

Feasibility Study Report

HDPE/LLDPE Production Plant

Industry: Polymers and Petrochemical
Geography Region: Iran and the World

Employer:



Kazerun Petrochemical Co.

Consultant:



SAM Market Analysis & Development

Report Code: 206-1,3
Third edition

7/2017

Management Summary

This document is an economic feasibility study report of a 300 thousand tons per year polyethylene (high density and linear low density) plant. Polyethylene is consumed in various products such as civil and industrial pipes including water, sewer and gas pipes. Linear low density polyethylene is consumed in producing packaging films and other products.



Figure 1- polyethylene granules

According to surveys and studies, 12 petrochemical companies are producing HDPE in Iran. Some of these domestic plants are using HD/LL swing technology. It should be noted that 80% of these plants actual production is considered as HDPE and 20% of actual production is considered as LLDPE. The following table estimates domestic production capacity and actual production of HDPE and LLDPE in 2015:

Table 1- HDPE domestic production capacity and actual production (NPC)

No.	Company	Product	Nominal Capacity (TMT/Y)	Actual production (TMT/Y)
1	Mahabad Petrochemical Co.	HDPE/LLDPE	300	107
2	Ilam Petrochemical Co.	HDPE	300	171
3	Amirkabir Petrochemical Co.	HDPE	140	108
		LLDPE	260	244
4	Lorestan petrochemical Co.	HDPE/LLDPE	300	187
5	Shazand Petrochemical Co.	HDPE	85	99
		LLDPE	75	74
6	Tabriz petrochemical Co.	HDPE/LLDPE	100	86
7	Mehr Petrochemical Co.	HDPE	300	290

No.	Company	Product	Nominal Capacity (TMT/Y)	Actual production (TMT/Y)
8	Jam petrochemical Co.	HDPE/LLDPE	300	313
		HDPE	300	271
9	Marun petrochemical Co.	HDPE	300	277
10	Kermanshah petrochemical Co.	HDPE	300	314
11	Arya Sasol polymer Co.	HDPE/MWPE	300	316
12	Basparan Bandar Imam Co.	HDPE	150	137
Total			3,510	2,994

*TMT/Y: thousands of metric tons per year

Thus, according to Iran mercantile exchange and imports of HDPE and LLDPE, domestic consumption is demonstrated in table below:

Table 2- HDPE & LLDPE domestic consumption (2015)

Title	Amount (TMT/Y)	
	HDPE	LLDPE
Domestic Trade	557	163
Imports	80	6
Consumption	637	169

In order to evaluate the potential export markets, neighboring and regional countries HDPE and LLDPE importation was studied. Based on HDPE and LLDPE imports volume, Iranian manufacturers current market share and political & trade relations between target country and Iran, an accessible percent of target countries market share was determined. Since Iranian manufacturers are exporting PE to Turkey and China, accessible percent of these two countries is considered lower than other target countries.

Table 3- HDPE export market estimate (Metric Tons)

No.	Country	Average Import (last three years)	Accessible Percent	Accessible Amount
1	Turkey	734,521	3	22,000
2	China	4,820,530	2	102,000
3	India	496,522	5	30,000
4	Pakistan	148,109	5	9,000
5	Malaysia	370,545	3	16,000
6	Russia	276,615	5	10,000

	Kazerun Petrochemical Co.	HD/LL production plant feasibility study report
		Management Summary

No.	Country	Average Import (last three years)	Accessible Percent	Accessible Amount
7	Egypt	148,214	0	0
8	Singapore	472,206	5	21,000
9	Vietnam	278,948	3	10,000
10	Indonesia	312,833	3	11,000
SUM				261,000

According to the conducted surveys, most of Iran's HDPE and LDPE market demand is supplied by domestic manufacturers. Meanwhile some especial grades (such as black high density polyethylene required for pipes) are imported. Few domestic companies such as Jam, Kermanshah and Maroon petrochemical companies has taken steps in this matter. Hence, some of these plants are going to go operational in next coming year. Thus, polyethylene domestic market is almost saturated and it is not rational to recommend high capacity plant for domestic market. On the other hand, there are high potential export markets available in the region. China and Turkey which imported respectively 4,820 and 734 thousands of metric tons polyethylene (HDPE & LLDPE), are the largest importers of polyethylene in the world and the region. In 2015, about 21.5 million tons of polyethylene is imported by different regions. The world's biggest polyethylene exporter is Saudi Arabia with 4.2 million tons in 2015 (United States and the UAE, are standing in second-and third place of main HDPE exporters. Iran is standing in fifth place). Thus, two main exporters of this product are located in the region and this matter is threat to potential export markets. In general, there threats and opportunities in constructing this plant that have been mentioned below:

Threat

- ✓ Saturated domestic market
- ✓ Multiple under construction plants
- ✓ Two main exporters are located in region

Opportunity

- ✓ convenient access to export markets
- ✓ Possibility of expanding exportation to foreign clients
- ✓ Multiple potential export markets
- ✓ Convenient access to feedstock

According to presented data and market growth in target export markets, it seems that establishing an export oriented plant is rational. Therefore, a 300 thousands of metric tons plant is recommended to manufacture (HD-LL) high density polyethylene and linear low density polyethylene. Since minimum recommended capacity for HD-LL is 300 thousands of metric tons, about 175 thousands of metric tons (58%) is

	Kazerun Petrochemical Co.	HD/LL production plant feasibility study report
		Management Summary

allocated to HDPE and 125 thousand of metric tons (42%) is allocated to the LLDPE. The following table shows the recommended capacity:

Table 4- Recommended capacity – (TMT/Y)

Product	Capacity	Domestic market	Export market
HDPE	175	45 (25%)	130 (75%)
LLDPE	125	30 (24%)	95 (76%)
Total	300	75 (25%)	225 (75%)

Since polyethylene domestic market is almost saturated, 75% of recommended capacity is allocated to export markets and 25% of recommended capacity is allocated to domestic market.

The following table shows a complete list of total fixed investment costs. Fixed investment costs is estimated to be 13,479,114 Million Rials: 2,617,317 Million Rials in local currency and 273 Million Euros in foreign currency.

Table 5- Total fixed investment cost


Description	Foreign currency (Thousands of Euros)	Local currency (Million Rials)	Total (Million Rials)
Land Purchasing	0	160,000	160,000
Land preparation and civil works	0	29,676	29,676
Non industrial Buildings	0	128,800	128,800
Warehouse (products and raw materials)	0	312,000	312,000
License and Engineering	18,000	0	715,140
Main equipment	13,230	0	5,213,768
Lab, Workshop and Firefighting equipment	8,422	0	334,606
Spare parts	3,009.54	0	119,569
Transportation and insurance	6,824	0	271,118
Additional costs of custom clearance	0	480,000	480,000
Bank fees	0	189,600	189,600
Construction, Installation and Commissioning	69,173	0	2,748,243
Pre operation expenditures	0	848,245	848,245
Steam generator	1,639	0	65,117
Cooling tower	1,313	3,336	55,501

Description	Foreign currency (Thousands of Euros)	Local currency (Million Rials)	Total (Million Rials)
Nitrogen generator	1346.127	0	53,482
Oxygen generator	0	0	0
Instrument air	495/846	0	19,700
Water treatment equipment & water storage tanks	7,510.194	93,257	391,637
Power plant/electricity grid connection expenditures	5,714	209,098	436,115
Industrial wastewater	1,229	0	478,828
Storage tanks	0	13,440	13,440
Harbor/Anchorage	0	0	0
Feed line	0	0	0
Gas line	4,466	8,016	185,450
Road preparation/ rail way	0	0	0
Residential buildings	0	0	0
Welfare and medical centers	0	0	0
Assets (including administrative and service equipment)	0	17,215	17,215
Contingency (5%)	13,018.585	124,634	641,863
Total fixed investment cost	273,390	2,617,317	13,479,114

Ethylene is the main raw material required for polyethylene production. The annual consumption of raw materials are shown in following table. It should be noted that ethylene purchasing price is determined by considering last four years stock prices of Iran mercantile exchange and four coming year price forecast.

Table 6- raw materials costs

No.	Raw material	Annual consumption		Unit cost		Total cost		
		Amount	Unit	Rial/kg	Cent/kg of product	Dollars	M. Rials	
1	Ethylene	290,000	Ton	20,890	0	0	6,058,071	
2	1-Butene	20,000	Ton	35,917	0	0	718,340	
3	Catalyst			0	0.9	2,700,000	0	
4	Contingency (3%)						81,000	203,902
Total						2,781,000	6,979,703	

	Kazerun Petrochemical Co.	HD/LL production plant feasibility study report
		Management Summary

As mentioned above, from 300 thousands of metric tons per year recommended capacity, 175 thousands of metric tons is allocated to HDPE and 125 thousands of metric tons is allocated LLDPE. Domestic and export sales is demonstrated in following table.

Last four years stock prices of Iran mercantile exchange and four coming year price forecast is considered to calculate sales price and domestic sales revenue. Export price is considered 5 percent more than domestic price. The next table shows plant's annual sales.

Table 7- Annual sales estimation

No.	Product	Capacity (MT/Y)	Unit price (Dollars/Ton)	Unit Price (Million Rials/Ton)	Total annual Sales (Dollars)	Total annual Sales (Million Rials)
1	HDPE-Export	130,000	1,266	-	164,580,000	5,842,590
2	HDPE-Domestic	45,000	-	43.404	0	1,953,200
3	LLDPE-Export	95,000	1,333	-	126,635,000	4,495,542
4	LLDPE-Domestic	30,000	-	45.716-	0	1,371,479
Total		300,000	---	---	---	13,662,811

The plant operation rate is considered 75% for the first year. This ratio increase to 90% in second year and will reach 100% in third year. After the third year, the plan will produce with full capacity.

Two scenarios are considered for project financing. In the first financing scenario, the plan is fully financed by shareholders in cash. The second financing scenario includes 30 percent in cash by shareholders and the remained 70 percent is provided through loans.

Scenario No. 1: 100 % by shareholders

Construction period and operation period is considered 4 and 20 years respectively in calculation of financial statement (including profit and loss and cash flow, etc.). Plan's economic indicator calculations is fully conducted by COMFAR III computer software. The results are presented as attachment. The following table represents COMFAR III results.


	Kazerun Petrochemical Co.	HD/LL production plant feasibility study report
		Management Summary

Table 8- Evaluation results

NPV (at 20.00 %)	696,781.14
IRR	20.95
MIRR	20.95
NPV (shareholders) (at 20.00 %)	696,781.14
IRRE (shareholders)	20.95
MIRR (shareholders)	20.95
NPV calculation start date	April 2017

Scenario No. 2: 30 % in cash by shareholders, 70% by loan

Construction period and operation period is considered 4 and 20 years respectively in calculation of financial statement (including profit and loss and cash flow, etc.). Plan's economic indicator calculations is fully conducted by COMFAR III computer software. The results are presented as attachment. The following table represents COMFAR III results.


Table 9- Evaluation results

NPV (at 20.00 %)	897,410.85
IRR	21.22
MIRR	21.22
NPV (shareholders) (at 20.00 %)	4,429,209.89
IRRE (shareholders)	31.67
MIRR (shareholders)	31.67
NPV calculation start date	April 2017

	Kazerun Petrochemical Co.	HD/LL production plant feasibility study report
		Abstract

Plan's First scenario Summary: 100% by shareholders

General Description	
Product	HDPE'LLDPE
Nominal Capacity	HDPE (175 thousands of tons) & LLDPE (125 thousands of tons)
Workers quantity	125 persons
Products application	Pipes, Packaging, Home appliances
Plant's Location	Kazerun (Fars Province)
Plan's consultant	SAM Market Development and Anlysis
Plan's studies date	July 2017
Market Study	
Actual domestic Production (2015)	HDPE (2,345) and LLDPE (273) thousands of tons
Domestic consumption (2015)	HDPE (637) and LLDPE (169) thousands of tons
Import (2015)	HDPE (80) and LLDPE (5.7) thousands of tons
Export (2015)	HDPE (1,405) and LLDPE (22.8) thousands of tons
Sales price	Export HDPE (1,101 Dollars per Ton) Domestic HDPE (37,743 Rials per Ton) Export LLDPE (1,159 Dollars per Ton) Domestic LLDPE (39,753 Dollars per Ton)
Plan's Technology Study	
Land	20 Hectare
Licensor	Basell - Germany
Raw Material	Ethylene (290,000 Tons/Y) & 1-Butene (20,000 Tons/Y)
Raw Material Supply Origins	Domestic-Import
Water	2,890,800 cubic meters/Year
Electricity	195,000,000 kWh
Steam	80,400 Tons
Inert Gas	14,250,000 Normal Cubic Meters
Instrument Air	9,570,000 Normal Cubic Meters
Fuel	67,320,000
Plan's Economical and financial study	
Construction period	4 Years
Project Horizon	20 Years
Construction Start Date	April 2017
Operation Start Date	April 2021
Dollar's Exchange Rate	35,500 Rials
Euro's Exchange Rate	39,730 Rials
Project's Discount Rate	20%
Shareholder's discount Rate	20%
Loan Interest	---
Operation Rate	75% (first Year), 90% (Second Year), 100% (after second Year)
Fixed Capital	2,617,317 Million Rials, 273 Millions of Euros
Working Capital	237,621 Million Rials
Total Investment	13,716,735 Million Rials
Annual Sale	13,662,811 Million Rials
IRR	20.95 %


	Kazerun Petrochemical Co.	HD/LL production plant feasibility study report
		Abstract

IRRE	20.95 %
First Year BEP	49.47%
Third Year BEP	37.13%
NPV	696,781 Million Rials
NPV (Shareholders)	696,781 Million Rials
Payback Period	3.26 Years
Financing	100% by Shareholders

	Kazerun Petrochemical Co.	HD/LL production plant feasibility study report
		Abstract

Plan's Second scenario Summary: 30% by shareholders and 70% by Loan

General Description	
Product	HDPE'LLDPE
Nominal Capacity	HDPE (175 thousands of tons) & LLDPE (125 thousands of tons)
Workers quantity	125 persons
Products application	Pipes, Packaging, Home appliances
Plant's Location	Kazerun (Fars Province)
Plan's consultant	SAM Market Development and Anlysis
Plan's studies date	July 2017
Market Study	
Actual domestic Production (2015)	HDPE (2,345) and LLDPE (273) thousands of tons
Domestic consumption (2015)	HDPE (637) and LLDPE (169) thousands of tons
Import (2015)	HDPE (80) and LLDPE (5.7) thousands of tons
Export (2015)	HDPE (1,405) and LLDPE (22.8) thousands of tons
Sales price	Export HDPE (1,101 Dollars per Ton) Domestic HDPE (37,743 Rials per Ton) Export LLDPE (1,159 Dollars per Ton) Domestic LLDPE (39,753 Dollars per Ton)
Plan's Technology Study	
Land	20 Hectare
Licensor	Basell - Germany
Raw Material	Ethylene (290,000 Tons/Y) & 1-Butene (20,000 Tons/Y)
Raw Material Supply Origins	Domestic-Import
Water	2,890,800 cubic meters/Year
Electricity	195,000,000 kWh
Steam	80,400 Tons
Inert Gas	14,250,000 Normal Cubic Meters
Instrument Air	9,570,000 Normal Cubic Meters
Fuel	67,320,000
Plan's Economical and financial study	
Construction period	4 Years
Project Horizon	20 Years
Construction Start Date	April 2017
Operation Start Date	April 2021
Dollar's Exchange Rate	35,500 Rials
Euro's Exchange Rate	39,730 Rials
Project's Discount Rate	20%
Shareholder's Discount rate	20%
Loan Interest	Domestic Loan (18%), Foreign Loan (8%)
Operation Rate	75% (first Year), 90% (Second Year), 100% (after second Year)
Fixed Capital	2,617,317 Million Rials, 273 Millions of Euros
Working Capital	237,621 Million Rials
Total Investment	13,716,735 Million Rials
Annual Sale	13,662,811 Million Rials
IRR	21.22 %

	Kazerun Petrochemical Co.	HD/LL production plant feasibility study report
		Abstract

IRRE	31.67 %
First Year BEP	49.47%
Third Year BEP	37.13%
NPV	897,410 Million Rials
NPV (Shareholders)	4,429,209 Million Rials
Payback Period	3.18 Years
Financing	30% by shareholders and 70% by Loan