Republic of Indonesia

SURVEY REPORT

on

the P.N. Soda Expansion and Related Industry

April, 1971

Prepared for

Government of Japan

Overseas Technical Cooperation Agency

by

A. MISHIMA

M. USUI

Members of Survey Team for

Mining & Manufacturing Industry in Indonesia

Preface

Submitted herewith is a pre-feasibility report on Soda Waru Expansion Project for which the Government of Indonesia has requested the International Governmental Group on Indonesia to extend their technical and economic cooperation.

The survey was carried out by two experts; Messrs. A. Mishima and M. Usui during the period between March 3 and March 23, 1971.

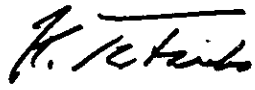
The experts were dispatched by the Overseas Technical Cooperation Agency which is an executing agency for the Government of Japan, and they reviewed the report on Soda Waru Expansion Project prepared by the Indonesian Authorities and collected necessary data.

After return to Japan, the team studied the marketability of chlorine and related biproducts as well as economy of the project on the basis of the data collected during the survey. The results of these studies are incorporated in this report.

I sincerely hope that this report will be of great help to expediting the implementation of the project thereby strengthening the rapport between the two nations.

In closing, I would like to take this opportunity to express my sincere gratitude to officials of the Government of Indonesia and other Organizations for their hospitality and kind assistance.

May, 1971



Keiichi Tatsuke
Director General
Overseas Technical Cooperation Agency

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SUMMARY

The conclusions reached by the team are summarized as follows:

Because of the rapid increase of consumption, a large amount of caustic soda and chlorine derivatives are now imported. From the point of view of marketability and profitability, the planning of a P.N. Soda expansion to 200% design capacity seems reasonable if the following conditions are satisfied.

1. In order to guarantee a stable development of a soda and chlorine industry as a basic industry in Indonesia, production should be centralized to one manufacturer thereby establishing a basic economic unit.

2. In order to improve techniques of operation and maintenance, a technical consulting system should be adopted for a reasonable period.

3. It is recommended that a polyvinyl chloride industry be established requiring a large amount of chlorine as a basic ingredient. This will ensure the stabilization of chlorine consumption. It is also recommended that the Indonesian Government make a detailed long range study with serious consideration to the planning and development of a chlorine industry in Indonesia.

4. It is hoped that Indonesian Government will provide not only some kind of political protection for the soda industry, but also political and economic assistance under a strong governmental policy, with an eye to long term development.

Marketability of Chlorine and its Derivatives

1. The pulp and paper industry and the mono sodium glutamate industry are the most important large scale consumers of chlorine derivatives. The consumption of paper in Indonesia is increasing gradually, about 72 x 10^3 tpa, but domestic supply is only 18% of total consumption.

It is expected that the production capacity will be increased by the implementation of the 5-year plan.

2. Concerning MSG industry, P.T. AJINOMOTO INDONESIA is planning to expand their capacity and to install a fermentation plant, so a rapid increase of hydrochloric acid consumption can be expected during the 1972 - 73 and 1974 - 75 periods.

Considering these circumstances, P.N. SODA intends to expand to 200% design capacity keeping pace with the increasing demand.

3. Table - 1. The total demand for chlorine derivatives per year is expected to increase rapidly.

4. Table - 2. *The total amounts of consumption which have been fixed by* P.N. SODA as ideal targets to which P.N. SODA is eager to promote sales.

5. Table - 3. *Considering the plant capacity and the actual demands by* consumers, P.N. SODA intends to expand their plant capacity step by step. These figures show the actual amounts which P.N. SODA will be able to supply.

Table - 1

Chlorine Demand in Indonesia

Unit metric ton

	1971	1972	1973	1974	1975
Hydrochloric acid (35%)	4,500	12,500	16,000	19,000	28,000
Liquid chlorine	3,500	5,300	8,000	10,000	11,500
Bleaching liquor (8%)	7,500	12,000	15,000	20,000	25,000

Table - 2

Demands of Fixed Consumers

Product	Site	Caustic Soda	Hydrochloric Acid	Liquid Chlorine	Bleaching Liquor
Soap	Surabaya	4,500			
Pulp and paper	Letjes	2,400			2,400
	Banjuwangi	1,000		600	
	Others		300	750	
Textile		250	150		2,400
M.S.G.	Modjekerto	600	4,500		
	Others		500		
Petrochemical	Gresik	1,000			
Chemical			1,500		
Refinery	Pertamina		1,000		
Power station	Djakarta			288	
	Surabaja		150	288	
	Makassar			144	
Electric cell	Djakarta		2,400		
Metal industry			750		
Feed industry					640
Cosmetics			240		
Pharmaceutical					600
Swimming pool					800
City water				450	6,000
Laundry					2,000
Self-consumption			200		
Others		1,000		300	
Total		10,750	11,690	2,880	14,240
(t/Y)					(m3/y)

Table - 3

Actual Chlorine Demand near Surabaja

Unit 100% C12.

Fiscal year	1970/71	1971/72	1972/73	1973/74	1974/75
Pulp & paper	570	800	1,300	1,500	1,600
M.S.O.	150	300	2,000	2,000	3,900
City water	385	385	385	385	385
Power station	55	60	70	80	90
Grisek	130	130	130	130	130
Soap	300	300	300	300	300
Refinery		500	500	1,000	1,000
Metal		120	120	120	120
Textile	150	150	150	150	150
Total	1,740	2,745	4,955	5,665	7,675

Profitability of Expansion Project

1. Construction Cost

After discussions with P.N. SODA, it has been concluded that the cost of expansion will be about 1,250,000 (one million two hundred fifty thousand) U.S. Dollars on the basis of rehabilitation implementation even though P.N. SODA has estimated the cost to be only about 750,000 U.S. Dollars. However, it should be realized that detailed plans, design and estimates are necessary before implementation of the project. (Table - 4)

2. Sales and Production Planning

Using 619 x 10^6 Rupiahs per year as an approximate manufacturing cost, total sales are expected to amount to about 985 x 10^6 Rupiahs. (Table - 5, 6)

3. Profitability

Including depreciation and interest on loan, total profit after taxes is expected to be around 458 x 10^6 Rupiahs. Payout Period is 5.1 years and the Break Even Point is about 50%. (Table - 7)

4. Analysis

4-1. Salt

Compared with world prices, the price of salt is very high in Indonesia.

4-2. Electric Power

4-3. Fixed Cost

Compared with the variable cost, the fixed cost is very high, and some rationalization of the factory is necessary.

4-4. Salaries, Health & Welfare Expenses

Total number of P.N. SODA workers is now about 375. After a 200% capacity expansion, it is expected that the plants will operate smoothly with the same number of workers.

4-5. Tax

P.N. SODA is now operating the plant at half capacity because the demand for chlorine derivatives is very small, even though the demand for caustic soda is not fully satisfied.

To increase the consumption of chlorine derivatives, sales tax should not be imposed on the hydrochloric acid. If some tax income is necessary, it should be imposed on soda consumption. Further, we consider that some governmental policies for development and protection of such industries will be necessary.

4-6. Transportation and Packing

Transportation and distribution of products and raw materials should be smoothly controlled. These problems seem to be the critical factors which prevent full capacity operation.

5. Protection and Assistance

5-1. Some consumers are now planning to construct electrolysis plants with small capacities to provide for themselves. From the point of view of a national industry, it is clear that a collective production with a large capacity is more economical than production by many small plants.

5-2. As the center of the soda industry, P.N. SODA should consider importing soda derivatives from abroad. And at the same time, to encourage soda industry, it might be necessary to impose an import tax on the importer and to establish some kind of grace system for the manufacturer.

5-3. For the improvement of techniques for operation and maintenance, it is recommended that a Technical Consulting System be adopted for an appropriate period.

Table - 4

Tentative Budget for Expansion Project

No.	Unit Program	Quantity	Total $
I.	WATER TREATMENT		
1.	Intake pump	2 sets	5,060.-
2.	Chemical dozing equipment	1 set	6,000.-
3.	Piping and other materials	-	15,000.-
4.	Feeding pump	4 sets	10,000.-
5.	Electrical equipment and instruments	-	5,000.-
6.	Sand filter equipment	1 set	10,000.-
			51,000.-
II.	POWER STATION		
1.	Electric transmission installation (P.L.N.)	1 lot	110,000.-

No.	Unit Program	Quantity	Total $
III.	BRINE PURIFICATION		
1.	Portable belt conveyer	4 sets	840. -
2.	Raw salt washer	2 "	5,768. -
3.	Purified brine level tank	1 set	1,020. -
4.	Dechlorinator	1 "	1,933. -
5.	Brine cooling tower	1 "	3,553. -
6.	Desulphurising mixer	1 "	770. -
7.	Chemical mixer	2 sets	4,150. -
8.	Brine distributor	1 set	140. -
9.	Hydrochloric acid mixer	1 "	70. -
10.	Portable compressor	1 "	458. -
11.	Pump to dechlorinator tower	2 sets	1,690. -
12.	Pump to brine cooling tower	2 "	1,690. -
13.	Pump to chemicals mixer	2 "	1,690. -
14.	Pump to brine filter	2 "	2,356. -
15.	Pump to purified brine level tank	2 "	1,690. -
16.	Back washing	2 "	3,340. -
17.	Recovered brine pump	2 "	1,478. -
18.	Slurry pit pump	2 "	844. -
19.	Portable brine recovering pump	1 set	633. -
20.	Brine pit pump	2 sets	844. -
21.	Brine cooling fan	1 set	633. -
22.	Dichlorination fan	1 set	670. -
23.	Instrument	1 set	20,000. -
24.	Piping material	1 set	17,500. -
25.	Electrical	1 set	17,500. -
26.	Structure steel	1 set	4,888. -
27.	Paint	1 set	1,933. -
			97,981. -

No.	Unit Program	Quantity	Total $
IV.	RECTIFORMER		
1.	Rectiformer	1 set	50,000.-
2.	Interphase reactor	1 "	1,000.-
3.	Rectifier control panel	1 "	3,000.-
4.	Automatic control current control panel	1 "	3,000.-
5.	Oil filter and dryer	1 "	1,250.-
6.	Electrical materials	1 "	11,000.-
7.	Structure steel	1 "	750.-
			70,000.-
V.	ELECTROLYSIS ROOM		
A.	Modification of Old Cell:		
1.	Cell body	13 block	15,600.-
2.	Graphite anodes	13 block	6,500.-
3.	Accessories	13 sets	9,100.-
4.	Oil switch	40 "	16,000.-
	A		47,200.-
B.	New Cells (45 KA)		
1.	New electrolysis	1 set	6,500.-
2.	Graphite	3 sets	1,500.-
3.	Accessories	2 "	1,200.-
4.	Decomposer	1 set	1,400.-
5.	Product facilities	-	18,000.-
6.	Oil switch	9 sets	3,150.-
7.	Busbar		30,500.-
	B		62,250.-
	Total A + B		109,470.-

No.	Unit Program	Quantity	Total $
VI.	HYDROCHLORIC ACID PLANT		
1.	Mist catcher	1 set	330. -
2.	HCl, specific gravity measuring bottle	1 "	150. -
3.	Cooling water distributor weir	1 "	320. -
4.	Combustion and absorption facility	1 "	20,000. -
5.	Waste gas elimination tower	1 "	400. -
6.	Waste gas mist catcher	1 "	300. -
7.	Cooling water head tank	1 "	300. -
8.	Pure water level tank	1 "	400. -
9.	Condensed acid receiver	1 "	800. -
10.	HCl. receiver	1 "	800. -
11.	Chlorine gas fan to combustion tower	1 "	750. -
12.	Waste gas fan	1 "	750. -
13.	Pump to HCl. storage tank	1 "	807. -
14.	Cooling water booster pump	1 "	520. -
15.	Piping material	1 "	4,500. -
16.	Instrument	1 "	5,000. -
17.	Electrical	1 "	3,500. -
18.	Structure steel	1 "	600. -
19.	Paint	1 "	334. -
20.	Storage		-
			40,561. -
VII.	INSTRUMENT AIR FACILITIES		
1.	Air compressor	1 set	3,115. -
2.	Dehydrator	1 "	3,460. -
3.	Piping materials	1 "	750. -
4.	Electrical materials	1 "	2,000. -
			9,325. -
VIII.	LIQUID CHLORINE AND BLEACHING LIQUOR		
1.	Refrigeration unit	1 set	25,000. -
2.	Cl_2 facilities	1 "	40,000. -
3.	Piping materials	1 "	5,000. -
4.	Electrical materials	1 lot	10,000. -
			80,000. -

No.	Unit Program	Quantity	Total $
IX.	SPARE PARTS		
1.	Water treatment	1 set	750. -
2.	Power station	1 "	6,000. -
3.	Rectifier	1 "	1,000. -
4.	Brine and cells	1 "	20,000. -
5.	HCl. plant	1 "	2,000. -
6.	Electrical equipment and instruments	1 lot	20,000. -
			49,750. -
		Sub-Total:	618,137. -
X.	FREIGHT AND INSURANCE		75,000. -
XI.	PRODUCT DISTRIBUTION FACILITIES		150,000. -
XII.	LICENSE FEE		90,000. -
XIII.	DESIGN AND ENGINEERING		35,000. -
XIV.	SUPERVISION COST FOR ERECTION, OPERATION AND MAINTENANCE		130,000. -
XV.	TRAINING FEE		50,000. -
XVI.	UNFORESEEN EXPENDITURES		101,863. -
		Grand Total	1,250,000. -

Table - 5

Sales Planning
after Expansion to 200% D.C.
(as of: MARCH 1971)

Kind of Product	Total of Product	Unit Sales Price per Ton	Total Sales Price
	Ton/Year	Rp.	Rp.
1. Caustic soda 100% NaOH	6,600	60,000. -	396,000,000. -
2. Liquid chlorine	2,640	150,000. -	396,000,000. -
3. Bleach liquor 8-9% $C1_2$	4,950	15,000. -	74,250,000. -
4. Hydrochloric acid 35%	7,920	15,000. -	118,900,000. -
			985,150,000. -

Table - 6

Production Planning
after 200% Designed Capacity
(as of: MARCH 1971)

Basis of calculation: 330 effective operating Days per Year.

I. THE TARGETED PRODUCTION AMOUNT

1. Caustic soda = 20 T/D
2. HCl. 35% = 24 T/D
3. Liquid Cl_2 = 8 T/D
4. Bleach liquor = 15 T/D

II. MANUFACTURING COST

A. VARIABLE COST:

A.1 LOCAL MATERIAL:

1. Salt	Rp.	57,400,000.-
2. Electric power	Rp.	137,000,000.-
3. NaOH-100%	Rp.	10,300,000.-
4. HCl. - 35%	Rp.	3,460,000.-
5. Lime	Rp.	5,940,000.-
6. Refrig. oil	Rp.	550,000.-
	Rp.	214,650,000.-

A.2 IMPORTED MATERIAL:

7. Mercury	Rp.	10,550,000.-
8. $BaCl_2$	Rp.	10,100,000.-
9. $Al_2(SO_4)_3$	Rp.	5,160,000.-
10. Graphite	Rp.	6,700,000.-
11. Soda Ash	Rp.	4,220,000.-
12. Freon - 22	Rp.	3,160,000.-
13. H_2SO_4(C)	Rp.	1,850,000.-
	Rp.	41,740,000.-

Total Variable Cost = Rp. 214,650,000.- + Rp. 41,740,000.- = Rp. 256,390,000.-

B. FIXED COST:

1. Salaries	Rp.	35,000,000.-
2. Health and welfare	Rp.	26,000,000.-
3. Maintenance	Rp.	22,640,000.-
4. Depreciation	Rp.	105,600,000.-
5. General	Rp.	12,000,000.-
6. Insurance	Rp.	27,760,000.-
7. Interest of loan	Rp.	134,000,000.-
Fixed Cost:	Rp.	363,000,000.-

C. TOTAL MANUFACTURING COST = Rp. 256,390,000.- + Rp. 363,000,000.-
= Rp. 619,390,000.-

BREAK EVEN CHART
AFTER EXPANSION OF 200% DESIGNED CAPACITY
(as of: MARCH, 1971)

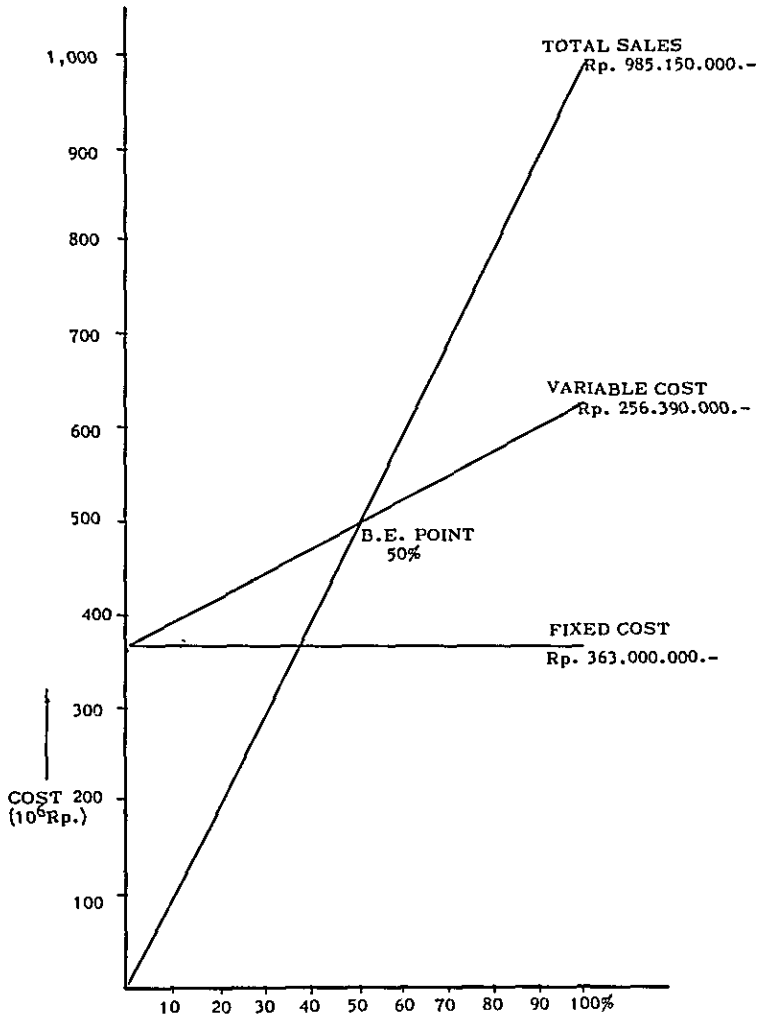

Table - 7

Profitability of Project
Estimated Income Statement
(as of: MARCH, 1971)

No.	Items	Rupiahs
1.	Net Sales	985,150,000.-
2.	Cost of Goods Sold	
	a. Variable cost	256,000,000.-
	b. Fixed cost	330,000,000.-
		586,390,000.-
3.	Gross Profit before Taxes	398,760,000.-
4.	Corporation Income Taxes	180,000,000.-
5.	Net Profit	218,760,000.-
6.	Pay Out Period =	

$$\frac{(\$1,214,000 \times 378 + 85,000,000.-) + (\$1,250,000 \times 378 + 100,000,000.-)}{218,760,000.-}$$

$$= \frac{1,117,000,000.-}{218,760,000.-} = 5.1 \text{ years}$$

7. Break Even Analysis

A. Total Income From Sales

1.	NaOH - 100%	Rp. 396,000,000.-
2.	HCl - 35%	118,900,000.-
3.	Liquid - Cl_2	396,000,000.-
4.	Bleach liquor	74,250,000.-
		Rp. 985,150,000.-

B. Break Even Point

1. Unit sales price = $\frac{985,150,000.-}{6,600}$ = Rp. 149,000.-

2. Unit V. cost = $\frac{256,390,000.-}{6,600}$ = Rp. 38,900.-

3. B.E.P. = $\frac{363,000.-}{149-38.9}$ = 3,300 tons

4. % B.E.P. = $\frac{3,300}{6,600}$ x 100% = 50%

BASIS OF INSTALLMENT OF CREDIT
(as of: MARCH, 1971)

No.	Item	Rupiahs
1.	Net Profit:	218,760,000.-
2.	Depreciation:	105,600,000.-
3.	Interest on loan:	134,000,000.-
		458,360,000.-

Implementation Schedule

To meet a large increase of demand in the fields of pulp, paper and MSG industries, expansion must be planned in the above fields during 1972 and 1974. (Page 6 Table 3).

However, even when the above expansions are completed the supply of chlorine derivatives will cover only 30 - 34% of the total demand in Indonesia. (Table 8)

Table - 8

Actual Supply of Chlorine Derivatives by P.N. Soda

Unit Cl_2 tpa.

	1971	1972	1973	1974	1975
Total Demand	5,600	9,400	14,500	17,900	22,800
P.N. SODA Supply	1,700	2,800	5,000	5,700	7,700
%	30	30	34	32	34

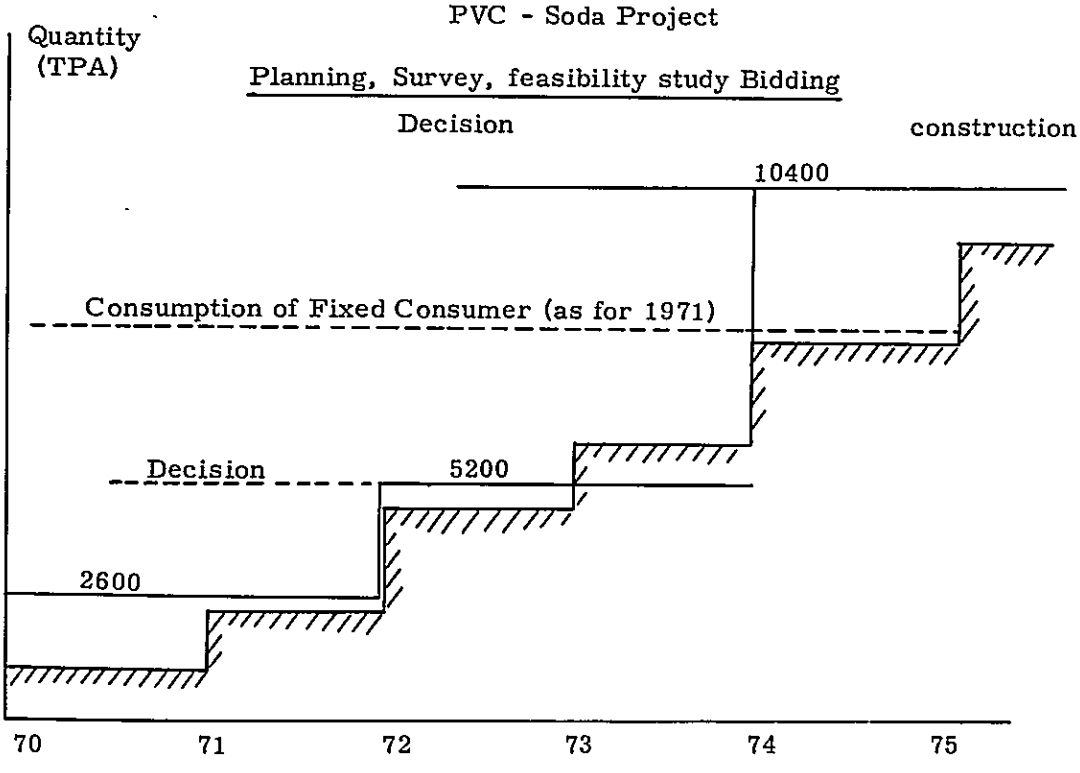

Fig. 1. Plant Capacity & Actual Demand near Surabaja

Long Term Planning

If the petrochemical industry in Indonesia develops rapidly, the demand for synthetic fibre and plastics will greatly increase. Indonesia is importing a large quantity of these materials, such as polyethylene, polyvinyl chloride, etc. To develop these petrochemical industries and to promote the national prosperity of Indonesia, the soda and chlorine industries are important factors to be considered. For example, according to Japanese statistics, 40% of the total consumption of produced chlorine is used for the chemical industry, 50% for the pulp and paper industry; 40% of the total consumption of produced hydrochloric acid is used for the chemical industry and 30% for the glutamate industry in Japan.

Based on the demand for soda and chlorine in Indonesia, which was calculated by P.N. SODA (Table 9), the team assumes that the amount of actual supply by new firms is about fifty per cent of the above estimated demand, and operation efficiency of such new firms covers eighty per cent. Considering the demand in 1975, we have calculated the plant capacities as follows:

Plant	Capacity T/Y
Caustic soda (100%)	60,000
Soda ash	40,000
Hydrochloric acid (35%)	17,000
Chlorine (liquid)	5,200
Bleaching liquor	15,500

Consumption figures of petrochemical products in Indonesia were not investigated in our survey. However, it is evident that a large amount of plastics and synthetic fibres are now imported from abroad. PVC resin and compounds are used for sandals, tablecloths, handbags, leather, carpets, electric conduits, water pipes as well as other industrial uses, and the demand for high density polyethylene is expected to increase for packing and wrapping materials.

Ethylene fraction is used for polyethylene, polyvinyl chloride, ethylene glycol, ethanol and other chemicals. However, as ethylene derivatives, the team has considered polyvinyl chloride and polyethylene, and estimated their consumption to be about 60,000 T/Y and 28,000 T/Y respectively.

Propylene is used as raw material for polypropylene, acrylonitrile, isopropyl alcohol, oxoalcohol as well as other chemicals. Polypropylene is used mainly for jars, bottles, bags and films, and woven bags are expected to be utilized for the packing of chemical fertilizers and other agricultural products.

Acrylonitrile is one of the most useful products from chemical grade propylene and ammonia, if surplus ammonia could be used at the chemical complex.

The team considered polypropylene or acrylonitrile monomer as propylene derivatives.

Concerning the capacity of the naphtha cracking furnace, the team considered a plant which will produce 60,000 T/Y ethylene and 30,000 T/Y propylene.

As for C_4 fraction, Butane-Butene is hydrogenated and mixed to LPG, and higher cracked gasoline must be hydrogenated and blended with gasoline for fuel. On the other hand, soda ash is used for the ceramics (especially glass) and chemical industries. However, when a synthetic process is planned in Indonesia, the economical evaluation of synthetic soda ash should be checked carefully, because Kenyan soda ash (natural) is exported to many neighboring countries at a reasonable price.

In Japan, the production of soda ash is about 1,200,000 T/Y and 45,000 T/Y of Kenyan soda ash is imported.

Soda Ash Exported from Kenya (1968)

Exported to	Quantity MT	Price US$
Singapore	9,989	29.50
Hong Kong	5,352	19.20
Malaysia	3,080	29.50
Pakistan	2,347	27.40
Japan	44,789	19.10
Thailand	12,091	28.90
Others	32,980	
Total	110,718	average 24.60

For long term plans, the combination of a petrochemical and a soda industry should be considered. As a basic industry in Indonesia, a balanced consumption of soda and chlorine should be developed to ensure a sound and prosperous operation.

(Refer to Fig. 2)

Note: In addition to these projects, aluminium, rayon and glass industries also have close relation with soda, and chlorine.

Table - 9

Demand of Soda in Indonesia

A. SODA ASH

Unit M Ton

	1971	1972	1973	1974	1975
Glass industry	10,000	15,000	20,000	22,000	25,000
Pulp and paper	2,000	3,000	5,000	5,000	6,000
Caustic soda	-	-	-	-	-
Sodium bicarbonate	-	-	-	-	-
Metallurgy	1,000	2,000	3,000	5,000	6,000
Textiles	800	1,500	2,000	2,500	3,000
Soap	2,000	3,000	4,500	5,500	6,000
Ceramics	-	-	-	-	-
Petroleum	600	800	1,000	1,500	1,800
Water softening	3,000	4,500	5,000	6,000	7,500
Photography	500	600	700	750	800
Agriculture	-	-	-	-	-
Sugar	-	-	-	-	-
Food industry	-	-	-	-	-
Chemicals	2,500	3,500	5,000	7,000	8,000
Total	22,400	33,900	46,200	55,250	64,100

B. CAUSTIC SODA

	1971	1972	1973	1974	1975
Soap industry	25,000	30,000	35,000	40,000	45,000
Petroleum	1,000	2,000	3,500	5,000	7,000
Textiles	2,000	4,000	5,500	7,000	9,000
Pulp and paper	5,000	6,500	7,500	8,500	10,000
Rayon	-	-	-	-	-
Dye, cleansers	1,500	2,000	3,000	4,000	5,000
Chemicals and others	4,000	5,000	7,000	8,500	10,000
Aluminium	2,000	3,000	6,000	7,500	9,000
Total	40,500	52,500	67,500	80,500	95,000

C. CHLORINE

	1971	1972	1973	1974	1975
HYDROCHLORIC ACID					
MSG-industry	2,000	8,000	9,000	10,000	16,000
Petroleum	1,500	2,500	4,000	5,000	7,000
Chemicals and others	1,000	2,000	3,000	4,000	5,000
	4,500	12,500	16,000	19,000	28,000
LIQUID CHLORINE					
Pulp and paper	2,000	3,000	5,000	6,000	6,500
Textiles	500	800	1,000	1,500	2,000
Disinfectants	1,000	1,500	3,000	3,500	3,000
	3,500	5,300	8,000	10,000	11,500
CHLORINE GAS					
PVC - plant	-	-	-	-	50,000
BLEACHING LIQUOR	7,500	12,000	15,000	20,000	25,000

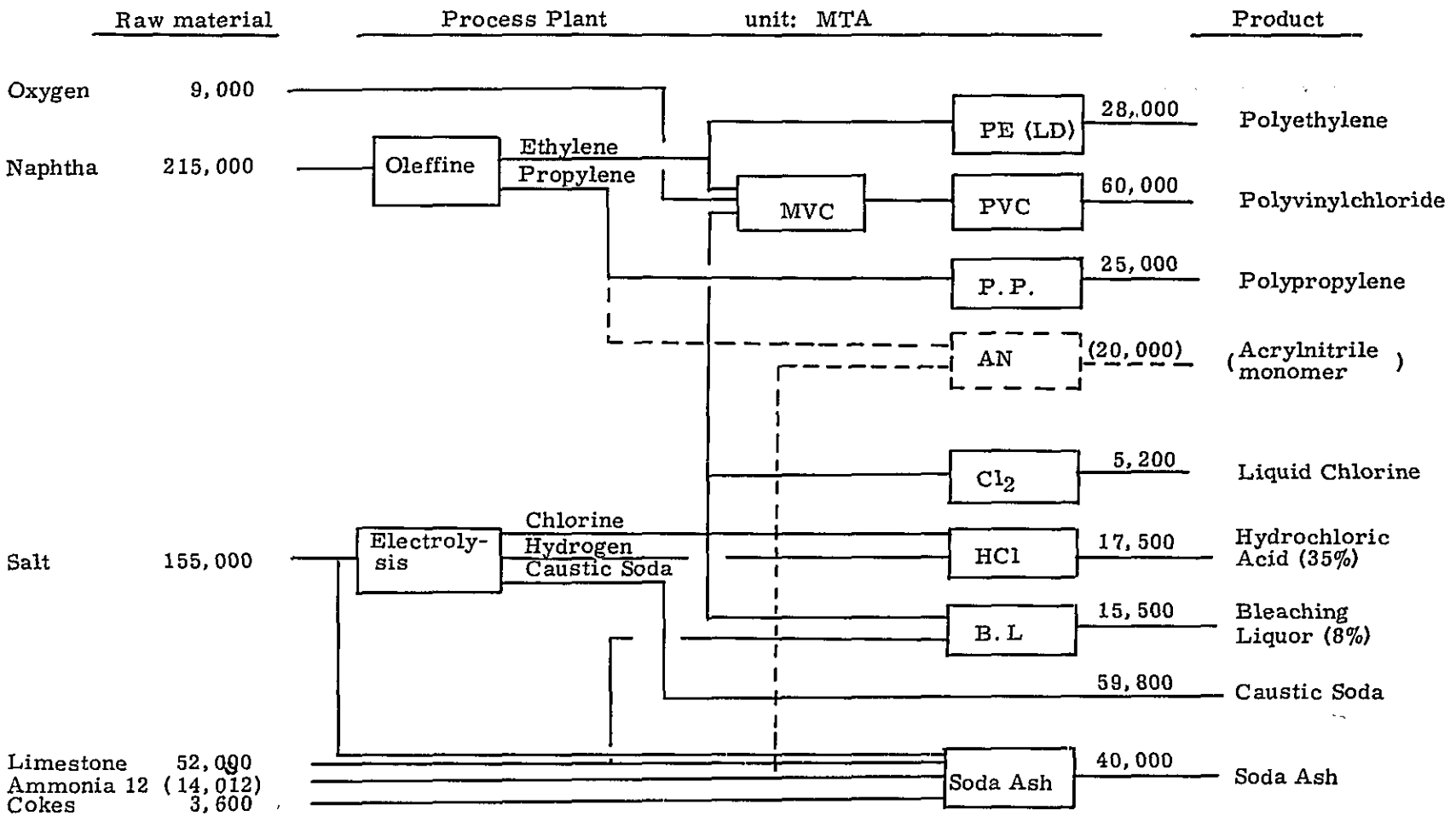

Fig. 2 Related Pattern of Soda and Petrochemical Industry

Recommendation

As was stated previously, from the point of view of long term planning, a soda industry and a petrochemical industry are closely related. At present, the overall development of a petrochemical industry is being studied and discussed as an important project in Indonesia. It is believed that this project will be realized in future. However, considering the overall situation of the chemical industries in Indonesia, it is recommended as a first step, to import ethylene from neighboring countries (including Japan) and the construct PVC plants using chlorine produced from salt electrolysis plants. As was shown in Fig. 3, the production capacity of 40,000 T/Y of caustic soda and 34,000 T/Y of PVC as major products of chlorine derivatives will fully satisfy the demand of the Indonesian market.

In conclusion, it is expected that the following implementation schedule will be followed:

First stage	Expansion (Waru)	3,300 MT NaOH/Year
Second stage	Expansion (Waru)	6,600 MT NaOH/Year
	PVC-Soda Centre (Gresik)	34,000 MT PVC/Year
		40,000 MT NaOH/Year
Third stage	Expansion as Complex (Gresik)	30,000 MT PE/Year
		60,000 MT PVC/Year
		60,000 MT NaOH/Year
		40,000 MT Soda Ash/Year

Considering the overall situation of chemical industry of Indonesia, the survey team has concluded that development of polyvinyl chloride plants seems most profitable in the present industrial scheme, so as to satisfy a large domestic demand for synthetic resin, and also to pursue the continuous and stabilized expansion of chlorine derivatives consumed in Indonesia. In this connection, it is advisable to establish a long range plan guided by strong governmental policies.

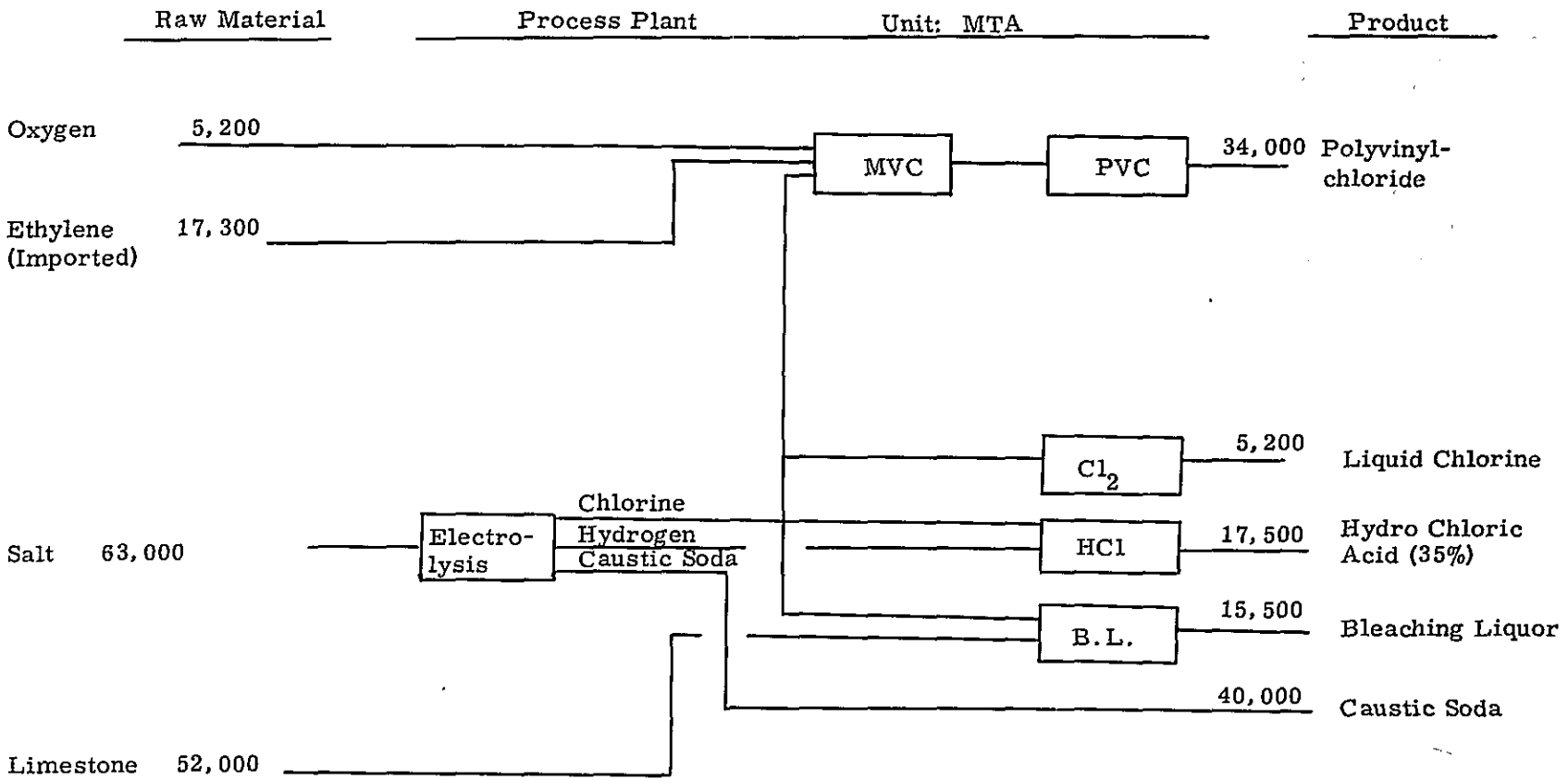

Fig. 3 Caustic Soda and PVC Production

Acknowledgement

It is our pleasure to submit this report on the marketability of chlorine and the profitability of P.N. SODA Expansion Project, as members of the study team for the industrial development of Indonesia.

During our study, many Indonesians have supported our work, and we very much appreciated their kindness and hospitality. We will be happy to receive any advice and guidance on this report.

APPENDIX 1. - ITINERARY

March 4, (Thu)	- Courtesy call at Japanese Embassy
March 5, (Fri)	- Courtesy call at Department of Industry
March 6, (Sat)	- Discussion with Department of Industry
March 8, (Mon)	- Discussion with P.N. Soda, Waru
March 9, (Tue)	- Discussion with P.N. Soda, Waru
March 10, (Wed)	- Visit P.T. Ajico, Modjokerto
March 11, (Thu)	- Visit Power Station and City Water Plant, Surabaja
March 12, (Fri)	- Visit Petrochemical Plant, Gresik
March 13, (Sat)	- Visit Unilever Indonesia, Surabaja
March 14, (Sun)	- Discussion with P.N. Soda
March 15, (Mon)	- Visit Banjuwangi Paper Plant
March 16, (Tue)	- Visit P.N. Kertas Letjes
March 17, (Wed)	- Classification and analysis of data
March 18, (Tue)	- Preparation for Brief Report
March 19, (Fri)	- Courtesy call at Japanese Embassy
March 20, (Sat)	- Courtesy call at Department of Industry
March 22, (Mon)	- Courtesy call at Bappenas

APPENDIX 2. - MARKET SURVEY

AJINOMOTO in Modjokerto

A fermentation plant is being planned by Ajinomoto, which will use Indonesian raw material (cane molasses), and it is expected to be completed by the middle of next year (June, 1972). After the completion of the plant, the consumption of hydrochloric acid will rapidly increase from 36 tpm to 480 tpm, and by the next expansion stage, the plant capacity is expected to increase up to 1,000 tpa M.S.G. production in the future. If P.N. Soda does not meet their demand, they will import hydrochloric acid from abroad or construct their own plant to satisfy their requirements, as has been done in Thailand.

POWER STATION in Surabaja

The power station is now importing 1 tpm of liquid chlorine from U.S.A. The net price of this chlorine is US$270/t, but including the bottle containers, it's actual price is US$870/t.

If P.N. Soda can guarantee safe handling by suitable treatment of the container packing and a reasonable price compared with imported chlorine, they will not hesitate to use domesitc products.

The expansion of the plant which has a capacity of 120 MW is expected during 1974-75.

CITY WATER PLANT in Surabaja

This plant is importing bleaching powder (containing 60% chlorine) from Japan and U.K. and using 6 tpm.

If P.N. Soda can steadily supply bleaching liquor, guarantee the quality of product, solve the problems of transportation and storage and price is reasonably, it can be assumed that they will willingly use bleaching liquor manufactured by P.N. Soda.

PETROCHEMIA in Gresik

This plant is still under construction and repair. To maintain these facilities, they are now importing chlorine and it's derivatives, while using caustic soda manufactured by P.N. Soda.

After this plant begins operation, it will use 113 tpa of bleaching powder, 20 tpa of liquid chlorine and 100 tpa of caustic soda.

UNILEVER INDONESIA in Surabaja

There are two factories in Indonesia, one in Djakarta and the other in Surabaja. Each plant uses 1000/1500 tpa and 700/1000 tpa of caustic soda respectively and 100/70 tpa of hydrochloric acid.

Solid caustic soda is imported from U.K. and hydrogen chloride is purchased from P.N. Soda. If P.N. Soda is able to supply caustic soda solution continuously, P.N. Soda would be preferable as a supplier, because a solution is better than solid for soap manufacturing. Some capacity expansion is planned in the future, and the consumption of raw materials will increase accordingly.

PULP AND PAPER PLANT in Banjuwangi and Letjes

Two paper factories were visited - Banjuwangi Paper Plant and Letjes Paper Plant. Design capacity of the Banjuwangi Plant is 30 tpa, producing writing and printing paper.

They started operation in October 1969, but because of mechanical troubles, only 5472 tpa were produced in 1970, and the target capacity for 1971 is 7200 tpa.

The Banjuwangi Plant was built by Japanese companies while the Letjes Kertas Plants were built by West German companies and are operating successfully with the same production capacity. Pulp and paper plants are big consumers of P.N. Soda products.

APPENDIX 3.

Members of Indonesia Organizations Who Have Participated in the Discussions

Djakarta

BAPPENAS	Kepala Biro	Ir. Sugen Sundjaswadi
Department of Industry	Director General	Ir. Agus Sujono
	Director	Ir. Mohawat Sarudji
	Chief	Ir. J.F. Wattimena
	Chief	Ir. R.D. Notosuwarso
		Ir. Amin Wansito
State Coal Mines	President Director	Ir. Surodjo Ranukusumo

Waru

P.N. Soda	President Director	Mr. Soenjasworo
	Director	Ir. Soeparnadi
	Director	Ir. Nawawi
	Manager	Dr. Soerjono
		Mr. Soedjono
		Mr. Soehardi
		Mr. Robbianto
		Mr. Soewadio
		Mr. Tjahiono
		Mr. Harsojo

Modjokerto

P.T. Ajinomoto	President Director	Mr. S. Ino
	Manager	Mr. Nishida

Surabaja

P.L.T.U.	Station Superintendent	Mr. Soeharto
Perusahaan Air	Production Manager	Ir. Mohamad Dahlan
Minum	Chief of Bureau	Mr. R. Soenardi
Unilever	General Works Manager	Ir. Jamany Hasan
Sinar Djaja Trade Co.	Director	Mr. Soegiarto Adiroesoemo

Gresik

Projek Petrolimia	Director	Ir. Endarto
	Manager	Ir. Anoegrah

Probolinggo

P.N. Kertas Letjes	President Director	Ir. Oetjok B. Notokoesoemo
	Conductor General	Ir. L. Rahadi
		Mr. Moh Jajib

Banjuwangi

Pabrik Kertas	President Director	Ir. Abubakar Suetikno
"BASUKI RACHMAT"	Director	Ir. Sjamsudin
	Manager	Mr. Santosa