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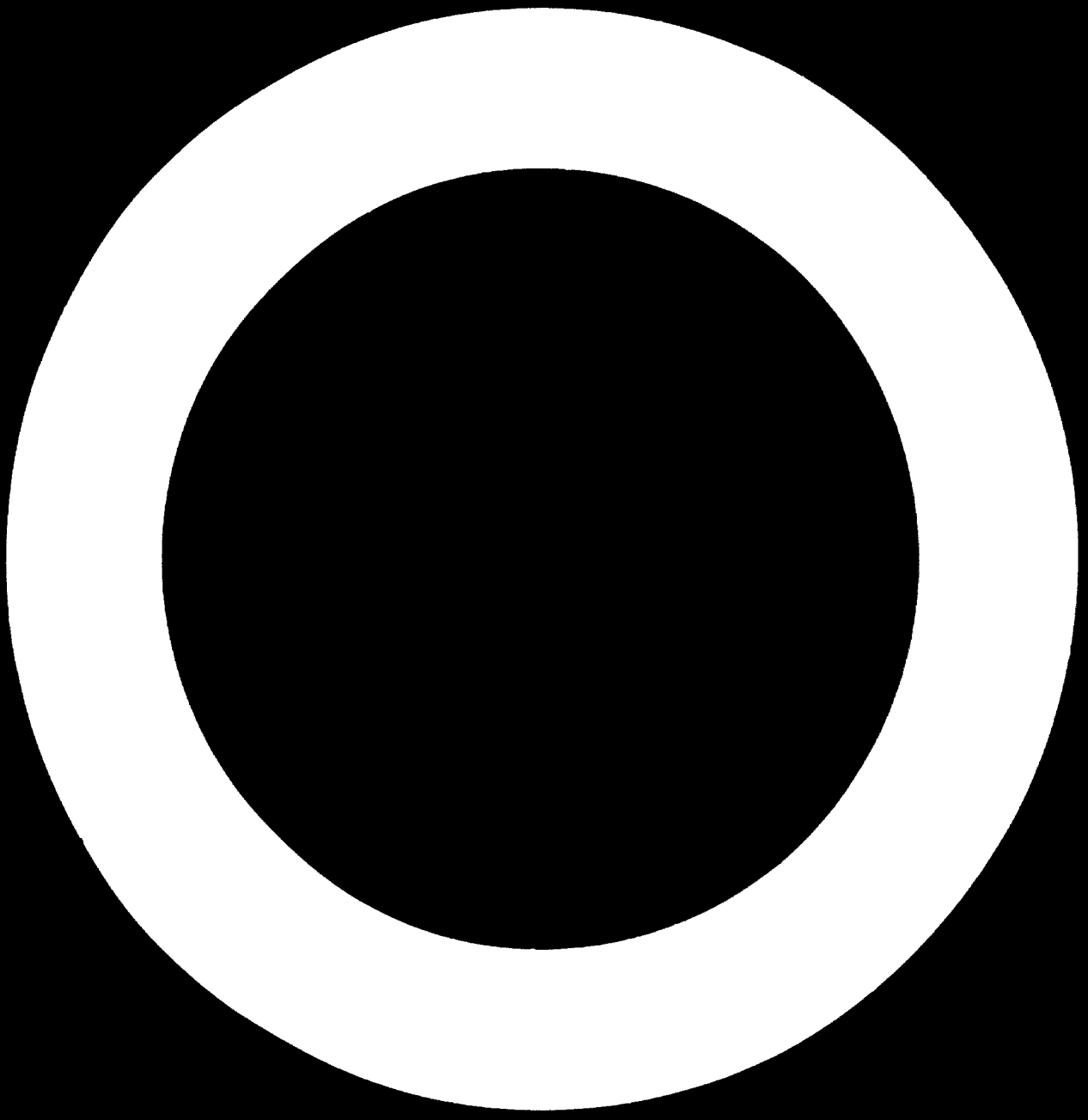

Table 1

According to the "Iranian Industrial Statistics 1968" published by the Bureau of statistics of the Ministry of Economy, the Summary Statistics on Industrial Establishments of Chemical Industries in Iran in 1347 (1968/69) were as follows:

		Central Province	Isfahan and Yazd Province	Iran
Number of establishments		180	28	360
Total persons engaged		8964	247	11717
- from these: owners, employers and family members		411	40	638
salary & wage earners - operatives		6802	205	9070
- others		1751	2	2009
New investment (before depreciation)	1000 Rls.	778064	67089	855125
Value of gross output	"	7053981	67944	8283147
Gross value added	"	2971947	11408	3407794

Table 2

Summary Statistics on Industrial Establishments - Manufacture of Petroleum and its Products, excluding NIOC Plants and Coal in Iran in 1347 (1968/69) were as follows:

		Central Province	Isfahan and Yazd Province	Iran
Number of establishments		9	-	9
Total persons engaged		790	-	790
- from these: owners, employers and family members		115	-	115
salary and wage earners - operatives		562	-	562
others		113	-	113
New investments (before depreciation)	1000 Rials	176054	-	176054
Value of gross output	"	960383	-	960383
Gross value added	"	527984	-	527984

Table 3

Time Series of the Value of Output, Value Added, Total Employees, Wages and Salaries by Chemical Industries and Oil and Coal Industries and Their Products (excluding NIOC petroleum products)

	1341 (1962/3)	1342 (1963/4)	1343 (1964/5)	1344 (1965/6)	1345 (1966/7)	1346 (1967/8)	1347 (1968/9)
Value of Output - 10^6 Rials							
Chemical Industries	3458	3806	5288	5557	6309	7922	9053
Oil and coal industries	-	747	880	1051	935	1911	2161
Total	3458	4553	6168	6608	7244	9833	11214
Value Added - 10^6 Rials							
Chemical Industries	1418	1050	1124	1944	2870	2988	3408
Oil and coal industries	-	123	145	173	154	323	528
Total	1418	1173	1269	2117	3024	3311	3936
Chemical Industries							
Total employees	6577	7911	8728	9474	8123	8766	11079
Total wages and salaries - 10^3 Rials	256547	360129	456719	395819	473274	541864	779628

Table 4

Time Series of Sales of Chemical Products, Produced in Iran - According to the "Iranian Industrial Statistics 1968" published by the Bureau of Statistics of the Ministry of Economy.

	1341 (1962/3)	1342 (1963/4)	1343 (1964/5)	1344 (1965/6)	1345 (1966/7)	1346 (1967/8)	1347 (1966/9)
Sodium Sulphate tons	1180	2531	2550	1600	1220	649	500
Chlorides "	574	1279	2141	705	266	304	649
Chloride Acid "	371	878	1751	3179	3117	6134	8237
Plastic articles "	6125	7350	8810	6900	8260	9229	15111
Foam-rubber and poly-ethylene sponge sheets tons	573	215	360	551	594	46	203
Amonium nitrate "	20	2550	11294	10221	13940	18256	20749
Urea "	-	5320	19362	23958	39815	45846	59054
Industrial oil, linseed, varnish etc. tons	1703	2126	5181	4405	2383	3250	2257
Paints "	2792	2950	3245	6688	7920	9680	11639

[illegible]	4711	3274	59822	39416	42336	44477	39451
[illegible] articles 1000 lr	52613	19552	83397	99754	133078	446958	640347
Pharmaceuticals "	336013	296951	527353	424986	953853	1071202	1273431
Washing powders "	3100	3316	3844	7398	8982	13446	15033
Matches, pull boxes	524	512	679	644	583	545	533
Brushes " "	1.6	63	34	45	46	47	50
Sulphuric acid tons	848	464	561	613	503	695	1056
Other 1000 Rials	334728	350093	488765	1215441	1573239	2409956	2 [illegible]
Total 1000 Rls.	3458076	3805594	5287601	5557410	6309248	7922242	9053162

Table 5

Time Series of Sales of Petroleum and Coal Products (excluding NIOC Products) According to the "Iranian Industrial Statistics 1968" published by the Bureau of Statistics of the Ministry of Economy

	1341 (1962/3)	1342 (1963/4)	1343 (1964/5)	1344 (1965/6)	1345 (1966/7)	1346 (1967/8)	1347 (1968/9)
Lubricating oil 1000 ltr	-	1146	20724	25712	19777	25616	27978
Grease tons	-	540	765	218	1842	2368	3028
Others 1000 Rls.	-	726380	543217	693519	600964	1298991	1556269
Total 1000 Rls.	-	747000	880000	1051000	935000	1961000	2161062

Table 6

Chemical, Rubber, Plastics, Petroleum and Coal Products Industries - Comparison of the Fourth and Fifth Five-Year Plans According to the Fifth Five-Year Plan.

		1346 (1967/8)	1354 (1972/3)	Growth Rate	1356 (1977/8)	Growth Rate
Number of persons engaged		**58500**	**88200**	**1,52**	139000	1,58
Cummulative investment	**10^6Rials**	**4300**	**46200**	**10,74**	156700	3,38
Production	**10^6Rials**	**15300**	**40000**	**2,62**	115000	2,88
Value added	**10^6Rials**	**5300**	**15000**	**2,82**	43100	1,97
Imports	**10^6 Rials**	**11900**	**21900**	**1.84**	46200	2,12
Exports	**10^6 Rials**	**1000**	**4600**	**4,6**	11000	2,39
Demand	**10^6 Rials**	**26200**	**57300**	**2,18**	150200	2,62

Table 7

Chemicals, Rubber, Plastics, Petroleum and Coal Products - Comparison of the Fourth and Fifth Five-Year Plan

	the Fourth Five-Year Plan	the Fifth Five-Year Plan
Total new employment	29700	50800
Total new investment - Mill. Rials	41900	110500
Value added " "	9700	28100
Annual growth rate of employment - %	8, 6 %	9, 5 %
Annual growth rate of investment - %	57, 0 %	21, 1 %
Annual growth rate of production - %	21, 2 %	23, 7 %
Annual growth rate of value added - %	23, 0 %	23, 6 %
Capital-labour ratio 1000 Rls/person labour	1410, 7	2175, 1
Value added -/ratio 1000 Rls/person	326, 5	552, 1
Capital to value added ratio	4, 32	3, 92

Source: the Fifth Five-Year Plan

CODE NO. 31 MANUFACTURE OF CHEMICALS AND CHEMICAL PRODUCTS

Code No. 311 Manufacture of basic industrial chemicals, including fertilizers

Code No. 312 Manufacture of vegetable and animal oils and fats

Code No. 313 Manufacture of paints, varnishes and laquers

Code No. 319 Manufacture of medical, pharmaceutical and cosmetics products.

Manufacture of vegetable and animal oils and fats - Code No. 312 is delt in Master Demand Study for Mechanical and Capital Goods Industry, Part 1, 2. Food, Beverage and Tobacco Industries under Code No. 2091 - Manufacture of oil products for cooking except butter.

CODE NO. 311 MANUFACTURE OF BASIC INDUSTRIAL CHEMICALS INCLUDING FERTILIZERS

Code No. 3111 Preparation of Chemical elements not included in basic metal industry, sulphur, phosphorus

Code No. 3112 Manufacture of acids and alkalis

Code No. 3113 Preparation of all salts except table salt

Code No. 3114 Manufacture of dyes for cloth

Code No. 3115 Manufacture of explosives and fireworks

Code No. 3116 Manufacture of all synthetic products, plastics and resins including synthetic fabrics, imitation rubber

Code No. 3117 Manufacture of chemical fertilizers

Code No. 3118 Manufacture of technical gases

Code No. 3119 All other own chemicals

KHARG CHEMICAL COMPANY LTD. (KHEMCO)

Khemco is a joint Iranian-American venture with equal partnership between the National Petrochemical Company in Iran (an agency of the NIOC) and the Amoco International Oil Company of the United States. The two companies signed an agreement in June 1967, setting up the Kharg Chemical Company. Initial capital investment in the facilities of the Kharg Chemical Company has been some $ 45 million.

The complex can utilize up to 145 million standard cu. feet of sour gas per day from crude production facilities at the Darius Field. This gas is derived from both the Iran Pan American Oil Company and the Iran Oil Exploration and Producing Company facilities on Kharg Island. The complex is self contained with its own water, power, specialized marine terminal.

Products & Processes

The following products are produced from sour gas:

- 600 tons per day of sulphur
- 6000 barrels per day of liquified petroleum gas
- 1000 barrels per day of natural gasoline.

Sulphur is pumped of the plant in liquid form to a special storage space where the sulphur solidifies into blocks. The blocks of sulphur are broken into lump form and loaded on ships via a 500 ton hour capacity conveyor system to the Kharg Chemical Co. export jetty.

Propane of the refined gases, about 3800 barrels of propane is produced per day. The propane is dispatched to special storage tanks of 260,000 barrel capacity. In storage the propane is maintained under slightly higher than ordinary pressure at a temperature of minus 41°C. For export, the propane is pumped at the rate of 7000 barrels per hour to special refrigerated vessels berthing at the Kharg Chemical Co. export jetty.

Butane. About 2200 barrels of butane is produced per day. The butane is kept in storage tanks of 128,000 barrels capacity, at minus 5°C and pumped to refrigerated vessels.

NLG - natural gasoline is sold to the Iran Pan American Oil Co. on Kharg Island for export through their own facilities.

Incoming gases are first compressed to satisfactory pressure levels then amine sweetened to remove hydrogen sulfite (acid gas) from hydrocarbon gases. The acid gas flows into the sulphur recovery unit where sulphur is recovered by partial oxidation-catalytic conversion process. Hydrocarbon gases pass from the sweetening plant through the dehydration unit for water removal on to a refrigerated (-10°F) absorption system where dry residue gases are rejected to fuel or to other utility uses. Propane and heavier materials are moved into the fractionation unit for separation into propane, butane and gasoline fractions by distillation. Propane and butane are then treated in molocular sieve treaters for removal of trace amounts of sulphur before storage and shipping. Gasoline is returned to one of the crude oil producers which supplies sour gas to Khemco.

[illegible] ABADAN

[illegible] was established in June 1966 as [illegible] Petrochemical Company and the N. F. [illegible] with an initial paid-up capital of Rls. 600 million.

Project Programme

[illegible],000 tons per year of PVC (polyvinyl chloride)

[illegible],000 tons per year of DDB (dodecyl benzene)

24,000 tons per year of caustic soda

Raw Materials: The primary raw materials for Abadan Complex are obtained from local sources: Hydrocarbon gases from Abadan Refinery and salt from mines close to Abadan. While benzene is being imported at present, it is anticipated that this raw material will also be available from local sources in the near future.

Abadan Petrochemical Complex is comprised of seven production units:

1.	Olefine - ethylene	12000 tons/year
	propylene	15000 tons/year
2.	Electrolysis - chlorine	21000 tons/year
	caustic soda	24000 tons/year
3.	Ethylene dichloride	36000 tons/year
4.	Vinyl chloride	21350 tons/year
5.	Polyvinyl chloride (PVC)	20000 tons/year
6.	Propylene tetramer	9600 tons/year
7.	Dodecyl benzene (DDB)	10000 tons/year

Olefine Plant Hydrocarbon gases from adjacent Abadan Refinery are used as raw materials for the olefine unit. The product ethylene is combined with chlorine to produce ethylene dichloride, and the propylene is polymerized to its tetramer as an intermediate in the manufacture of DDB.

Electrolysis Plant

The raw material for this unit is salt obtained from natural deposits near Hamadan. In converting the salt into chlorine and caustic soda this plant

[illegible]

Ethylene Dichloride Plant

In this plant chlorine and ethylene are combined in the presence of catalyst to produce 36000 tons per year of ethylene dichloride. Since the reactants and the products present in this unit are very chemically reactive, special resistant materials of construction were employed to give the necessary protection against corrosion.

Vinyl Chloride Plant

In the vinyl chloride monomer unit, ethylene dichloride is cracked under pressure with the application of heat into vinyl chloride monomer and hydrochloric acid. After cracking, the vinyl chloride is purified to polymerization grade monomer. The capacity of the unit is 21350 tons per year of vinyl chloride monomer, and by-product hydrochloric acid.

Polyvinyl Chloride Plant

In the PVC polymerization plant vinyl chloride monomer is polymerized into a variety of types of polymers which find application in the fabrication of pipes and hoses, shoes, film and sheet, electrical insulation, and variety of other household and industrial products.

Propylene Tetramer Plant

The propylene from the olefine unit is polymerized into its tetramer at the rate of 9600 tons per year. This material, after separation from impurities and by-products is used as the feed stock to the dodecyl benzene unit. The by-product propylene recovered in this operation is returned to the olefine unit for cracking.

Dodecyl Benzene Plant

The purified polymer from the tetramer unit is catalytically combined with benzene to produce dodecyl benzene. Dodecyl benzene is the primary raw material used in the manufacture of household and industrial detergents.

[illegible]	17500 KW
[illegible]	6000 l per min.
[illegible] water	750 l per min.
Compressed air	80 m^3 per min.
Steam (from Abadan Refinery)	23 tons per hour
[illegible] and product storage	10000 m^3 capacity

Manpower

270 staff employees, 340 labour employees.

Future Prospects

The actual market demands for some of the Company's products has exceeded all forecasts. The domestic consumption of PVC is at present i.e. in 1349 (1970/71) 3600 tons/year and is estimated to increase to 49000 tons/year by 1352 (1973/4) and 75000 tons/year by 1356 (1977/8). Even at the time of the plant inauguration, plans are already being formulated for expanding the production capacity. These plans include doubling the capacity for the manufacture of PVC within the next two years and expanding the product line to include emulsion polymers. Other studies involve expanding the other manufacturing units in the complex.

The following expansion is projected for completion in 1352 (1973/4):

P. V. C.	from 20000 tons/year to 40000 tons/year
Caustic soda	from 24000 tons/year to 32000 tons/year

The entire output of PVC will be consumed in the domestic market.

When the original plant was designed the vinyl chloride plant was installed with twice the initial required capacity. Minimum expansion of the small polymer plant is required. The bulk of the new expenditure will be required for the oxychlorination unit for recycling hydrochloric acid. Gas from the cat cracker in the Abadan Refinery has been supplied to the Olefine unit, but the amount by 1352 (1973/4) will be reduced so other sources of feed stock will be arranged for meeting the requirements of this project.

Only 66 more men will be required.

CHEMICALS FROM IRON AND STEEL PLANT IN ESFAHAN

In the frame of Iron and Steel Plant in Esfahan is built coke oven and by-product plant. In the first stage of construction (550, 000 tons of steel products per annum) annual production volume of the by-produ plant is as follows:

Dehydrated tar	20, 200 tons/year
Ammonium sulphate	5, 600 "
Sulphuric acid 100%	4, 700 "
Phenolates (as 100% phenol-cresols)	100 " *)
Crude benzol (run up to 180°)	6, 400 "
Total production	37, 000 tons/year

Products of crude benzol rectification:

Pure Benzol	4, 500 tons/year
Toluene	800 "
Xylenes	200 "
Solvent	200 "
Still Bottoms	300 "
Solar Solvent-naphta	300 "

Tar distillation plant is not provided at the given stage of construction of the coke oven and by-product plant.

All sulphuric acid will be utilized in the by-product plant for production of ammonium sulphate, for needs of the benzol rectification plant, phenols decomposition and for needs of the chemical water treatment etc.

---

*) seems to be abnormally low.

[illegible] will be re-
[illegible] by-products:

[illegible]	145 tons/year
[illegible]	80 tons/year
Wash oil (solar)	640 tons/year
Lime	215 tons/year

Under the assumption that the second and third stage of construction of Iron and Steel Mill in Esfahan will be based on own coke, i.e. the coke will not be imported from abroad, the annual production volume of the by-product plant will be as follows:

	Second Stage	Third Stage
Dehydrated tar tons	50,000	113,600
Ammonium sulphate tons	14,000	31,800
Sulphuric acid 100% "	12,700	28,900
Crude benzol distilled up to 180° tons	15,700	35,700
Total production tons	92,400	210,000

Products of crude benzol rectification

Pure benzol	tons	11,100	25,600
Pure toluene	"	2,000	4,500
Xylene	"	500	1,100
Solvent	"	400	900
Crude phenols (100)%	"	300	-
Crude residues	"	900	2,000
Solvent oils	"	800	1,900

Products of tar distillation in the third stage of construction

		Total production	for Sale
Light oil	tons	500	
Absorbing oil	"	4,200	700
Sleeper impregnating oil	"	13,200	13,200
Pressed naphtalene	"	8,000	8,000

Medium temperature pitch	tons	67, 400	66, 400
Road Tar	"	10, 000	10, 000
Crude Phenols (100%)	"	1, 400	1, 400
Crude Anthracene	"	4, 000	4, 000
Power fuel	"	5, 500	5, 500

Most of sulphuric acid will be utilized in the by-product plant etc., only 1300 tons/year in the second stage and 3800 tons/year in the third stage will be for sale.

The following chemicals from outside resources will be required for production of carbonization by-products (tons/year):

	Second Stage	Third Stage
Caustic Soda, 92%	300	1, 050
Soda ash, 95%	400	900
Solar oil	1, 570	-
Contact mass	1. 3	3
Lime 100%	390	390
Orthophosphoric acid	17. 3	39. 4

It is recommended that by-products of carbonizing will be used in the following way:

Ammonium sulphate will be used as a fertilizer for agriculture products of crude bensol distillation (pure bensol , toluene, xylene, solvent) may be mainly used as solvents when producing varnishes, paints, rubber products and also may be used as initial raw materials for organic synthesis of phenol, aniline, caprolactam, washing agents and toxic chemicals.

Products of the tar distillation plant find application in road construction, as binder for production of electrodes and briquetting of steam coal, manufacture of building materials, impregnation of sleepers, as power fuel, etc.

CODE NO. 2116 MANUFACTURE OF PLASTIC ARTICLES

There are two main groups of plastics:

Thermosets - phenol and cresol formaldehyde resins (bakelite), urea, melamine formaldehyde etc., are purchased in form of moulding powder (mixture of chemicals with fillers like wood dust, china clay etc. and colours). The powder is put into the mould where it is formed under pressure and high temperature to the required shape. After cooling the material becomes solid and if heated again, it does not regain its plasticity. To shorten the time of shaping in the mould and to reduce the specific pressure, the powder is compressed into tablets on tableting presses and the tablets are pre-heated before feeding to the mould.

Thermoplasts - PVC, polystyrene, polyamide nylon, cellulose acetate, polymethyl-methacrylate, polysthylene, polypropylene are supplied to the factory in the form of granules or powders which are mixed on the spot. Thermoplasts are again formed under pressure and high temperature to the required shape. After cooling the material is solid, but if reheated it regains its plasticity (i.e. it could be reformed). There are different methods of forming thermoplasts to final shape:

Moulding - granules are heated in the mould and by pressure are formed to the prescribed shape.

Injection moulding - plastic is heated outside the mould and then injected into the mould.

Calendering - The plastic is heated and shaped on calenders. In this way thin sheets are produced with plain or textured surface, coloured etc.

Extrusion - Granules are pre-heated and extruded by a screw through a die which gives the material its final shape. In this way, plastic pipes, insulated wires and cables, rods, thicker sheets, shapes etc. are produced.

[illegible] special [illegible] compressed [illegible] mould [illegible] different kinds of textile [illegible] impregnated

Slush moulding material is sliced from cylinder like veneer - in Iran not in use.

Plastic Laminates are produced by heating sandwiches of sheets under pressure. Liquid or sheet plastics are used with textile, paper, fibrous glass, wood sheets etc.

Welding - thermal or solvent is used for joining the similar plastic material.

PRODUCTION OF PLASTIC SHOES

There are 16 factories in Iran at present producing plastic shoes on medium or big scale and approximately 70 small producers. For names of these firms see Code No. 2411. There is big difference in the data on production of shoes published by the Statistic Department of the Ministry of Economy and "The Iran Shoe Industry and the Components - An ILO-SSI-IEI Report". The ILO Report gives the plastic shoe production in 1346 as 28, 717, 000 pairs, whereas the statistical department's figure is for the year 1346 - 6, 177, 355 pairs, and in 1347 - 11, 387, 226 pairs. It seems that data given by the statistical department are low. The existing capacity of machinery and equipment for production of plastic shoes (approximately 60 - 70, 000, 000 pairs) far exceeds the needs of the Iranian market. This was taken into account in calculating machinery and equipment for the next fifteen years.

Forecast of Production of Plastic Shoes

	1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Production of shoes 1000 pairs	30, 000	35, 000	41, 000	48, 000
Existing capacity 1000 pairs	60, 000-70, 000			

[illegible] production of plastic shoes has been made by the author on the basis of growth rates applied to production in the year 1348 (1969/70). Projected growth rates were derived by correlation with expected levels of gross national product and by reference to per capita consumption of footwear in other countries (see Master Demand Study for Mechanical and Capital Goods Industry, Part I, 4. Leather and Footwear Industries).

Description of Existing Machinery, Equipment and Process

Plastic shoes are made on special injection presses with revolving table with 8 up to 12 positions (one for pressing, the rest for cooling and removing of finished products). The most expensive plastic shoes are lined with textile. After pressing flashes are removed either by hand or by grinding and cutting machines.

Some of the special injection presses with revolving tables were produced in Iran but the quality of them is very poor.

PRODUCTION OF ARTIFICIAL LEATHER

There are 6 factories in Iran at present producing artificial leather:

Fereydon Zardoshti and Co. Tehran	- Production in 1348	-	1800	tons	(in	3 shifts)
Rokesh Parcheh Iran Co. Ltd. Tehran	"	"	900	"	"	
Darakhshan Tehran	"	"	900	"	"	
Tolydi Tehran	"	"	900	"	"	
Savabi Tehran	"	"	900	"	"	
Kambiz Tehran	"	"	900	"	"	
Total production in 1348 (1969/70)			8300 tons			

Description of Existing Machinery, Equipment and Process

All 7 sets of machinery and equipment, installed in factories are new. Plastic leather is produced by calendering.

Forecast of Production of Artificial Leather

	1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Production of artificial leather in tons	7000	14000	20000	28000

[illegible] 969 [illegible] orela-
[illegible] up shoes made [illegible]

PRODUCTION OF OTHER PLASTIC ARTICLES

There were 73 factories in Iran in 1348 (1969-70) producing plastic articles on medium and large scale employing over 10 workers in each factory and unknown number of small shops employing less than 10 workers.

The biggest factories are

Plascokar Factory Tehran employing	783 workers
Pars-Plast Co. Tehran employing	394 workers
Karkhanejat Lolidi Tehran employing	229 workers
Linoleum Factory Tehran employing	181 workers
Iran Gharb Co. Tehran employing	141 workers
Sherkat Sahami Drakhshan employing	127 workers
Katrang Co. Tehran employing	129 workers
Novaform Co. Tehran employing	93 workers
Nylon Tex Tehran employing	91 workers
Pars Co. Tehran employing	73 workers
Plastolux Co. Ghazvin employing	55 workers
Meccaleum Co. Tehran employing	52 workers
Nersi Co. Tehran employing	50 workers
Unilit Factory Tehran employing	45 workers
Polica Company Tehran employing	46 workers
Plastofoam Co. Tehran employing	41 workers

The remaining 57 factories are employing 10 up to 40 workers. These factories and shops are producing all kinds of products made of thermoplasts as well as thermosets, for example:

- sheets plain or printed made of PVC and other plastics, table clothes and products made of sheets - bags, sacks, strips, packages etc.

- bottles, vials, phials, medicinal flasks, syringes etc.

[illegible] cigarettes etc.

[illegible] pans, cases [illegible]

- [illegible] like dolls, models of cars, swimming facilities, artificial flowers etc.

- plastic pipes, hoses, tubes etc.

- foamed plastics, sponges, dunlop pillow etc.

- Linoleum

- polypropylene fibres etc.

- Components and parts of different products of mechanical as well as electrical engineering like cars, refrigerators, radios, TV sets, electrical fittings etc.

Some big firms producing refrigerators, radios, TV sets, electrical fittings, telephone apparatuses, beverages etc. (for example Azmayesh Co. Tehran, Shishe va Gas Tehran, G.E.I. Rasht, Pars America Co. Tehran etc.) are producing components, parts, boxes etc. for their own use in specialized shops. Though these shops are employing sometimes tens of workers they are not included in standard list of firms producing plastics and their production is not included in statistics.

Production of Plastic Articles (according to the Statistical Department of the Ministry of Economy).

		1344 (1965/6)	1345 (1966/7)	1346 (1967/8)	1347 (1968/9)
Production of plastic articles	kg	7,512,290	9,447,255	11,808,750	18,539,738
	m	611,711	250,000	125,000	137,000
	sq. m	-	901,620	991,782	1,090,960
	cu. m	4,530	-	4,983	5,481
	pcs.	5,388,015	9,115,000	15,404,350	26,033,351

Production of wires and cables insulated by PVC see Code No. 3703. It is estimated that total production of plastic articles

Description of Existing Machinery, Equipment and Process

Mostly new factories with modern machinery and equipment. Small factories and shops are using sometimes hand operated presses instead of mechanical or hydraulic presses.

Forecast of demand for various kinds of plastic articles has been made by the Research Centre for Industrial and Trade Development for years 1356 (1977/8) until 1361 (1982/3) and by the author of this study for year 1366 (1987/8) on the basis of growth rates applied to demand in the year 1349 (1970/71). Projected growth rates were derived by corelation with expected levels of gross national product and by reference to per capita consumption of plastics in other countries.

Forecast of Demand of Plastic Products in 1000 tons

	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Extruded and calendered products	25	48	80
Extruded products	28	72	125
Blow moulded products	4	12	36
Injection moulded products	7	12	20
Plastic film	28	48	72
Pressed products	10	24	48
Foam	10	24	48

CODE NO. 3117 MANUFACTURE OF CHEMICAL FERTILIZERS

According to the Soil Institute of Iran actual fertilizers used in 1347 up to 1349 (1968 up to 1970) and projected annual consumption for 1351 (1972/3) is as follows (in tons)

	1347 (1968/9)	1348 (1969/70)	1349 (1970/1)	1351 (1972/3)	[illegible]
Urea	74,000	83,000	108,000	177,000	[illegible]
Ammonium Nitrate*	17,700	18,000	25,000	27,000	[illegible]
Ammonium Sulphate	11,400	6,500	15,600	10,000	[illegible]
Diammonium Phosphate	30,000	44,000	54,000	84,000	[illegible]
Triple Super phosphate	21,000	26,700	26,000	28,700	[illegible]
Potassium Sulphate	1,200	400	900	1,100	[illegible]
Mixed fertilizer	26,600	21,700	3,000	3,200	[illegible]
Others	30	80	510	570	[illegible]
Total	181,930	200,380	233,010	332,070	[illegible]

* The projected consumption figure is equal to the maximum production capacity of Iran Fertilizer Company in Shiraz.

The trend continues to rise but the proportion of different kinds of fertilizers (plant foods) is different. The demand in 1351 (1975/6) will be dominated by urea and diammonium phosphate. The Iranian soil are very alkaline and their response to applications of potassium is poor or even negligible.

There are two factories producing chemical fertilizers at present in Iran.

IRAN FERTILIZER COMPANY SHIRAZ

The Shiraz Marvdasht fertilizer plant includes:

1) An ammonia unit of an original design capacity 111 tons per day but output has been increased to 122 t/day.

2) A nitric acid unit producing 120 t/d HNO_3 - 100%

3) An ammonitrate (20% N) unit of 120 t/d capacity of CAN but there is an ammonia limitation owing to the increased urea output.

4) An urea (46% N) unit of 120 t/d capacity but output has been increased to 170 t/d.

Gas preparation follows the Foster-Wheeler process. It includes:

- Hydrodesulphurisation mercaptans reduced from 400 to 1 p.p.m. final caustic soda wash.
- Primary steam reforming at 150 psi 700°C CJB plant
- Secondary reforming
- Shift conversion
- MEA CO_2 absorption

After compression at 2100 psi the gas is washed in copper-ammonia solution, Casale synthesis follows at 7300 psi. Gas circulation in reactor is obtained through an ejector. This is characteristic of the Casale process and obviates the use of circulation pump. The production is in liquid form and is stored in pressure tanks.

Nitric Acid

The unit uses the Societe 'Belge de l'Azole process; ammonia combustion occures at atmospheric pressure and absorption at 37 psi in 5 towers in series. Concentration is 52%.

Calcium Ammonium Nitrate (CAN)

Designed to the S. B. A. process, the unit delivers 120 t/d of pelletized product, which is stored in bulk-capacity of storage 7000 tons.

Urea

120 tons/day of prilled urea are produced by the Fauser-Montecatini process, and stored in a warehouse similar to that for nitrate (Urea prilling tower is 170 feet high).

Water

Seven cooling towers supply the needs in cold water 8000 m^3/hr make up water are pumped from the nearby Kur River. A treatment plant supplies boilers with filtered and dimineralized water.

Services

Control laboratory, Maintenance shop, Fire fighting network.

Steam

At 600 psi is produced by 3 boilers (one as stand by) of 42 t/h capacity each.

Electricity

Is produced under 5700V by 3 turbo-alternators of 4700 KW each (one as stand by).

SHAHPOUR CHEMICAL COMPANY LIMITED

In 1969 when Shahpour went into production, Iran became one of the great leaders in the international fertilizer business. Shahpour is designed to produce, from a combination of natural gas and imported phosphate rock, the following products:

1000 tons of ammonia per day
1500 tons of sulphur per day
500 tons of urea per day
1300 tons of sulphuric acid per day
450 tons of phosphoric acid per day
380 tons of diammonium phosphate (DAP) or
450 tons of triple super phosphate (TSP) per day

The ammonia, urea, DAP and TSP are essential plant foods or plant food intermediates which, when applied in solid or liquid form will vastly increase the yield of his crops, such as wheat, rice, cotton, tea, vegetables and so on.

The plants have experienced many starting up troubles. The sulphur plant is operating at a rate of 1100 tons pending, being limited by foaming troubles. The ammonia plant has a hot spot in the converter necessitating a long shutdown. The phosphate plants have run reasonabl well.

Shahpour Complex Expansion

Due to an increase in the domestic demand for fertilizers the Shahpour Complex will be expanded as outlined below:

Product	From	To
Urea	164, 000 tons/year	296, 000 tons/year
Sulphuric acid	450, 000 tons/year	860, 000 tons year
Triple superphosphate & diammonium phosphate	121, 000 tons/year	242, 000 tons/year

The expansion of the urea plant capacity from 164, 000 tons per year to 296, 000 tons per year will increase the total capacity for urea manufacture to 346, 000 tons per year which is the same order as the estimated demand for urea for fertilizer purposes in 1354 (1975/6).

The joint capacity for making triple super phosphate and diammonium phosphate will be increased to 242, 000 tons per year. The estimated demand for these products total to 172, 000 tons in 1354 (1975/6) so the capacity will not be fully utilized until 1978 unless the surplus tonnage available can be exported.

This extension will cost $ 50 million and is expected the start-up will be in 1352 (1973/4).

[illegible] MANUFACTURE OF ALL OTHER CHEMICALS

[illegible] Alcohol

[illegible] distilleries producing industrial alcohol in Iran:

Arak Distillery Kerman - employing 14 workers

Kerman Distillery Kerman - employing 10 workers

Iran Distillery Khorasan - employing 12 workers

Ara Distillery Fasa - employing 12 workers

In all distilleries industrial alcohol is made by molasses distillation.

Description of Machinery, Equipment and Process

The same as in Code No. 211 - See Master Demand Study for Mechanical and Capital Goods Industry, Part I - 2. Food, Beverage and Tobacco Industries.

CODE NO. 3192 - MANUFACTURE OF SOAP

There are 8 factories in Iran at present, producing soap on la and medium scale and approximately 30 - 40 producers on small s The biggest are:

	Capacity tons/year	Product tons/year
1. Behshahr Industrial Group Co. Ltd. Tehran	36,000	20,000
2. Pars Industrial Group Co. Ltd. Parsavan (Khorramshahr)	36,000	20,000
3. Kaf Co. (Darugar) Tehran	2,000	2,000
4. Akbar Sadeghi Co., Tehran	2,100	1,000
5. Pary Negad Tehran	2,000	1,000
6. Sadeghi Brothers, Tehran	975	1,000
7. Moatar Industrial Co., Tehran	600	600
8. Roushan Co., Tehran	20	600
	79,695 t/y	44,620 tons

Forecast of Production of Soap

	1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Production of Soap tons	42,000	56,000	75,000	100,000

Forecast of production of soap has been made by the author of this study on the basis of growth rates applied to production in the year 1347 (1968/9). Projected growth rates were derived by corelation with expected levels of gross national product and by reference to per capita consumption of soap in other countries.

According to the data given above installed capacity will cover consumption in Iran until 1361 (1982/3). Unless there should be some export of soap, there will be no need of new capacity until 1361 (1982/3). This has been taken into consideration in calculating machinery and equipment, needed in near future.

Industrial fat and oil	(imported)	18,000 tons
Tallow	(local, imported)	2,000 tons
Coconut oil	(imported)	1,000 tons
Soap stock	(local)	1,500 tons
Palm oil	(imported)	200 tons
Olive oil	(imported & local)	150 tons
Castor Oil	" "	100 tons
Caustic soda	(local)	3,800 tons
Fullers' earth	(imported)	300 tons
Sodium silicate	(imported & local)	800 tons
Optical brightener	(imported)	40 tons
Perfume	(")	300 tons
Titanium dioxide	(")	30 tons
Versen (antiwater)	(")	160 tons
Dye	(")	20 tons
Potassium hydroxide	(")	50 tons
Salt	(local)	3,500 tons
Total		31,650 tons

Both production methods - saponification as well as the hydrolysis of the fats (fat splitting) are used in the existing plants.

In the first case (mostly used) fats and oils are put in a soap boiling pan, the contents are heated as they are agitated with the addition of the caustic soda solution. Fats and oils are decomposed, producing mixture of soap and glycerine (saponification). After saponification salt is added and in this way different compounds i.e. soap, metallic soap and soap spent-lye are separated. From spent-lye glycerine is recovered (in other plants). Soap is pulled out from soap boiling pan into an intermediary tank with a steam jacket. Other ingrediences are added, the solution is mixed and then dried in vacuum dryers. After becoming solid the soap is mixed

[illegible] de-airing [illegible] and calandered (the best [illegible] of s[illegible] [illegible] shaped in de-air[illegible] auger, cut to pieces, dri[illegible] [illegible] covers shaped in horizontal pressing machine and then automa[illegible] [illegible] packed and transported by conveyors to stores.

In small factories most of these operations are performed by ha[illegible]

CODE NO. 3194 - MANUFACTURE OF CANDLES

There is only one plant producing candles on medium scale, em-ploying 15 workers; the production in the year 1348 (1969/70) was 2,000,000 candles. Production in small shops in bazaar is not known.

In future, there will be no substantial change of production of candles in Iran.

CODE NO. 3195 - MATCH FACTORIES

There are 26 Match factories in Iran at present. Most of them are operated on small scale, only the 3 biggest factories are well mechanized:

Kebrit Sazi Tavakoli, Tabriz - production in 1347(1968) - 165,400,000 boxes/year
Kebrit Sazi Momtaz, Tabriz - " " - 175,700,000 " "
Kebrit Sazi Tabriz (Sadeghiyani), Tabriz " " 1346(1967) - 105,800,000 " "

The production of match boxes was

	1339 (1960/1)	1343 (1964/5)	1344 (1965/6)	1345 (1966/7)	1346 (1967/8)	1347 (1968/9)
Match boxes (in 1000 pieces)	125,000	679,000	644,000	583,000	600,000	610,000

Source: Bureau of Statistics of the Ministry of Economy

[illegible] present requires less than 2,000,000 match boxes p[illegible] [illegible] actual capacity exceeds by far this quantity and ex[illegible] [illegible] capacity of the industry six years ago. Therefore, the four [illegible] [illegible] co-operation, limiting voluntarily their production [illegible] selling prices and agreeing on some kind of quality and dimens[illegible] standards.

Forecast of Demand of Matches in Iran

	1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Production (in 1000 boxes)	685,000	835,000	1,020,000	1,240,000

Forecast of production of matches has been made by the author of this study on the base of growth rates applied to production in the years 1339 (1960/1) until 1347 (1968/9). Projected growth rates were derived in correlation with expected levels of gross national product, consumption of cigarettes and tobacco and by reference to per capita consumption of matches in other countries.

As the utilization of machinery and equipment in most of the factories is low (mostly one shift operation) it is seen that at least in next 5 - 7 years there will be no need of new capacity. This was taken into consideration at the calculation of the needs of new machinery and equipment.

Characteristics of Existing Machinery and Equipment (in the biggest factories)

1. Splint Manufacturing. Lumber is cut to suitable lengths by a circular or band saw. After the peeling of the bark and log steaming the log is peeled into veneer-like thin long shavings by the peeling machine. The ribbon of wood is chopped into splints by a splint chopping machine. The splints are then dried and polished in the dryer and the splint polishing machine.

2. Match Manufac[illegible]. Polished splints [illegible] [illegible] and fed [illegible] the air [illegible] machine feeds the splints which are placed on spec[illegible] [illegible] making machine where the [illegible] dipped in paraffin and [illegible]table ingredients then dried [illegible] continuous match making machine. The machine disc[illegible] ready match splints.

3. Match Box Manufacturing. Lumber is cut to suitable [illegible] a circular or band saw. After the peeling of the bark and [illegible] steaming, the pieces of wood are peeled into shavings 0.6 [illegible] thick by the peeling machine. The shavings are then s[illegible]pped and pasted with bobbin paper, folded in folding machines [illegible] to inner or outer part of the boxes. Printed labels are pas[illegible] on the outer boxes in labelling machines. After drying of boxes in the seasoning kilns they are filled in the filling machines [illegible] match splints packed into packages a 12 boxes either by hand or by packing machine and then into cartons. All machines are interconnected by conveyors or by pneumatic conveyors.

In small factories most of the special machines are replaced by manual work.

CODE NO. 3198 - MANUFACTURE OF WASHING POWDER

There are 4 factories in Iran at present, producing washing powder (detergents):

1. Behshahr Industrial Group Co. Ltd. Paksan, Tehran — capacity 2 tons/hour
2. Pars Industrial Group Co. Ltd., Khorramshahr — capacity 3 tons/hour
3. Tolid Darou, Tehran — capacity 5 tons/hour
4. Pak Kon, Tehran — capacity 0.75 tons/hour

... powder in 1348 (1969-70) ... 42,000

... equipment was utilized to about 80% ...

... Washing Powder

	1351 (1972-73)	1356 (1977-78)	1361 (1982/3)	1366 (1987-88)
... Washing ... tons	38,000	52,000	70,000	93,000

... production of washing powder has been made by the ... of this study on the base of growth rates applied to production ... for 1348 (1969-70). Projected growth rates were derived by correlation with expected levels of gross national product and by reference to per capita consumption of washing powder in other countries.

According to the data given above installed capacity will cover ... consumption in Iran including export until approximately 1359-60 (1980-81), i.e. there will be no need of new capacity until 1359 (1980/1). This has been taken into consideration in calculating machinery and equipment needed in the near future.

Description of Existing Machinery and Equipment

All plants are equipped mostly with modern machinery and equipment.

CODE NO, 32 - MANUFACTURE OF PRODUCTS OF PETROLEUM & COAL

Code No. 3211 Petroleum Refineries

Code No. 3212 Coke Ovens

Code No. 3291 Manufacture of asphalt and tar road materials

Code No. 3292 Manufacture of waterproof materials including roofing, tarred gunnies

Code No. 3293 Manufacture of fuel briquettes and packaged fuel

Code No. 3294 Manufacture of lubricating oils and greases not made in petroleum refineries

Code No. 3299 Miscellaneous petroleum products manufacture

Manufacture of fuel briquettes - Code No. 3293 is delt in Master Demand Study for Mechanical and Capital Goods Industry, Part I., 1. Mining and Quarrying, Code No. 11 Coal Mining.

CODE NO, 3211 PETROLEUM REFINERIES

There are 5 petroleum refineries in Iran at present in operation, producing over 70 different kinds of products and covering not only the needs of Iranian industry and transport facilities, but most of their products are also exported to different countries. The biggest refinery in Iran, Abadan refinery is one of the biggest refineries in the world, having refining capacity of 430,000 barrels per calendar day. Most of its products are exported from the new oil products export terminal at Bandar Mahshar.

	[illegible]	1346 (1967/8)	1347 (1968/9)	1[illegible] (196[illegible])
[illegible]	[illegible]	1[illegible]	63,[illegible]	
[illegible]	[illegible]	857,805	731,902	1,[illegible]
[illegible]	1,246,999	927,847	1,312,171	1,192,[illegible]
[illegible]	[illegible]	1,[illegible]19,433	1,997,780	1,89[illegible]
[illegible]	[illegible]	474,246	796,043	[illegible]
[illegible]	[illegible]	812,874	1,266,854	1,[illegible]
[illegible]	[illegible]	[illegible]71,044	308,[illegible]	4[illegible]6,[illegible]
[illegible] oil		-	110	1,468,[illegible]
[illegible] ace and [illegible]	[illegible]901,312	9,458,345	11,032,352	9,84[illegible]
Paraffine distillates	195,002	116,205	50,009	39[illegible]
Mineral resins, petroleum pitch	73,454	92,600	68,497	109,84[illegible]

[illegible] Refineries – Products in 1000 barrels/year

	Abadan	Tehran	Naphte-Shah	Kerman-shah	Masjed Solaiman
Total refinery capacity	156,950	31,025	1,460	1,825	27,375
Gas oil	22,700	5,000	300	200	-
Fuel oil	59,800	11,200	700	700	7,100
Motor gasoline	11,800	4,300	400	500	-
Kerosene	15,000	3,900	400	400	-
LPG	500	500	-	-	-
Bitumen	1,800	400	-	-	-
Diesel oil	1,600	-	-	-	-
Aviation spirit	6,300	-	-	-	-
Aviation turbine fuel	-	13,300	-	-	-

ABADAN REFINERY *

There are four large modern crude oil distillation units at the Abadan Refinery, having capacity of 430,000 barrels/day. The crude oil is heated to between 600°F and 630°F and fed into the distillation units. The heaviest molecules, which do not vapourize at this temperature, remain at the bottom and comprise the bitumen and fuel oil fractions. The lighter, more volatile fractions rise to various heights in the distillation columns where they are removed as straight run or 'first' cut products. This process results in six main cuts: raw gasoline, naphtha, kerosene, gas oil, fuel oil and bitumen. After the initial separation, the heavier molecules are cracked in catalytic cracker-having the capacity 37,000 barrels per day to enable surplus quantities of heavier liquids to be converted into lighter products such as additional high octane motor and aviation gasoline components. Other processes are the separation of special fractions by further distillation with the extraction of impurities by filtration of special solvents, acid refining and blending of final products. The naphtha fraction is processed in a modern catalytic reformer having the capacity 25,000 barrels per day. It is used for the manufacture of high octane gasoline and high grade blending components for aviation gasoline. Alkylation and Izomerization Complex consists of two units, having the capacity 9400 barrels per day. The main chemicals in use at the Refinery are sulphur, catalytic reforming catalysts, caustic soda and tetra ethyl lead.

Crude oil is supplied to Abadan Refinery through two trunk line systems, connecting the refinery with more than a dozen major Oilfields. Approximately 100,000 barrels per day of crude oil are refined for domestic consumption and delivered to NIOC which maintains the product pipeline system, branching out to the main consuming centres in north, northest and northwest Iran. Several products, such as lubricating oils and liquid petroleum gas, have been produced only for

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* According to "Facts about Abadan" - IOOC

[illegible] between 25 to 30 percent of the refinery's output [illegible] and components, corresponding to the production [illegible] barrels per day of crude runs in recent years. [illegible] produced for export.

NEW REFINERIES

SHIRAZ REFINERY

The construction work on Shiraz Refinery started in 1350 (19[illegible] and it is estimated that this refinery will be in operation in 13[illegible] The required crude oil will be pumped from Gachsaran through a 10 pipeline over a 230 km distance. The Shiraz Refinery will have a capa[illegible] of 2 million tons a year. The principle units of the refinery will [illegible]

1. 40,000 BPD atmospheric distillation unit with gasoline stabilizer and splitter.
2. 18,400 BPD vacuum [illegible] distillation unit.
3. 8,990 BPD visbreaker
4. Kerosene treatment - 2120 BPD Unifiner and 3000 BPD Merox
5. An LPG unit with the capacity 423 BPD liquid propane and 1158 BPD liquid butanes. The refinery production of LPG will be about 1000 BPD.
6. 5250 BPD naphtha Unifiner
7. 6245 BPD Platformer which will produce 4800 BPD of 95 clear octane gasoline
8. 9280 BPD Isomax
9. 17 million SCFD hydrogen plant
10. Refinery gas purification plant
11. 34 tons per day sulphur plant.

Petroleum Products Demand (1000 Barrel per ...

	1348 (1969-70)	1351 (1972-73)	1356 (1977-78)	1361 (1982-83)	1366 (1987-88)
[illegible] LPG	[illegible]	[illegible]	10.7	18.0	[illegible]
Aviation gasoline	0.3	0.3	0.5	0.5	[illegible]
Motor gasoline	15.7	25.9	41.4	64.6	[illegible]
Jet fuels-gasoline type	1.4	2.7	5.9	8.0	[illegible]
-kerosene "	0.3	0.8	1.4	2.9	[illegible]
Kerosene	10.4	14.1	78.3	102.4	[illegible]
Gas oil	45.9	67.1	99.3	164.9	[illegible]
Fuel oil	48.4	60.4	91.8	144.4	[illegible]
Oil company use	2.8	3.1	3.5	3.6	[illegible]
Total internal	160.6	219.7	332.0	519.5	838.0
External Market: Gas oil	0.3	0.7	2.2	4.9	[illegible]
Marine diesel oil	2.0	1.8	1.6	1.4	[illegible]
Marine fuel oil	83.1	94.2	111.4	116.7	120.0
Jet fuels-gasoline type	0	0	0	0	0
-kerosene "	2.3	3.5	5.3	7.6	[illegible]
Aviation gasoline	0	0	0	0	0
Total external	87.7	100.2	120.5	130.6	141.0
Total Petroleum	218.3	319.9	452.5	650.2	964.0

Year 1351, 1356, 1361 According to the "Demand for Energy in Iran", Stanford Research Institute.

Natural Gas Displacement - in 1000 Barrels per Day*

	1348 (1969/70)	1351 (1972/3)	1356 (1977/8)	1361 (1982/3)
Residential and commercial	0, 1	0, 1	18, 0	48, [illegible]
Other industrial	1, 7	15, 2	46, 9	89, [illegible]
[illegible]	0, 4	20, 5	34, 1	97, 8
Government	0	0	1, 5	2, 1
Total natural gas	2, 2	35, 8	100, 5	237, 0

* According to the "Demand for Energy in Iran", Stanford Research Institute.

Forecast of Demand for Natural Gas for Energy Purposes (Millions Cubic Feet)

	1348 (1969/70)	1351 (1972/3)	1356 (1977/8)	1361 (1982/3)
Residential and commercial	100	200	34, 800	92, 800
Government	-	-	2, 900	4, 200
Electric generating plant	800	41, 600	69, 200	198, 300
Refinery fuel	33, 300	40, 700	56, 600	68, 300
Other industrial	3, 400	30, 800	95, 200	180, 400
Sub total	37, 600	113, 300	258, 600	543, 900
Field use	19, 700	20, 700	22, 200	23, 600
Total energy use	57, 300	133, 900	280, 800	567, 500

* According to the "Demand for Energy in Iran", Stanford Research Institute.

Petroleum Refinery Products

		1345 (1966/7)	1346 (1967/8)	1347 (1968/9)	1348 (1969/70)
Internal Market					
LPG	tons	25,500	40,200	59,300	83,800
Aviation gasoline	1000 ltr.	33,500	36,700	33,500	30,000
Motor gasoline	1000 ltr.	800,000	860,000	940,000	1,100,000
Jet fuel-gasoline type	1000 ltr.	46,600	50,000	52,800	96,500
kerosene "	1000 ltr.	11,500	11,700	29,200	23,400
Kerosene	1000 ltr.	1,530,000	1,810,000	1,990,000	2,350,000
Gasoil	1000 ltr.	1,480,000	2,180,000	2,460,000	2,660,000
Fuel oil	1000 ltr.	1,980,000	2,240,000	2,580,000	2,820,000
Natural gas	1000 cu.m	1,370,000	1,380,000	1,480,000	1,620,0
External Market					
Gas oil	1000 ltr	5,600	8,500	8,500	14,100
Marine diesel oil	1000 ltr.	127,000	144,000	131,000	111,000
Marine fuel oil	1000 ltr.	3,180,000	4,330,000	4,700,000	4,810,000
Jet fuel-gasoline type	1000 ltr.	-	-	-	-
-kerosene "	1000 ltr.	100,000	147,000	120,000	135,000
Aviation gasoline	1000 ltr.	2,900	-	-	-

CODE NO. 32=2 - COKE OVENS

There are 12 producers of coke in Iran at present. Most of them are combined with coal mines (7 producers) - see Code No. 11

Coke Production in Iran in tons

	1341 (1962/3)	1342 (1963/4)	1343 (1964/5)	1344 (1965/6)	1345 (1966/7)	1346 (1967/8)	1347 (1968/9)
Government sponsored production	8129	11129	9675	12320	10578	11335	9265
Private	11261	10048	10453	12495	15000*	18000*	31100
T o t a l	19400	21177	20128	24815	25578*	29335*	40365

* Estimates
Source: Bureau of Statistics of the Ministry of Economy

Description of Existing Machinery and Equipment

Coke till now is produced in primitive beehive coke ovens (the circular brick ovens with domed roof). Capacity of each oven is 15-35 tons and coke is produced in 9-12 days. Efficiency of these ovens is only 45-55 %, gas and chemical by-products are not utilized.

Other types of ovens, used till now in Iran: Honeycomb oven, capacity 4-5 tons in 4 days, efficiency approximately 55%; Uppolet oven, Coppee oven, Simon Carves oven. Coke produced in these ovens is of low quality, has low compression strength and is very expensive - 3700 Rials/ton (year 1348). The high price of the coke is due to the fact that by-products are not utilized, even when they are representing 34 % of the value of the coke and due to low mechanization of coking plants.

The consumption of coke in 1349 (1970/1) was approximately 55000 tons. The difference between production and consumption was covered by import of coke from USSR.

In the frame of Iron and Steel Plant in Esfahan is built modern coking and by-product plant having capacity of 444,000 tons/year of which 346,000 tons/year of metallurgical coke, 49,000 tons/year of foundry coke and 49,000 tons/year of coke fines. From this production 319,000 tons of metallurgical coke will be used in Plant and 76,000 tons/year of metallurgical and foundry coke and 49,000 tons/year of coke fines will be sold.

The project provides for recovery of the coke oven by-products: coke oven gas - 180,9 mill. cu.m/year, dehydrated tar 20,200 tons/year, ammonium sulphate 5600 tons/year, 100% sulphuric acid 4700 tons/year, phenolates (as 100% -phenol - cresols) 100 tons/year, crude benzol (run up to 180^{0}C) 6400 tons/year, i.e. 37,000 tons/year of chemicals. Products of crude benzol rectification: pure benzol 4500 tons/year, toluene 800 tons/year, xylene 200 tons/year, solvent 200 tons/year, still bottoms 300 tons/year and solar solvent naphtha 300 tons/year. Coke oven gas will be used as technological fuel for heating coke ovens. For

production of carbonization by-products the following chemicals will be required: 100% suphuric acid of self production - 4300 tons/year, 92 % caustic soda 145 tons/year, 95% soda ash 80 tons/year, wash oil (solar) 640 tons/year and lime 215 tons/year.

Description of Machinery, Equipment and Process in Iran and Steel Plant in Esfahan

The scope of the coke oven and by-product plant is as follows: Railway wagons with coal are unloaded in the stationary wagon tippler of rotary type. From wagon tippler and coal receiving bins the coal is transported by the belt conveyor to the top of the coal storage of closed type. The preliminary crushing section is provided with double-roller tooth crusher and electromagnetic drum for removal of ferromagnetic articles. The coal storage consists of 20 cylindrical bunkers of 12 m in diameter and 42 m in height, capacity of each bunker being 2500 tons. Coal is charged into bunkers of discharging bogie travelling the length of the conveyor, from bunkers it is discharged by means of automatic proportioning device into belt conveyors conveying it to the final crushing section with three hammer crushers. The crushed blend is mixed in the mixing machine of semi-desintegrating type and transported to the top of the coal tower for charging into bunkers by means of 2 portable reversing conveyors.

The coke oven plant consists of one battery of 2 blocks, each comprising 29 coke ovens. Both blocks are located on one line and have one coal tower. Dimensions of the carbonisation chamber: effective length 14, 200 mm, effective height 4700 mm, width on the pusher side 390 mm, on the coke side 430 mm, effective capacity of the chamber 27, 3 cu. m. For operating the coke oven battery the following machinery is provided: coke pushers 2 pcs. coal charging cars 2 pcs., door extractors 2 pcs., coke quenching cars 2 pcs., electric locomotives 3 pcs. The quenching station for wet quenching of coke being descharged from ovens is located on the coke side. The pump house, settling tanks, clarified water sollecting tanks, platforms for dewatering and loading slurry, the trestle for grab carriage are located close to the quenching station.

[illegible] from the quarries or is discharged onto the wharf, loaded [illegible] and transported to the coke screening plant, where is [illegible] three sizes 80 mm, 25-80 mm and 0-25 mm and transported [illegible] row of bunkers. Bunkers have a provision for loading coke sizes into railway wagons and lorries.

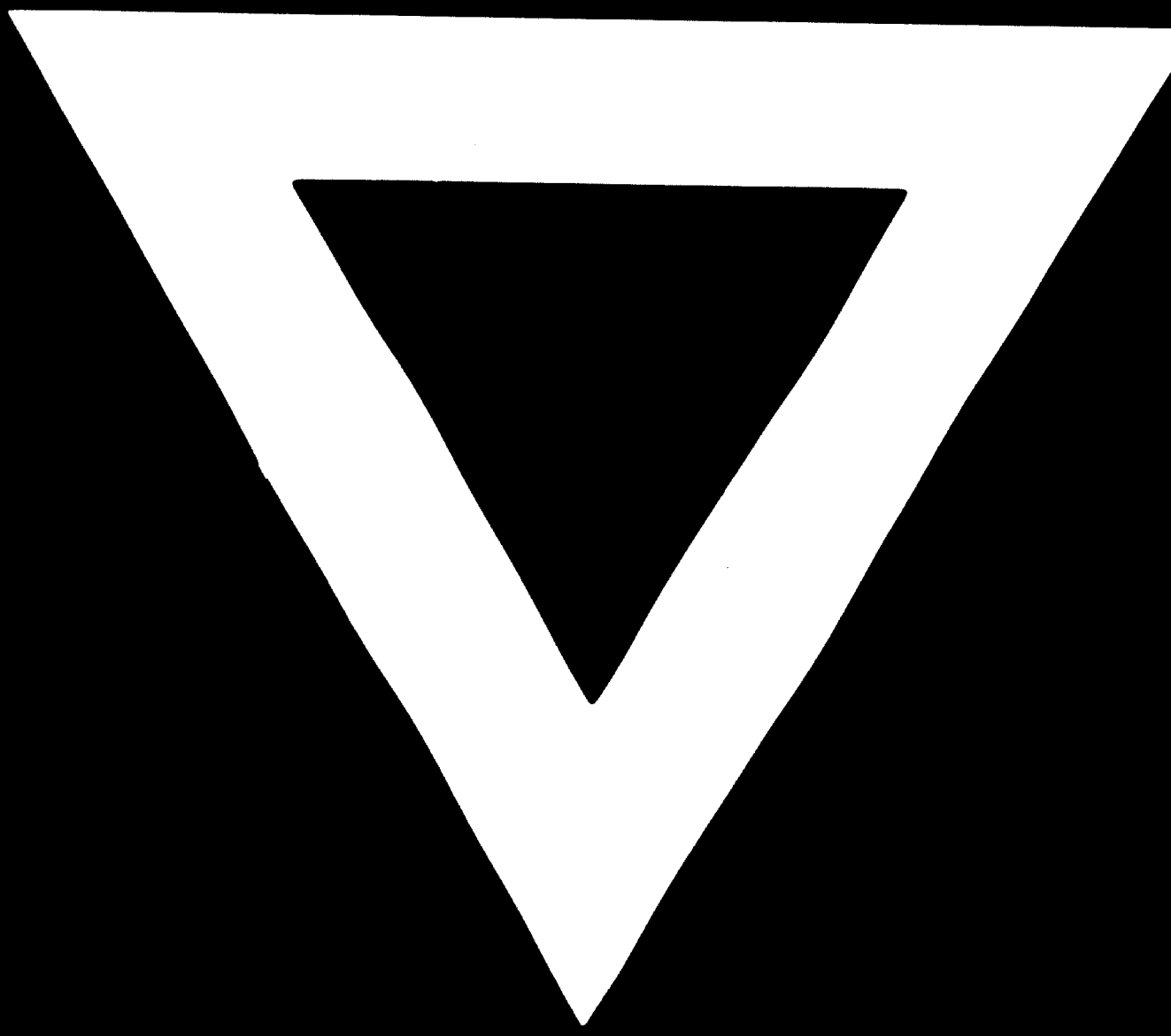
By-product recovery plant is described in chemical industry Code No. 31. The second stage of construction envisages erection of coke oven battery No. 2 similar to the battery No. 1 which is under construction. Coal handling plant and coke screening stations remain without any changes. By-product plants, plants for gas cleaning from hydrogen sulphite and for crude benzole rectification will be expanded insignificantly. In the third stage of construction coke oven batteries No. 3 and 4, the coal handling plant No. 2, by-product plant No. 2, plant No. 2 for coke oven gas cleaning from hydrogene sulphide will be erected. Each battery will consist of 65 ovens each with volume of 32, 5 cu. m. By-product plant will consist of recovery of benzole of coke oven batteries No. 3 and 4 and construction of tar distillation plant of the batteries No. 1-4. To reduce the content of naphtalene in coke oven gas provision is made for naphtalene cleaning plant.

It is assumed that in the sixth and seventh Five-Year Plans new steel mill will be built with own coke oven plant.

All data given in forecast of production of coke are based on assumption that 1) the second and third stage of construction of Iron and Steel Mill in Esfahan will be based on own coke, i. e. the coke will not be imported from abroad and 2) there will be surplus of 78, 000 tons in the second stage and 155, 000 tons in the third stage for outside customers.

Forecast of Production of Coke

	1351 (1972/3)	1356 (1977/8)	1361 (1982/3)	1366 (1987/8)
Production of Coke-total tons	440, 000	1, 400, 000	3, 000, 000	4, 200, 000
from these in Steel Plant Esfahan tons	400, 000	1, 000, 000	2, 350, 000	2, 350, 000



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