



**General** Catalogue  
Ver 1.0



# Kangan Polymer Development Company

The background of the slide features a series of concentric circles in a light gray color, centered on the left side. Overlaid on these circles are several thin, parallel diagonal lines that sweep across the entire frame from the bottom left towards the top right.

# **Introduction of the PDH-PP Plant**





KPDC  
PDH-PP Plant









# Feasibility Study PDH-PP



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# Introduction

JAM Petrochemical Company (JPC) is one of the largest producers of petrochemicals products in Iran. Due to having huge resources of propane, Iran has a special advantage in the production of propylene and its wide chain. Therefore, JPC plans to develop its portfolio in the Polypropylene value chain by implementing its phase III strategic development plan via the management of its 100% subsidiary,  
**Kangan Polymer Development Company (KPDC).**



# ***Project Summary***

## **Plant**

PDH/PP/U-O

## **Client**

Kangan Polymer Development Company (KPDC)

## **Location**

Pars Special Economic Zone 2, Bushehr province, Iran

## **Assigned Land**

49.5 ha

## **License**

1. PDH Plant: UOP-Honeywell
2. PP Plant: BASEL Technology

## **Plant Capacity**

1. PDH: 600kta / PP: 300kta
2. Excess propylene to be finalized based on feasibility study.
3. Utility/Offsite according to process unit requirement.

## **Contractual Strategy**

1. Process units (PDH/PP): EPCC + F
2. Utility/Offsite: Basic Design + EPCC

## **Cost Estimate**

1092 million euros

## **Employment**

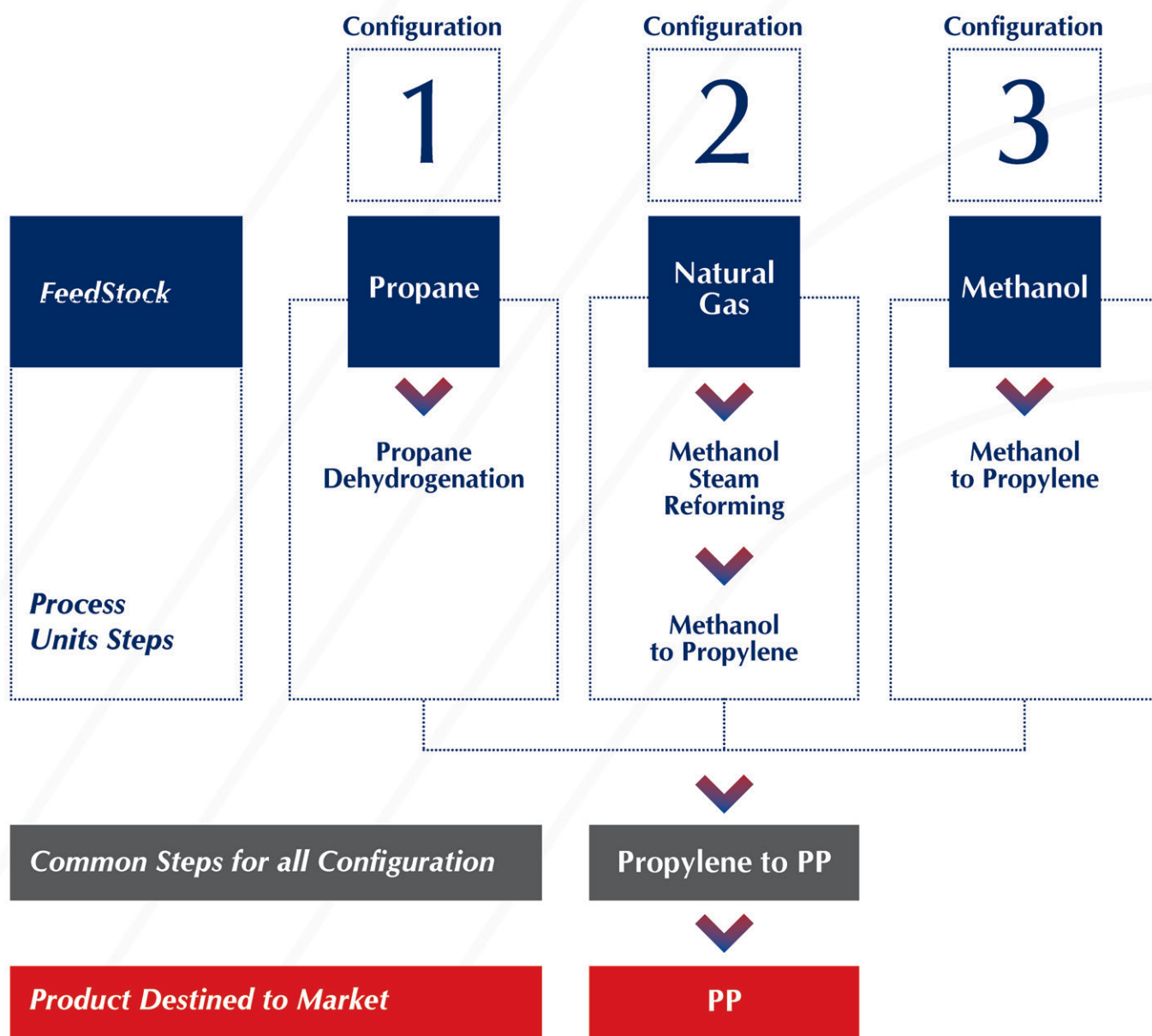
500 people directly

## **Duration**

57 months

# Introduction

Nexant® is retained by JPC  
to conduct a feasibility study of the following on purpose propylene routes:





By reviewing the feedstock, product markets, pricing analysis and available technologies, Nexant® proposed the **PDH** to polypropylene (**PDH-PP**) as the most attractive route to consider for the project.

Nexant provided a technology review to JPC. The review compared the UOP Oleflex® technology and the ThyssenKrupp STAR® technology. The utility cost, track records and risk related to scale-up is considered. Based on the Nexant report, JPC purchased the **UOP Oleflex® schedule A technology**.

## ***Project Advantages***

- Valid permits to carry on the project
- Valid propane feed contract with NIGC
- Independent utility strategy for the plant
- Valid license and construction technology and available lean basic engineering documents
- Available JPC corporate guarantee
- Potential foreign finance through JPC product export income
- Vicinity to sea which facilitates sea export
- Tax waivers due to free zone regulations



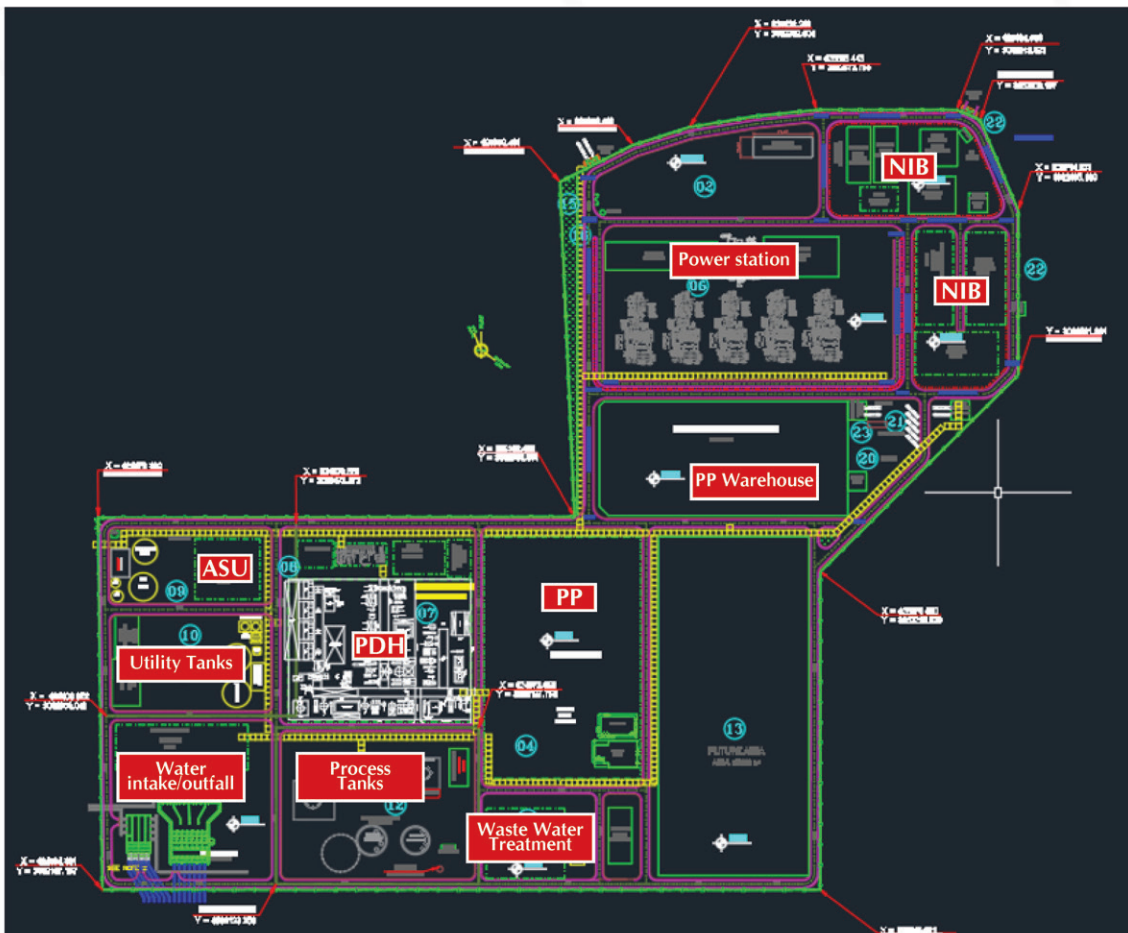




Pars Special Economic Energy Zone,  
Kangan, IRAN

49.5 ha  
Total KPDC Plant LAND

## Overall Plot Plan

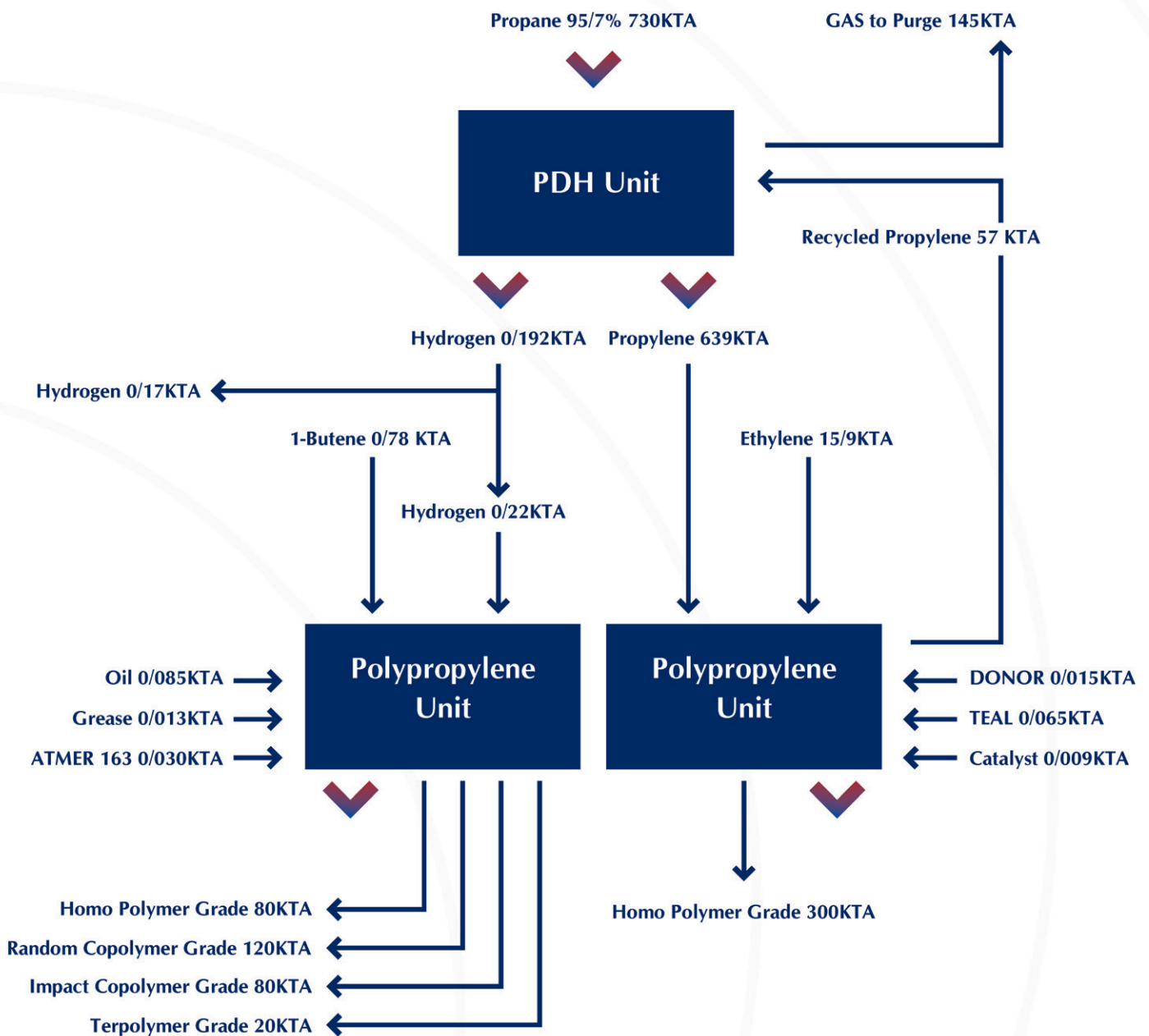




## Production Process

Propane feed\* is sent to the 600kta propylene production unit (PDH). The product is then guided towards the polymerization units with a capacity of 300kta each. Due to the greater demand for homopolymer grade productions, production of 380 KTA copolymers, 120 KTA random copolymers and 80 KTA impact copolymers and 20 KTA terpolymers is considered. As claimed by technical studies, selected technology (Uop's Oleflex™) to produce each ton of polymer grade propylene requires 1.19 tons of propane with 95.7% purity as feedstock, which means that feed-to-product conversion ratio in this technology Equivalent to 1.14 (based on 100% purity of propane).

# Simplified block flow diagram



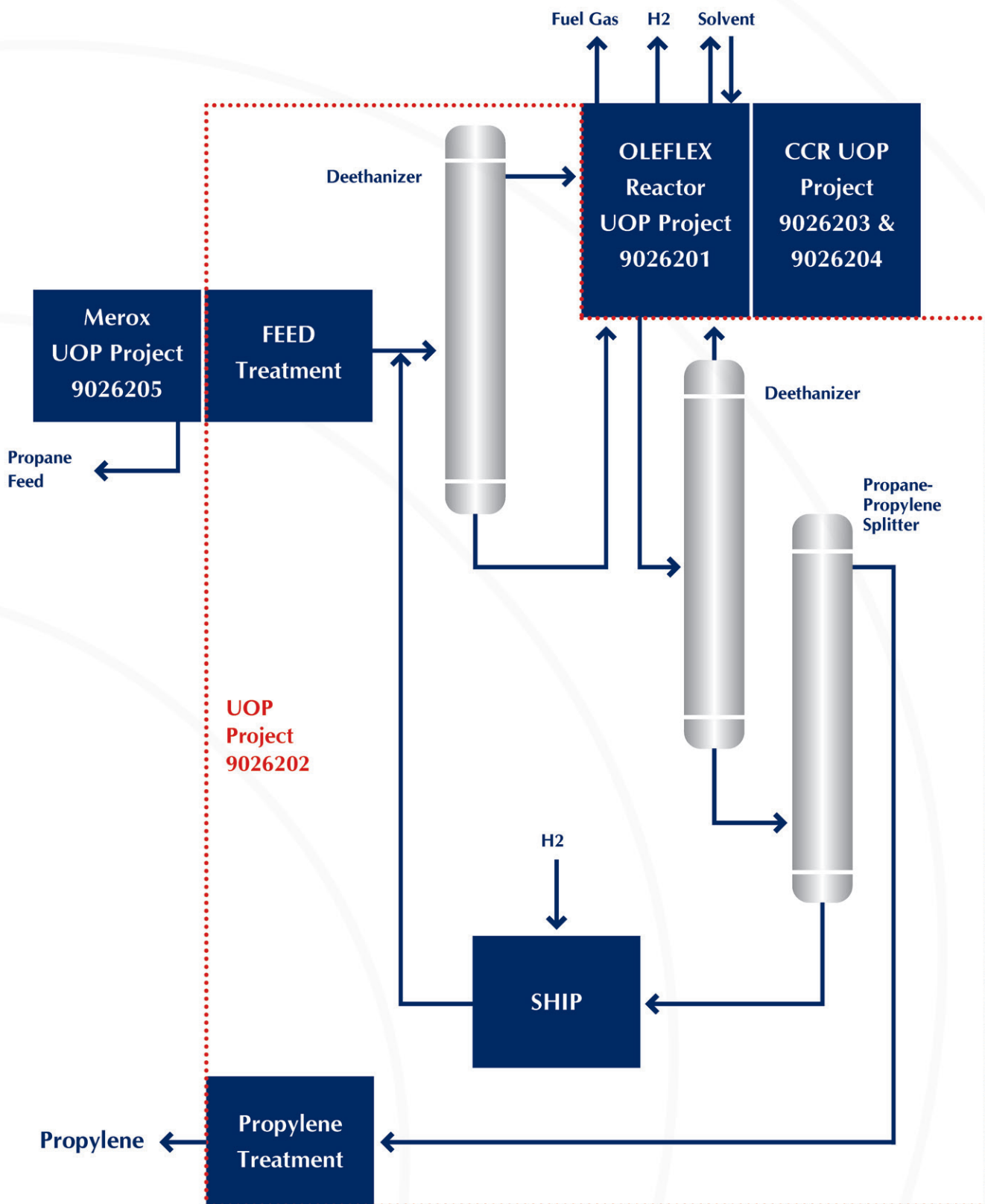


# Production Process

JAM Petrochemical intends to install the Plant comprising of the Oleflex Unit and Huels SHP Unit to produce 600,000 Metric Tons per year (MT/yr) of 99.5 vol-% propylene by the catalytic dehydrogenation of propane in Kangan, Islamic Republic of Iran.

The Oleflex<sup>TM</sup> Process selectively dehydrogenates propane to propylene using platinum on alumina catalyst. The reactions occur in the vapor phase. Oleflex reactors operate at low pressure and high temperature. High conversion and good selectivity in the reactors is maintained by a continuous circulation of catalyst allowing coked catalyst to circulate out of the reactors to the Regeneration Tower where coke is burned and catalyst is regenerated. The Oleflex vapor phase reactor effluent is compressed and the C<sub>2</sub>+ hydrocarbons are condensed within the Separation System. Liquid production is pumped to the Fractionation Section where fractionation columns segregate the hydrocarbons to produce a high purity propylene stream and a propane stream that is recycled back to the Oleflex Reaction Section.

The propane recycle is processed in a Selective Hydrogenation Process (SHP) reactor which saturates dienes that were produced as side reactions in Oleflex reactor back to their respective olefin before being mixed with fresh treated feed and fractionated in the Depropanzier.



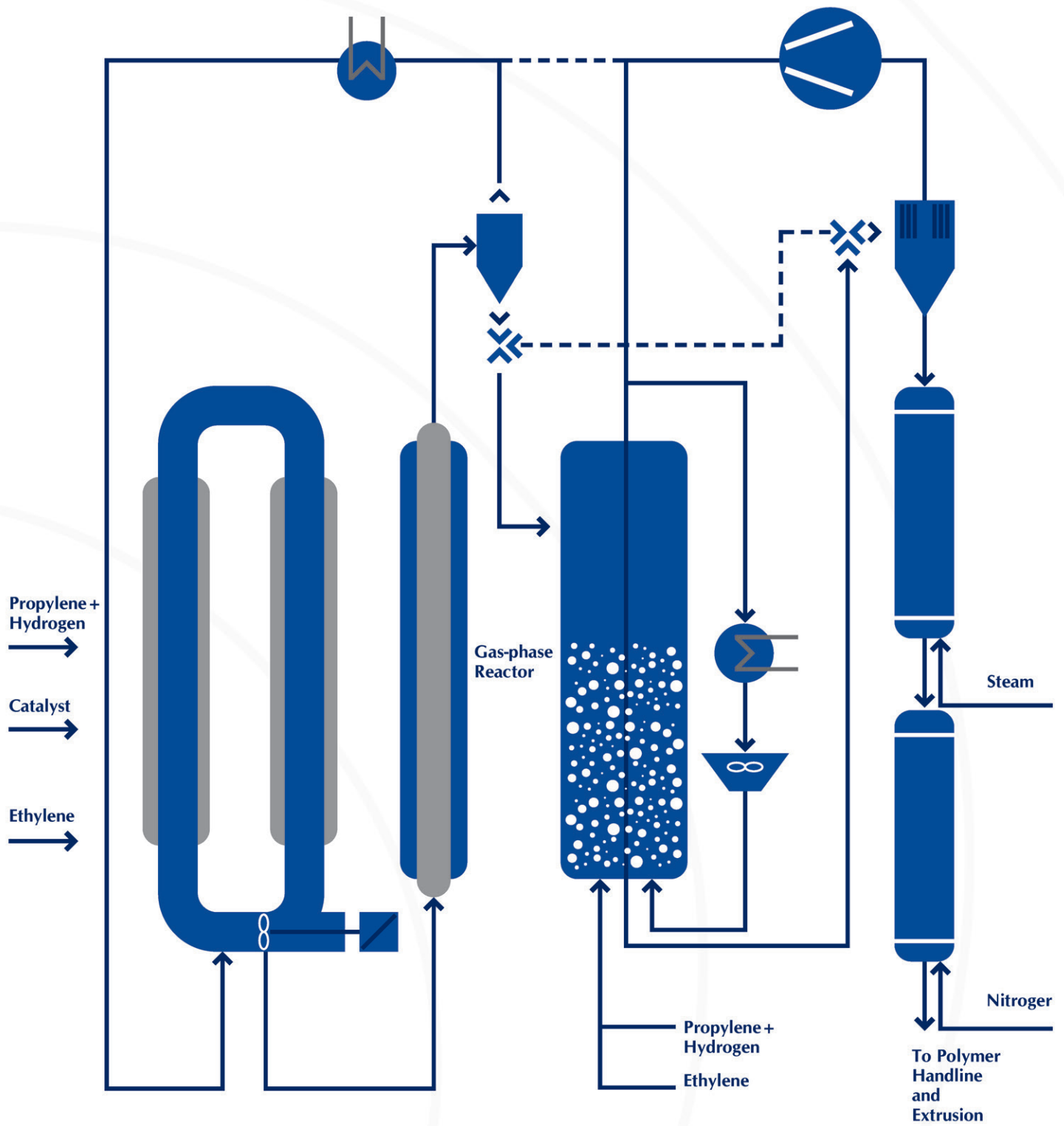
## *PP Process Description Based on Basell Spheripol Technology*

The Spheripol process is a modular technology consisting of three main process steps:

- Catalyst and raw material feeding,
- Polymerization and
- finishing

The catalyst, liquid propylene and hydrogen for molecular weight control are continuously fed into the loop reactor. The bulk polymerization typically occurs in two tubular loop reactors filled with liquid propylene and optional gas-phase copolymerization reactors. Reduced reactor residence time and economically optimized equipment sizing can be achieved relative to other technologies due to the high monomer density and increased catalyst activity. The finishing section consists of highly efficient liquid propylene vaporization operations at very high polypropylene concentrations, separation of the unconverted monomers, and complete recycling of the monomers back to the reactor.





# CAPEX

Description	Total Costs (Thousand Euros)
Land	9,033
Landscaping	16,110
License	17,500
Basic Engineering	8,400
Process Units	566,600
Catalyst	31,600
General facilities	376,077
vehicles	900
Supervision (Project MC)	11,000
Contingencies	26,600
<b>Total fixed Assets</b>	<b>1,063,821</b>
Pre-production Costs(net of interest)	5,180
<b>Total</b>	<b>1,069,001</b>
Interest Before Repayment	80,772
<b>Total fixed investment costs</b>	<b>1,149,773</b>
<b>Working Capital</b>	<b>54,655</b>
<b>Total investment costs</b>	<b>1,204,428</b>



<b>Description</b>	<b>Duration Day</b>	<b>2026</b>	<b>2027</b>	<b>2028</b>	<b>2029</b>		<b>2045</b>
Propane	2	1,150	1,286	1,353	1,353		1,353
oleflex Catalyst	360	0	0	0	26,821		26,821
SHP Catalyst	360	0	0	0	0		934
PP Catalyst	360	1,214	1,214	1,214	1,214		1,214
Additives & Stabilizers	90	1	2	2	2		2
Other Raw material s	14	356	398	419	4 19		419
Packaging materials	30	71	79	83	83		83
Spare patts	180	3,580	4,001	4,212	4,212		4,212
Inventory	1	727	811	854	928		854
Produced commodity	3	2,184	2,437	2,564	2,788		2,564
Accounts Receivable	15	11,013	12,292	12,932	14,049		12,932
Revolving fund	30	2,804	3,113	3,268	3,268		3,268
Working capital		23,099	25,633	26,900	55,137		54,6550
Increase in working capital		23,099	2,534	1,267	28,237		0
<b>Total working capital</b>							<b>54,6550</b>

# OPEX

## Utility Consumption

Electricity	732,000,000	KWh	Product in unit
Cooling Water makeuo	639,408,000	m3	
Instrument air	19,600,000		
Unit air	1,600,000		
Nitrogen	24,000,000		
HP Steam	1,819,200	ton	
MP Steam	480,000		
LP steam	240,000		
Natural Gas	402,930,000	m3	0,009 Euro/m3
DMwater	3,336,000		Product in Unit
service water	32,000		
Potable water	31,350		
Sea water	1,040,000,000		



Description	Operation Period					2045
	2026	2027	2028	2029		
Propane	207,036	231,393	243,572	243,572		243,572
Catalyst	1,214	1,214	1,214	28,035		1,214
Additives & Stabilizers	5	6	6	6		6
Other Raw materials	9,153	10,230	10,768	10,768		10,768
Packaging materials	850	950	1,000	1,000		1,000
Insurance	1,677	1,677	1,677	1,677		1,677
Auxiliary services	2,968	3,317	3,492	3,492		3,492
Maintenance	28,633	32,001	33,686	33,686		33,686
Spare parts	7,160	8,002	8,423	8,423		8,423
salary	1,084	1,212	1,275	1,275		1,275
Miscellaneous and contingencies	1,859	2,077	2,187	2,187		2,187
<b>Production Costs</b>	<b>261,639</b>	<b>292,080</b>	<b>307,300</b>	<b>334,122</b>		<b>307,300</b>
Organizational & Administrative Costs	395	395	395	395		395
<b>Operating Costs</b>	<b>262,033</b>	<b>292,474</b>	<b>307,695</b>	<b>334,516</b>		<b>307,695</b>
Depreciation	72,557	72,557	72,557	72,557		0
Financial costs	97,944	82,063	66,718	48,842		0
<b>Total Production Cost</b>	<b>432,534</b>	<b>447,094</b>	<b>446,969</b>	<b>455,915</b>		<b>307,695</b>
Direct Marketing costs	2,267	2,533	2,667	2,667		2,667
<b>Costs of Product</b>	<b>434,801</b>	<b>449,628</b>	<b>449,636</b>	<b>458,582</b>		<b>310,361</b>

in thousand euros

# Revenue

Description	Nominal sales (ton/year)	Unit price (Euro/ton)	Sales Revenue (Thousand Euros)
PP homopolymer	380,000	872	331,170
PP Random copolymer	120,000	915	109,809
PP Impact copolymer	80,000	915	73,206
PP TerPolymer	20,000	943	18,851
<b>Total</b>			<b>533,036</b>

The price of PP grades has been determined by inquiring from the National Petrochemical company as the FOB price of the Persian Gulf in an average of 8 years (3 years ago and forecast for the next 5 years) and the price of surplus power is based on Mobin petrochemical company financial statements.

Description	Operation Period				2024
	2026	2027	2028	2029	
Operating Rate (%)	85%	95%	100%	100%	100%
Selling Rate (%)	84%	94%	99%	99%	99%
Revenue from the sale of products	449,336	502,199	528,630	528,630	528,630
Sales Revenue	449,336	502,199	528,630	528,630	528,630

# Profit (Loss)

Description	Operation Period					2045
	2026	2027	2028	2029		
Sales Revenue	459,275	512,159	538,590	538,590		538,590
Less variable and fixed costs	336,857	367,565	382,918	409,740		310,361
Operationa l Margin	122,418	144,594	155,672	128,851		228,229
Less Financial Costs	97,944	82,063	66,718	48,842		0
	24,474	62,531	88,954	80,009		228,229
Income Tax	0	0	0	0		57,057
Net Profit	24,474	62,531	88,954	80,009		171,172
Equity Capital Refund	0	0	0	0		17,117
	24,474	62,531	88,954	80,009		154,054
	24,474	87,005	175,960	255,968		2,419,649

(in thousand euros)

By implementation of the plant in the Kangan Free Zone, the tax exemption will be 10 years from the first year of operation and then is calculated at a rate of 25%.



# Financial Analysis

Financial Resources	<b>Total Investment</b>	<b>Thousand Euros</b>	<b>1,204,428</b>
	Equity Capital Public share of	Thousand Euros	165,391
	project Pre-sale of products	Thousand Euros	219,126
	Foreign loan- bank	Thousand Euros	219,126
	local loan bank	Thousand Euros	154,997
	Facilities through participation	Thousand Euros	26,761
	bonds Profit during the	Thousand Euros	283,288
	partnership	Thousand Euros	80,772
	Working capital	Thousand Euros	54,655
Financial Results	<b>Total</b>	<b>Thousand Euros</b>	<b>1,204,428</b>
	NPV (discounting rate 15%)	Thousand Euros	400,654
	<b>Internal Rate of Return (IRR)</b>	%	<b>15.53%</b>
	Payback Period since startup	Year	6.6
	<b>Internal Rate of Return on Equity (IRRE)</b>	%	<b>17.97%</b>
	Return of Equity (ROE) since Start-up	Year	5.9
	Break Even Point (in 3th year of operation)	%	35.6%
	Construction Period	Month	36

# Sensitivity Analysis

The sensitivity analysis of the **IRR index** is as follows:

Variation (%)	Sales revenue	Increase in fixed assets	Increase in fixed assets
-20%	% 6.57	% 19.55	% 19.55
-16%	% 8.50	% 18.62	% 18.62
-12%	% 10.36	% 17.76	% 17.76
-8%	% 12.14	% 16.97	% 16.97
-4%	% 13.86	% 16.22	% 16.22
0%	% 15.53	% 15.53	% 15.53
4%	% 17.16	% 14.88	% 14.88
8%	% 18.74	% 14.27	% 14.27
12%	% 20.29	% 13.70	% 13.70
16%	% 21.80	% 13.16	% 13.16
20%	% 23.28	% 12.65	% 12.65

According to the above table, IRR has a high sensitivity to sales revenue, if the sale prices vary from 0 to 20 percent, the IRR will increase from 15.53% to 23.28%. On the other hand, the IRR is sensitive to operating costs, if operating costs vary from 0 to -20 percent, IRR rises from 15.53% to 20.14%. The least sensitivity of the project is to increase in fixed assets.

# Financial Analysis

The sensitivity analysis of the **NPV** and **NPVE** indexes are as follows. NPV and NPVE indexes are calculated at a discounting rate of 10% and 20 years operation period.

Discounting Rate (%)	NPV	NPVE
0%	2,994,585	2,696,074
10%	400,654	393,830
20%	-159,314	-44,256.06
30%	-298,821	-140,730
40%	-324,002	-156,830
50%	-313,255	-151,307
60%	-291,272	-140,171
70%	-266,833	-128,298
80%	-243,196	-117,200
90%	-221,505	-107,274
100%	-202,049.91	-98,536

(Thousand Euro)



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