Future Challenges and Needs of the Refining Industry

MERTC

23rd – 24th January, 2017

Manama, Kingdom of Bahrain

Dr. Dawood Nassif

Board Director, BAPCO

D. Nassif  MRTC, January, 2017
Refiner’s Challenges
Key challenges for Refiners

- Crude and Product pricing
- Sustain long-term profitability in uncertain market conditions
- Lower operating costs
- Change in Product Specifications
- Agility and flexibility to adapt to the latest technologies
- Meet environmental regulations and future policy changes
- Availability of skilled manpower for project implementation and operations
Refinery Competitiveness is driven by the following parameters:

**PARAMETER** | **KEY OBJECTIVES**
--- | ---
Size | Capture economies of scale
Complexity | Upgrade low value products
Location | Access to local, deficit markets
Integration | Synergies with adjacent facilities e.g. feedstocks, power, petrochemicals
Factors affecting Refining Margins

- Asia and the Middle East will continue to lead world demand growth for refined products.

- Product demand growth in the most developed markets over the medium to long term will be dampened by measures to improve vehicle efficiencies and control of green house gas emissions.

- Ongoing refining capacity developments are expected to be located in the Middle East and Asia.

- Investment in new refining capacity has slowed in most regions.

- Increases in US crude oil production will provide cost-advantaged crude oil supplies.

- Additional refining capacities in the Middle East and upgrading of Russian refineries will increase pressure on European refineries.

- Increased production of biofuels will reduce demand for gasoline.
Industry Outlook
Petroleum Product Demand Outlook

- Total global demand for refined products in 2030 is projected to be 42 percent above 2010 levels.
- Diesel/gas oil demand will grow the most.
- Incremental Global Oil Product Demand, 2010-2030 (million barrels per day)
Diesel/Gas Oil Demand Outlook

- Global diesel/gas oil demand is forecast to grow 2.2%/year, increasing to over 13 MMBPD by 2030
- Asia will have the strongest growth (3.1%/year)
- Incremental Global Diesel/Gas Oil Product Demand, 2010-2030 (million barrels per day)
Gasoline Demand Outlook

- Global gasoline demand is forecast to grow at an average rate of 1.3%/year, increasing to over 6 MMBPD by 2030
- More ethanol use will dampen increased demand for petroleum-derived gasoline
- Incremental Global Gasoline Demand, 2010-2030 (million barrels per day)
Fuel Oil Demand Outlook

- Global residual fuel oil demand is forecast to grow by less than 1 MMBPD or 0.5%/year
- Essentially flat demand will put continued pressure on fuel oil pricing
- Incremental Global Fuel Oil Product Demand, 2010-2030 (million barrels per day)
Middle East Trends
Middle East Demand Growth

- Middle East refined product demand growth is above global averages; will be up 4+ MMBPD (2.8% per year)

- Major refined product production is expected to increase nearly 5 MMBPD, reflecting the surge in project development that is taking place in the region

- Middle East will continue to be a net exporter of diesel and other middle distillates, but is expected to shift from being a net importer of gasoline to a net exporter.

  However, the region’s future gasoline trade position is heavily dependent upon developments in Iran, and thus is subject to considerable uncertainty.

- The region is proceeding with very large scale investment in both refining and petrochemicals driven by ambitions to diversify economies.
Factors that can affect future growth of refining industry in the GCC region:

- Market share of exports of refined products
- Internal demand for fuels
- Other competing national initiatives
Bahrain National Outlook
Stakeholder’s Vision

• To balance economic growth objectives, domestic industrialization and crude oil sales.

• Sustained profitability of one of Bahrain’s leading contributors to the GDP, in light of rapidly evolving global business scenario.

• Enhancement of Bahrain’s image in the world as a business friendly nation that is developing at a healthy rate.

• Technical training of Bahrainis and their employment in local industries

• Meet and exceed the requirements of all environmental regulations
Bapco Modernization Program (BMP)
An Introduction to Bapco

• The Bahrain Petroleum Company (Bapco) is wholly owned by the Government of Bahrain. The Bapco Refinery was established in 1936 and over the years, it has seen numerous expansions and modifications in response to changing market requirements and product needs.

• The Bapco Refinery – the first in the Gulf – refines over 260,000 barrels of crude every day.

• The Bapco Refinery produces a full range of products, with the most valuable products being middle distillates which constitute about 58% of the refinery production.

• We have now embarked on the Bapco Modernization Program (BMP).
Bapco’s History and Evolution

1929
- BAPCO established by Standard Oil Company of California

1932
- The Bahrain Refinery is inaugurated – with a capacity of 10,000 barrels per day

1936
- Bahrain Refinery expansion program completed with 250,000 b-day capacity

1945
- Original A-B pipeline laid between Bahrain and Saudi Arabia.

1968
- Start-up of Ultra Low Sulphur Diesel Complex – 75 years after first oil discovery

2004
- Inauguration of Ultra Low Sulphur Diesel Production Project (USD1.1 billion)

2007
- Inauguration of joint venture Lube Base Oil Plant (USD430 million)

2011
- Inauguration of Waste Water Treatment Plant at a cost of USD120 million

2013
- Inauguration of Bapco Lubricants

2014
- First oil discovery in the Arabian Gulf: Well #1 in Bahrain

D. Nassif  MRTC, January, 2017
Driven by the aspiration to remain competitive and continue its traditional role as a key contributor to the national economy, Bapco launched its ambitious Bapco Modernization Program (BMP) that would place it amongst the most competitive and profitable refineries in the region beyond 2020. BMP’s objectives are:

- **Refinery Configuration and Gross Margin** – A modernized Refinery configuration that allows for higher throughput, improves the product slate and increases gross margin with the objective of remaining competitive under a wide range of prices and market scenarios.

- **Energy Efficiency** – Improve energy efficiency and lower the Energy Intensity Index (EII) of the Refinery by installing new energy-efficient process units.

- **Environmental Compliance** – All new units will function in compliance with applicable local environmental regulations and World Bank guidelines.
BMP Technology Selection Process

• A ‘Preliminary Assessment’ carried out for BMP to meet project objectives and modernize Bapco established that the most effective way of improving gross margin was to concentrate on middle distillates production at an increased refinery capacity with resid conversion units to reduce or eliminate fuel oil.

• Selection of the most appropriate residue upgrading technology was one of Bapco’s biggest challenges.

• Bapco evaluated multiple combinations of residue conversion technologies with the following intent:
  – maximize the most valuable product (diesel) while retaining the capability to address niche product demands for the foreseeable horizon
  – be commercially proven, environmentally compliant, reliable and operationally flexible
  – have enough complexity so that the Refinery remains profitable when margins remain depressed for prolonged periods. Based on current trends only such refineries will survive in the future.
Bapco evaluated the following residue upgrading technologies and technology combinations for a range of refinery capacities:

- **Ebullated Bed Residue Hydrocracking Unit (RHCU)**
- **Delayed Coking (DC)**
- **Fixed Bed Residue Desulphurization (RDS)**
- **Solvent Deasphalting (SDA)**
- **Residue Fluidised Catalytic Cracking (RFCC)**

- These technologies cover commercially proven options available for a modern refinery. Their combinations were also evaluated under a broad range of crude slate and multiple sensitivity constraints.
- The RHCU route offered the highest IRR for the range of crude capacities evaluated.
Post BMP Refinery

305 MBPD Arab Light Crude supplied via the new AB Pipeline (capacity up to 350 MBPD)

50 - 60 MBPD Local Bahrain Crude Production

Existing Refinery Units*:
- 5 Crude Units
- 3 Vacuum Units
- Diesel Hydrodesulphuriser
- Unifiner/Platformer
- VGO Hydrocracker
- FCCU
- Visbreaker
- Hydrogen Plants
- Sulphur Recovery Units
- Base Lube Oil

New Refinery Units:
- 2 Crude Units
- 2 Vacuum Units
- Residue Hydrocracking Unit
- 2 VGO Hydrocracking Units
- 2 Diesel Hydrotreating Units
- Hydrogen Plants
- Sulphur Recovery Units
- Saturated Gas Plants
## Scope of BMP

<table>
<thead>
<tr>
<th>Unit</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude Unit</td>
<td>225 MBPD</td>
</tr>
<tr>
<td>Vacuum Unit</td>
<td>100 MBPD</td>
</tr>
<tr>
<td>Residue Hydrocracking Unit</td>
<td>65 MBPD</td>
</tr>
<tr>
<td>VGO Hydrocracking Unit</td>
<td>58 MBPD</td>
</tr>
<tr>
<td>Diesel Hydrotreating Unit</td>
<td>50 MBPD</td>
</tr>
<tr>
<td>Hydrogen Plants</td>
<td>2 x 125 MMSCFD</td>
</tr>
<tr>
<td>Sulphur Recovery Units</td>
<td>3 x 250 MTPD</td>
</tr>
<tr>
<td>Saturated Gas Plants</td>
<td>2 x 30 MMSCFD</td>
</tr>
<tr>
<td>Offsites, Utilities, Revamps/Upgrades</td>
<td>sized to match</td>
</tr>
</tbody>
</table>
Improved Competitiveness

Post BMP, Bapco’s size will increase from 267,000 to 360,000 bpd and its complexity will increase from 6.3 to 7.1
Refinery and Petrochemicals Integration
• The APC is a 50-50% Joint Venture between nogaholding of Bahrain and PIC of Kuwait.

• The APC presents an attractive opportunity. The Heavy Naphtha from BMP will be used as APC feedstock to be converted into high-value products such as Para-Xylene and Benzene.

• APC will produce Hydrogen as a valuable by-product. BMP needs significant amounts of Hydrogen, where about half the requirement will be supplied by the APC.

• Aromatics production is likely to remain attractive for a long period because the supply tightness is structural.

• UOP has been selected as the technology licensor for the APC.
Adding Value to Crude

Market Price (say, $ per Ton)

Crude

Fuels

Diesel
Gasoline
Fuel Oil

Petrochemicals

p-X
Benzene
o-X
Propylene
Ethylene
Styrene
PP

Aromatics can add significant value
Thank You!