Refinery & Petrochemical Integration-
An IOCL Perspective

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Volatility in Crude Oil Prices

WTI Crude (US) Monthly Avg $/Bbl

Global Financial Crisis

Global

Arab

Iranian

Iraq

War

War

Asian

Financial

Crisis

Dubai+Oman

BRENT(DATED)

Indian Basket

Source: Argus

25 & 26 MAY 2017, BEC, MUMBAI, INDIA
Integration reduces Risk

The integrated downstream supply chain provides more options and inherent flexibility to optimize not only crude-mix but also each stream of entire supply chain to fetch higher value depending upon prevailing supply demand situation and pricing in domestic and international market.
Petrochemicals have proven to be financially attractive for the multinational integrated oil majors.
Value Addition through Integration

Typical Value addition over the cost of raw material (%)

- Crude Refining: 14%
- Liner Alkyl Benzene: 11%
- Paraxylene/PTA: 70%
- Naphtha Cracker: 85%
- Total Petrochemicals: 77%
Value Addition

Petrochemical offer one of the highest value additions in manufacturing sector

Source: Report of the Sub-group on Petrochemicals for the 12th 5-yr Plan
Options for PetroChemicals

Refinery

Cracked LPG
- Fuel
- Propylene

Naphtha
- Gasoline
- Fertilizer
- Power Plant

Aromatic Naphtha

Paraffinic Naphtha
- Ethylene
- Propylene C4’s

Kerosene
- N-Paraffins
- Fuel

PetroCHEMICALS

GLOBAL REFINING & PETROCHEMICAL CONGRESS

THEME: THE AGE OF DOWNSTREAM TRANSFORMATION

25 & 26 MAY 2017, BEC, MUMBAI, INDIA
IOCL Experience
Key Integration Drivers / Push & Pull Factors

Push Factors:
1. Low demand growth globally for refined products with hybrid and energy efficient vehicles
2. Transition from Fossil Fuels to Renewables
3. Carbon Foot-Print minimization
4. Low refinery capacity utilization globally.

Pull Factors
1. Low cost Feed: Surplus Naphtha feedstock availability-Low transportation Cost. More consumption of RLNG and sparing of Naphtha.
2. Leveraging Refinery Intermediate streams as advantage feed to Petrochemical complex
3. Blending of Petrochemical By-Products into refinery fuel products leading to lower cost of conversion
4. Utilities: Significant Cost reduction in Shared Utilities & Infrastructure
5. Shared Services: Engineering, Maint., Procurement, Laboratory, HSE, Security, HR, Admin, IS etc.

> Higher Cash Margins
Key Integration Drivers…cont’d

- Using existing strengths in refining, marketing & supply chain
- More flexibility in reprocessing, storing and transporting off specification products
- Energy savings in well-integrated hydrocarbon processes
- Feedstock flexibility to capitalize on available low cost crude oils and intermediates
- Independence of feed stocks and supply security.
Value Addition by Return Streams to Refinery

> C4: After extracting Butadiene, balance Stream exported for added LPG Production

> C5-C6: routing to Refinery
  - Non-aromatic Streams shared with refinery for MS Maximization
  - Additional Naphtha Processing capability of Cracker (~ 7%)
  - Value addition: 35-40 million USD/yr

> C7-C8: for PX yield enhancement & MS Octane Boosting
  - C7-C8 is split into C7 & C8 (About 70:30 ratio).
  - Potential value addition: 5-10 million USD/yr.
Value Addition by Return Streams to Refinery…2

> C9+ for Enhancement of Diesel pool
  - Majority absorption in Diesel pool & partially to MS with Reformate sharing with Other refineries
  - Value addition: 4-5 million USD/year.

> PFO for -Low Sulphur Fuel Oil
  - Cutter Stock to maintain Low-Sulphur Specs in IFO

> Acid Gases ex NCU
  - Sharing of Refinery’s SRU infrastructure
Exploiting Low Cost Olefin stream from Refinery

> C2 Stream
  ● Ethylene Maximization: Extracting C2 from FCC/Coker/Indalin Offgas

> C3 Stream
  ● Maximizing Propylene from Captive Refinery’s FCC using advanced catalysts (ZSM-5)
  ● Supplemental Propylene Generation from Coker LPG
  ● Saturating Poly-Propylene capacity using Orphan Propylene from other Standalone Refinery

> Hydrogen Stream Sharing with Refinery
  ● 2-way sharing increases Operation flexibility
Aromatics-Refinery Integration

Streams to Hydrogen Grid
- Platformer – PSA Product hydrogen
- Tatoray Separator Off Gas-CRU (80% H2)

Streams to Diesel Pool
- HA Column Bottoms
- Oxygen Stripper Net Overhead
- NHT Stripper Overhead
Aromatics-Refinery Integration

- Streams to MS Pool
  - Reformate and Tatoray feed Tank (C7/ C9 Str)

- Streams to LPG Pool
  - LPG from Platformer

- Streams to Naphtha Pool
  - SSU (Shell Sulpholane unit) Raffinate to Naphtha blending

- Future Streams
  - C9 Stream from PNC PGHU to PX-Feed Naphtha
Challenges faced by Naphtha Crackers

> Cheap Ethylene from Gas Crackers
> Cheap Shale Gas \(\rightarrow\) Crackers switching Feed
> On-purpose Propylene technologies
  - PDH, OCT, MTO

Naphtha Cracker Strengths

> Value Addition by Integration
> Liquid Streams (e.g. Butadiene, Styrene etc) hold key to incremental profits
> Maximize Propylene potential
Huge Olefin Deficit

Capacity Additions

PROJECTED GROWTH OF ETHYLENE AND PROPYLENE CAPACITY IN INDIA
Way Ahead for IOCL

Expanding Existing PetChem Assets

- 800 to 1147 kta NCU revamp
- 300 to 425 kta MEG Revamp at Panipat
- 553 to 700 kta PTA revamp at Panipat Refinery
- 120 to 162 kta LAB revamp at Koyali Refinery
- FCC-Indmax revamp(s) at Refinery locations

Greenfield PetChem Projects

- 680 kta PP Plant at Paradip
- 335 kta MEG Plant at Paradip
- Olefin Recovery from Refinery OffGas
- Oxo-Alcohol Complex based on 150 kta Butly Acrylate plant at Gujarat
- Styrene Recovery Project at Panipat
- Proposed PP at Barauni
- 60 MMT-West Coast Integrated Refinery & Petrochemical Complex
In conclusion

- Integrating Petrochemicals with Refineries offers attractive benefits
  - Better realization from value added products
  - Mitigate the effects of volatile oil prices and highly competitive refining business.
  - Provides earnings Stability across the value chain

- Crackers esp. Naphtha Based provide opportunity to tap a host of high-value Liquid Streams

- The petrochemical Synergy with refinery is a win-win by way of
  - Definite value addition for both refinery and petrochemical operations
  - Enhanced overall profitability of the complex
THANK YOU!