investments in that area, largely owing to export marketing problems. The theoretical value of methane if it were to be exported as such would have to be reduced by the pipeline costs. Its value in the possible alternative of lower gas imports, which might have become more relevant at the margin (para 7), does not seem to exceed US$45 per thousand cubic meters, the approximate price charged to Romania by the USSR under a long-term agreement for limited quantities.

33. The economically most attractive alternative use for the methane to be used by the project seems therefore to be as a fuel in power stations, and in particular as a replacement for fuel oil in such uses, which fuel oil would in turn be freed to export, or possibly imported in lesser amounts (the alternative of replacing cheaper, locally available coal or lignite has a smaller economic value). Based on international fuel oil prices of US$70 per ton (price presently prevailing in the Mediterranean area) and on relative calorific contents, the relevant economic value of the project's methane, i.e. the one accruing from its most attractive alternative use is US$65 per thousand cubic meters.1/ This price was used in the economic analysis for the base case, and sensitivity tests were conducted for various basic energy (i.e. fuel oil) prices.2/

Product Prices

34. About 15% of the economic revenues expected from the project are in offgases which were priced in the same way as the methane input, i.e. on an energy content basis (Annex 9, Table 8). About 10% of the revenues

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1/ Rather than literally replacing fuel oil in power stations, the methane gas in question would actually allow stations presently using gas as fuel not to be converted to fuel oil. Since this conversion carries additional capital costs, the above economic price of US$65, which does not account for this, should be, if anything, higher.

2/ It should be mentioned that the prices of some other inputs to the project, besides methane gas, were also linked to this basic fuel oil price and moved together in the sensitivity analysis.

represent the benefits of substituting acetylene from methane for acetylene from carbide. These benefits were taken to be the recurrent costs of producing first carbide (mostly power), and thence acetylene from carbide. The remaining 75% are due to the various acetylene-based products and to methanol. Economic prices for these products were discussed at length both here and in the field on the basis of available information on international prices and markets for these products (Annex 9, Table 6). For three major products, methanol, acetic acid and vinyl acetate (and hence polyvinyl acetate), the mission requested specialized consultants to supply the capital and operating cost, as well as future demand and supply data required to assess a long-run equilibrium price (Annex 9, Table 12). These products account for more than half of total project revenues.

35. For products partly destined for export markets, two-thirds of the exported portion were penalized by an average 10% EEC tariff.[1] The portion representing import substitution was credited by 3% to reflect savings in insurance and transportation.

Economic Return

36. In spite of what have to be considered as generally optimistic assumptions, the project's economic return does not exceed 9 percent in the base case:

Basic Energy (Fuel Oil) Price (per ton)	Corresponding Methane Price (per 1,000 m^3)	Economic Return for the Project (%)
$59	$55	11.5
$65	$60	10.2
70	65	8.8 (Base Case)
75	70	7.4
81	75	5.9
86	80	4.3

Even if the long-run price of fuel oil were for some reason to fall under its present level on the international market, the decrease in its price required to bring the project above 12% (all other things being equal) would exceed 15%, which is not likely.

37. Sensitivity analysis for the base case showed the following results (Annex 9, Table 2):

1/ Percentage given by DANUBIANA representatives.

Economic Return for the Project Under Varying Assumptions
(in percentages; base case: 8.8%)

Parameter	+15%	+10%	-10%	-15%	Sensitivity Factor[1]
	Range of Variation in Parameter				
Product Prices	16.7	14.3	2.3	-1.5	0.60
Variable Op. Costs	2.5	4.8	12.5	14.2	0.40
Capital Costs	6.7	7.4	10.5	11.5	0.15
Fixed Op. Costs	8.2	8.4	9.3	9.5	0.05

1/ Decrease/increase in return from base case 8.80 points due to a one percent change in parameter.

It is felt that the economic prices adopted are reasonable (mainly where cost-based equilibrium prices have been calculated) and in certain cases, high compared to present actual transaction prices (although not necessarily list prices). It should however be kept in mind that the prices of some of the chemicals in question are quite difficult to forecast, as is the case with many organic chemicals.

VII. MAIN ISSUES

Economic Viability

38. There seem to be several general types of causes for the relatively low economic return expected from the project under its present form, although they do not apply to the same degree to the different plants included in the project. The main cause is the small size of most of the plants. The second possible cause is that capital cost estimates for some of the plants are higher than expected. Finally, the relative inefficiency of the acetylene route, compared to other routes for the manufacture of certain organic chemicals (Annex 2) might also be responsible for the low overall return, but most likely only for a small part.[1]

39. A relevant analysis of the relative importance of these causes can however only be done on a plant-by-plant basis. Due to the integrated nature of the project and missing information regarding plant-by-plant operating costs, the mission has as yet been able only to analyze tentatively three of the plants in isolation, with the following results:

1/ A large part of the project's additional acetylene output will be used for the production of vinyl acetate, for which the acetylene route is still relatively efficient (Annex 2).

	Economic Return (in percentages)
All Plants Included in Complex	8.8 (Base Case)
Methanol Plant Alone	12.9
All Plants Other Than Methanol Plant	7.2
Among Which:	
Polyvinyl Alcohol and Butyl Acetate Plants Together	negative
All Remaining Plants	10.8

40. These results would indicate that there is scope for improving the project's viability by redesigning its concept and product mix, in particular by eliminating at least the polyvinyl alcohol plant and the butyl acetate plant. The return for the complex, without these two plants would in this case increase to 11.5%.1/ Other recommendations for the improvement of project economics could most certainly be made provided enough information is available. It is possible that some of these recommendations could be implemented in a relatively straightforward fashion, but most likely some of them could require a more difficult and time-consuming redesign effort, due to the very ingenuity of the original design, aiming at taking full advantage of the benefits of plant interlinkages. Although the plants concerned are not likely to be those whose construction is to start first (i.e. the methanol, acetic acid and CO separation plants), the project approval process, which is already well advanced (paras 19 and 20) would have to be delayed. The Romanians might therefore be reluctant to accept the suggestion of redesigning any part of the project. In any case, the Bank should be prepared to send a mission to continue the above-mentioned plant-by-plant analysis and discuss the alternatives for improving the project's economic attractiveness, if the Government so requests.

41. Provided that the project is actually redesigned so as to produce a satisfactory economic return and that other issues (see below) are resolved, the project ought to be suitable for further consideration by the Bank, although most likely as a FY 79 project. In this respect, it should be emphasized that the project has significant merits from the Country's point of view, which are not readily quantifiable in the economic analysis. First, it would produce chemicals from locally available gas feedstock and thus imply a reduced degree of dependence on less predictable imported hydrocarbons supplies for chemical uses. Second, the comparatively small size of a complex of this type produces tonnages of products more in line with the size of the domestic market than would be the case, all other things being equal, with a petrochemical complex of the size most commonly built nowadays (see Annex 2).

1/ And could probably be higher if instead of simply eliminating the production of butyl acetate, a plant were to be erected which would use the standard process for butyl acetate from butanol and acetic acid; this process is already being operated at Craiova.

Market and Marketing

42. The project and its product mix appear to have been designed largely on the basis of technical considerations. As mentioned above, little attention has been given to the assessment of the markets as well as to the question of effective marketing arrangements. For some of the products, like methanol, acetic acid and anhydride, a large part of the production will have to be initially exported. In the case of these quasi-commodities, it would seem important to look at the future state of the market in Europe, in COMECON countries, and in the Middle East.1/ Internal uses for these products also need to be carefully addressed, in particular with regard to the congruence between future needs in other branches of the chemical industry (e.g. cellulosic fibers, single cell protein plants) and the production available from the project for the home market. For other products, such as polyvinyl alcohol, the problem which deserves the most attention is that of the marketing organization's ability to locate individual customers and provide them with satisfactory technical services.

43. In the latter case, the problem could disappear if the polyvinyl alcohol plant were to be eliminated as the preliminary economics would seem to suggest. For the first group of products, an in-depth market analysis would be needed at a later stage, assuming the Bank chose to proceed with the evaluation of a redesigned project.2/

Financing Arrangements

44. Although the financing plan was not discussed in detail during the mission's visit, it appeared that the Government would have liked to meet the total direct and indirect foreign exchange requirements, estimated at US$76 million, through Bank financing. The Government might nevertheless be prepared to consider co-financing for this project. The license and the specialized equipment package for the acetic acid plant would possibly be suitable for this, provided the selected technology is one of the two considered at present. Since a revised design of the project would alter the estimates for total and foreign exchange capital costs, this issue ought to be taken up at a later stage if the Bank chooses to proceed with the project.

1/ No discount (other than tariffs) has been allowed for in the economic analysis to reflect the difficulty of selling products from the project on possibly saturated foreign markets, although such a discount might possibly be appropriate in certain cases, e.g. for acetic acid where Europe is reported to be a net exporter. If such a discount had been used, the project's return would have been somewhat lowered.

2/ As Romania expands its chemical industry and becomes more and more dependent on external trade, there seems to be a general need for a more effective system of monitoring of export markets and locating new markets so as to minimize the effects on the planned economy of business cycles abroad and provide reliable informational inputs to investment decisions.

Procurement

45. Advance contracting for the acetic acid, CO separation and possibly methanol plants would have constituted an issue if it had been advisable to proceed with the project under its present form. Since it is recommended that the project be redesigned if the Bank is to keep it under consideration, delays for the entire project are likely to occur (para 40) which would eliminate this issue.

VIII. RECOMMENDATIONS

46. It is recommended that the Romanians be advised (i) that the Craiova Chemical Project is not economically viable under its present form and that it would need redesigning before it could become suitable for further consideration by the Bank, presumably as a FY 79 project, (ii) that the mission's analysis of the overall project and of some of the plants will be communicated to them as agreed and (iii) that a mission can be sent to discuss this analysis and collaborate with the engineering institute in working out an improved project configuration, if the Government is willing in principle to redesign project. The mission's findings and recommendations should be discussed within the Bank and a telex sent to the Romanians along the above lines.

ETortorelli/DCaplin/JFRischard:siv

Attachments

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ROMANIA - CRAIOVA CHEMICAL PROJECT
Project Preparation Mission

List of Persons Met by the Mission

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Mr. Rogoz, Deputy Minister
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Craiova Chemical Complex

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Industrial Projects Department
June 17, 1977

ACETYLENE AND ACETYLENE-BASED PRODUCTS

1. Introduction. Acetylene has been used in metal cutting and welding for many years and since the early part of the 20th century has played an important role as a chemical intermediate. Its maximum utilization was reached in the mid 1960s; since then technologies based on lower cost ethylene and propylene from large naphtha and ethane crackers have to a large extent replaced the processes based on acetylene. However, for countries with an indigenous source of natural gas (methane) and insufficient petroleum feedstocks such as naphtha, the use of acetylene based processes may still be attractive; since acetylene is produced typically on units with much smaller capacities (10,000-80,000 tpy) than have become common for olefines production, the acetylene based processes continue to receive attention when domestic demands for derivatives are at levels which would not justify large scale production, and where the technologies employed to produce these derivatives do not exhibit significant economies of scale.

2. Production Methods. Formerly, acetylene was produced mainly from calcium carbide. The carbide itself is manufactured by mixing lime and coke in a 60/40 mixture and heating it to over 2000°C in an electric furnace. The process is extremely energy intensive, requiring 2,900 KWH of carbide (over 9,000 KWH per tone of acetylene), and was often used where cheap hydroelectric power was available.

An alternative process, much used at one time in Germany, is via electric arc cracking of methane; this is even more energy intensive than the carbide route, requiring over 12,000 KWH per tone of acetylene.

The preferred route today for acetylene production is by the partial oxidation of methane. This process also produces as co-product offgas which is suitable for use as synthesis gas in ammonia plants; carbon monoxide and hydrogen may be separated from the offgas and used as raw materials in a variety of chemical synthesis products.

3. Uses. Acetylene, possessing a triple bond, is a highly reactive chemical and can be used as the raw material to produce a large number of common organic chemicals.

The principal end products are used in plastics manufacture and in the production of coatings, paints, adhesives, solvents, textile auxiliaries, and pharmaceuticals. Among the major ones are:

Polyvinyl chloride (PVC) is the second most important thermoplastic today, being used primarily for pipe manufacture, as a leather substitute, and as a metal substitute in industrial plants and the building industry. Recent studies have demonstrated a high incidence of cancer in workers exposed to vinyl chloride monomer, and the future growth of PVC demand is now in doubt.

Acrylates find outlets as coatings and in the textile industry where they are used to give permanent press characteristics to fabrics.

Polyvinyl acetate has become extremely important as the main component of water based paints which have made large inroads in the market formerly dominated by lacquers. It is also used in the manufacture of adhesives.

Polyvinyl alcohol is used for textile warp sizing, in the manufacture of adhesives, in paper coatings, and as an emulsifier. A promising new use is in the production of a fibre with good heat insulation properties which may find outlets in the manufacture of work clothes for steel workers, firemen, etc.

Chlorinated solvents, particularly trichlorethylene, are used for degreasing metal parts in metal fabrication and as grease solvents in the dry cleaning of fabrics.

A variety of organic solvents, such as ethyl and butyl acetates, can be manufactured from acetylene derivatives. They find their main use in paints, coatings, and adhesives. They lost ground in thenitrocellulose lacquer field to other cheaper solvents, but have recently gained some popularity as they cause less air pollution compared with competing products.

Acetic acid and anhydride are used for the production of cellulose acetate, a classical ~~intermediate for artificial~~ fibres, films, and plastics. The use of cellulose acetate in the manufacture of cigarette filters is still growing, but in all other uses, it is being displaced by synthetics based on olefines.

Acetic anhydride is also used in the manufacture of aspirin; this market is expected to be stable for many years to come.

4. Other Routes to Acetylene-based Chemicals and Future Acetylene Demand. In many cases, however, competitive processes using lower cost olefines as raw materials have displaced the acetylene routes, e.g. in the production of vinyl chloride (or PVC) and in acrylonitrile production.

Chlorinated solvents, such as trichlorethane, trichlorethylene, and perchlorethylene are easily produced by reacting chlorine with acetylene. Competitive routes, starting from methane or ethylene, exist, but more then half of the trichlorethylene produced today is still obtained using acetylene as raw material.

Quantities of acrylics (used in the paint and textile industries) are still manufactured by carbonylation of acetylene, but technologies based on propylene are popular. Nonetheless, about 40% of acrylics produced are still based on the route via acetylene.

Acetic acid and acetic anhydride can be obtained from acetylene via acetaldehyde, but newer routes from ethylene, methanol, or butane oxidation have all but superseded the acetylene based technology.

However, in the production of vinyl acetate and polyvinyl acetate (or PVA, of great importance in adhesives, paints, coatings), the situation is not as clear cut. While vinyl acetate is often made today by reacting ethylene, oxygen, and acetic acid, the process employing acetylene and acetic acid has only marginally higher production costs.

Virtually all the derivatives made from acetylene can be produced from olefines derived from petrochemical feedstocks, and the demand for acetylene, while primarily determined by the relative costs of production of derivatives via acetylene compared with the olefines routes, will to a lesser extent be influenced by the demand for end use products made from these derivatives. While it is expected that the tonnage of acetylene destined for these uses will fall somewhat in the future, the use of acetylene for tetrahydrofurfuron and for Reppe chemicals (a series of acetylene based chemicals used as intermediates for a variety of purposes) will probably compensate for part of this decline.

ANNEX 3

Product	Units	Before Expansion: Effective Plant Capacity	Before Expansion: Consumed on Site	Before Expansion: Available for Sale	After Expansion: Effective Plant Capacity	After Expansion: Consumed on Site	After Expansion: Available for Sale	After Expansion: Incremental Tonnage Available For Sale
Acetylene 2/								
via carbide	tpy	16,000	16,000	-	(16,000)	2,560	13,660	13,660 2/
via partial oxid.	tpy	33,000	33,000	-	63,000	63,000	-	-
Oxygen	million m^3	-	-	-	120	120	-	-
Acetaldehyde 1	tpy	60,513	59,163	1,350	70,388	70,388	-	(1,350)
Carbon Monoxide	million m^3	-	-	-	40	40	-	-
Hydrogen	million m^3	-	-	-	100	100	-	-
Methanol	tpy	-	-	-	210,000	42,420	167,580	167,580
Butanol	tpy	28,000	2,787	25,213	28,000	10,287	17,713	(7,500)
Acetic Acid	tpy	26,000	12,369	13,631	86,000	44,666	41,334	27,703 3/
Acetic Anhydride	tpy	-	-	-	10,000	-	10,000	10,000
Vinyl Acetate 1	tpy	15,000	12,585	2,615	40,000		10,760	8,325
Polyvinyl Acetate	tpy	23,000	-	23,000	36,000	-	36,000	13,000
Polyvinyl Alcohol	tpy	850	850	-	5,850	1,347	4,503	4,503
Butyl Acetate	tpy	6,000	-	6,000	16,000	-	16,000	10,000
Ethyl Acetate	tpy	-	-	-	8,025	75	7,950	7,950
Nicotinic Acid and derivatives	tpy	310	-	310	310	-	310	-

1/ Current production is restricted by raw material shortage

2/ Acetylene via carbide may be shut down entirely if capacity of new partial oxidation plant proves to be higher than design capacity.

3/ Actual sales from project are 31,946 tpy. The difference is acetic used by the vinyl acetate plant.

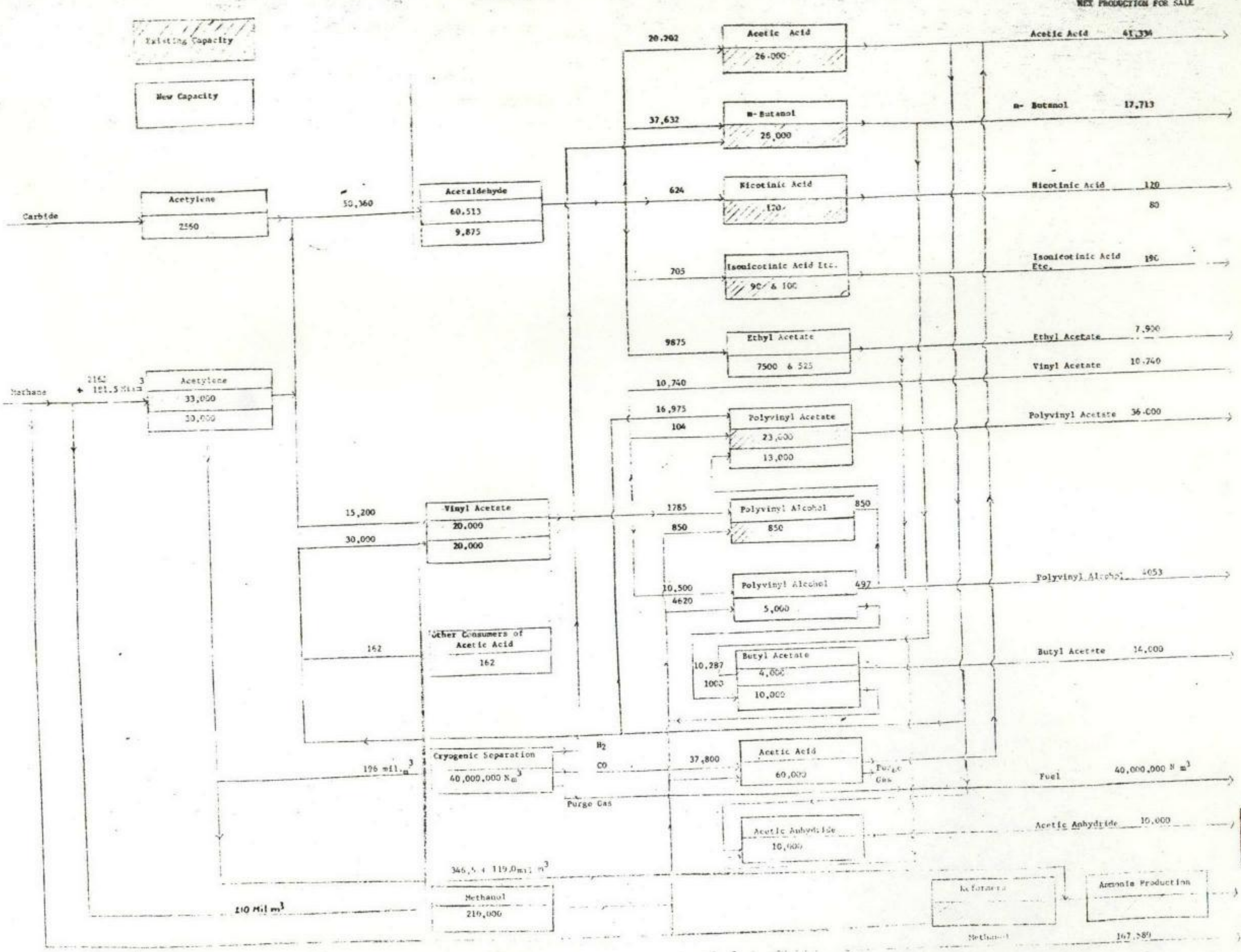
Craiova Chemical Complex
Summary of Financial Statements
(in million lei)

	1971	1972	1973	1974	1975
Sales	1,494	1,581	1,569	1,771	1,884 1/
Cash Operating Costs	1,025	1,028	1,012	1,130	1,269 1/
Depreciation	224	218	208	225	230
Benefits (Before allocations to State)	245	335	349	416	385
Current Assets	435	468	409	1009	696
Current Liabilities	311	291	251	785	455
Net Fixed Assets	2,855	2,668	2,564	2,537	2,429
Projects Under Construction 2/	120	201	657	986	1,695
Benefits as a % of Sales	16.4	21.2	22.2	23.5	20.4
Current Ratio	1.4	1.2	1.6	1.3	1.5

1/ Excludes tax on productive assets (200 million in 1975), since it was abolished in 1977.

2/ Investment activity since 1973-74 relates mainly to the construction of a NPK fertilizer plant

FLOWSHEET OF CRAIOVA ORGANIC CHEMICAL OPERATIONS
(tons per year)



Process Design and Technology

1. Craiova is planning the installation of an extra 30,000 tpy of partial oxidation capacity, virtually doubling up their present capacity by this route. The process is based on Tenneco and Societe Belge d'Azote know-how. The current manufacturing facilities came on stream in 1964; it is not known whether any problems have been experienced in the past in the operation of this unit, but it seems to operate satisfactorily at this time.

2. The total production of acetylene via partial oxidation will rise to 63,000 tpy and will permit the more expensive route via carbide to be phased out. An oxygen plant will be erected to meet the total oxygen requirements of the partial oxidation units. The nitrogen produced in this unit will be used for hydrogen washing in the cryogenic separation unit. About 8,000 tpy of the extra acetylene produced will be converted to acetaldehyde in the existing plant (where spare capacity exists) and the remainder will be used for the expanded production of vinyl acetate.

3. The offgases from both acetylene plants will be sent to a new cryogenic separation plant where carbon monoxide and some hydrogen will be separated; the hydrogen stream will be used to replace synthesis gas (of lower hydrogen content) for the hydrogenation of crotonaldehyde in the existing n-Butanol plant, while the carbon monoxide will be used to carbonylate methanol in a new plant for the production of 60,000 tpy of acetic acid. This is one of the preferred routes for the manufacture of acetic acid today. Two processes --- a high pressure process (BASF) and a low pressure route (Monsanto) have been considered. The former has been selected, since it is claimed that is more suitable for smaller capacities. It is believed that BASF was more flexible on the question of catalyst producing facilities in Romania than Monsanto. At least two plants in the 30,000 - 65,000 tpy range are in operation using the BASF process.

4. The remainder of the offgases essentially form synthesis gas which will be used on the ammonia units already in operation; the syngas will partially replace the methane feed in current use, and thus reduce operating costs, since the fuel currently required to convert the equivalent tonnage of methane to syngas will be saved.

5. The full utilization of the acetaldehyde plant referred to above will yield an extra 10,000 tpy of acetaldehyde. It is planned to utilize this extra production for conversion to ethyl acetate in a new unit of 8,000 tpy capacity.

6. Of the extra 60,000 tpy of acetic acid produced,13,000 tpy will be used to produce 10,000 tpy of acetic anhydride via cetene, and absorption in acetic acid; the process technology is well established. Acetic acid will

also be used with acetylene (with a zinc catalyst) to produce an extra 20,000 tpy of vinyl acetate in a new plant, thus doubling the present capacity. The new polyvinyl acetate unit will use the present emulsion polymerization process, and will have a capacity of 13,000 tpy. Three emulsion grades will be manufactured. An interesting feature of the process is the use of polyvinyl alcohol as the emulsifier instead of the more usual cellulosic compounds. It is claimed that the product quality is improved by the method which is also used by Japanese producers.

7. The 38,000 tpy of methanol required for the new acetic acid plant will come from a 210,000 tpy methanol plant using methane as raw material, and a copper catalyst.

8. Methanol will also be used as a raw material in a series of processes leading to the production of 5,000 tpy of polyvinyl alcohol and 10,000 tpy of butyl acetate. These processes are based on research and development carried out by IITPIC's design center for chemical processes.

9. The starting point for these processes is vinyl acetate which is block polymerized and then hydrolized in a methanol solution. In this process, some 40,000 tpy of methanol are used, of which 4,600 tons are actually consumed in the manufacture of polyvinyl alcohol. 28,000 tpy of an aqueous solution of methanol are recovered from the process; the solution contains methyl acetate produced as a by-product in the manufacture of polyvinyl alcohol.

10. This mixture passes to a new butyl acetate plant, where n-butanol is added and transesterification of the methyl acetate to butyl acetate takes place; the methanol is recovered and is then recycled to the polyvinyl alcohol plant.

11. From the study of the Flowsheet (Annex 5) it can be seen that considerable ingenuity has been used in developing the conception of the integrated expansion of production; the fullest use has been made of capacity already available in secondary product units; novel production methods have been incorporated; and considerable upgrading of intermediates and by-products has been achieved.

12. The capacities installed, however, are small and are of the same order as domestic demand. The incidence of fixed charges and capital charges will therefore tend to be rather high compared with those incurred by larger production units in Europe and U.S.A.

ROMANIA-CRAIOVA CHEMICAL COMPLEX PROJECT
PROJECT COST AND FINANCING REQUIRED
(in U.S. $ million)

	Direct Imports: Equipment and Technology	Direct Imports: Special Materials Instruments and Supplies	F. Ex.Cost of Local Supplies & Other F.Ex.Costs	Total F. Exchange Costs	Total Local Cy Costs 1/	Total Costs
Land and Site Improvement	-	-	-	-	0.2	0.2
Equipment and Materials						
Process	25.5	8.1	11.1	44.7	48.3	93.0
Utilities	2.3	0.9	0.1	3.3	4.1	7.4
Spares	0.8	-	-	0.8	1.0	1.8
Freight and Insurance	-	-	0.9	0.9	1.0	1.9
Erection	-	-	0.2	0.2	7.4	7.6
Duties and Other Expenses	-	-	1.4	1.4	2.3	3.7
Buildings and Civil Works	-	-	0.8	0.8	28.1	28.9
Engineering, Licenses and T.A.	2.4	-	-	2.4	4.1	6.5
Training	-	-	-	-	1.3	1.3
Administrative and Pre-operating Expenses	-	-	-	-	3.7	3.7
Basic Cost Estimate	31.0	9.0	14.5	54.5	101.5	156.0
Contingencies						
Physical Contingencies	1.3	0.4	0.6	2.3	4.2	6.5
Price Escalation	5.0	1.4	2.1	8.5	-	8.5
Total Installed Cost	37.3	10.8	17.2	65.3	105.7	171.0
Working Capital	-	-	3.0	3.0	7.0	10.0
Expected Project Cost	37.3	10.8	20.2	68.3	112.7	181.0
Interest During Construction	-	-	7.8	7.8	1.6	9.4
Total Financing Required	37.3	10.8	28.0	76.1	114.3	190.4

1/ includes expenses in non-convertible currencies amounting to U.S. $14.5 million

CRAIOVA Chemical Project - Tentative Market Forecasts (1980-1985)

	1980		1981		1982		1983		1984		1985	
	Tons	%	Tons	%	Tons	%	Tons	%	Tons	%	Tons	%
Acetic Acid												
Home Sales	11,000	46	14,000	49	16,500	52	19,600	61	22,200	70	26,400	83
Exports	12,960	54	14,750	51	15,450	48	12,350	39	9,750	30	5,550	17
Net Production for Sale	23,960	100	28,750	100	31,950	100	31,950	100	31,950	100	31,950	100
Methanol												
Home Sales	24,220	19	30,820	20	36,370	22	43,200	26	51,000	30	167,580	100
Exports	101,470	81	120,000	80	131,210	78	124,380	74	116,580	70	-	-
Net Production for Sale	125,690	100	150,820	100	167,580	100	167,580	100	167,580	100	167,580	100
Acetic Anhydride												
Home Sales	1,000	18	1,000	11	2,000	20	2,000	20	2,000	20	2,000	20
Exports	4,600	82	8,000	89	7,900	80	8,000	80	8,000	80	8,000	80
Net Production for Sale	5,600	100	9,000	100	9,900	100	10,000	100	10,000	100	10,000	100
Vinyl Acetate												
Home Sale			6,240	100	7,490	100	8,330	100	8,330	100	8,330	100
Exports			-	-	-	-	-	-	-	-	-	-
Net Production for Sale			6,240	100	7,490	100	8,330	100	8,330	100	8,330	100
Poly Vinyl Acetate												
Home Sales			4,940	100	11,050	100	12,740	100	13,000	100	13,000	100
Exports			-	-	-	-	-	-	-	-	-	-
Net Production for Sale			4,940	100	11,050	100	12,740	100	13,000	100	13,000	100
Ethyl Acetate												
Home Sales			3,000	99	5,000	74	5,600	72	6,300	79	7,000	88
Exports			20	1	1,760	26	2,190	28	1,650	21	950	12
Net Production for Sale			3,020	100	6,760	100	7,790	100	7,950	100	7,950	100
Butyl Acetate												
Home Sales			3,800	100	6,000	71	8,000	82	9,000	90	10,000	100
Exports			-	-	2,500	29	1,800	18	1,000	10	-	-
Net Production for Sale			3,800	100	8,500	100	9,800	100	10,000	100	10,000	100
Polyvinyl Alcohol												
Home Sales			1,000	59	1,300	34	1,700	39	2,000	44	2,200	49
Exports			710	41	2,536	66	2,710	61	2,500	56	2,300	51
Net Production for Sale			1,710	100	3,836	100	4,410	100	4,500	100	4,500	100

Industrial Projects Department
June 1977

CRAIOVA CHEMICAL PROJECT - Economic Projections and Rate of Return Calculations for the Craiova Expansion Project

(in US $ millions and at 1977 constant prices)

	Details Shown in Table	1977	1978	1979	1980	1981	1982	1983	1984	1985-92	1993
(A) Capital Resources Used Up by the Project											
Fixed Capital	Table 3,4	(4.0)	(32.9)	(68.2)	(39.3)	(16.0)	-	-	-	-	-
Working Capital	Table 5				(4.5)	(3.4)	(2.4)	(0.6)	(0.1)	-	11.0
Subtotal (A)		(4.0)	(32.9)	(68.2)	(43.8)	(19.4)	(2.4)	(0.6)	(0.1)	-	11.0
(B) Economic Value of Production	Table 6,7,8,12				35.9	63.0	82.3	86.6	87.5	87.5	87.5
(C) Economic Costs of Production											
Variable Costs	Table 7,9				(23.5)	(41.2)	(53.8)	(56.6)	(57.2)	(57.2)	(57.2)
Fixed Costs	Table 9				(6.1)	(6.1)	(6.1)	(6.1)	(6.1)	(6.1)	(6.1)
Subtotal (C)					(29.6)	(47.3)	(59.9)	(62.7)	(63.3)	(63.3)	(63.3)
(D) Economic Surplus (Deficit) from Production (B) - (C)					6.3	15.7	22.4	23.9	24.2	24.2	24.2
(E) Economic Surplus (Deficit) from Project, Including Capital Costs (A) + (D)		(4.0)	(32.9)	(68.2)	(37.5)	(3.7)	20.0	23.3	24.1	24.2	35.2

BASE CASE ECON. RETURN: 8.8% Table 2

CRAIOVA CHEMICAL PROJECT - Rate of Return and Sensitivity Analysis

A. Base Case and Sensitivity Analysis for Base Case

Base Case: 8.8% (using basic energy cost equivalent to fuel oil at $70 per ton)

Sensitivity Analysis for Base Case:

Parameter	+15%	+10%	-10%	-15%	Sensitivity Factor 1/
	Range of Variation in Parameter				
	--- resulting rate of return % of ---				
Product Prices	16.7	14.3	2.3	-1.5	0.61
Variable Op. Costs	2.5	4.8	12.5	14.2	0.39
Capital Costs	6.7	7.4	10.5	11.5	0.16
Fixed Op. Costs	8.2	8.4	9.3	9.5	0.04

1/ decrease/increase in rate of return due to a 1% change in parameter

B. Return Under Varying Assumptions Regarding the Price of Energy

Basic Engergy (Fuel Oil) Price (per ton)	Corresponding Methan Price (per 1000 m^3)	Return (%)
$59	$55	11.5
65	60	10.2
70	65	8.8 (Base Case)
75	70	7.4
81	75	5.9
86	80	4.3

C. Plant by Plant Returns

Methanol Plant: 12.9% (see Table 10)

Polyvinyl Alcohol and Butyl Acetate Plants together: Negative (see Table 11)

CRAIOVA CHEMICAL PROJECT - Derivation of Overall Capital Expenditure Pattern[1/]

Plant Unit	Com. Date	Plant Cost (lei million)	% of Total[2/] Project Cost	Expenditure Pattern, in Percentages[3/] 1977	1978	1979	1980	1981	Total
CO Separation	10/79	131.7	5	5	40	55	-	-	100
Acetic Acid	12/79	369.0	15	5	40	55	-	-	100
Methanol	12/79	691.4	27	5	40	55	-	-	100
Acetic Anhydride	3/80	71.0	3	5	40	55	-	-	100
Vinyl Acetate	12/80	156.7	6	-	5	40	55	-	100
Oxygen	3/81	189.7	7	-	5	40	55	-	100
Acetylene	6/81	395.9	16	-	-	25	48	27	100
Polyvinyl Alcohol	6/81	242.0	10	-	-	25	48	27	100
Polyvinyl Acetate	6/81	26.9	1	-	-	25	48	27	100
Ethyl Acetate	6/81	77.6	3	-	-	25	48	27	100
Butyl Acetate	6/81	139.5	5	-	-	25	48	27	100
Storage Facilities[2/]	Various	52.2	2	-	-	51	13	36	100
Total Project	Various	2,543.6[3/]	100%	2.5	20.5	42.5	24.5	10.0	100.0

Notes: 1/ Basic pattern for each plant is 5% in first year, 40% in second year, and 55% in year preceding commissioning date. Above figures reflect also different zero dates in calendar year for the start of project implementation.

2/ Expenditures for storage facilities supposed to be incurred during year preceding commissioning of various plants.

3/ Includes only equipment, instruments, materials, erection, civil works and buildings. Other capital cost items are not available on a plant by plant basis.

CRAIOVA CHEMICAL PROJECT - Derivation of Fixed Capital Expenditures for the Economic Projections

(in US $ and at 1977 constant prices)

	1977	1978	1979	1980	1981	Total
% Expenditure Pattern (Table 3)1/	2.5	20.5	42.5	24.5	10.0	100.0
Fixed Capital						
Expenditures Before Price Contingencies and Without Duties 2/						
Local 3/	2.6	21.3	44.0	25.4	10.3	103.6
Foreign 3/	1.4	11.6	24.2	13.9	5.7	56.8
Total	4.0	32.9	68.2	39.3	16.0	160.4

Notes: 1/ Assumes that expenditure pattern for equipment and civil works will apply to total capital costs (see Table 3, note 3/.

2/ As per Annex 7. Custom Duties amount to US $ 2.1 million.

3/ Same expenditure pattern applied to local and foreign costs for simplicity's sake.

ANNEX 9
Table 4

CRAIOVA CHEMICAL PROJECT - Working Capital Requirements, Preliminary Estimate[1/][2/]

(in US $ million)

	1980	1981	1982	1983	1984	1994 (notional recovery)
Incremental Needs[3/]	(4.5)	(3.4)	(2.4)	(0.6)	(0.1)	11.0

Notes: [1/] Detailed inventory data by product will be worked out by the Romanians in the near future.

[2/] Assumes an average of 2 months of sales (applies only to products sold outside the Complex). Export inventories are generally higher than this in Romania.

[3/] Build-up pattern from Table 7.

ANNEX 9
Table 5

CRAIOVA CHEMICAL PROJECT - Product Prices: Data and Assumptions Made for Economic Analysis

(at 1977 US $ and Prices)

Product	Unit	Domestic Price, Translated in US $	Foreign Prices by Source: Danubiana	Tes Study	Germany[1/] List Prices	Italy[1/] List Prices	US List[1/] Price	Economic Price[4/]	Prices Used in Economic Analysis
Acetic Acid	t	290	260	350-400	460	420-450		400[4/]	400
Vinyl Acetate	t	490	400-500	400-500	610	510		490[4/]	490
Polyvinyl Acetate	t	420	350	n-a	670	520		n-a	520
Acetic Anhydride	t	450	250	n-a	480	385		n-a	420
Ethyl Acetate	t	898	n-a	n-a	570	500		n-a	500
Butyl Acetate	t	694	450	n-a	620	530		n-a	550
Methanol	t	53	85	60-110	110-150[2/]	110-150[2/]		130[4/]	130
Polyvinyl Alcohol	t	3,295	1,000-2,000	n-a	n-a	n-a	1,530[3/]	n-a	1,500
Offgases		Calorific Content							
Purge gas (fr. CO plant)	000 m^3	4.0 Gcal						30.6[5/]	30.6
Purge gas (fr. Ac.Ac.plt.)	000 m^3	3.0 Gcal						22.9[5/]	22.9
Hydrogen	000 m^3	11.0 Gcal						84.1[5/]	84.1
Wastegases	000 m^3	3.4 Gcal						26.5[5/]	26.0

Notes: 1/ List prices are generally higher than actual transaction prices.

2/ European contract price range.

3/ DuPont top grade.

4/ Calculated by the mission based on capital and operating cost data obtained from specialized consultants for the purpose of evaluating this project. Detailed assumptions are contained in Table 12.

5/ Based on calorific content and methane price of US $65 per thousand cubic meters. Romania's methane has a calorific content of 8.5 Gcal per thousand cubic meters. A separate allowance, not reflected in the price of waste gas, has been made in Table 8 to credit the project for additional benefits due to the by-passing of the synthesis gas unit of the fertilizer plant (essentially savings in fuel).

CRAIOVA CHEMICAL PROJECT - Production Build-up for the Project

Product Product	Plant	Com. Date	% of Value of Prod. Table 8	Production Build-Up 1/ 1980	1981	1982	1983	1984
Acetic Acid	same	12/79	15	75	95	100	100	100
Methanol	"	12/79	25	75	95	100	100	100
Acetic Anhydride	"	3/80	5	56	90	99	100	100
Vinyl Acetate	"	12/80	5	-	75	95	100	100
Acetylene	"	6/81	9	-	38	85	98	100
Polyvinyl Alcohol	"	6/81	8	-	38	85	98	100
Polyvinyl Acetate	"	6/81	8	-	38	85	98	100
Ethyl Acetate	"	6/81	5	-	38	85	98	100
Butyl Acetate	"	6/81	6	-	38	85	98	100
Purge Gas	CO separ.	10/79	1	75	95	100	100	100
Purge Gas	Ac. Acid	12/79	-	75	95	100	100	100
Hydrogen	CO separ.	10/79	10	75	95	100	100	100
Waste gas	Acetylene	6/81	3	-	38	85	98	100
Total Project			100	41	72	94	99	100

Note: 1/ Basic pattern: 75%, 95%, 100% in first three years of operations.
Above figures also reflect different commissioning months in calendar year.

CRAIOVA CHEMICAL PROJECT - Economic Value of Production at 100% Capacity Operation 1/

(in US $ million)

Product	Unit	Quantity at 100% cap.ut. (only quantities sold or transferred.)	Economic Price Assumed, $ (Table 6)	Value of Production (before adjustments for export/import substitution)	% Due to Product	Initial % of Prod. Exported (average first 3 years.)	Aver. % Export Over Project Life 2/	Value of Production (after adjusting for tariffs on part of exported portion & for ins.& transp. savings on portion representing import substitution) 3/
Acetic Acid	t	31,946	400	12.8	15	51	17	13.0
Vinyl Acetate	t	8,325	490	4.1	5	-	-	4.1
Polyvinyl Acetate	t	13,000	520	6.8	8	-	-	6.8
Acetic Anhydride	t	10,000	420	4.2	5	84	28	4.2
Ethyl Acetate	t	7,950	500	4.0	5	23	8	4.1
Butyl Acetate	t	10,000	550	5.5	6	19	6	5.6
Methanol	t	167,580	130	21.8	25	79	26	21.9
Polyvinyl Alcohol	t	4,503	1,500	6.8	8	60	20	6.9
Acetylene	t	13,430	600 4/	8.1	9	-	-	8.1
Purge Gas (fr.CO plt.)	mil. m^3	26.4	30.6	0.8	1	-	-	0.8
Purge Gas (fr.AA plt.)	mil. m^3	14.4	22.9	0.3	-	-	-	0.3
Hydrogen	mil. m^3	100.0	84.1	8.4	10	-	-	8.4
Waste Gas	mil. m^3	119.0	26.0	3.1	3	-	-	3.1
Credit for fuel saved by by-passing syngas unit				0.2	-	-	-	0.2
Total Value of Production				86.9	100			87.5

Notes: 1/ At 1977 prices

2/ One third of initial export percentage (arbitrary assumption, with little effect on economics).

3/ Two-thirds of the exported portions are penalized by 10% to reflect average EEC tariff (source: Danubiana); goods substituting for imports are credited an amount of 3% above the price to reflect savings in insurance and transportation.

4/ Recurrent (economic) costs of producing carbide, and from this acetylene, according to data gathered by the mission in Romania.

ANNEX 9
Table 9

CRAIOVA CHEMICAL PROJECT - Operating Costs at 100% Capacity Utilization

(in US $ million)

	Quantity	Romanian Price (US $)	Econ. Price (US $)	Econ. Costs at 100% C.UT.
Variable Costs				
Methane Feed	391.5 m^3	3	65 1/	25.4
Methane Fuel	83.37 m^3	10	65 1/	5.4
Fuel Oil	25,500 t	24	70	1.8
Gas Oil	9,000 t	30	115	1.0
Power	330,360 Mwh	19	25	8.3
8 atm Steam	1,114,548 t	na	5.5	6.1
13 atm Steam	38,940 t	na	6.5	0.3
Ind. Water	15 m^3	38	38	0.6
Drinking Water	1.4 m^3	38	38	0.1
Butanol	7,500 t	423	375	2.8
Catalysts, Chemicals	Various	Various	Various	5.4
Subtotal				57.2
Fixed Costs				
Labor				2.5
Repairs, maintenance				3.0
General				0.6
Subtotal				6.1
Grand Total				63.3

Note: 1/ Price based on calorific content compared to fuel oil at $70 per ton.

CRAIOVA CHEMICAL PROJECT - Economic Projections and Return Calculations for the Methanol Plant
(in US$ million and at 1977 prices)

	1977	1978	1979	1980	1981	1982	1983	1984	1985-1992	1993
(A) Capital Resources Used										
Fixed Capital	(2.1)	(16.0)	(21.4)	-	-	-	-	-	-	-
Working Capital				(3.5)	(0.9)	(0.2)	-	-	-	4.6
Sub-Total (A)	(2.1)	(16.0)	(21.4)	(3.5)	(0.9)	(0.2)	-	-	-	4.6
(B) Economic Value of Production										
Methanol				20.6	26.0	27.4	27.4	27.4	27.4	27.4
Credit for Steam				0.8	1.0	1.0	1.0	1.0	1.0	1.0
Sub-Total (B)				21.4	27.0	28.4	28.4	28.4	28.4	28.4
(C) Economic Costs of Production										
Variable Costs				(14.8)	(18.7)	(19.7)	(19.7)	(19.7)	(19.7)	(19.7)
Fixed Costs				(1.2)	(1.2)	(1.2)	(1.2)	(1.2)	(1.2)	(1.2)
Sub-Total (C)				(16.0)	(19.9)	(20.9)	(20.9)	(20.9)	(20.9)	(20.9)
(D) Economic Surplus (Deficit) from Production (B) - (C)				5.4	7.1	7.5	7.5	7.5	7.5	7.5
(E) Economic Surplus (Deficit) from Project (A) + (D)	(2.1)	(16.0)	(21.4)	1.9	6.2	7.3	7.5	7.5	7.5	**12.1**

ANNEX 9
Table 10

CRAIOVA CHEMICAL PROJECT - Economic Projections and Return Calculations for Polyvinyl Alcohol and Butyl Acetate Plants

	1977	1978	1979	1980	1981	1982	1983	1984	1985-92	1993
(A) Capital Resources Used										
Fixed Capital			(6.1)	(11.4)	(6.4)	-	-	-	-	-
Working Capital			-	-	(0.8)	(1.0)	(0.3)	(0.1)	-	2.2
Subtotal (A)			(6.1)	(11.4)	(7.2)	(1.0)	(0.3)	(0.1)	-	2.2
(B) Economic Value of Production										
Polyvinyl Alcohol					2.9	6.4	7.4	7.5	7.5	7.5
Butyl Acetate					2.1	4.7	5.4	5.5	5.5	5.5
Subtotal (B)					5.0	11.1	12.8	13.0	13.0	13.0
(C) Economic Cost of Production										
Variable Costs					(4.5)	(10.1)	(11.7)	(11.9)	(11.9)	(11.9)
Fixed Costs					(1.3)	(1.3)	(1.3)	(1.3)	(1.3)	(1.3)
Subtotal (C)					(5.8)	(11.4)	(13.0)	(13.2)	(13.2)	(13.2)
(D) Economic Surplus (Deficit) from Production (B) - (C)					(0.8)	(0.3)	(0.2)	(0.2)	(0.2)	(0.2)
(E) Economic Surplus (Deficit) from Project										
(A) + (D)			(6.1)	(11.4)	(8.0)	(1.3)	(0.5)	(0.3)	(0.2)	2.0

ANNEX 9
Table 11

Table 12

CRAIOVA Chemical Project - Economic Prices for Methanol, Acetic Acid and Vinyl Acetate
(based on 20% before tax ROI assumption)

Acetic Acid

Monsanto Process
Capacity: 375 M lb per year
340 days of operations
US Gulf Coast location
---- $million at 1976 prices ----

Capital Costs

On site	32.2
Off sites	13.7
	45.9
Working Cap.	3.6
Total	49.5

Operating Costs and long-run Profit

Methanol	12.4
Fuel gas	8.4
Cat.,Chemicals	0.5
Royalties	0.5
Labor	0.8
Power	1.6
Water	0.3
Steam	3.8
Maintenance	1.6
Supplies	1.3
Taxes, Ins.	0.9
Depreciation	4.6
Overhead	0.7
B.T. Profit (20% ROI)	9.9
	47.3

Per ton Prices

Based on above at 1976 prices: $280
Scale-adjusted and at 1977 prices: $320
Glacial Grade at 1977 prices: $400

Methanol

Low Pressure Process
Capacity: 1,875 M lb per year
340 days of operations
US Gulf Coast location
---- $million at 1976 prices ----

Capital Costs

On site	68.0
Off sites	40.0
	108.0
Working Cap.	8.0
	116.0

Operating Costs and long-run Profit

Natural Gas	53.6
Labor	0.7
Power	0.5
Water	0.4
Maintenance	4.3
Supplies	0.4
Cat.,Chemicals	0.9
Taxes, Ins.	2.2
Depreciation	10.8
Overhead	1.0
B.T. Profit (20% ROI)	23.2
	98.0

Per ton Prices

Based on above at 1976 prices: $115
Scale-adjusted and at 1977 prices: $130

Vinyl Acetate

Celanese/Bayer Process
Capacity: 425 M lb per year
340 days of operations
US Gulf Coast location
---- $million at 1976 prices ----

Capital Costs

On site	20.1
Off sites	6.2
	26.3
Working Cap.	5.8
	32.1

Operating Costs and long-run Profit

Ethylene	18.5
Acetic Acid	44.5
Oxygen	1.6
Labor	0.7
Cat.,Chemicals	0.3
Power	0.3
Steam	4.3
Water	0.2
Maintenance	0.9
Supplies	0.1
Taxes, Ins.	0.5
Depreciation	2.6
Overhead	0.9
B.T. Profit (20% ROI)	6.4
	81.8

Per ton Prices

Based on above at 1976 prices: $425
Scale-adjusted and at 1977 prices: $490

Prog. Coord.

FORM NO. 590
(1–75)

IBRD AND IDA – SUPERVISION SUMMARY

This summary is [XX] the initial summary / [ ] part of a mission report / [ ] a semi-annual update / [ ] the completion summary

Regional Office:	Project Name:	Project Code:	Loan [X] Credit [ ] No.:	L/C Amount ($xx.xm):
EMENA	CIMPULUNG-MUSCEL POLYESTER PROJECT	5RØMIT01		$50 million

Country:	Borrower/Beneficiary:	Board Date:	Signing Date:	Effective Date:
Romania	Inv. Bank/Cimpulung Synth.Fiber Enterprise	6/07/77	6/15/77	expected 9/77

Projects Dept./Div. Name:	Org. Code No.:	Projects Officer:	Loan Officer:
Industrial Projects/III	305/30	Antonio S. Tarnawiecki	Nicholas W. Noon

SECTION 1: SUMMARY PROJECT DESCRIPTION The project consists of the construction of facilities for a new polyester plant designed to produce 31,500 tons per year of cotton, wool and flax-type polyester fiber and 15,200 tons of polyester chips. The feedstocks will come from petrochemical plants located in nearby cities and the plant will generate most of its utilities.

SECTION 2: PERFORMANCE RATING

	This Summary	Last Summary
STATUS: 1 - Problem-free or Minor Problems; 2 - Moderate Problems; 3 - Major Problems	1	1
TREND: 1 - Improving; 2 - Stationary; 3 - Deteriorating	2	2
TYPES OF PROBLEMS: F - Financial; M - Managerial; T - Technical; P - Political; O - Other *(Explain in Section 5)* If more than one type of problem, enter most critical factor first.		

Designated a "problem project" in most recent SVP review? Y - Yes; N - No [ ]

SECTION 3: PROJECT DATA

Estimated/Actual:	Project Completion (Mo./Yr.)	Loan/Credit Closing (Mo./Day/Yr.)	Total Project Cost[1] ($xx.xm)	of which: Foreign Currency ($xx.xm)	of which: Local Currency ($xx.xm)	Cumulative Disbursements through most recent Quarter ended (/ /) ($xx.xm)
Appraisal Est.	03/81		136.1	56.4	79.7	0.0 (Est.)
Last Summary (/ /)						(Actual)
Current						

SECTION 4: MISSION SCHEDULE

	No. of Staff on Mission	No. of Days in Country	Return to HQ (Mo./Day/Yr.)	Final Report Date (Mo./Day/Yr.)
Latest/Present Mission				( )*
Previous Mission				( )*

Next Mission Departure (Mo./Yr.) 11/77 Recommended interval between missions (Months) 6 End of period covered by latest progress report (Mo./Day/Yr.)

* *Type of Report: FS = Full Supervision; CS = Combined Full/B-T-O; C = Completion; A = Appraisal; O = Other (explain below)*

SECTION 5: COMMENTS *(Explain "other" in Section 2 and clarify, if necessary, data in Sections 3 and 4)*

[1] Using the exchange rate of U.S. $1 = Lei 20. Includes interest during construction and working capital.

SECTION 6: SUMMARY OF PROJECT STATUS, TREND, AND MAJOR PROBLEMS:

The Cimpulung Synthetic Fiber Enterprise has been established in May 1977. Work at the site has begun and is proceeding satisfactorily. The supplier for the main technology and equipment package has been selected.

Preparing Officer: J.F. Rischard Initials: JFR Date 6/15/77

April 8, 1977

Mr. Mauro Guia, Director
Politeno
Av. Presidente Vargas,
309-11º Andar
Rio De Janeiro, Brazil

Dear Mauro:

Here is the user's manual of a program, similar to the Conform and Infotab programs, but which has been developed by the World Bank. I understand that it might not be as good as the commercial programs, but its main advantage is that the program can be obtained from the Bank at no cost (although its installation on the computer is at the expense of the user).

Yours sincerely,

Jean-Francois Rischard
Industrial Projects Department
Division III

JFRischard:mmm

Enclosure

Mr. Chauncey F. Dewey February 28, 1977

Don Brown, J.F. Rischard and E. Ashtari-Tafti

BRAZIL - Identification Mission for Petrochemical Project
Back-to-Office and Full Report

I. INTRODUCTION

1. A Project Identification Mission visited Brazil during the second half of January 1977 to identify a petrochemical industrial project for possible Bank participation and to make a preliminary evaluation of its technical, financial and economic aspects. A list of persons met is given in Annex 1.

2. In line with its development strategy of promoting large-scale import substitution and geographical dispersion of industry, the Government of Brazil has decided to expand the country's petrochemical production capacity with a third petrochemical complex to be located in Rio Grande do Sul. The raw materials center will be owned by COPESUL (Petroquimica do Sul), a company sponsored by Petrobras Quimica S.A. (PETROQUISA), andaffiliate of the Government-owned PETROBRAS, and by Banco Nacional do Desenvolvimento Economico (BNDE) through its affiliate FIBASE. Private industry will participate in the seven downstream units.

3. The third petrochemical complex appears to be economically justifiable although several issues remain to be resolved, including market analysis, project timing, capital costs, procurement and financing arrangements. These issues are discussed in paras. 22 to 32, below.

II. PETROCHEMICAL INDUSTRY IN BRAZIL

General Background on Petrochemicals

4. A background note on sources and trends for petrochemical products is contained in Annex 2, reviewing the sources and uses for basic petrochemicals such as ethylene, propylene, butadiene and aromatics.

Petrochemical Industry in Brazil

5. There are at present two major petrochemical complexes in Brazil (i) one under operation, which has developed around a PETROBRAS refinery near Sao Paulo and, (ii) a second complex in Bahia, which is expected to come on stream in mid- or end-1978. The raw materials plants which form the score of the Sao Paulo Complex[1] can produce about 940,000 tons per year (tpy) of

1/ IFC has participated in the financing of the Petroquimica Uniao raw materials plant.

petrochemical feedstocks and intermediates, out of which about 340,000 tpy is ethylene. The main raw material is naphtha purchased from the PETROBRAS refinery in Cubatao. The products are sold mostly to downstream companies in the vicinity producing a variety of plastics, synthetic fibers, solvents, reagents, pesticides and detergents. The North-Eastern Complex, located in Camacari in Bahia ia composed of 21 projects under construction or recently completed and is expected to come on stream fully in mid-1978. In addition to naphtha and gas oil from a nearby PETROBRAS refinery, the raw materials center will use a small amount of associated gas from the oil fields in the North-East. Total capacity will be about 900,000 tpy, out of which ethylene capacity will be about 380,000 tpy.

III. MARKET FOR PETROCHEMICAL PRODUCTS IN BRAZIL

6. Demand for petrochemical products in Brazil has been expanding very rapidly over the last decade (although from a small base) as shown by the following table, which compares US and Brazilian consumption growth rates for a variety of petrochemical products:

Growth Rates of Consumption of Major Petrochemicals
(in % per annum)

Products	Brazil (1966-74)	USA (1964-74)
Low Density Polyethylene (LDPE)	37	12
High Density Polyethylene (HDPE)	27	16
Polyvinyl Chloride (PVC)	24	11
Polypropylene (PP)	60	24
Polystyrene (PS)	20	8
Styrene Butadiene Rubber (SBR)	19	8
Feedstocks		
Ethylene	36	11
Propylene	52	11
Benzene	23	7
Butadiene	24	4
Toluene	19	8
Xylenes	32	19

Source: Brazil: A Industria Petroquimica Brasileira, IBP, Nov. 1976

USA : Stone Webster, January 1976

7. Demand had been primarily met by imports until the main raw materials plant started operations in Sao Paulo in 1972. In 1976, about 35% of the total consumption tonnage of ethylene-based petrochemical products was still met by imports (the ratio is 4%, 13%, 41% and 60% for propylene, butadiene, benzene and xylene-based products respectively). Imports will drop significantly after the North-Eastern Complex starts operations and will increase again in the early 1980s as demand continues to grow (albeit at a smaller rate than during the last decade), creating further potential for import-substitution.

8. The projected supply/demand situation for ethylene, the major petrochemical feedstock, is shown below:

Projected Supply and Demand

(1000 tpy Ethylene)

	COPESUL Estimate			Mission Estimate		
	Supply a/	Demand	Surplus (Deficit)	Supply a/	Demand	Surplus (Deficit)
1976	300	380	(80)	300	380	(80)
1980	720	990	(270)	720	790	(70)
1981	1,060	1,190 b/	(130)	1,060	910	150
1982	1,120	1,430	(310)	1,120	1,050	70
1983	1,170	1,720	(550)	1,170	1,210	(40)
1984	1,170	2,060	(890)	1,170	1,390	(220)
1985	1,170	2,470	(1,300)	1,170	1,600	(430)

a/ Based on 450,000 tpy ethylene in the proposed project. Production forecast based on assumption that the North-Eastern Complex would come on stream in 1978 and the Rio Grande do Sul Complex in 1981.

b/ Forecast not given beyond 1981, but Brazilians anticipate at least 20% per annum growth thereafter. Above 1981-85 figures assume 20% growth rate.

The Brazilian forecast, essentially, is based on unrestrained, exponential-type growth, as predicted on the basis of the per capita consumption levels which prevailed at various income levels in about 20 countries before the oil crisis. It shows a large deficit, much greater than the proposed third project's ethylene capacity. The mission's forecast assumes a 20% annual growth rate during 1976-1980 and 15% thereafter, based on the more conservative assumption of a tapering off in the per capita consumption growth rates as development proceeds. It should be emphasized that the mission's forecast is of a very preliminary nature. It aims primarily at illustrating the implications of more conservative growth assumptions and should not be viewed as a definite forecast. Such a forecast would have to be based on a more thorough market study, including end-uses (para. 25).

9. The growth rate for other petrochemicals would, in general, follow a somewhat similar trend as ethylene. Annex 3 shows the two forecasts in graph form. Based on the mission's assumed growth rate, the third petrochemical complex should not be in commercial operation until the end of 1982, at the earliest. The effect of market on project timing is a major issue and is discussed more fully in paras. 22-24 below.

IV. PROJECT SCOPE AND COSTS

Project Scope

10. The raw materials center of the proposed petrochemical complex to be constructed near Porto Alegre in Rio Grande do Sul will use naphtha from the nearby PETROBRAS refinery and would produce feedstocks (mainly ethylene, propylene, butadiene and benzene) for conversion in downstream units (seven proposed as of now, to be owned by separate companies predominantly in private hands) into plastics and rubber for use in Brazil's industrial and agricultural sectors as well as for consumer goods. Capacities for the complex are shown below:

Raw Materials Center	Capacity, tpy
Ethylene	350,000 a/
Propylene	120,000
Butadiene	45,210
Benzene	107,440
Xylenes	32,150
Downstream units	
Low-Density Polyethylene (LDPE)I	100,000 b/
Low-Density Polyethylene (LDPE)II	115,000 b/
High-Density Polyethylene (HDPE)	60,000
Polyvinyl Chloride (PVC)	200,000 c/
Polypropylene (PP)	50,000
Styrene/Polystyrene (PS)	80,000/160,000
SBR Rubber	70,000
Total Downstream	675,000

a/ An alternative of 420,000 to 450,000 tpy is being studied.
b/ An alternative total capacity of 250,000 tpy for both LDPE units together is being studied.
c/ An alternative of 240,000 tpy is being studied.

11. An alternative production capacity of 420,000 to 450,000 tpy of ethylene is being studied by COPESUL. It would involve higher severity cracking and additional equipment (with an equipment cost increase of about 10%). Feedstock needs would increase by about 30%, along with the available amount of co-products. Although no detailed calculations are available, this alternative would result in higher economic and financial returns because of the low incremental capital costs involved (para. 19). This alternative would permit the larger capacities for LDPE and PVC mentioned in the table above. The raw materials center would also produce by-products such as pyrolysis gasoline (123,810 tpy), LPG (88,570 tpy), and residue (72,450 tpy), all to be returned to the refinery. It would also produce steam, power and treated water for its own use and for the downstream units. Other sources such as maintenance would be provided on a centralized basis as well.

12. In view of identifying a possible project for FY 1978, the mission has considered the sole raw materials center, including utilities. In regard to downstream units, the mission informed the Government that we would in principle not be prepared to consider participation in downstream units. Other sources of financing, such as IFC and IDB, should be explored. We will follow this investigation with interest.

Project Cost

13. Total financing required for the raw materials center is very tentatively estimated at about US$640 million, including 35 million in interest during construction, 40 million for working capital and 105 million in price contingencies. These estimates are based on calculations made by the project sponsors, using admittedly very conservative capital cost estimates. A tentative breakdown of capital cost is shown below. Only direct foreign exchange costs are shown:

Capital Cost Summary (Preliminary Estimates)
(in US$ million)

	Local	Foreign a/	Total	Percentage
Land and Improvements	12.3	-	12.3	3.0
Basic Engineering & Licenses	1.4	7.0	8.4	2.0
Detailed Engineering	17.3	4.5	21.8	5.2
Civil Works	46.1	-	46.1	11.2
Equipment	135.0	67.2	202.2	48.6
Freight & Insurance	n.a. b/	11.8	11.8	2.8
Erection	78.2	-	78.2	18.8
Pre-operating Costs	31.5	3.4	34.9	8.4
Basic Cost Estimate	321.8	93.9	415.7	100.0
Physical Contingencies (10%)	32.2	9.4	41.6	
Price Contingencies (25%)	82.2	24.1	106.3	
Sub-total	436.2	127.4	563.6	
Working Capital	39.1	-	39.1	
Interest During Construction	19.0	17.1	36.1	
Total Financing Required	494.3	144.5	638.8	

a/ Assumes 70% of equipment reserves.
b/ Included in local equipment cost estimates.

14. The foreign exchange financing required amounts to about US$145 million not including indirect foreign exchange costs (yet to be determined). However, considering the conservative nature of the cost estimates, we would expect total and foreign exchange costs to be reduced by 10 to 20% once more accurate estimates are available.

Sponsors and Financing Plan

15. The raw materials center will be owned by COPESUL, whose equity will be owned by PETROQUISA (51%) and FIBASE (49%). FIBASE is an affiliate of BNDE which takes participations in Brazilian companies with the objective of selling its participants to private investors after a certain period of time (about 5 years as a rule). Management and staff will be provided by PETROQUISA and its affiliate companies and few problems are foreseen in this respect.

16. The debt/equity ratio for COPESUL will be 60/40, with the debt capital provided for by BNDE, covering the local currency costs and the remainder being financed by foreign sources, as yet unidentified. In December 1976, BNDE approved a loan of Cr $2.5 billion carrying a 6% annual interest, with a maximum monetary correction on debt service of 20% per annum, and relatively short repayment terms (4 years of grace, 8 years of repayment) (see paras. 31 and 32).

Status and Timing of Project

17. COPESUL as well as four of the downstream units have received the required approval from CDI (Conselho de Desenvolvimento Industrial) to go ahead. Technip of France has been selected as the engineering firm from among a group of four candidates. The letter of intent is expected to be signed by COPESUL shortly. For basic engineering, Technip will collaborate with Montreal, a Brazilian engineering group. Detailed engineering will be virtually entirely Brazilian. Project construction is expected by the sponsors to take four years, so COPESUL anticipates that the project would come on stream in mid-1981. However, as discussed in paras. 22-23, project timing is a potential issue and the COPESUL schedule could possibly be too optimistic.

Location and Availability of Raw Materials

18. If the project were situated at the first petrochemical complex near Sao Paulo, which is densely crowded with both industry and population, high infrastructure and other social costs would likely offset any direct capital savings. The Government has made a general decision to decentralize industry and investment away from the congestion in Sao Paulo; the Porto Alegre location is a firm decision, which has been given high priority. Furthermore, the market area in the three southern states should absorb virtually all of the production of the third complex by the mid-1980s. The selected site, near Pòrto Alegre, is well suited and presents no major problem in regard to construction, utility availability and environmental factors. The site is more than 10 Km away from the nearest

built-up area and has favorable characteristics in terms of disposal and pollution control. Ample skilled and unskilled labor are reported to be available. Raw materials would come from a nearby PETROBRAS refinery, although it must be expanded to provide sufficient naphtha. Naphtha is readily available, however, from other PETROBRAS refineries. The Porto Alegre refinery expansion itself may proceed somewhat slowly. The Government is in the midst of rethinking its energy policy and is likely to continue restricting consumption of gasoline and other petroleum products and thus some PETROBRAS refinery projects may be postponed or cancelled. However, such a policy would increase overall naphtha availability, and thus would not jeopardize the petrochemical project. In conclusion, project location and raw materials availability are not considered constraints.

V. PRELIMINARY ECONOMIC AND FINANCIAL ANALYSIS

19. Preliminary financial projections for the raw materials center are shown in Annex 4. The financial rate of return is satisfactory (about 14%). The very preliminary economic return calculations are based on projections shown in Annex 5. Unit price and volume data for inputs and outputs are shown in Annex 6 and the assumptions made are listed in Annex 7. The preliminary economic return would be about 15%, but this figure is not more than a first benchmark at this stage. The larger capacity under consideration (para. 11) will probably add about 2-3% to this figure due to the relatively low incremental capital costs implied by this alternative, indicating that the economic return could be considered satisfactory . Sensitivity analysis has been conducted with the following results:

Economic Rate of Return Under Varying Assumptions
Base Case: 15%[a]

	Percentage Change in Item		Sensitivity Factor[b]
	+ 15%	- 15%	
Fixed Capital Costs	12.7	18.0	∓ 0.13%
Raw Material Costs	11.1	18.6	∓ 0.25%
Fixed Operating Costs	14.4	15.8	∓ 0.05%
Product Prices	21.5	6.8	∓ 0.50%
Delay of one year: ERR=13%			

a/ A shadow foreign exchange price factor of 1.25 was used.

b/ Increase or decrease in return due to a one percent change in a cost/price parameter.

20. Economic prices are difficult to determine for the main products such as ethylene and propylene since they are not commonly traded internationally (special vessels and terminals are needed for ocean shipping, making it a still expensive route). Normally these gases are used captively or transported short distances over a pipeline grid. Ideally, one should derive economic prices for these intermediates from an economic analysis of the entire complex being analyzed. However, not enough time and data were available to perform such an analysis for the Rio Grande do Sul Complex. The economic prices used for the projections have therefore been based on present West European transfer prices, adjusted by a notional 10% to account for the depressed market conditions prevailing in Europe and for the fact that the replacement costs are not fully reflected in the present transfer prices.1/ Although this approach is considered adequate for the moment, a more thorough analysis on the basis of the entire petrochemical complex will be required if we decide to pursue the appraisal of this project, in view of the high sensitivity of the economic return to changes in product prices (see table above). The economic pricing of naphtha would also require a more thorough analysis of its future opportunity cost to Brazil. Changes in capital costs also have a major impact on the economic return. As explained above (para. 13), the currently available capital cost estimates appear overly high, so that the likely impact of revised capital costs will be an improvement in the economic rate of return.

21. Other economic benefits from the project include significant foreign exchange savings (para. 25) and far-reaching employment effects, both directly and indirectly through the second and third generation downstream activities. The third generation activities (transformation into final products) are relatively labor-intensive and provide attractive opportunities for small and medium-sized enterprises.

VI. MAIN ISSUES

Project Timing

22. The project sponsors are proposing to start implementation as early as possible, with procurement of equipment starting during the second half of this year. Following that schedule, they would expect the entire complex to come on stream by mid-1981. Using the Brazilian market forecasts as a basis, this schedule does not appear to pose any problems of timing, in view of the large deficits in petrochemicals implied by these forecasts (para. 8). The Brazilian market forecasts nevertheless rely on assumptions which the mission, on the basis of its preliminary assessment, considers overly optimistic, such as the assumption of exponentially growing per capita consumption levels of petrochemicals as per capita GNP levels increase. If on the other hand one uses the mission's forecasts, which admittedly are of a very preliminary nature, insights into the implications of more conservative growth rate estimates, are provided which in turn would indicate that if the start of project implementation were delayed by about one year, the probability of the complex operating initially at low levels of capacity for want of demand would be significantly reduced (see Annex 3).

1/ The resulting economic prices are roughly in line with constant price forecasts obtained from oil companies.

23. This timing, if it were to be followed, would imply that no expenditures (with the exception of preparation work) be made in 1977 and that execution and procurement not start until early or mid-1978. One complementary consideration behind this course of action is that additional preparation work could thus be undertaken with the objective of facilitating a smooth implementation of the project and of avoiding causes of delays which have been experienced by the promoters of the North-Eastern Complex in Bahia. The total amount of investment for the entire complex (plus refinery expansion) is expected to be of the order of US$1.5 billion or more, and the Government, considering its budgetary and foreign exchange constraints, may very well welcome a modified schedule, if it is shown to be more justified.

24. At this stage we recommend that the Bank reviews with the Government the implications on project timing which more conservative market forecasts and potential financial constraints might have. These discussions should usefully be complemented by a more thorough market study (as recommended below) enabling the Bank to make recommendations resting on a firmer view of the true market potential. With a somewhat slower project implementation, the project should be ready for Board consideration during the last quarter of FY 1978.

Market and Marketing

25. The market is a key consideration for this project. The economic return is very sensitive to sales revenues (para. 19) and a more realistic assessment of the market potential will have to be made in view of the questionable nature of some of the assumptions underlying the economic forecasts used by the Brazilians (paras. 8 and 22). More importantly, very little research seems to have been made regarding (i) the end-uses of the various petrochemicals to be produced by the complex and (ii) the development of the "third generation" transformation industries which would process the latter for final use. On the basis of preliminary information obtained during discussions with existing producers of thermoplastics, we believe that a large part of the products would end up in industrial uses (pipes, construction materials) and agricultural uses (mulching, canal linings, fertilizer and milk bags), thus making a valuable contribution to these sectors. Nevertheless an accurate analysis of what portion of the ultimate products will end up in industrial, agricultural and consumer uses and of what effects these end-uses would have in terms of foreign exchange savings and other economic benefits is needed and would be made during project appraisal. Irrespective of the conclusions of the end-use analysis, one should nevertheless realize that all the end products are tradeable plastic and rubber commodities and that the basic justification for the complex (and the project) is import substitution and regional development. As a preliminary estimate, the net annual foreign exchange earnings and savings from the project (raw materials center) would amount to US$55 million. Based on this figure, the foreign exchange capital expenditures on the project could be recouped after less than three years of operations and this project could thus contribute significantly to improving Brazil's balance of payment situation.

26. We recommend that, if a decision is made to give further consideration to this project, a project preparation mission be sent to Brazil, within the next 2-4 months, in part, to study the end-use market more thoroughly and in part to follow-up on the above recommendation that a more substantiated assessment of the overall market potential be obtained (para. 24). The mission would consist of two Bank staff plus one consultant or UNIDO/Bank Cooperative Program expert specialized in market and marketing of plastics and rubber. The objective of this mission would be, among others, to gather sufficient information on the market to enable the Bank to give further consideration to the project. However, at a later stage it may be necessary to ask the Government to undertake a comprehensive petrochemical market study.

Project Scope and Capital Costs

27. A change in the scope of the project involving higher amounts of ethylene and other co-products and based on higher severity cracking with some additional equipment is currently being studied by the Brazilians. Such a change would have a favorable effect on the overall economics of the complex (para. 19). Furthermore, the currently available capital cost estimates are believed to be on the high side (para. 13) and will have to be revised. This review could be started by the project preparation mission proposed above, whose timing would enable it to use the capital cost estimates of the selected engineering firm which should be in an advanced stage of preparation by the time the mission is in the field.

Financing Arrangements

28. The financing arrangements and timing for the project are not fully known at present. The very approximate financing plan is shown below based on tentative and conservative capital cost estimates (para. 13):

Equity	US$ Million Equivalent
PETROQUISA (51%)	131
FIBASE (49%)	125
Subtotal	256
Loans	
BNDE	238
Other (Foreign Loans and Suppliers' Credits)	145
Subtotal	383
Total	639

Agreement (or commitments) on equity contribution plus the BNDE loan have been made. However, all of these funds (about US$500 million) are from the Government budget either directly or indirectly. Thus, any Government decision on decreased annual allocation of funds to BNDE, FIBASE (through BNDE) and PETROQUISA (through PETROBRAS) would have a major impact on the speed of project implementation. No foreign exchange loans have been arranged. About US$30 million of foreign exchange costs represents engineering and equipment that would be suitable for financing from suppliers/buyers credits and we would recommend that the financing plan include at least US$30 million of such credits. The remainder, about US$115 million would be suitable for procurement under Bank guidelines and it is possible that a part could be procured under co-financing arrangements similar to other projects in Brazil and/or from the Inter-American Development Bank. The mission made no contact with any other lending source.

Procurement

29. Although procurement arrangements have not been completed, the indication is that procedures similar to other recent Industrial Projects in Brazil will be proposed by the Government, i.e. 60-70% of equipment reserved for Brazilian suppliers. It would be inappropriate to suggest that all equipment be bid internationally, as a high percentage would be won by Brazilians, but the Government may be receptive to a smaller reserve list, i.e. 40-50%, along the lines of the Valefertil project if we can demonstrate significantly lower project costs. The project would also require advance contracting for engineering and possibly some equipment, including local engineering.

30. We should initially propose a reserve list that is reasonable on project grounds bearing in mind the requirements for technical viability and the risk of an excessive increase in project cost due to non-competitive prices from Brazilian suppliers. Formulation of the reserve list in principle plus reaching agreement on other procurement procedures would also be discussed by the proposed project preparation mission if the Bank decides to go ahead with an evaluation of this project (paras. 24 and 26 above). At this time, it would appear that financing of advance contracting and payments and local engineering could be readily obtained from either commercial credits, or from BNDE or equity contributions.

BNDE Loan Terms

31. The BNDE loan terms may present a financial burden to the company. A loan commitment between BNDE and the project sponsor was signed in December, 1976 - for Cr. $2.5 billion at 6% annual interest with four years grace plus eight years repayment. The debt service is subject to a maximum of 20% per year monetary correction. We would anticipate that the project would require

four years grace minimum plus 10 to 12 years of repayment to reduce debt service to a manageable level, (even four years of grace, because of the possibility of a protracted construction schedule, may imply a total debt repayment in the fifth year in excess of generated funds).

32. We would recommend that the Bank propose to the Government that BNDE be asked to increase its loan terms to a level that would ensure adequate debt service coverage as was done in the case of Valefertil. Other possibilities include putting in FIBASE equity first so loan repayments would not start as soon, or some form of rearrangement of the financial plan including additional financial contributions by PETROQUISA in the early operating years. Brazilian regulations, to establish 15% domestic preference in procurement, require at least 15 years maturity for foreign loans and thus we would suggest four years grace and 11 years repayment for the Bank loan.

Cleared with and cc: Mr. Mirza

cc: Messrs. Lee, Israel, Chittleburgh, van der Tak, Fuchs, Moore, Thadani, Cash, Sheldrick, Soncini, van der Meer, McClure (IFC), Skillings, Perram, Tortorelli, Tarnawiecki, Plant (IFC), Andrews (IFC), Azevedo (IFC), Ruisanchez (IFC), Pratt, Evans

J-FRischard:mmm

BRAZIL: RIO GRANDE DO SUL PETROCHEMICAL POLE

LIST OF PERSONS MET BY THE MISSION

Rio de Janeiro

COPESUL (Petroquimica do Sul Ltda)

Mr. J.J. Molinos, Director, Projects
Mr. C.G.M. Guttmann, Director, Finance
Staff

BNDE (Banco Nacional de Desenvolvimento Economico)

Dr. L. Correia Nunes Viana de Oliveira, Department Chief, Chemical Industries
Dr. A.M. de Carvalho Jr.
Staff

FIBASE (Insumos Basicos S/A - Financiamento e Participacoes)

Mr. J. Clemente de Oliveira, Director

POLITENO (Politeno Industria e Comercio S.A.)

Mr. Mauro Guia, Director Finance
Mr. O. Cardoso Fernandes Pontes, General Project Coordinator

POLYOLEFINAS/UNIPAR

Mr. Michel Hartveld, Director (PQU)
Mr. Jorge Neves de Noronha, Chemical Eng., (Unipar)

PETROPRAS (DIREP - Refinery Division)

Mr. Jorge Rona, Director, Refinery Division

PETROQUISA (Petrobras Quimica S.A.)

Mr. L. Martins da Costa, Director, Finance
Mr. H. Camarota, Assistant of the Director, Marketing Research

CDI Industrial Development Council, under the Ministry of Commerce and Industry

Dr. Mansur, CDI Coordinator for Rio Grande Do Sul Petrochemical Pole

Brasilia

SEPLAN (Secretario de Planejamento)

Dr. Costa, SUBIN
Dr. Marilia Mandelli, Coordinator, Economic Cooperation
Dr. J. Carlos de Oliveira (Min. of Finance)
Dr. Jair do Santos Lapa, Assistant
Dr. Luis Moreira, Deputy Secretary General
Dr. Guilherme de Camargos, Assistant to the Minister
Dr. Edison Barbosa, Assistant to the Sec. General
Ms. M. Lourdes Marques, Economist

IPEA (Instituto de Planejamento Economico e Social)

Mr. Carlos Alberto Monteiro Rego

Ministry of Industry and Commerce

Dr. P.V. Belotti, Secretary General

Ministry of Mines and Energy

Dr. Arnaldo Rodrigues Barbalho, Secretary General
Dr. N. Webster de Araujo, Deputy Secretary General, Technology Staff

PETROCHEMICAL PRODUCTS, SOURCES AND TRENDS

General

1. One of the most active sectors in many developed and developing countries is the petrochemical industry. About 20 years ago, only half of the world's output of organic chemicals was based on petroleum and natural gas, but today, this proportion is 90 percent. Products derived from petrochemical sources are now used to meet most basic needs - clothing, shelter, transportation, storage and conservation, medicines, and even food. Since natural sources of commodities such as fibers, timber, drugs, fuels and fertilizers have become insufficient to meet increasing populations and living standards, man-made materials made from petrochemical feedstocks have often surpassed the amounts of available natural products.

Ethylene

2. Just as ammonia is regarded as the major basic petrochemical for fertilizer production, ethylene is considered to be the most important petrochemical building block. It is used for making (i) industrial and consumer plastics, e.g. polyethylene (high and low density - HDPE and LDPE), polyvinyl chloride (PVC), polystyrene (PS); (ii) ethylene oxide and ethylene glycol used to produce polyesters and polyester fibers; and (iii) many heavy organic intermediates. World production of ethylene has increased tremendously from 3.3 million tpy in 1960 to about 30 million tpy in 1975 (an annual increase of 16%). It is now used to produce 30% of all petrochemicals and is a major cost determinant. World demand is expected to increase to at least 60 million tons by 1985 (Table 1). This twofold increase is nevertheless considered conservative by many observers.

3. Based on the current economic-sized plant of one billion pounds per year (450,000 tpy) and allowing for several closures of existing plants for obsolescence, about 70 large, new ethylene plants will be required in the next decade. Although there is some apprehension that ethylene production in the Middle-East may swamp world markets, it appears that even ten large plants operating at full capacity by 1985 would only correspond to about 15% of anticipated world demand. Thus it is unlikely that Middle-East production will have a major impact on the world ethylene situation.

4. In addition to producing ethylene from ethane and/or other light hydrocarbons, it can be, and is, made from a variety of other petroleum-based feedstocks e.g. refinery gas, naphtha, gas oil, residual oils and even from alcohol made via fermentation of carbohydrates such as molasses1/. Preferred feedstocks are ethane and propane from associated or non-associated gas, but with growing shortages of natural gas and rising ethane and propane prices, most ethylene producers have started to, and are expected to continue to,

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1/ Brazil has a small production of ethylene from molasses.

Table 1

FORECASTS OF ETHYLENE CAPACITIES, SUPPLY AND DEMAND

(THOUSAND METRIC TONS)

	1975			1980			1985		
	Capacity	Supply	Demand	Capacity	Supply	Demand	Capacity	Supply	Demand
Western Europe	13245	11200	9950	15815	14200	14490	18105	16300	19980
Eastern Europe	2040	1632	2060	3540	2730	2800	5240	4200	4470
North America	12597	11300	11050	15137	13600	14570	18000	16200	19520
Japan	5065	4500	4000	7700	6930	6150	8750	7870	9050
Latin America	1172	940	1040	1972	1600	1880	2319	1900	3275
Asia			1295			2038			3326
and	1317	800		2946	1900		5016	3350	
Middle East			162			357			687
Africa	150	120	213	275	190	355	1500	1050	580
Australia/N.Z.	275	208	208	275	208	345	1100	880	514
TOTAL	35861	30700	29978	47660	41358	42985	60030	51750	61402

turn increasingly to such raw materials as naphtha and gas oil. Naphtha-based plants are about 30% more expensive than ethane-based ones for an equivalent amount of ethylene, but result in additional saleable products so that credits for sale or use of these by-products must be considered in looking at capital as well as feedstock costs (see below).

Main Ethylene-Based Plastics and Their Uses

5. As mentioned above, plastics and fibers are ethylene's primary outlets. Polyethylene (LDPE or HDPE) accounts for about 40% of world ethylene consumption, followed in order by ethylene oxide and ethylene glycols, PVC and styrene - all of which account for over 70% of ethylene consumption.

6. Current plastic (polymer) world production is believed to be by percentage:

	Percent	Main Feedstock(s)
LDPE	30	Ethylene
HDPE	8	Ethylene
PVC	20	Ethylene
PP (Polypropylene)	15	Propylene
PS	15	Ethylene, Benzene
Others[a/]	12	Various
	100	

a/ nylon, acrylics etc.

LDPE can be converted to goods for industrial, agricultural and consumer uses by all methods suitable for thermoplastics, especially injection molding, blow molding and extrusion. However, the availability of stiffer polymers, e.g. PP, HDPE has diminished the use of molded LDPE. Major LDPE applications are extruded pipe and fiber, and to a lesser extent hot-coating of numerous articles. Bags for food, fertilizers, other commodities, or garbage collection, are widely and increasingly used. In many countries, such as Brazil, milk is shipped to end-markets in LDPE bags. Large expanding markets exist for water conservation, especially in many developing countries in the form of reservoir and canal linings, irrigation and drainage piping as well as mulching, whereby soils are covered with black film to retain moisture, promote plant growth (through holes in the film) and retard weeds.

7. HDPE is tougher and harder than LDPE. This difference in properties has led to different usage patterns, with blow molding applications representing the single most important use of HDPE (40%). Several sources in the plastics industry believe PP, which is made from propylene, will displace a large share of the market for HDPE because of (i) better physical properties of PP (e.g. rigidity, strength etc.) and (ii) the greater availability of PP resulting from the increased use of naphtha in ethylene crackers (see below).

8. PVC is still the second most important thermoplastic despite lower expected growth rates due to the carcinogenic effects of VCM monomer. Most applications are in pipes, various industrial and construction uses, and such consumer goods as artificial leather.

9. Polystyrene is used for insulation, as a wood substitute and as packaging and construction material (besides its uses in the synthetic rubber industry).

Propylene, Butylene and Heavier Hydrocarbons and their Derivative Products

10. The proportion of these by-products in proportion to ethylene depends on the feedstock chosen, as shown in Table 2:

Table 2

Typical Yields of Ethylene and Other Products from Different Feedstocks after Thermal Cracking
(Millions of Pounds per Annum)

Product	Feedstock: Ethane	Feedstock: Naphtha
Ethylene	1,000	1,000
Resid. Gas, H_2, CH_4	175	484
C_3 cut (incl. Propylene)	31	392
C_4 cut (incl. Butadiene)	25	205
C_5 cut (400°F Gasoline)	19	644
Cracked Fuel Oil	-	175
Total Feed Needs	1,250	2,900
% Feed Conversion (or Severity)	60%	high

Source: Oil & Gas Journal July 1975

The possibility to use alternative feedstocks and simultaneously produce valuable co-products immensely complicates the production and pricing economics and policies regarding ethylene, its related hydrocarbons and other derivatives. In the case of naphtha 1/ feed, the quantity and proportions of ethylene and co-products can be furthermore modified by changing the cracking severity. Higher severity cracking results in increased needs of feedstock which appears as additional ethylene and co-products; for the latter it results mostly in higher proportions of pyrolysis gasoline and aromatics in the form of a larger BTX (benzene, toluene, xylene) fraction (see below).

11. About one fifth of propylene goes into PP (see above), another fifth into cumene (for in part phenol production), and the remainder is used

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1/ or gas oil.

for detergents, acrylic fibers, plasticizers and various other uses. About 90% of butadiene is used up by the production of various synthetic rubbers, and mostly styrene-butadiene rubber (SBR)1/.

Aromatics

12. An important group of by-products from cracking heavy liquids are aromatics such as benzene, toluene and xylenes (BTX) - chemicals characterized by a structure in ring form instead of in chain form, as found in olefines such as ethylene, propylene, butylene and their derivatives. Major products in that group are benzene, toluene, ortho-xylene, para-xylene, meta-xylene, phenol resins and polyamide (nylon 6) fibers. Ortho-xylene is converted to phthalic anhydride for producing plasticizers, paints and resins. Para-xylene is a key component of polyester fibers (along with ethylene glycol derived from ethylene). Toluene is used to produce high-octane gasolines, explosives and other materials, and sometimes converted to benzene.

Future Demand Outlook for Derivative Petrochemical Products

13. Assuming no new projects were to come on stream, forecasted world shortages by 1985 of the major olefinic - and aromatic based materials are given below:

Table 3

Product or Intermediate	Millions of Tons/Year Shortage	Principal End-Uses
Low Density Polyethylene (LDPE)	4.5	packaging, piping, consumer goods, cordage
High Density Polyethylene (HDPE)	2.4	premium packaging, industrial and consumer goods
Polypropylene	3.7	as for HDPE
Polystyrene	3.0	wood substitute insulation synthetic rubbers, packaging, construction
Vinyl Chloride/ Polyvinyl Chloride	3.5	packaging, piping, cosumer and industrial goods

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1/ which accounts for more than half of total synthetic rubber consumption.

Product or Intermediate	Millions of Tons/Year Shortage	Principal End-Users
Polyester Fiber Intermediates:		
Terephthalates	4.0	Clothing, industrial fibers
Ethylene Glycol	1.2	
Acrylic Fiber Intermediate: Acrylonitrile	2.0	acrylic fiber, nitrile rubber, plastic copolymers
Synthetic Rubbers butadiene, styrene, isoprene, acrylonitrile types	possibly in balance if above intermediates available	transportation, industrial, construction uses

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Source: UNIDO El Halfawy, 2nd Arab Petrochemical Conference, Abu Dhabi, March 1976.

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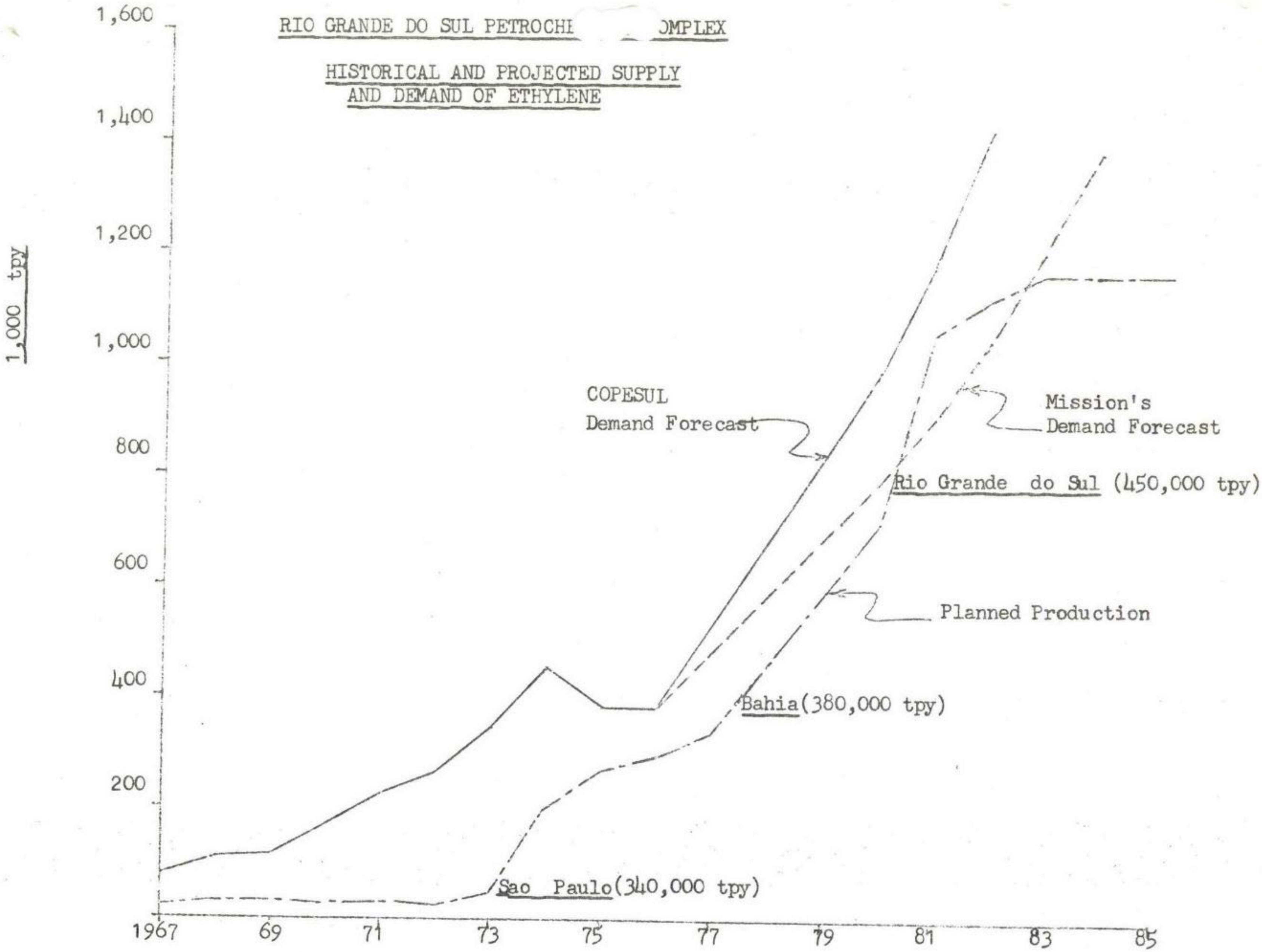

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ANNEX 3

BRAZIL - RIO GRANDE DO SUL PETROCHEMICAL COMPLEX - RAW MATERIALS CENTER

FINANCIAL PROJECTIONS
(in thousand Cr$ and mid-1976 Prices)

Year	0	1	2	3	4	5	6	7	8	9-14	15
Capital Expenditures											
Fixed Capital 1/	(440,357)	(1,363,269)	(2,375,117)	(740,400)	(14,856)	(1,981)	(1,408)	(187)	(187)		321,750
Working Capital				(270,860)	(32,575)	(18,315)					
Revenues											
Capacity Utilization					75%	90%	100%	100%	100%	100%	100%
Sales Revenues (incl. tax)					2,951,583	3,541,900	3,935,445	3,935,445	3,935,445	3,935,445	3,935,445
ICM Tax (net debit) 2/					(375,450)	(450,540)	(500,600)	(500,600)	(500,600)	(500,600)	(500,600)
PIS Contribution 3/					(22,137)	(26,564)	(29,516)	(29,516)	(29,516)	(29,516)	(29,516)
Net Sales Revenues					2,553,996	3,064,796	3,405,329	3,405,329	3,405,329	3,405,329	3,405,329
Variable Costs											
Naphtha 4/					(1,053,932)	(1,264,718)	(1,405,242)	(1,405,242)	(1,405,242)	(1,405,242)	(1,405,242)
LPG 4/					(75,487)	(90,584)	(100,649)	(100,649)	(100,649)	(100,649)	(100,649)
Refinery Gas 4/					(23,705)	(28,446)	(31,607)	(31,607)	(31,607)	(31,607)	(31,607)
Auxiliary Chemicals 4/					(17,945)	(21,534)	(23,927)	(23,927)	(23,927)	(23,927)	(23,927)
Power 4/					(3,699)	(4,439)	(4,932)	(4,932)	(4,932)	(4,932)	(4,932)
Fuel Oil 4/					(50,894)	(61,072)	(67,858)	(67,858)	(67,858)	(67,858)	(67,858)
Subtotal					(1,225,662)	(1,470,793)	(1,634,215)	(1,634,215)	(1,634,215)	(1,634,215)	(1,634,215)
Fixed Costs											
Labor 4/					(199,782)	(199,782)	(199,782)	(199,782)	(199,782)	(199,782)	(199,782)
Power (Fixed Portion) 4/					(4,121)	(4,121)	(4,121)	(4,121)	(4,121)	(4,121)	(4,121)
Maintenance					(80,886)	(80,886)	(80,886)	(80,886)	(80,886)	(80,886)	(80,886)
Insurance					(40,193)	(40,193)	(40,193)	(40,193)	(40,193)	(40,193)	(40,193)
Overhead					(20,000)	(20,000)	(20,000)	(20,000)	(20,000)	(20,000)	(20,000)
Depreciation 5/					(533,857)	(533,857)	(533,857)	(533,857)	(533,857)	(369,774)	(27,397)
Subtotal					(878,839)	(878,839)	(878,839)	(878,839)	(878,839)	(714,756)	(372,379)
Before Tax Income					449,495	715,164	892,275	892,275	892,275	1,056,358	1,398,735
Income Tax (30%)					(134,849)	(214,549)	(267,682)	(267,682)	(267,682)	(316,907)	(419,620)
After Tax Income					314,646	500,615	624,593	624,593	624,593	739,451	979,115
Depreciation					533,857	533,857	533,857	533,857	533,857	369,774	27,397
Cash From Operations					848,503	1,034,472	1,158,450	1,158,450	1,158,450	1,109,225	1,006,512
Net Project Cash Flow	(440,357)	(1,363,269)	(2,375,117)	(1,011,260)	(801,072)	1,014,176	1,157,042	1,158,263	1,158,263	1,109,225	1,328,262

1/ No terminal value except notional working capital recovery. Project life: 12 years.
2/ Difference between ICM tax charged by COPESUL to its customers and the ICM tax which it has paid on purchased supplies.
3/ 0.75% of sales revenues inclusive of ICM tax.
4/ From Annex 6.
5/ Declines overtime since different items are depreciated over different periods (5, 10, 20 years). The benefit of accelerated depreciation has been requested by COPESUL

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BRAZIL: RIO GRANDE DO SUL PETROCHEMICAL COMPLEX - RAW MATERIALS CENTER

ECONOMIC PROJECTIONS
(in US$ million and mid-1976 prices)

Year	0	1	2	3	4	5	6	7	8	9-14	15
Capital Resources Used up by the Project 1/											
Fixed Capital	(34.8)	(108.7)	(191.2)	(60.0)	(1.6)	(-)	(-)	(-)	(-)		
Working Capital				(20.1)	(2.4)	(1.4)					23.9
Value of Production					198.0	237.6	264.0	264.0	264.0	264.0	264.0
Cost of Production											
Naphtha					(90.6)	(108.7)	(120.8)	(120.8)	(120.8)	(120.8)	(120.8)
LPG					(2.0)	(2.4)	(2.7)	(2.7	(2.7)	(2.7)	(2.7)
Refinery Gas					(5.3)	(6.4)	(7.1)	(7.1)	(7.1)	(7.1)	(7.1)
Auxiliary Chemicals					(1.7)	(2.0)	(2.2)	(2.2)	(2.2)	(2.2)	(2.2)
Power					(0.3)	(0.3)	(0.4)	(0.4)	(0.4)	(0.4)	(0.4)
Fuel Oil					(4.6)	(5.5)	(6.1)	(6.1)	(6.1)	(6.1)	(6.1)
Subtotal					(104.5)	(125.3)	(139.3)	(139.3)	(139.3)	(139.3)	(139.3)
Labour					(14.8)	(14.8)	(14.8)	(14.8)	(14.8)	(14.8)	(14.8)
Power (fixed portion)					(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)
Maintenance					(6.0)	(6.0)	(6.0)	(6.0)	(6.0)	(6.0)	(6.0)
Insurance					(3.0)	(3.0)	(3.0)	(3.0)	(3.0)	(3.0)	(3.0)
Overhead					(1.5)	(1.5)	(1.5)	(1.5)	(1.5)	(1.5)	(1.5)
Subtotal					(25.6)	(25.6)	(25.6)	(25.6)	(25.6)	(25.6)	(25.6)
Economic Surplus (Deficit) From Operations					67.9	86.7	99.1	99.1	99.1	99.1	99.1
Net Economic Surplus (Deficit) From Project	(34.8)	(108.7)	(191.2)	(80.2)	63.9	85.3	99.1	99.1	99.1	99.1	123.0

BRAZIL - Rio Grande do Sul Petrochemical Complex - Raw Material Center

Input/Output Profile and Unit Prices (at their mid-1976 level)

	Units	Quantities at 100% Capacity Operations	Local Selling Price, incl. taxes 3/ (in Cr$)	Local Selling Price excl. taxes 7/ (in US$)	International Prices (European contracts) 8/ (in US$)
Outputs					
Ethylene	ton	350,000 2/	5,281	424	320-335
Propylene	ton	120,000	3,433	273	220-230
Butadiene	ton	45,209	7,657	610	350-365
Benzene	ton	107,436	5,281	421	275-280
Xylenes	ton	22,154	4,449	357	150
Residue	ton	72,447	1,584	126	85
LPG 1/	ton	88,572	1,605 4/	150	115
Pyrolysis Gasoline 1/	ton	123,814	1,605 4/	150	120
High Pressure Steam	ton	408,000	68 5/	6	--
Medium Pressure Steam	ton	1,632,000	60 5/	5	--
Low Pressure Steam	ton	326,400	37 5/	3	--
Filtered Water	1,000 m^3	16,034	753 5/	60	--
Demineralized Water	1,000 m^3	1,485	4,359 5/	348	--
Drinking Water	1,000 m^3	124	2,318 5/	185	--
Nitrogen	1,000 m^3	17,014	341 5/	27	--
Inputs					
Naphtha	ton	1,050,499	1,338	120	115
Refinery Gas	ton	67,000	472	--	40
LPG	ton	62,000	1,619	--	115
Catalysts	m^3	38	-	--	--
Inhib., Anti-oxidants	ton	92	-	--	--
Absorbents	ton	153	-	--	--
Solvents	ton	15	-	--	--
Soda Ash	ton	451	7,700	713	
MEA	ton	164	17,000	1,574	
Other Chemicals	ton	45	-	--	--
Chemicals, Water Treatment	ton	1,790	-	--	--
Power	1,000 KWH	24,480,000	370	34	10-30
Fuel Oil (for TPS)	ton	152,592	445	--	70
Labor	workforce	1,343	74/hour 6/	7	>8

1/ returned to the refinery

2/ the Brazilians are presently considering the alternative of raising the ethylene production from the project to 420,000-450,000 TPY by increasing the cracking severity to 32% and adding a number of pieces of equipment worth about US$10 million.

3/ local taxes comprise an 11% ICM tax (value - added tax system) and an industrial tax of about 5%.

4/ returned to refinery at a fixed price of 20% above the naphtha price - no taxes added.

5/ all utilities sold to downstream units will be priced so as to yield an 8% return on investment to COPESUL.

6/ average hourly labour cost incl. social and welfare contributions.

7/ translated at July 1976 exchange rate of US$1.0= Cr$ 10.8. Present rate (Jan. 1977) is US$ 1.0= Cr$ 12.7.

8/ Median price for US and European contracts as of mid-1976 for ethylene, propylene, butadiene and benzene. Own or Brazilian estimates elsewhere.

Industrial Projects Department
February 1977

BRAZIL: RIO GRANDE DO SUL PETROCHEMICAL POLE

ASSUMPTIONS FOR THE ECONOMIC ANALYSIS

1. All projections in mid-1976 constant dollars, translated when necessary, at the then prevailing exchange rate of Cr$10.8 = US$1.0.

2. Capital costs as per the financial data since the project is expected to be 100% exempt of custom and local duties. The locally procured capital cost items have been shadow priced using a 1.25 foreign exchange shadow price factor (applied to the above exchange rate).

3. Project life was assumed to be 12 years, with no terminal value except a notional working capital recovery.

4. Product prices for the petrochemical outputs of the project are based on Western European transfer prices, adjusted by a notional 10% to cover replacement costs not fully reflected in present transfer prices.1/ Western European producers use predominantly naphtha and heavier hydrocarbons as raw materials, while US producers still use ethane at regulated prices. Since the trend is towards naphtha and gas oil (Annex 2), Western European prices were preferred as basis for long-run economic prices. It is nevertheless important to note that economic prices for items such as ethylene and propylene, which are not traded internationally in the usual sense of the word (ocean shipping costs being prohibitive), should be derived from an analysis of the global economics of the particular complex being analyzed. Using foreign transfer prices is only a rough approximation pending the availability of more data and time to perform such an extensive analysis.

5. Utility prices are the local Brazilian ones.

6. The naphtha price is on a FOB basis since the alternative for the country, according to the Brazilians, is exports. A more detailed analysis of this point will be needed in the future.

7. All local operating costs have been translated at the shadow-priced exchange rate.

1/ After this correction the economic prices retained are roughly in line with constant price forecasts obtained from major oil companies.

October 11, 1976

Mr. P.N. Menon
Chief Project Manager
FEDO
UDYOGAMANDAL-683 501,
Via. Cochin, INDIA

Dear Mr. Menon:

In the absence of Mr. Rischard, who is away on mission at present, I am enclosing a copy of the Completion Report for the Gorakhpur Expansion Project as requested in your letter of September 24, 1976, to Mr. Tortorelli of our Division.

I will convey your regards upon Mr. Rischards return.

Sincerely yours,

Secretary to Mr. Jean-Francois Rischard
Industrial Projects Department

/mmm

cc: Tortorelli

July 9, 1976

Mr. Joseph V. D'Ambrisi
Mobil Oil Corporation
150 East 42nd Street
New York, New York 10017

Dear Mr. D'Ambrisi:

Thank you for your letter dated July 2, 1976. Exchanging one organization chart for another, here is the Bank's (somewhat complicated) chart, to which I added a further breakdown for those departments in which you are most interested.

Let me attempt to give some explanations, starting with the Europe, Middle East and North Africa Country Programs Department I, which is, among others responsible for Saudi Arabia. Within a Regional Vice Presidency, there are one or two Country Programs Departments and a Regional Projects Department. Each Country Programs Department deals with a group of countries in its Region. It maintains close working relations with governments and the principal financial economic, and planning agencies concerned with development. It has primary responsibility for conducting the Bank's basic country economic studies and drawing up country lending programs. It also has responsibility for coordinating activities of the various parts of the Bank as they bear on its operations in each country.

The Projects Department in each Region is responsible for the Bank's work on sector analysis, project preparation, appraisal and execution in the main economic sectors which account for the bulk of Bank lending, such as agriculture, education, highways, ports and pipelines, etc. In the case of the Europe, Middle East and North Africa Projects Department, there is also a Technical Assistance Division which deals primarily with Saudi Arabian types of technical assistance.

The Industrial Projects Department occupies a special place in the sense of being one of the few project outfits which are not regionalized but centralized under a special Vice-President's office. This is because the nature of the work requires functional rather than regional emphasis.

In the case of technical assistance to Saudi Arabia, which is somewhat different from the usual Bank project work (culminating in a loan), the concerned projects department work in close collaboration with the Technical Assistance Division included in the Europe, Middle East and North Africa Projects Department and also with the Region's concerned Country Programs Department which acts, as is usual in the Bank's structure, as the coordinating unit and diplomatic channel in relations with the government.

Finally, the four-men Saudi Arabia Resident Mission, headed by Sir Gordon Mackay (assisted by Roger Carmignani) assures the liaison and local contact with the Saudi Arabian government and agencies.

I hope that these explanations are helpful and not too confusing and look forward to working with you again very soon.

Sincerely,

Jean-Francois Rischard
Industrial Projects Department

JFRischard:mmm

Files July 7, 1976

Antonio Tarnawiecki, Donald Brown and
Jean-Francois Rischard

ROMANIA: Chemical Industries
Project Identification Mission
Amendment to Back-to-Office Report

1. Following the receipt of new information and after further analysis of product prices and capital costs, the Mission revised its preliminary economic return estimates for the synthetic fiber project of Cimpulung and the two tire projects of Turnu-Severin and Zalau. These changes do not alter the conclusions of the Back-to-Office report dated June 4, 1976 and confirm the preliminary selection of Cimpulung and Turnu-Severin (the latter as a stand-by project) for further consideration by the Bank in FY 1977. This fact, and the small number of these changes render it unnecessary to issue a full report. The corresponding corrections to the Back-to-Office report are given below.

1. The economic return for Cimpulung was revised to 13.5% up from the original estimate of 12%. The basis for this are revised capital cost estimates worked out by Geerdes Industries at our request as well as a set of economic input and output prices slightly different from the original ones.

2. The preliminary economic returns for the two tire projects, Turnu-Severin and Zalau were lowered to 14.4% and 26.1%, down from 19.2% and 38.2%, respectively, as a result of a downward revision of the base price per kg for all tires (except giant heavy-duty tires) of about 18% on the basis of new information obtained by the Mission.

3. The revision of the preliminary economic return for the Vaslui project, which would use as inputs about a quarter of Cimpulung's total production, has not yet been finalized, pending the solution of problems surrounding the Romanian capital cost estimates. On the basis of capital estimates tentatively submitted by Geerdes Industries, it would however appear as if the economic return for Vaslui could be higher than 10%. Further elements of information to be obtained in Romania will help to clarify the issue, which seems to hinge on the use for Vaslui of capital cost estimating practices which are not consistent with the ones followed for other projects included in the list submitted to the Bank.

JFRischard:mmm

cc: Messrs. van der Tak(5), Fuchs, Kalmanoff, Moore, Thadani, Cash, Soncini, Dewey, Sheldrick, Pratt, Sandig, Noon, Kopp, Tsantis, Pepper

Mr. Chauncey F. Dewey July 2, 1976

Geoffrey Evans and Jean-Francois Rischard

SAUDI ARABIAN Technical Assistance
Mobil Petrochemical Project - Yenbu
Mission to New York, June 30, 1976
Back-to-Office Report

In accordance with Terms of Reference dated June 29, 1976 a meeting was held with representatives of the Mobil Chemical Company in their New York offices to hear their presentation of a proposed scheme for construction of a petrochemical project at Yenbu, Saudi Arabia.

Those in attendance were:

Mr. J.V. D'Ambrisi	Manager-Co-ordination and Services (Saudi Arabia)
Mr. E.D. Walen	Manager, Planning Coordination, Special Projects Division
Mr. R. Walker	Assistant Manager, Coordination & Services (Saudi Arabia)
Mr. R.W. Schreiber	Administrative Manager, Coordination & Services (Saudi Arabia)
Mr. J.E. Wylie	Senior Planning Associate
Mr. T.L. Cranmer	Financial Representative
Mr. W. Zaske	Project Leader, Yenbu Refinery, Mobil Oil Company
Mr. C.F. Dewey	Bank
Mr. G. Evans	Bank
Mr. J.F. Rischard	Bank
Mr. N. Sukkar	IBRD Resident Mission, Riyadh

1. Mobil's Operations in Saudi Arabia

Prior to presentation of the petrochemical project, Mr. D'Ambrisi explained that in addition to its ongoing participation in ARAMCO, Mobil presently had several other projects in the planning or construction stage under various arrangements with the Saudi Government or its agencies, and consequently saw for itself a significant and long term role in the future development of the Kingdom. These projects included joint ownership with PETROMIN of a new crude oil refinery at Yenbu (planning), joint ownership with PETROMIN of a $100 million lube oil refinery (under construction), planning of a new sea-port 20 km north of Jeddah, planning of a jet fuel distribution pipeline network, management of design and construction of the east-west crude oil and natural gas liquids pipelines, planning of marine facilities to handle west coast hydrocarbon exports, and development of a national automotive fuel distribution and marketing network.

2. The Yenbu Petrochemical Project

The Mobil representatives' presentation indicated that the project would be a 50/50 Mobil/MIE joint venture petrochemical complex built around a one billion lb/yr. ethylene plant located near Yenbu. According to them, the location of the complex on the west coast would provide the joint venture with various competitive advantages, especially with regards to logistics. The ethylene would be entirely consumed in three derivative plants within the complex producing 440 million lb/yr. low density polyethylene, 350 million lb/yr. ethylene glycol and 930 million lb/yr. styrene monomer respectively. For feedstock and fuel the project would use ethane extracted from natural gas liquids brought by pipeline from the eastern region. The ethane extraction facilities and the pipeline would be constructed by ARAMCO. Capital investment would be $1037 million to be financed 70/30 debt to equity by the joint venture partners plus an additional $204 million fixed capital for infrastructure and services to be provided by the Government. The project would take four years to complete from award of the major engineering contract. Based on ethane and benzene feedstock prices of 50¢/MMBTU and 80¢/gal. respectively, and product sales values in 1980 of 36¢/lb. for LDPE, 23¢/lb. for glycol, and 23¢/lb. for styrene, the project was expected to provide a 15.5% (constant price) DCF rate of return on equity. The product prices used in this calculation are assumed to be those that would yield a 15% constant price return on equity to a similar complex located in Northern Europe and coming on stream in 1980. This return was shown to be most sensitive to product price variations (a 14% reduction in LDPE price causing a 50% reduction in DCFRR) and capital cost overruns (20% plant cost increase causing a 40% reduction in DCFRR).1/

The Mobil representatives indicated that the complex could be expanded at a later stage to comprise facilities for the production of polystyrene, TPA as well as polyester fiber and film.

3. Status of Project Preparation

The Mobil representatives indicated that the basic project report as issued in March 1975 was intended primarily to define the scope of the project rather than to establish its feasibility and had been based on data collected at end 1974. Capital cost estimates had been based on US Gulf Coast erected costs indexed for Saudi conditions on the basis of Saudi cost data obtained from ARAMCO and Mobil's own engineering group. Mobil believed however, that the accuracy of the estimate as it presently stood would not approach ± 25% and was in need of further refinement to bring it closer to the ± 10% accuracy. expected of Mobil's own projects prior to their submission for board approval. The Mobil representatives indicated therefore that they wished to further review the feasibility of the project including a re-appraisal of the market situation and construction schedule. Accordingly during their presentation of the project scheme to MIE staff in Riyadh on June 20, 1976, the parties had agreed to discuss during further meetings planned for July 10, 11 in Riyadh the possibility of entering into an interim agreement to undertake some detailed engineering to

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1/ It appeared from the discussion that the nature of the incentive package would need to be clarified. According to the Mobil representatives, the company would prefer a front-end cash grant to an income tax holiday.

permit closer definition of the project. The Mobil representatives informed that H.E. Al Zamil had requested at that time, however, that they not discuss details of such a possible arrangement with the World Bank beforehand. While the nature and objectives of such an interim agreement were therefore not discussed with Mobil in New York, Mobil did indicate that they considered it may take a period of 2 years and an expenditure of $40 million to reach a stage where the accuracy of the projected total investment and profitability of the project could be established to their satisfaction, and during this entire period and even subsequently Mobil, as was their normal practice, would expect to retain the option to terminate the project if such an action was dictated by sound business practice. They believed the MIE representatives had understood this position. They also stated that it was Mobil's practice to place cancellable orders during this phase and that on their part, they would be willing to give consideration to placing such orders during the execution of the study to be defined by the interim agreement.

4. Role of the Bank

The Bank's representatives explained the role of the Bank as general advisors to the MIE and the PIF but confirmed that up till the present time neither the MIE nor PIF had asked the Bank nor had the Bank agreed to undertake an evaluation of Mobil's petrochemical project. The Bank was not therefore requesting Mobil to undertake any work of whatever kind relating to the project at this stage. The Bank team indicated however that it believed there was little the Bank could do at the present stage to evaluate the project (if asked to do so) on the basis of the "Scoping Study" so far prepared which Mobil readily agreed was inadequate to determine the project's feasibility and was marked for a thorough review.

5. Conclusion

It became clear during the course of the meeting that Mobil was already aware of the deficiencies in the present project study and of the further work needed to bring the project to the stage where its viability could be examined. There would seem therefore to be little useful work the Bank could undertake on the project at this stage even if asked to do so. The project would give the appearance however at this stage of being suitable for review by the Bank when planning has reached a more advanced stage. Some staff time may therefore be provisionally budgeted for the fourth quarter of 1976 on the assumption that the MIE will not seek earlier Bank advice on arrangements for an interim engineering agreement. It is suggested the resident mission may be asked to clarify this point.

JFRischard:mmm

cc: Messrs. Fuchs, El Darwish, Asfour, Armstrong (3), Mahoney, Blay, Sukkar, Perram, Mackay, Carmignani, Scott

Mr. Chauncey F. Dewey June 23, 1976

Jean-Francois Rischard

INDIA: Credit No. 279-IN
Gorakhpur Expansion Project
Fertilizer Corporation of India
Supervision Report

Attached is the Supervision Report on the Gorakhpur Expansion Project based on the findings of a mission which visited India in May 1976.

J-FR:mmm

cc: Messrs. Lee, Israel, Chittleburg, Fuchs, Kalmanoff, Moore, Cash, Thadani, Sheldrick, Soncini, Dewey, Perram, Tortorelli, Tarnawiecki, Picciotto, Rajagopalan, Parmar (IFC), Diamond, Lerdau, Hansen, Kraske, Singh (Legal)
Mrs. Hamilton
Mrs. Robbin (Controller)

FORM NO. 590
(1 75)

IBRD AND IDA – SUPERVISION SUMMARY

This summary is
- [ ] the initial summary
- [x] part of a mission report
- [ ] a semi-annual update
- [ ] the completion summary

Regional Office:	Project Name:	Project Code:	Loan [ ] Credit [X] No.:	L/C Amount ($xx.xm):
South Asia	Gorakhpur Fertilizer Project	4 INDIC03	279-IN	10.0

Country:	Borrower/Beneficiary:	Board Date:	Signing Date:	Effective Date:
INDIA	Government of India	12/21/71	1/7/72	4/5/72

Projects Dept./Div. Name:	Org. Code No.:	Projects Officer:	Loan Officer:
Industrial Projects	305/30	E. Tortorelli	Ann O. Hamilton

SECTION 1: SUMMARY PROJECT DESCRIPTION

Expansion and balancing of existing plants so that ammonia capacity will be increased from 116,000 to 172,000 metric tons per year and urea capacity from 180,000 to 314,000 metric tons per year.

SECTION 2: PERFORMANCE RATING

	This Summary	Last Summary
STATUS: 1 - Problem-free or Minor Problems; 2 - Moderate Problems; 3 - Major Problems	1	1
TREND: 1 - Improving; 2 - Stationary; 3 - Deteriorating	2	2
TYPES OF PROBLEMS: F - Financial; M - Managerial; T - Technical; P - Political; O - Other *(Explain in Section 5)* If more than one type of problem, enter most critical factor first.		

Designated a "problem project" in most recent SVP review? Y - Yes; N - No: N

SECTION 3: PROJECT DATA

Estimated/Actual:	Project Completion (Mo./Yr.)	Loan/Credit Closing (Mo./Day/Yr.)	Total Project Cost ($xx.xm)	of which: Foreign Currency ($xx.xm)	Local Currency ($xx.xm)	Cumulative Disbursements through most recent Quarter ended (03/31/75) ($xx.xm)
Appraisal Est.	08.74	03.31.75	16.0	10.0	6.0	10.0 (Est.)
Last Summary (02/05/76)	03.76	03.31.76	24.5 1/	11.6	12.9	
Current	03.76	03.31.76	23.0 1/	11.4	11.6	10.0 (Actual)

SECTION 4: MISSION SCHEDULE

	No. of Staff on Mission	No. of Days in Country	Return to HQ (Mo./Day/Yr.)	Final Report Date (Mo./Day/Yr.)
Latest/Present Mission	2	4	05.17.76	06.23.76 (FS)
Previous Mission	1	8	01.31.75	02.18.75 (FS)

Next Mission Departure (Mo./Yr.) 07.76 Recommended interval between missions (Months) - End of period covered by latest progress report (Mo./Day/Yr.) 03.31.76

* *Type of Report: FS = Full Supervision; CS = Combined Full/B-T-O; C = Completion; A = Appraisal; O = Other (explain below)*

SECTION 5: COMMENTS *(Explain "other" in Section 2 and clarify, if necessary, data in Sections 3 and 4)*

1/ Last summary estimate based on exchange rate prevailing at appraisal; current estimate based on weighted average exchange rate for the project of US$1.0 = Rs 8.0

SECTION 6: SUMMARY OF PROJECT STATUS, TREND, AND MAJOR PROBLEMS:

The project was started up on December 27, 1975 and has begun commercial production on February 1, 1976. A draft completion report has been prepared and is scheduled for discussion with the Fertilizer Corporation of India in early July as part of the terms of reference of another mission to India. The present report summarizes the major findings of the present mission pending the finalization of the full completion report at a later date.

Preparing Officer: J. F. Rischard Initials: JFR Date: 06/23/76

Gorakhpur Expansion Project

The project is now fully disbursed; it was started up in December 1975 and has begun commercial production. Total capital costs amount to US $23 million against an appraisal estimate of US $16 million. About half of the total cost overrun is due to currency realignments between India and the main supplier countries.

Gorakhpur Expansion Project

List of Persons Met

Fertilizer Corporation of India, Head Office

Mr. K.S. Sarma, O.S.D. (Projects)
Mr. A.K. Menon, Chief (Management Reporting) and Staff
Dr. P.V. John, Director of Market Research

Gorakhpur Unit

Mr. M.S.L. Anand, General Manager
Mr. P.N. Menon, Project Manager and Staff

Gorakhpur Expansion Project

Completion Report Summary

Project Objective and Scope

1. The project consisted of the expansion and balancing of the facilities of FCI's Gorakhpur Unit, which had oversized and spare equipment available, so as to increase its urea production capacity from 180,000 to 314,000 TPY. It was started up in December 1975 and began commercial production in February 1976. In terms of nutrient tons, its additional capacity is equivalent to 10% of India's deficit in nitrogenous fertilizers during 1975/76.

2. The project comprised three main components: (i) addition of a third train in the ammonia plant, (ii) expansion of the urea production and prilling facilities in order to utilize the expanded ammonia capacity, and (iii) enlargement of the utilities and storage facilities. The detailed technical design was finalized by Toyo Engineering Company of Japan (TEC) in early 1972 and implied only minor departures from the design envisaged at appraisal. The corresponding net cost increase accounts for only 10% of the total cost overrun.

Project Summary Data

3. The following table compares major project parameters at appraisal with actual results upon completion:

Table 1

Project Summary Data

	Unit	Appraisal	Actual 1/
Capital Cost of Project	US$ Million	16.0	23.0 2/
Foreign Exchange Costs	US$ Million	8.7	11.4 2/
Capital Cost per Annual Ton of Urea	US$/Ton	119	172
Beginning of Construction		2/1972	7/1972
Duration of Construction	months	30	41
Start-up Date		8/1974	12/1975
Plant Capacity after Expansion:			
- Ammonia	TPY	172,000	172,000
- Urea	TPY	314,000	314,000
Sale Price, Urea (ex-factory)	US$/Ton	99	141
Ex-factory Cost per Ton	US$/Ton	58	117
Profit before Interest and Taxes per Ton	US$/Ton	41	24
Annual Foreign Exchange Savings at 95% Capacity	US$ Million	5.3	7.7
Economic Return at 95% Capacity		19.1%	18.6%
Financial Rate of Return at 95% Capacity		34.0%	13.4%

1/ Actual data are expressed in 1976/76 prices
2/ Translated at weighted average exchange rate for the project of US$1.0 = Rs 8.0

Project Construction and Completion

4. The start-up of the project was delayed by a total 16 months because of the following reasons:

i) the Indo-Pakistani conflict which broke out in December 1971 delayed the finalization of the contract terms between TEC and FCI, thus shifting forward by 5 months the zero date for construction:

ii) the appraised construction schedule was revised from 30 to 36 months after TEC concluded on the basis of its preliminary study that the scope for duplication of existing equipment had been reduced by changes in technology and that further safety measures appeared mandatory due to adjacent operations in the existing plant;

iii) the occurence of the oil crisis caused delays in the delivery of equipment ranging from 3 to 14 months. Despite this, project management made impressive efforts to keep project delay at a minimum and on account of the various measures taken, the construction period was extended by 5 months only.

Project Management

5. On the request of IDA, FCI agreed to appoint an experienced Project Manager assisted by the necessary staff and fully responsible for both project budget and schedule, whilst project management responsibility had been traditionally split between different persons and entities in other FCI projects. This organizational set-up has proven to be a key factor in the effective implementation of the project:

i) a more effective coordination than would otherwise have been possible was obtained by assigning full project responsibility to a person in constant and close contact with operations;

ii) the unusually large authority assigned to the project manager gave him the needed power and flexibility to make prompt and appropriate decisions in a context of recurring difficulties during the oil crisis. Without the various expediting measures taken, project completion might have been delayed by an additional 9-10 months;

iii) project management has been in a position to take several steps leading to substantial savings which might not have materialized in a different organizational context, such as commissioning sub-units ahead of schedule, and obtaining reductions in certain price and fee increases which were facilitated by the personal and immediate relationship established between individual suppliers and the project manager.

Change in Project Cost

6. Total financing for this project amounted to US$23 million against an original estimate of US$16 million, representing a cost overrun of about 45%. The actual foreign exchange costs amounted to US$11.4 million against an appraisal estimate of US$8.7 million, an increment of 30%. A detailed breakdown of the revised capital costs is given in the appendix to Annex 3.

7. An analysis of the overrun by major causes shows the following results:

Table 2

Breakdown of Cost Overrun by Origin

Part of Total Cost Overrun Due to:	% of Total Overrun
- Currency fluctuations (mostly Yen)	44
- Price escalation on equipment, materials and spares over and above initial price contingency	15
- Cost escalation on rates and tariffs for various services (freight, erection, insurance, etc.)	13
- Change in project design 1/	10
- Change in tax and custom duties	10
- Other	8
	100

1/ Includes increase in erection tonnage.

8. A major part of the equipment, materials and know-how needed for this project had been contracted from Japanese suppliers and underwent substantial cost increases as the exchange rate, valued at Rs 100 = ¥ 4,800 at appraisal, appreciated to Rs 100 = ¥ 3,350. Comparatively, the part of the overrun due to price escalation on equipment and materials was kept relatively low compared to other projects implemented in the aftermath of the oil crisis.

Financing and Procurement

9. Pursuant to the Credit Agreement, an amount equivalent to the IDA Credit was to be on-lent by the Government of India to FCI and the remaining project costs were to be financed by equity. No problems were encountered

in securing financing for the cost overrun and the GOI released a sufficient amount of free foreign exchange to meet the increased foreign exchange costs.

10. Expenditures categories recommended for IDA financing and actual disbursements are compared below, showing no major divergences:

Table 3

Withdrawal of Proceeds of IDA Credit

Categories	---- US$ Million ----	
	Appraisal	Actual
Equipment Bid Internationally	6.80	7.41
Equipment Imported for Standardization	0.40	0.47
Engineering, Procurement and Commissioning	2.20	2.12
Unallocated	0.60	-
	10.00	10.00

11. The countrywise percentage breakdown of the Credit amount was the following as of December 1975 (most recent data available):

Table 4

Countrywise Percentage Breakdown for IDA-Financed Items

Japan	72.5
India	10.5
Germany	6.6
UK	3.3
USA	2.8
France	1.4
Italy	1.1
Sweden	0.9
Netherlands	0.7
Other	0.2
	100.0

12. The overwhelmingly large share obtained by the Japanese suppliers was due to their high competitivity both in terms of price (before the massive currency realignment) and delivery times. Out of 26 ICB packages, only two were won by Indian suppliers. Local suppliers lost largely on account of price considerations rather than delivery times. However, 25% of the equipment was procured from within India without adopting ICB, against 4% envisaged at appraisal. In a significant number of cases, this became necessary when following the oil crisis, foreign supplies became subject to long delivery delays and local supplies had to be located to minimize delays in project completion.

Performance of Gorakhpur Unit Since Appraisal

13. Gorakhpur Unit's income statements for the fiscal years 1973 to 1976 are summarized below:

Table 5

Summary Income Statements for Gorakhpur Unit
(in Rs million)

Fiscal Year Ending March 31	1973	1974	1975	1976 1/
Sales (000 tons)	151	139	140	145
Capacity Utilization Percentage	84%	78%	88%	81% 2/
Revenues	158	181	269	222
Operating Expenses	146	173	255	240
Interest	7	6	5	6
Allocated Overhead	2	3	5	6
Net Profit (Loss)	3	(1)	4	(30)
Operating Profit as a Percentage Revenues	8%	4%	5%	-8%

1/ provisional figures
2/ excluding expansion project.

14. The deterioration of the Unit's profitability since appraisal is caused by: (i) problems encountered in reaching consistently high levels of capacity utilization; and (ii) a profit squeeze due to soaring production costs not compensated by adequate increases in the ex-factory price. Gorakhpur's inability to utilize the capacity fully stems for the major part from recurrent problems with the power supply. Out of 73,000 tons of nitrogen lost over the period 1972-76, about 49,000 tons, or two-thirds, were lost because of the occurence of power cuts, power failure or voltage dips.

15. The purchase of an implant generator from the proceeds of the Credit was envisaged at one point and then dropped from consideration because of the cost overrun on the main project components. The purchase of a generator for Gorakhpur was thereafter included in the Plant Operations Improvement Program accompanying the Trombay IV Credit. After the lowest bidder withdrew sometime after selection, difficulties in procuring the generator arose and it was decided that this part of the Credit would be used to finance decomposers for the urea plant and a waste heat boiler for the Unit. The Fertilizer Industry Credit recently granted by IDA will be used to finance a US$21 million 25 MW generator for Gorakhpur. The proposal has been approved by the FCI Board. The import license is to be issued shortly and the project, which will be started in the near future, could come on stream by mid-1980. This means that further production losses will be experienced during the next four years, particularly since the expansion project is now fully operational.

Changes in Operating Costs and Product Prices

16. The costs of major inputs such as naphtha, coal and power have been significantly altered since appraisal. Operating costs per ton for the existing plant and for the expansion project at 95% capacity compare as follows to appraisal estimates:

Table 6

Operating Costs Per Ton of Urea at 95% Capacity
(in current prices)1/

	Existing Facilities		Expansion Project		After Expansion	
	Appraisal	Actual	Appraisal	Actual	Appraisal	Actual
Variable Cost						
- Naphtha	109.7	343.7	109.5	343.9	109.7	343.8
- Utilities	170.4	350.1	155.6	350.9	164.1	350.4
- Other	136.0	217.5	62.5 2/	110.1 2/	104.5	171.6
	416.1	911.3	327.6	804.9	378.3	865.8
Fixed Costs						
- Depreciation	137.1	184.4	71.9	143.8	109.3	167.1
- Other	88.7	201.7	26.4	82.9	65.2	151.0
	225.8	386.1	105.5	226.7	174.5	318.1
Ex-Factory Operating Costs	641.9	1,297.4	433.1	1,031.6	552.8	1,183.9
Excise Tax	75.0	187.0	75.0	187.0	75.0	187.0
Freight	25.0	40.0	25.0	40.0	25.0	40.0
Delivery Costs	741.9	1,524.4	533.1	1,258.4	652.8	1,410.9

1/ Actual figures in 1975/76 prices; appraisal estimates in 1971 prices.
2/ Due to the absence of need for additional employment.

17. On the other hand, the domestic price of urea has undergone five changes since appraisal and a fertilizer poll equalization (FPE) charge is being levied since June 1974:

	Retail Price Per Ton of Urea	Including FPE Charge of
FY 72 (appraisal)	925	-
FY 73	960	-
FY 74	1,050	-
FY 75	2,000	610
FY 76	1,850	335 then 265 1/
FY 77 2/	1,750	165

1/ On September 9, 1975
2/ Effective April 1976

The per ton ex-factory price corresponding to the presently prevailing retail price equals Rs 1,240 after allowance for the FPE charge (Rs 165), excise duties (Rs 187), freight (Rs 40) and dealer margin (Rs 115). As appears from a comparison with the ex-factory operating costs per ton appearing in Table 6, the present price does not cover actual production costs for the existing facilities of Gorakhpur Unit. [1] This cost squeeze explains part of the deteriorating financial performance of the Gorakhpur Unit since appraisal, together with the inability to reach consistently high levels of capacity utilization.[2]

Updated Financial Analysis and Reappraisal of the Project

18. Although the prevalent ex-factory price of urea more than covers operating costs per ton for the expansion project due to the low incremental labor, depreciation and overhead costs implied by its operation, there has been a marked decline in the project's expected financial return. A variance analysis has been made to determine the relative effects in this respect of the following changes in the project parameters: (i) capital cost overrun; (ii) delay in construction and completion; (iii) expected power shortages up to FY 1980; and (iv) changes in the price and operating cost structure against appraisal assumptions.[3] The results are summarized in Table 7 and highlight the predominant effect of the change in the cost/price structure on the decrease in the financial return to be expected from the expansion project.

1/ Furthermore, the actual figures of Table 6 are based on 1975/76 costs i.e. about one year older than the present April 1976 price so that an upward adjustment of these costs would be necessary for comparison purposes.

2/ The operating cost figures per ton given in Table 6 are based on 95% capacity whereas the Unit reached only 81% during FY 76.

3/ This analysis can only reveal rough magnitudes, since the detailed results depend on what assumptions are made regarding the relevant general inflation and capital cost escalation indices. Different assumptions in this respect merely led to small changes in the proportions of the four component effects.

Table 7

Financial Return[1] and Variance Analysis
Between Appraised and Reappraised Return
(at 95% Capacity)

Financial Return, Appraisal	34.0%
Financial Return, Reappraisal	13.4%
Difference	(-) 20.6%
Out of Which:	
- Decrease in Return Due to Change in Price and Operating Costs	(-) 10.3%
- Decrease in Return Due to Cost Overrun	(-) 5.8%
- Decrease in Return Due to Expected Power Supply Problems Up to FY 1980[2]	(-) 2.5%
- Decrease in Return Due to Delays in Construction and Start-up[3]	(-) 2.0%

1/ Before income taxes.

2/ Assumes that until FY 1981 the expansion project would not operate above 80% capacity.

3/ Excludes that part of the total delay which is due to the shift in zero date for construction since it has no impact on DCF returns.

19. Because of its decreased financial profitability, the project will not be able to improve the profitability of the Gorakhpur Unit up to the point where it can produce profits. The break-even point for the Unit as a whole is now above 100%. The unrenumerative price conditions constitute however an industry-wide problem with serious implications not only for the Gorakhpur Unit, but for other FCI Units and manufacturers in the Indian Fertilizer Sector (see Supervision Report on Fertilizer Industry Credit dated May 25, 1976).

Updated Economic Analysis and Reappraisal of the Project

20. By contrast, the economic return to be expected from the project is practically unchanged. An analysis similar to the one above was used to determine the relative effects of the following changes: (i) capital cost overrun, (ii) delay in construction and completion, (iii) expected power shortages up to FY 1980, and (iv) changes in the economic price assumption underlying the projections, with regards to urea, naphtha, coal, power and other operating costs. The results are summarized in Table 8:

Table 8

Economic Return and Variance Analysis Between Appraised and Reappraised Return

Economic Return, Appraisal	19.1%
Economic Return, Reappraisal	18.6%
Difference	(-) 0.5%
Out of Which:	
- Increase in Return Due to Change in Economic Prices of Urea, Naphtha and Other Items1/	(+) 6.0%
- Decrease in Return Due to Cost Overrun	(-) 3.2%
- Decrease in Return Due to Expected Power Supply Problems up to FY 1980	(-) 2.3%
- Decrease in Return Due to Delays in Construction and Start-up	(-) 1.0%

1/ The latest price forecasts in real terms issued by the EPDES department were used. According to these forecasts, urea prices will increase from an average price of $137 for 1976 to $170 in 1985. It was assumed that naphtha prices would increase in parallel to real urea prices. Other costs were valued at financial prices minus tax elements, as had been done at appraisal.

21. The negligible change in the economic return to be expected from the project compared to appraisal estimates results from the neutralization of decreases in return due to the cost overrun, the protracted implementation schedule and the expected power supply problems during the first four years of commercial operation by the marked increase in return due to the higher (net) economic value of the project's production. The latter increase is due to the fact that the high level and projected increase in the price of urea is likely to more than compensate for the higher level and projected increase in the cost of naphtha, the main input, and for the 2 to 3-fold increase in other operating costs since appraisal.

22. Reflecting this, the net foreign exchange savings at 95% capacity and at 1976 prices are now estimated to amount to US$7.7 million against US $5.3 million estimated at the time of appraisal.2/

2/ The latter figure has been derived after adjusting the appraisal report estimate for comparison purposes.

Market Prospects for the Project

23. Recent figures for all India nitrogen production and consumption and short-term prospects are given as follows:

(in tons of N)

	Production	Consumption	Deficit
FY 1974(actual	1050	1830	780
FY 1975(actual)	1190	1770	580
FY 1976(estimate)	1540	2150	610
FY 1977(projected)	1850	2500	650

24. Despite a significant increase in production in FY 76 and further increases expected during the course of the year, the recovery of consumption after a four year stagnation will cause India to maintain a deficit in the order of 650,000 tons in the short term.

25. With regard to the UP market, there is still much scope for higher fertilizer consumption levels. This is particularly true for Gorakhpur's Eastern UP intensive marketing zone which is as yet less endowed than Western UP and is behind in terms of irrigation facilities. In particular, the completion of the Gandak project should significantly increase the area under irrigation in Gorakhpur's marketing zone. Furthermore, the Unit continues to be advantageously located to reach some areas in Eastern UP by being on the local metre-gauge railroad network. In any case, consumption forecasts for 1980 of 620,000 and 210,000 tons of nitrogen consumption for UP and Eastern UP respectively seem sufficiently higher than Gorakhpur's post-expansion capacity of 137,000 nutrient tons to render the marketing of the entire output unproblematic.

Covenants and Relationship with IDA

26. With one exception, no problems were encountered regarding the compliance with covenants, including those pertaining to reporting and procurement. A temporary controversy surrounded a provision under section 4.03 of the Project Agreement requiring FCI to maintain a ratio of current assets to current liabilities of 1.2:1. The problem, which hinged on the accounting treatment of revolving cash credits, was subsequently settled.

27. The reporting requirements concerning the project were fulfilled in a timely and informative fashion and in general, a very good relationship was established between project management and IDA. The project manager and his staff operated competently and contributed much to the successful implementation of the project.

Gorakhpur Expansion Project

Disbursement Schedule: Appraisal Estimate and Actual
(in US $ Million Equivalent)

	Appraisal Estimate (Cumulative)	Actual (Cumulative)
FY 1972		
June-March 1972	0.1	-
April-June 1972	0.6	-
FY 1973		
July-September 1972	1.1	-
October-December 1972	1.6	-
January-March 1973	2.1	0.3
April-June 1973	3.1	0.9
FY 1974		
July-September 1973	5.1	1.2
October-December 1973	7.6	1.4
January-March 1974	8.7	3.5
April-June 1974	9.4	6.4
FY 1975		
July-September 1974	9.8	7.1
October-December 1974	10.0	7.3
January-March 1975		8.1
April-Juen 1975		8.3
FY 1976		
July-September 1975		8.6
October-December 1975		9.1
January-March 1976		10.0
April-June 1976		

ANNEX 3
APPENDIX

Gorakhpur Expansion Project Supervision Report

Capital Cost Estimates (in million US $)

	APPRAISAL REPORT ESTIMATES LOCAL	FOREIGN	TOTAL	REVISED CAPITAL COSTS 1/ LOCAL	FOREIGN	TOTAL
Equipment and Materials						
*Proprietory Items	-	0.37	0.37	-	0.48	0.48
Items on Reserve List	0.21	0.05	0.26	1.92	0.48	2.40
*Items Bid Internationally	1.13	5.24	6.37	0.42	6.60	7.02
Sub-Total	1.34	5.66	7.00	2.34	7.56	9.90
*Ocean Freight	-	0.41	0.41	0.03	0.54	0.57
Inland Freight	0.21	-	0.21	0.50	-	0.50
Custom Duties and Sales Tax	1.95	-	1.95	3.20	-	3.20
Erection and Commissioning						
*Equipment Erection	0.45	-	0.45	1.64	-	1.64
*TEC Supervision	0.15	0.35	0.50	-	0.41	0.41
*FCI Supervision	0.04	-	0.04	0.04	-	0.04
Sub-Total	0.64	0.35	0.99	1.68	0.41	2.09
Civil Works	0.72	-	0.72	1.08	-	1.08
Plant Lightning	0.03	-	0.03	0.03	-	0.03
License Fees						
*Shell	-	0.05	0.05	-	0.16	0.16
*Benfield	-	0.08	0.08	-	0.03	0.03
*TEC	-	0.24	0.24	-	0.29	0.29
	-	0.37	0.37	-	0.48	0.48
[illegible]ign and Engineering						
[illegible]C Design Pakcage	-	0.56	0.56	-	1.00	1.00
*FCI Engineering	0.64	-	0.64	0.69	-	0.69
*TEC Assistance and Checking of Design	-	0.49	0.49	-	0.47	0.47
Sub-Total	0.64	1.05	1.69	0.69	1.47	2.16
*Procurement and Inspection	0.17	0.23	0.40	0.18	0.20	0.38
Preliminary Survey and Studies	-	0.01	0.01	-	0.01	0.01
FCI Overhead	0.26	-	0.26	0.55	-	0.55
Total Direct Costs	5.96	8.08	14.04	0.73	0.21	0.94
Contingency						
Equipment and Materials	0.11	0.29	0.40	-	-	-
Erection and Commissioning	0.11	0.04	0.15	-	-	-
Civil Works	0.08	-	0.08	-	-	-
Design and Engineering	0.05	0.08	0.13	-	-	-
Administration and Overhead	0.04	-	0.04	-	-	-
Sub-Total	0.39	0.41	0.80	-	-	-
Working Capital Including Spares	0.21	0.21	0.42	0.43	0.69	1.12
Total Fixed Capital	6.56	8.70	15.26	10.70	11.36	22.06
Interest During Construction	0.74	-	0.74	0.94	-	0.94
Total Capital Costs	7.30	8.70	16.00	11.64	11.36	23.00

*Items included in IDA financing.

1/ Translated into US $ at an average exchange rate of Rs. 8.0= US $1

WORLD BANK / INTERNATIONAL FINANCE CORPORATION

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OFFICE MEMORANDUM

Return to J.F. Rischard D-512

TO: Mr. Chauncey F. Dewey

DATE: June 4, 1976

JF Chron File

FROM: A. Tarnawiecki, D. Brown, J. F. Rischard

SUBJECT: ROMANIA: Chemical Industries
Project Identification Mission
Back-to-Office Report

Introduction

1. According to your terms of reference dated April 5, 1976 we arrived in Romania on April 25, 1976 for the purpose of identifying projects in the chemical industries sub-sector suitable for consideration by the Bank. While in Romania we held conversations with Government officials, members of the Investment Bank of Romania and executives and technicians of various industrial enterprises (Annex 1).

Background on the Chemical Industry Sector in Romania

2. The Nationalization Act of 1948 opened the way for making the Romanian chemical industry one of the centerpieces of the new Government's policy of emphasizing heavy industry. The unusual growth record of the sector over the period 1950-1970 appears from the following summary data:

Table 1

Main Indices for the Romanian Chemical Industry

	1950	1960	1970
Index of gross industrial output			
World	100	163	304
Romania	100	340	1,100
Index of gross chemical industry output			
World	100	225	531
Romania	100	658	5,400
Share of chemical industry in total gross industrial output			
World	7.0	9.6	12.0
Romania	3.1	6.1	10.1

	1950	1960	1970
Average number of wage-earners in Romania's chemical industry	21,200	53,100	134,800
Index of productivity per worker (Romania)			
Total Industry	100	237	488
Chemical Industry	100	276	886
Share of total industrial investment alloted to the chemical industry in Romania, in %	3.3	12.8	11.3
Proportion of exported chemicals in total Romanian exports, in %	1.7	2.2	8.0

The chemical industry has been the fastest growing industry in Romania (22.1% a year on average between 1950 and 1970) and occupies today the second place after the machinery manufacturing sub-sector which has grown at 17.8% annually over the same period. Other important characteristics of the Romanian chemical industry are the rapid - more than threefold - increase in per capita productivity in the last decade and a significant concentration in larger production units: 12 plants with turnover over $50 million in 1970 against only one in 1960.

3. The development of the sector has been based on the relatively large endowment of the country in oil and mainly methane gas, one of the purest in the world. Romania has had a long-standing (pre-oil crisis) policy of making the most rational use of these limited resources.1/ Accordingly, the fastest growing segments of the chemical industry have been the fertilizer, plastic and synthetic resin, synthetic fiber and yarn and synthetic rubber industries. For the same historical reason, in terms of geographical location, there is a tendency for the industry to be concentrated in the center and the south of the country, around the main refineries. The main centers of production are in Ploiesti and in the Pitesti areas where large refinery and petro-chemical complexes have been established producing a large range of refinery products, coke and carbon-black, aromatics (including paraxylene), dimethl terephtalate (DMT), ethylene glycol (EG), ethylene and propylene, polyethylene, etc.

1/ The first plant in the world producing hydrogen out of methane gas for ammonia production was opened in Tirnaveni in 1936.

4. Synthetic fibers are produced mainly in Savinesti (polyamidic and acrylonitrilic fibers and yarns) and in Iasi (polyester fiber and yarns). The two tire plants are located in Ploiesti and Bucharest. The chief locations for the fertilizer plants are in Craiova, Tirgu-Mures and Turnu-Magurele, Slobozia, Navodari and Valea-Calugareasca. Other chemical and petro-chemical centers include Craiova, Rimnicu-Vilcea, and Gheorghiu-Dej. The Romanians now attempt to distribute investments in the chemical industry away from the traditional centers, partly because of a desire to spread better paying employment opportunities and partly because of congestion, lack of water, scarcity of living quarters, and environmental factors.

5. In contrast to the average 22.1% annual growth which characterized the chemical subsector in the 1950-1970 period, a lower target of 17.5% was set for the 1970-75 period in the plan for this period, whilst 20% of total industrial investment was allocated to the chemical industry. The actual achievement fell somewhat short of target as the industry grew only by an average 16% between 1970 and 1974.[1] This was due partly to a severe explosion in 1974 that destroyed a substantial part of Romania's ethylene/propylene capacity and to delays in commissioning new units, and especially fertilizer plants. By 1975, the gross chemical industry output was expected to represent 13% of industrial gross output as opposed to 10.1% in 1970 (see Table 1).

6. The general trends for the production, import and export volumes of some of the main product groups of industry with an emphasis on those most relevant to the projects submitted to the Bank for consideration are shown in Annex 2. Some competing products and several end-use products have also been included.

Sector Prospects

7. Plans for the future, as implied by the directives of the 11th Congress, continue to attribute the highest priority to the chemical industry sector. Within the chemical industry, priority will be given to petro-chemicals which are forecast to account for 75% of the output of the chemical industry by 1980. The distribution of emphasis among some of the main segments of the sector appearsfrom the following table.

1/ Prdiminary figures subject to correction.

Table 2

1980 Growth Targets for the Chemical Industry Sector

(000 tons)

	1980 Targets	Target as % of 1975 production
Chemical fertilizers	3,300-3,500	168-178
Synthetic polymer products	1,100-1,100	212-233
Synthetic rubber	280-300	249-267
Artificial and synthetic yarns and fibers	310-330	181-193
Tires (000 pieces)	7,500-8,200	179-196

8. In 1963, prices had been set in Romania roughly corresponding to those prevailing internationally. Most of them remained unchanged until 1974-75 when a major re-setting exercise took place in compliance with a law enacted in 1971 whose aim was to bring prices which had become distorted in the interval back into line with international prices. Although the price of many products of the chemical industry remained unchanged, most prices indicated in the preliminary information sheets on the proposed projects are not too far off with those now prevailing in international trade. However, in some instances complaints have been registered about Romanian export prices and it is alleged that a small volume of synthetic fibers was dumped last year in the U.K. Under depressed market conditions small volumes entering trade may have distressing consequences. When a more balanced supply/demand situation develops, this type of problem should be expected to become rare.

Description of the Proposed Projects

9. Ten projects have been submitted for our consideration comprising two large petrochemical complexes, one fertilizer plant, four plants in the synthetic fiber sub-sector, one glass fiber plant and two tire factories.

a. Polyester Fibres Plant Cimpulung - Muscel
b. Polyester Fibres Unit "Vaslui"
c. Synthetic Fibres Plant Iasi
d. Polyamidic Fibres Installation - Roman
e. Fibre Glass Project
f. Tires Enterprise - Turnu Severin
g. Tires Enterprise - Zalau
h. Craiova Chemical Plant
i. Petrochemical Plant - Midia
j. Complex Fertilizer Plant - Satu Mare

The Cimpulung Project

10. It comprises four units for the continuous polycondensation of polyester (PES) with a total capacity of 46,700 TPY and spinning and drawing equipment for the manufacture of 15,200 TPY of PES chips, 11,500 TPY of staple and 20,000 TPY of tops and tow, of which about 6,000 TPY are expected to be exported by 1980. A site has been selected at Cimpulung, a town of 30,000 located about 50 km north of Pitesti, one of the Romanian refinery-petrochemical complexes. Feedstocks for the proposed plant will be ethylene glycol (EG) already being produced there and dimethyl terephtalate (DMT) from a plant under construction at this complex. The Cimpulung site will allow transportation of melted DMT avoiding the additional cost of remelting it (although auxiliary facilities will be installed to permit utilization of solid DMT as well). The plant will have units for the recovery of DMT, EG and methanol from waste products, and the latter (about 18,000 TPY at full production) will be shipped back to Pitesti. The proposed plant would be located in the most industrialized judet (district) in the country but this reflects the fact that Pitesti, the site of a large refinery and petrochemical complex, is located there and a number of people work in that city and commute daily to Cimpulung. Employment in the vehicle making plants near Cimpulung as well as in Pitesti is predominantly male and therefore the Cimpulung project may be able to tap a pool of female labor which is not being utilized at present. Nearby villages situated in the relatively poorly endowed agricultural area surrounding Cimpulung will also provide sufficient amounts of labor force.

11. The Vaslui Project. The PES chips produced in Cimpulung would be shipped approximately 360 km to this proposed plant, the main products of which will be flat yarns for knitted goods (9,000 TPY), curtains (1,000 TPY) and belt conveyors, transmission belts and other industrial uses (2,000 TPY). Approximately 36% of this project's output would be exported by 1980. Some of the waste products from this plant could be used to make hessian cloth yarn (800 TPY) and some could be shipped back to Cimpulung. Vaslui is a small town of about 25,000, in the judet of the same name, where very little industrial development has taken place, although it is only some 140 km away from the Savinesti synthetic (polyamidic and acrylonitrilic) fibre complex.

12. The Iasi Project. This is an expansion project of existing facilities in the city of Iasi (population 200,000) in the judet of the same name. The plant has at present capacity to manufacture 42,700 TPY of PES staple and 9,000 TPY of PES filament based on DMT and EG from the Ploesti complex, at a distance of approximately 380 km. The proposed project would add 6,000 TPY of filament and 1,000 TPY of spun yarn capacity. The Iasi plant is located in a highly industrialized site and although space for the expansion project is still available, it is unlikely that further additional facilities can be accommodated in this area, and many of the existing facilities are already somewhat cramped. Finding new staff for a new project may be difficult in this industrial town but the unit is expected to employ redundant workers displaced from the existing plants.

13. The Roman Project. This is the only polyamidic fibre project presented for consideration by the Bank. The fibre complex at Savinesti already has installed capacity of 18,000 TPY (2,000 TPY staple, 5,000 TPY filament yarn, 5,000 TPY tire cord, 3,000 TPY textured yarn and 3,000 TPY of industrial yarn). The proposed plant would double this capacity with facilities for 4,000 TPY staple, 4,000 TPY filament yarn, 3,000 TPY industrial yarn and 7,000 TPY tire cord yarn. Approximately 10% of the plant's production would be exported. Roman is a town of about 45,000 inhabitants located about 60 km east of Savinesti in the Neamt judet. The main raw material for the project would be caprolactam produced at Savinesti which would be transported by truck in the melted form.

14. The Fibre Glass Project. To be located in Bucharest, this project is envisaged to produce 6,000 TPY of glass fibre of which approximately 4,360 TPY would be consumed in the country as yarn and roving, 1,140 TPY would be further processed in the same plant for woven glass products and some 500 TPY would be available for exports. End uses of the products are mainly for reinforcing plastics in the manufacture of piping and construction materials (tiles and panels) and for the insulation of electric cables. Clay, having the required properties, will have to be imported, but the main raw materials (fairly pure quartz sand and limestone) and other inputs are available from local sources.

15. The Zalau Project. It is being planned for an annual capacity of two million radial tires for trucks and busses. To be located in a small town (population about 20,000) in the judet of Salaj in the Northwest, it would require imports of 17,200 TPY of natural rubber and various chemicals but no significant importation of foreign know-how. It is expected that 60% of the output will be exported but no detailed breakdown of these exports was available.

16. The Turnu-Severin Project. This is also a tire project but the proposed output would comprise two million radial tires for passenger cars (including small busses) and 20,000 giant tires for earth moving and other heavy duty equipment. Approximately 50% of the passenger car tires and 30% of the giant tires are earmarked for export by 1980. Turnu-Severin is a town (population about 60,000) located in the Mehendinti judet in the SW. Approximately 25% of the raw materials required (mainly 4700 TPY of natural rubber and some chemicals) would be imported. The other materials needed (styrene butadiene synthetic rubber, carbon black, rayon and nylon cord, bead wire, plasticizers, etc.) are manufactured locally. The project would require a substantial amount of imported know-how.

17. The Craiova Petrochemical Project. Several chemical industries are already installed at this location in the judet of Dolj. This complex would be based on the partial oxidation of natural gas (98.5% or more of low-sulfur methane) for the simultaneous production of acetylene and off-gas. About one third of the carbon would be directed to the 30,000 TPY acetylene stream from which acetic acid, acetaldehyde, ethyl acetate, polyvinyl acetate (PVA), vinyl acetate, polivinyl alcohol and butyl acetate would be made. This process for making acetylene has been used in the past in several countries and is now being used in Romania, the proposed project consisting of an expansion and diversification of existing facilities. At present the off-gas is used as fuel. The project intends to utilize this off-gas for the synthesis of methanol in a 200,000 TPY plant, of which 44,000 TPY would be used in the same plant, and the balance of 156,000 TPY would be exported.

18. The Midia Project. This complex would be associated to a 5 million barrel/year refinery based on imported crude to be installed on the Black Sea coast. It would produce : 200,000 TPY ethylene, 60,000 TPY high density polyethylene, 60,000 TPY low density polyethylene, 60,000 TPY polypropylene, 80,000 TPY styrene, 30,000 TPY propene oxide, 35,000 TPY ethylene oxide, 15,000 TPY propylene glycol, 50,000 TPY polystyrene, 20,000 TPY PES and 50,000 TPY DMT. The information received[1/] does not specify the proportion of the products, if any, that would be exported.

1/ In Romanian

19. The Satu Mare Fertilizer Project. It would consist of a standard 300,000 TPY ammonia plant coupled to a 420,000 TPY urea plant to be located on the Somes River in the judet of the same name. Present domestic demand projections indicate there is no need to start this project before 1980 unless it is built mainly for exports. Given the present outlook for world demand and capacity for nitrogen fertilizers this would not be recommendable.

Objectives and Constraints of Particular Importance for Project Selection in Romania

20. Foreign exchange availability. This has tended to be a major constraint to the achievement of the country's development targets, especially in recent years. After a surplus achieved in 1973, a deficit of $270 million occurred in 1974 as the non-convertible surplus fell short of covering the traditional deficit with the convertible currency countries. Special attention should therefore be directed towards measuring the impact of each project in terms of convertible foreign exchange generation.

21. Employment. There is strictly speaking no unemployment in Romania. Nevertheless, industry has been an important absorber of labor force freed by increased agricultural productivity. (The agricultural labor force decreased by no less than 2.5 million people between 1955 and 1975.) Furthermore, it is important to consider direct and indirect employment effects also within their local context. In the short term and in certain areas, industry's manpower needs could outpace the supply of work force generated in surrounding rural areas so that employment could turn out to be more of a constraint than an objective at a given site. Also, there have been occasional skilled manpower shortages in Romania. In some industries, the lack of experience of the work force has led in the past to problems of quality. With regard to the chemical sector, however, the Mission was favourably impressed by the training program undertaken by the Romanian chemical combines in close collaboration with the University. Within this program, an effective effort has been made to train a large number of more narrowly specialized "sub-engineers" through a shorter three year curriculum so as to gear up the educational resources while re-assigning full engineers to R & D, general plant supervision and project identification tasks.

22. Regional Development. Attention should also be devoted to the local level in terms of regional development. In recent years, Romania has successfully pursued an active policy of balanced regional deployment. Nevertheless, significant regional disparities persist between a small group of judets and the average. The 1974 Bank Economic Report on Romania recommends therefore that the Bank, in its choice of projects, also give some consideration to the regional factor, in harmony with Romania's own policy.

23. Transfers of Technology. Romania's ambitious industrial development plans, aiming at self-containment and at covering a large variety of activities, faces severe constraints in the small size of the domestic market and in other aspects which have been mentioned in previous paragraphs but, more importantly, in the rapid stretching of its know-how resources. As her industries become more sophisticated, investment alone is likely to yield diminishing returns unless coupled with access to the latest techniques and specialized expertise.1/ The implication of each project in terms of transfers of technology should therefore be taken into account in project selection.

Selection Criteria and Indicators

24. For purposes of project selection, it is useful to quantify, for ranking purposes mainly, the effects of each project on the objectives and constraints identified above as being especially relevant to the Romanian context. The indicators used under each heading mentioned above are listed below and the underlying assumptions are given in footnotes to Annex 3.

Table 3

Selection Criteria and Indicators

Objective/Constraint	Indicator
A. Economic Return and Sensitivity Analysis	1. Economic return 2. Factor by which est. economic prices for project output chemicals would have to be multiplied to yield a 10% return, assuming chemical input prices will remain at present level in real terms.
B. Financial Viability	1. Financial return. 2. Debt service coverage.
C. Foreign Exchange Effects	1. FE investment costs (million $) 2. FE costs as a % of total investment costs. 3. Annual FE savings as a % of FE investment costs.
D. Technology Transfer	1. Imported know-how as a % of total investment costs. 2. Imported know-how as a % of FE investment costs.

1/ See the note "Industrialization in Romania 1955-75" by Anthony Ody drafted by the Region. The need for imported technology in some fields does not contradict the fact that in many cases Romania exports its own technical know-how to other developing countries.

E. Employment Effects	1. Capital Costs per job created. 2. Project employment as a % of local (judet) occupied labor force. 3. % of local (judet) labor force occupied in industry.
F. Regional Development	1. Industrial assets per capita in judet, as a % of national per capita average. 2. Agricultural assets per capita in judet, as a % of national per capita average.
G. Bank Programming Considerations	1. FE requirements excluding indirect FE components. 2. Approximate date for placement of orders.

To a large extent, most of these indicators would be redundant or of little use if a full-fledged economic analysis was undertaken for each project, taking into account all relevant flows, shadow prices and uncertainties surrounding the variables. Because such an analysis can only be made at the appraisal stage, the indicators have been judged useful for selection purposes, despite the shortcomings of some of them.

25. The preliminary economic return calculation for each project which precedes these indicators is based on a rough-cut analysis. It uses economic prices derived from present world prices for most of the inputs and outputs pertaining to each project after adjusting them for the depressed level presently prevailing for many of them (See Annexes 4 and 5). Because of the uncertainty surrounding the correct magnitude of these adjustment factors, a rough sensitivity test was concurrently made to find the adjustment factor which would have to be applied, if necessary, to obtain at least a 10% economic return. No shadow-price adjustments were made for labor or foreign-exchange; the latter is valued at the rate used by the Bank, i.e. 20 lei per dollar.

26. The concept of financial viability has relatively little meaning at the enterprise level in Romania; the surplus/deficits of particular combines being (1) often determined by apparently inadequate pricing parameters which are nevertheless more or less intentionally kept at their level and (2) balanced at the Central's (Sectorial holding company) level. A rough financial analysis was nonetheless made since it seems difficult to formally justify a project in the absence of such an analysis within the Bank's current appraisal framework.

Analysis (Annex 3)

27. Among the synthetic fiber projects (Cimpulung, Vaslui, Iasi and Roman), only the first and the last have positive economic rates of return (on the basis of economic prices listed in Annex 4). Vaslui and Iasi on the contrary display disturbingly low economic and financial returns which might partly originate in unrealistically high capital cost estimates and make them in any case unviable candidates under the present conditions.

28. The Cimpulung and Roman projects would require about the same amount of foreign exchange financing; Roman looks better with respect to the criterion of employment creation but Cimpulung scores much better than Roman in in terms of economic returns, financial viability, and foreign exchange generation while having a higher imported know-how component (7.3% against 0.7% of total capital costs). Regional balance (based on judet figures) would give the advantage to Roman, but both projects are located in districts already well endowed with industrial capital, as appears from a comparison with the six other projects in the list. Cimpulung, however, is located in a less developed area of the Arges judet, where opportunities for higher paid industrial employment are fewer than in Pitesti, the judet's capital, where a refinery and a petrochemical complex are located.

29. Except for Cimpulung, the glass fiber project scores better than any of the synthetic fiber projects. A return of 10% or higher is within easy reach. This project also has the most significant relative imported know-how component (20% of the foreign exchange costs), is a strong foreign-exchange earner and has the lowest capital cost per job created. On the other hand, total foreign exchange requirements (US$30-35 million) are, as compared to the other projects in the chemical sub-sector, relatively low for Bank consideration.

30. Both tire projects emerge overall as the most interesting candidates in terms of economic return, employment and foreign exchange generation, although both have financial rates of return of less than 6%. Zalau has the highest preliminary economic rate of return (38%) but requires only an insignificant amount of imported know-how. Turnu-Severin has a somewhat lower proforma performance but its preliminary economic rate of return (19%) is satisfactory. It has a less dramatic effect on local employment and industrial wealth than Zalau but rates very high on technological transfers, imported technical know-how amounting to 12% (against Zalau's 0.6%) of total foreign exchange costs estimated at about US$105 million.

31. The Craiova petrochemical project has a less attractive economic return (5%) than the three preceding projects but could attain a return of 10% or more after plausible adjustments of the present economic prices of its chemical outputs. Its financial proforma performance is excellent but it scores low on account of foreign exchange and employment generation. (Not enough information has been obtained on the estimated value of imported technology.) In any case, its complexity renders further analysis mandatory, mainly as far as its methanol unit is concerned, given the present marketing difficulties experienced for this product and the possibility of using the residual gas for ammonia production within the planned expansion program of the Craiova fertilizer unit. A comparative analysis of the present configuration and the possible utilization of off-gas for ammonia synthesis as well as other configurations (such as the ethylene route for the same products) will be carried out in the following weeks.

32. Not enough information to make even a preliminary analysis of the Midia Petrochemical complex was made available to the mission. In view of the present nitrogen fertilizer market projections it is doubtful that the Satu Mare Fertilizer project can be considered for financing before 1980. Therefore further analyses of these two projects must be left for a later date.

Conclusions and Recommendations

33. In conclusion, the mission recommends that two projects be selected for further consideration by the Bank for FY 1977: The Turnu-Severin Tire Project and the Cimpulung Synthetic Fibre Project provided the further analyses of product prices and plant capital costs being carried out confirm the preliminary findings of the mission. Because of time constraints a decision should be made before the end of June. (The Fibre Glass project could be temporarily kept in reserve for the eventuality that the two previous projects were found to be inadequate; sufficient information exists on this project to make it possible for consideration in FY 1977).

34. For FY 1978 the following projects can be considered:

- Either Turnu Severin or Cimpulung (whichever was left over from the previous FY) provided implementation of the project by Romanian authorities has not already proceeded beyond the point where the Bank can have a useful role to play (both projects are supposed to start placing orders by April 1977).

- Craiova if further analysis proves that it, or the alternative configuration mentioned in para 31, is found to be economically viable and if project implementation has slipped from the present time table.

35. It is too early to attempt to define the selected project for FY 1979. Because of the time needed to study the petrochemical projects (if Craiova is not selected for FY 1978), these two projects are likely candidates for selection. If world market conditions for fertilizers were to improve dramatically, the Satu-Mare project could be considered by FY's 1979 or 1980.

ATarnawiecki:tqr

cc: Messrs. van der Tak (5)
Fuchs
Kalmanoff
Moore
Thadani
Cash
Soncini
Sheldrick
Pratt
Sandig
Noon
Kopp
Tsantis
Pepper

ANNEX 1

ROMANIA - CHEMICAL INDUSTRIES PROJECT IDENTIFICATION MISSION

INSTITUTIONS AND PERSONS VISITED

Ministry of Chemical Industries

- Mr. Gheorghe Manolescu, Deputy Minister
- Mr. Pompiliu Iobi, Director, Dept. of Investments
- Mr. Catita Pantilie, Dept. of Investments
- Mr. Emil Ghizari

Investment Bank of Romania

- Mr. Mihai Diamandopol, President
- Mr. Clement Gabrilescu, Director Foreign Relations Dept.
- Mrs. Viorica Beldeanu

Institute for General Design of Chemical Plants (IPUC)

- Ing. Ion Dumitru
- Mrs. Carmen Marinescu (Midia)
- Mr. Alexanderu Popescu (Midia)

Research and Design Institute for Refinery and Petrochemical Plants (ICPRP)

- Ing. Mihai Corobea (Craiova)
- Mr. Dumitru Seica (Midia)
- Mr. Valerius Macris (Midia)

Glass and Fine Ceramics (I.P.I.U.)

- Ing. Eugen Moraru, Counsellor, Chief of Project
- Mr. Constantin Cioscu, Economist
- Mrs. Elena Balan, Economist

UNDP

- Mr. A. Devarajah, Resident Representative in Bucharest

UNIDO/IBRD COOPERATIVE PROGRAM

- Mr. Erich Becker-Boost, Director, Vienna

ROMANIA - CHEMICAL INDUSTRIES PROJECT IDENTIFICATION MISSION
PRODUCTION AND TRADE VOLUMES OF MAIN INDUSTRIAL RAW MATERIALS AND PRODUCTS

		1950	1960	1965	1970	1971	1972	1973	1974
Methane gas (million m^3)	Production	2,057	6,707	13,038	19,971	21,365	22,287	23,639	24,217
	Imports	--	-	-	-	-	-	-	-
	Exports	--	204	200	200	200	200	195	205
Benzene (thousand tons)	P	.	6	45	125	109	132	126	115
	I	-	-	-	-	-	-	-	-
	E	-	-	-	-	-	-	-	-
Toluene (thousand tons)	P	.	2	32	118	125	124	135	122
	I	-	-	-	-	-	-	-	-
	E	-	-	20	47	73	55	31	21
Xylene (thousand tons)	P	-	.	29	129	137	144	142	124
	I	-	-	-	-	-	-	-	-
	E	-	-	-	-	-	-	-	-
Methanol (thousand tons)	P	--	--	--	--	--	--	--	--
	I	-	-	-	-	-	-	-	-
	E	--	--	13	37	41	24	9	0
Plastic & resins (thousand tons)	P	.	12	75	206	251	274	302	283
	I	-	-	-	-	-	-	-	-
	E 1/	--	.	17	44	77	94	77	40
Synthetic rubber (thousand tons)	P	-	-	31	61	71	73	82	92
	I	--	9	5	11	14	14	17	22
	E	--	-	11	25	29	32	33	32
Natural rubber (thousand tons)	P	-	-	-	-	-	-	-	-
	I	--	9	19	37	27	48	54	50
	E	-	-	-	-	-	-	-	-
Tires for cars, Tractors, aircraft (thousands)	P	74	337	1,222	2,457	2,647	2,946	3,249	3,517
	I	--	204	100	47	62	63	65	56
	E	--	.	362	512	501	476	579	520
Fibers artificial (thousand tons)	P	2	3	18	47	59	62	64	63
	I	-	-	-	-	-	-	-	-
	E	-	-	-	-	-	-	-	-
Fibers Synthetic (thousand tons)	P	-	1	3	30	36	38	52	96
	I	--	-	4	1	.	3	3	1
	E	--	-	.	5	14	15	16	20
Cellulose & semi-cellulose (thousand tons)	P	59	91	233	445	453	456	482	574
	I	-	-	-	-	-	-	-	-
	E	--	-	41	32	32	42	45	61

-- = not available
- = nil or negligible
. = less than half the smallest unit shown

1/ resins only

		1950	1960	1965	1970	1971	1972	1973	1974
Rayon Fiber (thousand tons)	Production	--	--	--	--	--	--	--	--
	Imports	--	20	18	20	10	22	18	22
	Exports	-	-	-	-	-	-	-	-
Jute Fiber (thousand tons)	P	-	-	-	-	-	-	-	-
	I	--	2	4	6	7	7	9	8
	E	-	-	-	-	-	-	-	-
Wool (thousand tons)	P	16	22	25	30	29	31	31	31
	I	--	2	1	2	3	3	4	4
	E	--	1	1	1	1	2	1	1
Cotton linter (thousand tons)	P	-	-	-	-	-	-	-	-
	I	--	51	67	83	91	97	108	104
	E	-	-	-	-	-	-	-	-
Woolen yarns (thousand tons)	P	13	19	25	36	38	41	46	49
	I	-	-	-	-	-	-	-	-
	E	-	-	-	-	-	-	-	-
Flax yarn (thousand tons)	P	6	13	19	27	27	28	30	30
	I	-	-	-	-	-	-	-	-
	E	-	-	-	-	-	-	-	-
Fabrics (million m^2	P	193	329	431	608	668	734	796	863
	I	--	--	--	--	--	--	--	--
	E	--	--	--	--	--	--	--	--
out of which: Cotton	P	148	248	319	437	482	531	571	612
	I	--	3	19	30	21	22	29	42
	E	--	25	34	84	68	81	98	60
Wool	P	23	32	41	63	70	74	83	94
	I	--	2	3	4	3	5	4	7
	E	--	-	-	-	-	-	-	-
Silk	P	13	25	32	48	54	65	74	78
	I	--	.	1	3	4	5	6	6
	E	--	-	-	-	-	-	-	-
Knittings (million pieces)	P	13	41	78	140	169	189	208	226
	I	-	-	-	-	-	-	-	-
	E 2/	--	--	--	--	--	--	--	--

2/ Knittings and confection textiles accounted for 1.8% respectively 3% of total export value in 1974. No volume data given.

			1950	1960	1965	1970	1971	1972	1973	1974
out of which:	Cotton	Production	5	27	53	95	116	127	141	145
		Imports	-	-	-	-	-	-	-	-
		Exports	--	--	--	--	--	--	--	--
	Wool	P	4	8	16	27	33	39	40	42
		I	-	-	-	-	-	-	-	-
		E	--	--	--	--	--	--	--	--
	Silk	P	4	6	9	18	20	23	27	39
		I	-	-	-	-	-	-	-	-
		E	--	--	--	--	--	--	--	--
	Stockings, socks (million pairs)	P	33	69	96	131	138	149	155	161
		I	-	-	-	-	-	-	-	-
		E	--	--	--	--	--	--	--	--

Source: Annual Statistics 1975

ROMANIA - CHEMICAL SECTOR IDENTIFICATION MISSION

SELECTION CRITERIA AND PROFORMA PERFORMANCE BY PROJECT

LOCATION	Cimpulung-Muscel	Vaslui	Iasi	Roman	Bucharest	Turnu-severin	Zalau	Craiova
PRODUCTS	Polyester Fiber & Chips	Polyester Yarn	Polyester Fiber & Yarn	Nylon Fiber & Yarn	Glass Fiber	Tires	Tires	Acetylene & Methanol Complex
- Beginning year	1976	1977	1976	1977	1976	1977	1976	1976
- Commissioning year	1979	1979	1977	1980	1978	1979	1979	1980
A. ECONOMIC RETURN & SENSITIVITY ANALYSIS								
1. Economic return in % 1/	12.0%	-6.5%	-100.0%	3.5%	9.2%	19.2%	38.2%	5.0%
2. Factor by which economic prices for chemical outputs would have to be multiplied to yield a 10% return assuming unchanged economic prices for chemical inputs.	0.97x	1.45x	2.05x	1.15x	1.00x	0.80x	0.65x	1.15x
3. Factor by which economic prices for chemical outputs and inputs would have to be multiplied to yield a 10% return.	0.92x	1.85x	5.35x	1.35x	1.05x	0.70x	0.40x	1.25x
B. FINANCIAL VIABILITY 2/								
1. Financial return in %	5.8%	-3.7%	-1.1%	-0.6%	5.6%	3.7%	5.7%	8.1%
2. Debt service coverage ratio 3/	2.25x	0.75x	0.75x	1.10x	1.25x	1.85x	3.15x	4.85x
C. FOREIGN EXCHANGE EFFECTS								
1. FE investment costs (million US $) 4/	70	126	45	73	33	107	132	149
2. FE costs as a % of total investment costs	36.9%	45.6%	35.1%	30.9%	56.7%	50.4%	49.0%	50.0%
3. Annual FE savings 5/ as a % of FE investment outlays 6/	45.8%	18.7%	15.6%	38.6%	42.7%	42.0%	59.8%	26.5%
D. TECHNOLOGICAL TRANSFER								
1. Imported know-how as a % of total investment costs	7.3%	0.6%	1.0%	0.7%	12.1%	6.1%	0.3%	..
2. Imported know-how as a % of FE investment outlays	19.8%	1.4%	2.9%	2.2%	21.4%	12.2%	0.6%	..
E. EMPLOYMENT EFFECTS								
1. Capital costs per job created (thousand dollars)	91	51	49	54	34	64	70	171
2. Project employment as a % of local (judet) labor force. 7/	0.9%	5.6%	1.2%	2.6%	0.1%	3.6%	6.4%	0.7%
3. Proportion of local (judet) labor force already occupied in industry. 7/	47%	34%	43%	51%	45%	37%	39%	36%
F. REGIONAL DEVELOPMENT FACTOR								
1. Industrial assets per capita in judet, as a % of national average. 7/	189%	30%	74%	132%	124%	100%	30%	100%
2. Agricultural assets per capita in judet, as a % of national average. 7/	62%	96%	74%	56%	16%	81%	62%	169%
G. BANK PROGRAMMING CONSIDERATIONS								
1. FE requirements excluding indirect F.E. components (million US $) 8/	59	101	36	52	30	104	127	80
2. Approximate date for Placement of orders 9/	4/77	11/77	4/77	11/77	10/76	4/77	1/77	3/77

1/ Assumptions: Construction evenly spread over 3 year period (4 for Craiova); 10% a year capital cost escalation and 7% long-run inflation rate; 12 year level cash flow from operations; no terminal value except working capital recovery; economic prices derived from 1976 world prices after provision for a variable price adjustment in real terms for output and input prices. (See Annexes 4 and 5) Own consistent estimates for working capital, repair, depreciation, OH & labor costs.
2/ Same assumptions as under 1/ but with financial prices and all duties included; uniform reinvestment rate of 5% assumed for all project proceeds.
3/ Operating cash-flow over constant principal and interest payment corresponding to FE loan as per C(1), or $60 million, whichever is lower, payable over 12 years after 3 years of grace and at a 10% on-lending interest rate.
4/ Equipment and material procured from Bank member countries plus foreign exchange component of locally manufactured equipment, uniformly estimated as 35% of Bank member countries total procurement; imported know-how, from Bank member countries; plus interest during construction and 10% cost escalation.
5/ Rough estimate assuming all outputs and material inputs are exported/imported at the margin but without distinguishing FOB and CIF basis.
6/ As defined in footnote 4.
7/ 197- data (Source: Anuarul Statistic 1975).
8/ Same definition as in footnote 4 but excluding the foreign exchange component of locally manufactured equipment.

Industrial Projects Department
June 4, 1976

ROMANIA - CHEMICAL INDUSTRIES PROJECT IDENTIFICATION MISSION

ECONOMIC RETURNS (FIBER PROJECTS)

It is generally recognized that present prices for synthetic fiber are exceptionally depressed, particularly in the U.S., because the showdown in consumption brought about by the generalized 1975 recession was coupled to a significant build-up of capacity generated by the higher prices prevalent a few years ago. Overcapacity is expected to remain a problem for this industry through 1980 but once demand catches up with supplies, the upward pressure on synthetic fiber prices will be considerable as a result of the level of capital costs now prevailing and certainly even more so for additional capacity which may be required after 1980.

An increase in long-term prices in real terms of 10-15% above present Western Europe prices - which is not an unreasonable expectation - allows for an adequate rate of return for the Cimpulung projects. The economic prices adopted in this report are shown in the Table next page.

ROMANIA - CHEMICAL INDUSTRIES PROJECT IDENTIFICATION MISSION

FINANCIAL AND ECONOMIC PRICES & COST FOR FIBER PROJECTS[2/]

	1976 PRICES		
	Financial Lei/Kg.	Present Western Europe (Mar/May'76) US$/lb	Assumed Economic $/Kg.
1. Cotton-type PES chips	17.2	0.40	1.05
2. PES Staple	22.4/23.5	0.71[1/]	1.60
3. PES Tow	22.5	0.60/0.75	1.70
4. PES Tops, White	23.9	0.75/0.80	2.10
5. PES Tops, dyed	74.6	1.15	3.30
6. PES Flat, yarn, textured	75.9	1.35	4.00
7. PES Industrial yarn	47.3	0.75	2.20
8. PES Fire (filament yarn)	80.7	1.05	2.80
9. Nylon 6 Industrial yarn	44.3		2.90
10. Nylon 6 Staple fiber	29.2	1.00	2.40
11. Nylon 6 Filament yarn	65.0	1.55	3.60
12. Nylon 6 Tyre-cord	44.3		3.00
13. DMT	8.8	0.39	0.66
14. Ethylene glycol	8.0	0.27	0.55
15. Caprolactam	19.29	0.57	1.20
16. Methanol	0.85	0.04/0/06	0.13
17. Waste Chips	4.50		0.45
18. Hessian cloth type yarn	27.0		2.50
19. Textile glass fiber	35.6	0.67	1.60
20. Woven glass fabrics	108.0	0.75	1.90
21. Power	.31/.38 Lei/Kwh		1.5 Cts/Kwh
22. Methane gas Lei/Nm^3	0.20 (=$0.27/MSCF)		1.40 MSCF
23. Fuel Lei/Ton	248 (Lei/ton		65 $/t

1/ There is at present considerable spread between prices in the U.S. and Western Europe and between branded and unbranded staple.

2/ After examination, it appeared that the financial prices for the Glass Fiber Project could be used as economic prices, partly because of the large proportion of non-tradables.

Industrial Projects Department
June 4, 1976

ROMANIA - CHEMICAL INDUSTRIES PROJECT IDENTIFICATION MISSION

FINANCIAL AND ECONOMIC PRICES FOR TIRES AND RAW MATERIALS

FOR TIRE MANUFACTURE

U.S. Export Prices for Tires

1 - Radial tires: $33.60 for A78x13 tires (4 ply rating)	$ 3.70/Kg
Mark-up : 50%	$ 2.47/Kg
2 - Truck Tires: $187.75 for 1100 x 20-16 Rib Type (119 lbs)	$ 3.47/Kg
Truck Tires: $204.84 for same size Lug Type (138 lbs)	$ 3.27/Kg
Average for the two types	$ 3.37/Kg
Price for conventional A78x13 - 4PR car tire, $24.64	$ 3.06/Kg
Ratio truck to car tire	1.10
Mark-up : 40%	

3 - Giant Heavy Duty (Rock Service) Tires

1800 x 25-24	$ 1018.64	(587 lbs)	$ 3.81/Kg
29.5 x 29-28	2815.62	(1,266 ")	$ 4.09/Kg
29.5 x 35-34	3807.77	(1,455 ")	$ 5.76/Kg
Avge.			$ 4.82/Kg
Ratio Heavy Duty Giant to car tires			1.5

Economic Prices for Tires

4 - For the present report, the economic prices have been estimated to be as follows:

Radial car tires	$ 2.44/Kg
Truck tires	$ 2.68/Kg
Giant Heavy Duty Tires	$ 3.42/Kg

These prices are in line with present U.S. export prices as there are properly speaking no international prices for tires. No adjustment to present prices were deemed necessary in order to derive the economic prices.

Economic Prices for Raw Material Inputs

a) Natural Rubber

Present (May 1976) Price	$ 0.40/lb
Probable balanced supply/demand 1976 price	$ 0.44/lb = $ 0.97/Kg

3.30
3.70
3.20

b) Synthetic Rubber

Present price (approx. the probable 1976 balanced price)	$0.35/lb = $ 0.77/Kg

c) Carbon Black

High abrasion furnace	11.5 US cts/lb = $ 0.253/Kg
Fast extruding furnace	10.5 US cts/lb = $ 0.231/Kg

d) Nylon cord

Present price	$1.10 lb = $ 2.42/Kg
Balanced figure	$3.00/Kg

e) Rayon cord

Present price	$2.62/Kg (Rayon is not expected to increase prices in real terms

Industrial Projects Department
June 4, 1976

Messrs. Don Brown and J. F. Rischard April 7, 1976

Chauncey F. Dewey

ROMANIA - Loan No. 1020 RO - Bacau Fertilizer Project
Supervision Mission - Terms-of-Reference

1. You should arrive in Romania on April 26 for supervision of the Bacau Fertilizer Project. You should stay in Romania for about one week after which you should proceed to India (see separate terms of reference). During the stay in Romania, you will assist Mr. Tarnawiecki on the Industrial Projects Identification mission for which separate terms of reference have been issued. However, all time required for this Supervision Mission must be made available.

2. You should obtain detailed information on the following points:

a) Commitments and expenditures made (you should point out that monthly progress reports currently do not contain information on commitments made);

b) Sources of finance used to meet expenditures and planned to be used to meet commitments;

c) Equipment procured or to be procured from Bank member countries, non-member countries and Romania, indicating the changes that have been made to the original procurement lists;

d) Revised project cost estimates, showing estimates for items to be procured from Bank member countries, non-member countries and Romania;

e) Revised project schedule;

f) Revised disbursement schedule for the IBRD Loan.

3. You should discuss with the Bacau fertilizer unit the financial statements submitted with the Progress Reports so as to obtain additional clarification.

4. You should seek to obtain the information needed to update the financial statements and forecasts included in the Appraisal Report with regard to Craiova Central.

5. You should remind the Investment Bank of its obligation to submit (three months after the end of each fiscal year) audited financial statements.

6. You should discuss with the project sponsors the fertilizer distribution study which has been submitted.

7. Upon your return to Washington, D.C., you should prepare a Supervision Report in the prescribed manner.

Cleared with and cc: Mr. Noon

cc: Messrs. Fuchs
Kalmanoff
Moore
Cash
Soncini
Thadani
Becher
Sheldrick
Lee
Israel
Chittleburg
El Darwish
K. Jones
Kopp
Helne
Asser
McClure (IFC)

Mr. Chauncey F. Dewey March 12, 1976

Jean-Francois Rischard

Meeting on Romanian Project List (Summary Notes)

Attending Meeting: Messrs. Dewey Rischard
Noon Tarnawiecki

Background

1. The Romanian Government submitted a list of 16 projects out of which nine are in the chemical sector. Description of a tenth (fiberglass) project was attached as well as somewhat more detailed information sheets on the latter and on a polyester project included in the list.

2. The lending program for Romania contains three unidentified industrial projects in FY 1977, 78 and 79. Programs Department asked IP (III) to review the project list so as to identify a suitable candidate for FY 1977 and to establish an approximate order of priorities for the following years.

Discussion

3. IP is not in a position to select a project for FY 1977 consideration on the basis of the sketchy information submitted. The data on markets, costs, inputs for instance are inadequate, sometimes unrealistic or simply nonexistent. Further information on project status (TES advancement and status of decisions regarding procurement procedures) would be needed to assess the sheer possibility for Bank consideration and/or inclusion into the appropriate FYs.

4. The Bacau Supervision mission leaving for Romanian at the end of April will include in its work program the collection of information and preliminary discussions with the Romanians regarding the chemical sector projects. For that purpose, IP will specify to the Romanians the kind of information needed to select two projects for Bank consideration in FY 1977 and FY 1978.

5. The most important issues appear to be:

a. timing - (TES status, and existing commitments, if any, to specific procurement procedures.) Some projects would seem to start too early for Bank consideration (e.g. #4) or should be examined casually for inclusion in later years (e.g. #5).

b. sector implications - In the case of an additional fertilizer project--#5 on the list--and of the three polyester facilities included under #7, 8 and 10.

c. complexity of evaluation - Two projects, #4 and 6, invlove core and downstream facilities requiring a complex evaluation even if the Bank were to finance the core plant only.

d. economic rationale and priority - Better data on consumption and external trade are needed and the priority of such projects as fiberglass should be assessed in view of more detailed information or planned end uses.

e. technical assistance - Some projects like #4 and 6 require advanced technology on an all-or-nothing basis and the Romanians' willingness to receive substantial amounts of western technical assistance has to be probed.

f. economic sizes and competitive advantages - Will have to be assessed in view of the larger, similar facilities being established in countries like Saudi-Arabia and the considerable reductions in world prices for certain products such as polyester. Some capital costs estimates are unplausible.

g. technical and economic information - In view of the expediting required to finalize a project for FY 1977, translated copies of the available TES studies or at the very least of their summaries should be available during the mission or as soon as possible.

h. Bank position - Bank should make clear that (a) except for project #5 (fertilizers), it has not financed any such projects in the past and (b) that in the absence of adequate information as requested, no project is likely to be included in FY 1977.

JFR:mmm
cc: Messrs. Brown
Noon
Tarnawiecki