

# Modernization of Libyan Oil Refineries and Petrochemical Plants



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## **Libyan refineries Capacities and Types**

Refinery	Capacity	Starting	Туре
	bbl/day	Date	
LERCO	220,000	1985	Topping
AZZAWIYA	120,000	1974	Hydro skimming
TOBRUK	20,000	1986	Topping
SARIR	10,000	1988	Hydro skimming
BREGA	10,000	1962	Hydro skimming

### **Total Capacity = 380 kbbl/day**



### **Production / Demand Comparison k t/y -2010**

Product	Production	Domestic / Demand	Surplus/ Deficit(-)
LPG	203	326	(123)
Gasoline	770	2,907	(2137)
Jet	1,876	588	1288
Diesel	4,163	5,059	(896)
HFO	6,719	2,653	4066

## **Total Production** = 13,731 k t/y



## Certain Libyan and EU Gasoline Specifications

Parameter	Libyan Spec.	EU Spec.
RON	95 min	95 min
Sulphur, ppm	<b>150</b> max	10 max
Olefins, vol. %	-	18 max
Aromatics, vol. %	-	35 % max
Benzene, vol.%	<b>4 %</b> max	1 % max
Oxygen, wt %	2.7 max	2.7 max



### Certain Libyan and EU *Diesel* Specifications

Parameter	Libyan Spec.	EU Spec.
Cetane index	50 min	46 min
Sulphur, ppm	<b>800</b> max	10 max
Flash point, <sup>0</sup> C	60 min	55 min
Aromatic, wt %	11% max	11% max
Density @ 15 °C kg/m <sup>2</sup>	Reported	820 - 845



## **Challenges Facing Libyan Oil Refineries**

Simple Configuration
Limitted Capacity
Products Specification

Libyan Petrochemical industries are limited in

- Capacity,
- Conversion units



### Why do we need to upgrade our refineries?

### -Market Factors

- . Increase in the production of transportation fuel
  - . Residue with high sulfur becoming more limited
    - . Tighter bunker fuel regulations
- -Economic Incentives
  - . Lower cost of fuel oil
  - . Increase yields of high value products

-Environmental

- . Products Specifications
- . Refinery Emissions



### What will Happened to Small Refineries?

-Because of their small size the costs on per liter basis would be higher. Therefore the existing small refineries in the country maybe upgraded with limited capital investment in order to satisfy the local demand for the area.



### **Petrochemicals**

# **RAS Lanuf Complex**1. Ethylene Plant

2. Polyethylene Plant

### Marsa Brega

- 1. Ammonia Plants -
- 2. Urea Plants\_\_\_\_\_
- 3. Methanol Plants





### **Petrochemicals at Raslanuf**

Feed (Naphtha)	<b>1200 KT/ YEAR</b>	
Product	Capacity (KT/Y) Start Date	
•ETHYLENE	330	
•PROPYLENE	170	——————————————————————————————————————
•MIXED C <sub>4</sub>	130	
•PY.GASOLINE	324	
•HDPE	80	<b>Aux</b> 1009
•LLDPE	80	Aug.1998



### **Petrochemicals at Mersa Brega**

Feed (Nat.Gas)		190 MMSCF/ DAY
Product	Capacity (T/D)	Start Date
•Ammonia -1	1200	1978
•Ammonia -2	1000	1982
•Urea - 1	1000	1981
•Urea - 2	1750	1983
•Methanol - 1	1000	1977
•Methanol - 2	1000	1985

### **Refining & Petrochemicals Integration** Drivers for Refining and Petrochemical Integration

- -Integrated refinery and petrochemical operations minimize costs and optimize product distribution
- -Optimized integration of hydrocarbon processes, energy, hydrogen, and water
- -Feedstock flexibility to capitalize on available low cost crude oils and intermediates
- -Supply chain optimization provides faster delivery of products
- -More flexibility in reprocessing , storing and transporting off specification products
- -More outlets for high-value products

## **Refinery-Petrochemical Interface**

Refinery Stream	Petrochemical	Alternative use for Refinery Stream
FCC offgas FCC Olefine Reformate Naphtha Gas oil LPG FCC Ethylene FCC Propylene FCC Butylene Kerosene FCC LCO	Ethylene Propylene, Butylenes BTX Olefins Olefins Olefins EB/ SM Polypropylene/ Cumene MEK, MTBE N-Paraffins Naphthalene	Fuel Gas Alkylation Gasoline Blending Gasoline Diesel Domestic Heating or cooking fuel Fuel gas Alkylation Alkylation Jet Fuel Diesel heating oil blendstock after
		hydrotreating

# <u>NOC New Strategic Plan for the Development and Upgrading</u> <u>the Existing Refineries and Petrochemical Plants</u> <u>Objectives</u>:

#### The main objectives of the strategic plan are:

Enhances and develop the down stream sector (refineries, petrochemical) through upgrading the existing refineries and petrochemical plants and/or building new refineries and petrochemical plants with economic capacity. In addition, the proposed plan should consider the possibility of integration between refineries and petrochemical industries. The strategic plan should fulfill the following:



Achieving maximum refining, gas and petrochemical margins by increasing value to the barrel of oil.

ecurity of supply of oil products and export the rest to the

international markets.

-Meeting the international market specifications and environmental regulations.

-Developing the human resources skills, teamwork and zero tolerance with respect to health, safety and environmental compliance.

- -Improving cost and operational efficiencies.
- Creating investment opportunity in the country.
- -Creating job opportunities for Libyan.
- -Facilitating the country's industrialization process.

and upgrading the existing refineries and petrochemical industries. This scenario also will include building new refinery (Hydroskiming Type) in the south of Libya with total capacity around 30 kbpd. This scenario consist of:

1. Upgrading Zawia oil refinery to refine 150 kbpd instead of 120 kbpd using Sharara-Hamada blend as a feedstock. The Main units that will be added are:

Pre-flash drum, Isomerization ,CCR, RFCC, Dimerization and Sulfur recovery unit.

### Products Pattern of Zawia Refinery after Development k t/y

Product Name	Current	Planned
LPG	70	173.8
Naphtha	618	-
Gasoline	853	3119.4
Kerosene	1019	828.8
Diesel	1338	1492.3
Fuel oil	1254	-
Slurry oil	-	156.8
LCO	-	399.0

2. Development and upgrading of LERCO Refinery by increasing the existing capacity to 380 kbpd. Different configuration schemes are considered by LERCO.

Development the existing ethylene plant at Ras Lanuf.

- 3. Upgrading Tobruk refinery by increasing the capacity to 30 kbpd. -NHTD and CCR
- 4. Building Grass root Refinery (Hydro-skimming) with design capacity 30 kbpd in the south of Libya.

5. Sarir and Brega Refineries are remained unchanged . The total crude oil to be processed according to this scenario is around 610 kbpd. Second Scenario: This scenario is based on widen the petrochemical industries through building two petrochemical complexes with economic capacity. In addition, new grass root refineries with high throughput are also considered in this scenario. Condensates and naphtha will be used as feedstock to the petrochemical industries. This scenario consist of :

1. Building grass root refinery with design capacity 300kb/d as well as petrochemical complex at the west of Libya. The naphtha from this refinery and the condensate from Mellita complex will be used as feedstock to the petrochemical.

The proposed configuration of the refinery is : CDU, CCR, RFCC, Hydrotreating unit, Alkylation, sulphur recovery unit . In addition, first, second generation of petrochemical products are considered in this scenario .

### Products Pattern of Zawia Refinery after Development k t/y

Product Name	Planned
LPG	310.5
Naphtha	3777.7
Gasoline	2585.1
Kerosene	1919.3
Diesel	3452.4
Fuel oil	-
Slurry oil	332.5
LCO	569.4
Propylene	508.9

 Building grass root refinery with design capacity around 300kbpd and a petrochemical complex at the east of Libya.
New small refinery (Hydroskimming) with design capacity nearly 30 kbpd at south of Libya is considered in this scenario.
Development and upgrading of LERCO Refinery by increasing the existing capacity to 380 kbpd. Different configuration schemes are considered by LERCO.

5. Sarir and Brega Refineries are remained unchanged

The total crude to be processed according to this scenario is around 1050 kbpd.



## **Conclusions**

1- The configuration of Libyan refineries are simple and the capacities are limited. As a result of this the processing cost per barrel is higher which affects negatively on the margin of the refineries. In addition, the local demand from fuels can not be met. Also Libyan specification particularly of transportation fuels are away from international specifications. Therefore expansion and upgrading of the existing refineries are necessary.

2- The petrochemical plants in Libya are limited in capacity and producing only primary petrochemical products. So, the expansion of this industry is important.

**3.** Two different scenarios are considered in the master plan. Upgrading and development of the existing refineries and petrochemical plants are considered in the first scenario with total crude oil processing capacity about 610 kbpd. The second scenario is based on widen the petrochemical industries through building two petrochemical complexes with economic capacity. In addition, new grass root refineries with high throughput are also considered in this scenario. Condensates and naphtha will be used as feedstock to the petrochemical industries.



# Thank you

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