Future of Refining & Strategies Ahead

Presented by:
Debasish Bera
PwC
Agenda

- Global Refining scenario
- Indian Refining scenario
- Dynamics affecting Indian refineries
- Possible strategies and options for refineries
Key events shaping the global volatile oil & gas market – Rebalancing continues in the crude oil market as price moves upward in 2017

1. Rebalancing continues in the crude oil market as global demand has exceeded supply in 2017 since 2 years.

2. OPEC compliance is expected to be high – managing oil markets.

3. Crude oil price is expected to move upwards in 2017 and hovers between 60-65 $/bbl.

4. Refinery margins are forecast to fall in 2017 as the crude market rebalances, ending 2 years of feedstock oversupply.

5. US President Donald Trump vows to unlock $66 trillion shale oil and gas revolution – US shale gas likely to show some recovery in 2017.
Global demand for refined products to grow at 1.3% annually from 2015 to 2020 with Asia is expected to drive the refining industry’s growth with an increase in demand by 2%.

Source: PwC Analysis, Database & Reports
Our perspectives on global refiners in terms of managing margins and end-to-end visibility

Refiners across the world are seeing that the impact of daily price and crack spread. Volatility dwarfs any margin improvements that they are able to make through optimization or operational initiatives.

They try to manage this volatility with governance and decision mechanisms along with associated data flows that were typically designed around functional and hierarchical structures that were appropriate two decades ago.

As a consequence, they are unable to either effectively drive margin improvement initiatives or measure the impact of related actions on the results with confidence.

In this era of fast changing price signals, refiners who are agile tend to perform better. However, agility without transparency into their supply chains (what inventories & where they are located, how this will evolve) or the right price sets, it can be a “hit or a miss” game.

Further more, companies are reluctant to increase their risks by delegating decisions to the front line (where trade offs need to be struck), if they cannot accurately measure and track their impact.
As per various expansion announcements, Indian refining capacity is may increase from the current capacity of ~250 MMTPA to approximately 300+ MMTPA by FY 20

Our analysis shows that conversion capacity is expected to grow faster than distillation capacity over next five years – resulting in growing overall average complexity and conversion rates. This is because of green field refineries coming up over next five years.

Source: PwC Analysis
Owing to ongoing and planned refinery capacity expansions, production of petrol and diesel are expected to grow at a CAGR of 8.7% and 13.2% respectively in the next four years.

Source: PwC Analysis, Database Reports
Government of India targets to roll out BS VI auto fuels by FY ‘20 which will impact refineries’ decision of capacity expansion

- In 2014 Planning Commission of India released Auto Fuel Policy and Vision, 2025

<table>
<thead>
<tr>
<th>Year</th>
<th>Description</th>
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<tr>
<td>2015</td>
<td>Majority of the refineries supply BS IV fuel. Rest produces both BS III and BS IV, except the North-Eastern refineries which produces only BS III. The coverage was most of North and South India in 2015.</td>
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<td>2017</td>
<td>As per April 2017, all the fuel outlets across India are serving BS VI fuel (diesel and petrol), except North-East. Oil companies have already started hiring consultants for carrying out feasibility study for roll out of BS VI from each refinery</td>
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<td>2020</td>
<td>Major cities area as proposed to be covered for BS-VI in 2019, with the addition of the rest of Rajasthan and all of Gujarat by FY 2019. While BS VI norms is planed to be implemented for vehicles by FY 20 for the rest of the country</td>
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- In Jan 2016, MoPNG declared to roll out BS VI by April, 2020 replacing BS IV on basis of COP 21 at Paris.
- Till date few refineries have conducted detailed feasibility study for manufacturing of BS VI compliant auto fuels. IOCL has contracted EIL for conducting feasibility study for six of its refineries namely Mathura, Panipat, Haldia, Gujarat, Digboi and Bongaigaon. Similar studies by other oil companies are also being undertaken.

India’s auto fuel product quality norms are currently aligned to BS IV norms and is yet to catch up with the global Euro norms VI.
Key challenges faced by Indian refiners in the journey to BS VI upgradation

- Biggest challenge for the companies to work on a 3 year time plan to upgrade all their existing engines to BS – VI compliant which in itself is difficult
- Deteriorating quality and fluctuating prices of crude oil
- Refineries need to ramp up capacities under expansion projects
- Finding financial resources could be a challenge due to lower refinery margins in recent time
  - Capital investment estimated for the refiners for fuel quality changes for BS-IV all over the country and further to BS –VI is Rs.45,000 crore and Rs.35,000 crore respectively.
- Rise in operational costs due to higher energy consumption
- Space constraint in case of many refineries for secondary process units may pose difficulties
- Readiness of the automobile sector to absorb BS VI standard fuels
  - BS –VI vehicles also have to be equipped with SCR (Selective catalytic reduction) and DPF (Diesel particulate filter) technology for which Auto firms claim they need 6-7 years
Several process units are required to be added by refiners through 2020 in order to meet BS VI gasoline and diesel fuel specifications

**Facilities for Meeting BS VI Quality Gasoline:**
- Capacity augmentation of VGO Hydro-treating Units or setting up of new VGO Hydro-treaters for pre-treatment of FCC feed.
- Capacity revamps of FCC gasoline treatment units.
- Setting up of new Alkylation unit/Dimerization unit.
- CRU up-gradation.

**Facilities for Meeting BS VI Quality Diesel:**
- Capacity augmentation of diesel hydro-treating unit vis-à-vis setting up of new DHDT.
- New hydro-cracker vis-à-vis revamp of existing hydrocracker capacity.
- Conversion of VGO hydro-treaters to mild hydrocrackers.
- Capacity revamps of hydrogen generation units.
- Additional Sulphur Recovery Units.
PwC’s perspectives on enabling key value levers of a refinery

1. Knowing what inventories you have where and how it is going to progress

2. Knowing the price exposure across the value chain for unhedged inventory (above or below “normal stock levels”)

3. Knowing gross and net margin generated per barrel processed on a daily basis

4. Knowing what is going on operationally across the value chain

5. Knowing and proactively managing optionality across shipping, plant and storage capacities, lifting and delivery windows, pricing basis, etc.
A typical refinery strategy and options includes various aspects ranging from crude sourcing to product offtake.

**Crude Sourcing**
Sourcing of crude from captive fields vs buying it through long term / spot term contracts.

**Refinery configuration**
Various units of a refinery determine the configurations possible. This has a bearing on not only the crude sourcing but also on the O&M strategy.

**Product offtake**
Selling the product through captive offtake agreements vs retailing of products through retail stations. In some cases standalone refineries may opt for wholesale agreements.

**Target Markets**
The supply chain strategy of a refinery depends upon the target markets for its end products. Export vs local consumption each has a different approach.

**Product Development**
Developing a long term product and technology strategy in-house vs being dependent upon external stakeholders.

**Operations Strategy**
Operating the refinery at optimum level to produce the desired end product.
Major areas which will provide sustained competitive advantage to Indian refiners in future uncertainties & regulatory environment

**Energy Efficiency Improvement**
- Energy optimization using Pinch & heat integration
- Improving Energy & loss management
- Optimizing utilities
- HC loss reduction

**Supply Chain Optimization**
- Supply Chain Design & strategy
- Supply Chain integration
- Inventory management
- Warehouse consolidation
- Procurement Strategy

**Supply Chain Integration**

**Refinery Margin Management & Improvement**
- Yield & product mix optimization
- Reliability & Maintenance
- Advanced process control
- Refinery Automation & Operational intelligence

**Energy Efficiency Improvement**

**Margin Improvement**

**Focus Areas for Indian Refiners**

**BS VI Fuel Quality Compliances**
To meet this requirement refiners would be required to upgrade their existing processing scheme and augment with new processing options
PwC’s market-backed approach breaks down refinery margin along refinery-bespoke value sources / leakages

<table>
<thead>
<tr>
<th>Breakdown of value levers</th>
<th>Insights from margin breakdown</th>
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<tbody>
<tr>
<td>Market Benchmark Margin</td>
<td></td>
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<tr>
<td></td>
<td>Crude Markers</td>
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<tr>
<td></td>
<td>Product Markers</td>
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<tr>
<td>Value categories</td>
<td>How advantaged is the chosen mix of crudes and products vs. running only the market markers?</td>
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<tr>
<td>Chosen Crudes &amp; Products</td>
<td></td>
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<tr>
<td>vs. Marker</td>
<td>Given the choice of volumes per cut, to what extent are you able to achieve market prices for those hydrocarbons?</td>
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<tr>
<td>Value categories</td>
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<tr>
<td>Realised prices vs. Market</td>
<td>What effect do the timing of purchases and sales have?</td>
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<td></td>
<td>What is the effect of running crude &amp; feedstock from inventory?</td>
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<td></td>
<td>What are the fees incurred from running at chosen plan?</td>
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<td>Value categories</td>
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<tr>
<td>Fees, Inventory and Purchase Timing effects</td>
<td>Actual Refinery Margin = Actual Mix of Crudes - Actual Mix of Products</td>
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THEME: THE AGE OF DOWNSTREAM TRANSFORMATION

25 & 26 MAY 2017, BEC, MUMBAI, INDIA
Integration of its business process is integral to achieve this objective in a collaborative manner in a faster manner

- Information on availability & demand (incl. Refining)
- Impact offtake priorities
- Information on availability & competitiveness
- Seek and prepare for supply flexibility
- Sales channel obligations & options
- Price sensitivities
- Assess options and evaluate profit opportunities
- Keep score and control activities
- Information on the market outlook
- Demand sensitivity and customer segments
- Actively consolidate information for meaning
- Determine exposures and approach to its management
- Supply and exchange obligations & options
- Supply & price negotiations
- Primary distribution obligations & options
- Information on competitors’ supply
- Refinery schedules and plans
- Seek and prepare for supply flexibility
Areas where refineries to improve more in the future

- Supply Chain Optimization & KPI/Dashboard
- Projects & Turnaround Management
- Contract & Inventory Management
- Energy Efficiency Improvement
- Reliability & Maintenance Improvement
- Research & development

Areas of improvement
The benefit of the approach is having a one stop shop for a margin management and a commercial culture

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<th>Process</th>
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<td>• Universal data clarity</td>
<td>• One set of data inputs for market-back tool</td>
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<td>• Market data-based discussions from single source of output</td>
<td>• Discussions based on market-back tool output</td>
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<td>• Ensures all possible opportunities are captured for consideration</td>
<td>• Unconstrained runs to identify opportunities</td>
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<td>• Allows for proactive hedging strategy and informs inventory plan</td>
<td>• Scenarios analysis of various possible mkt. &amp; refinery constraints</td>
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<td>• Provides accountability and ownership of the plan to the various</td>
<td>• Provision of input on potential constraints, downtimes &amp; inventory</td>
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<tr>
<td>functional stakeholders</td>
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<td>• Reinforce team' culture w/ shared agenda &amp; responsibilities</td>
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<tr>
<td>• Integrated inventory optimization with consolidated and realistic</td>
<td>• Scenario analysis simulate possible mkt. &amp; refinery constraints</td>
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<td>view on all inputs/outputs</td>
<td>• Inventory planning based on market insight</td>
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<th>One source of Truth</th>
<th>Enhanced Market Insight</th>
<th>Healthy Culture</th>
<th>Planning Foresight</th>
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Thank You

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