

JCCP 27th International Symposium

**Future vision of the oil industry –
Creating value from hydrocarbons and
approaches to new energy systems**



Challenges in oil refining

**Vikram M. Sampat
Reliance Industries Ltd.**

Tokyo, Japan

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Challenges of oil refining



- **Global trends**
 - Economic
 - Refining
- **Refining challenges-**
 - Outline
 - Response
- **Competitiveness**
 - Business excellence
 - Supply chain flexibility
 - Technology innovation
 - Ecology preservation
- **Reliance Jamnagar** - An example
- **Conclusions**

Global trends



- Economic
- Refining

Analyze trend to define refining challenge

Economic trend



- **Global economic recession** – falling crude & product prices
- **Demand destruction** – low refinery operating rates
- **Financial deleveraging** – low refining margins
- **Inevitable future oil price spike** – investment freeze in new oil

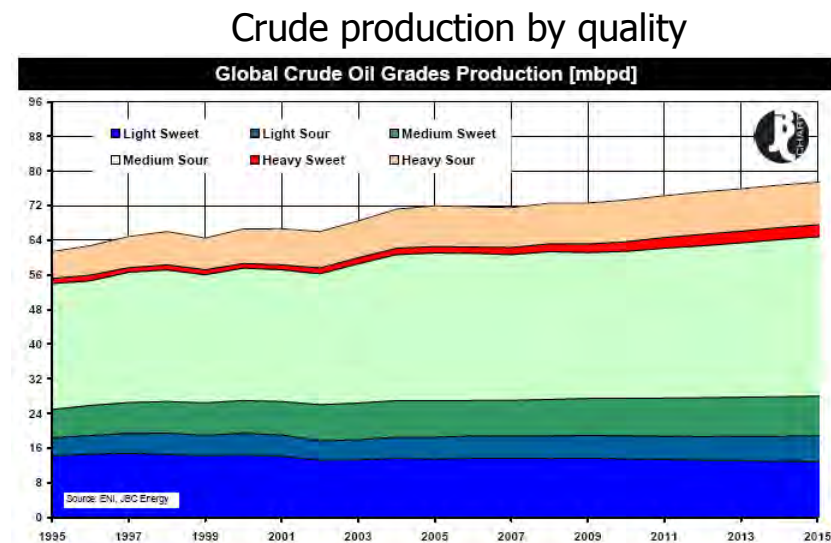
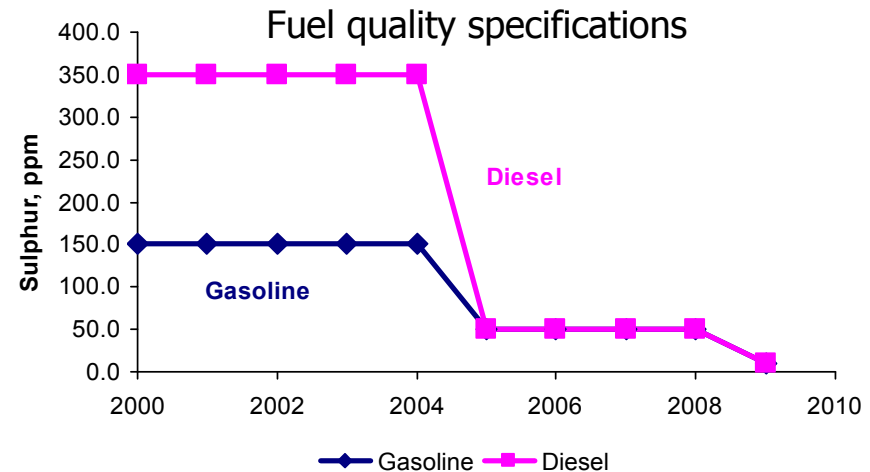


Utilize global downturn to correct energy/ecology balance

Refining trend



- **Old, inefficient refining assets** – consolidate
- **Heavier and tougher new crudes** – bottom-of-the-barrel conversion
- **Dieselization** – maximize diesel
- **Clean fuels** – ULSD & ULSG
- **Petrochem in Middle East** – maximize refinery petrochem integration
- **Environmental concerns** – minimize greenhouse gas emissions and carbon footprint

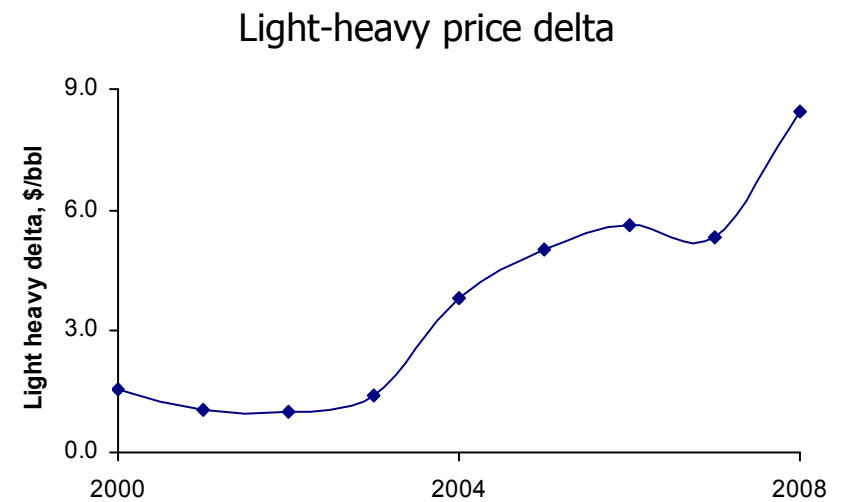
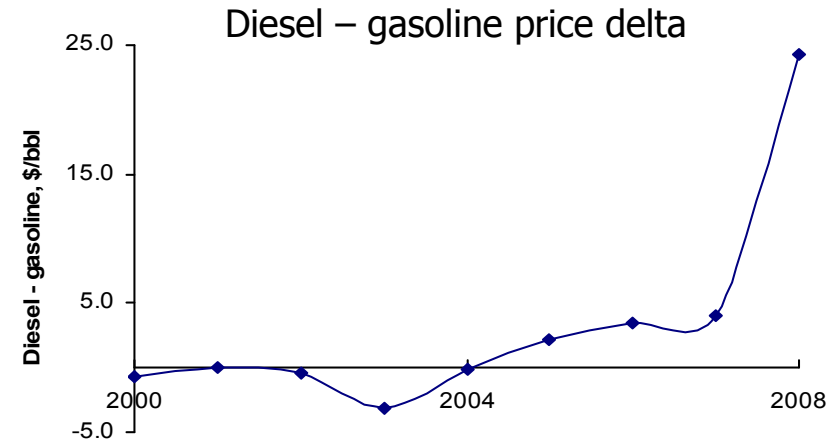


Refine oil more competitively

Refining challenges



- Diesel margin better than gasoline
- Discounted heavy crudes
- Low fuel oil & naphtha margins
- High volatility
- Environmental concerns



Major refining challenges of the future

Refining response



Stimulus

Response

- | | |
|-----------------------------------|---|
| 1. Diesel vs gasoline | ■ Shift diesel/gasoline ratio towards diesel |
| 2. Discounted heavy crude | ■ Increase heavy crude processing |
| 3. Low fuel oil & naphtha margins | ■ Eliminate fuel oil & naphtha products from refining |
| 4. Increased volatility | ■ Efficient supply chain for crude & products |
| 5. Environmental concerns | ■ Produce clean fuels |

Transform refining to meet challenges of future

Competitiveness drivers



- **Business excellence**
 - feedstock
 - product
- **Supply chain flexibility**
- **Technology innovation**
 - catalyst
 - materials of construction
 - processing
- **Ecology preservation**
 - energy efficiency
 - clean fuels

Improve refining competitiveness

Feedstock excellence



- **Maximize heavy & low cost crude feed for refining**
- **Add bottom-of-the-barrel processing** - evaluate coker, solvent deasphalting or resid hydrocracker to eliminate fuel oil
- **Add VGO conversion** - evaluate hydrocracker or FCC for max conversion to middle distillates/petrochemicals
- **Evaluate resid gasification for a “bottomless refinery”**

Stretch the crude barrel

Product excellence



- **Maximize high value products** – middle distillates & petrochemicals
- **Swing diesel/gasoline ratio towards max diesel**
- **Eliminate fuel oil & naphtha from refining product slate**
- **Evaluate value addition opportunities of fuel gas & residue** – cryogenic recovery & gasification

Extract max value from crude barrel

Supply chain flexibility



- **Efficient supply chain management** – for crude & products
- **Hedging and risk management** – to manage price volatility
- **Maximize processing/blending flexibility** – to manage demand volatility
- **Widen crude processing flexibility** – evaluate common upgrade for multiple refineries
- **Integrate planning, scheduling and operation optimization** – to manage supply chain

High velocity refining

Technology innovation



■ Catalysts

- **Novel catalyst design** - Nano pore engineering/Nano material sites
- **High throughput experimentation** - accelerate catalyst discovery & development

■ Materials of construction

- **New generation material of construction** - super tough, corrosion resistant & chemical resistant
- **Carbon nano tubes & nano fibres** – target quantum leap in price/performance ratio

■ Processing

- **Process intensification** – minimize processing steps in refining
- **Real time optimization** – maximize refining automation
- **Innovative separation** – next gen membranes and adsorbents

Innovative refining

Ecology preservation



■ Maximize energy efficiency

- Benchmark energy efficiency
- Reduce energy intensity w/global pinch & integration
- Minimize fuel and loss w/energy recovery system
- Shutdown refineries w/high carbon footprint

■ Clean fuels

- Produce ultra low sulphur diesel & gasoline
- Supplement natural gas as internal fuel

■ Integrate CO₂ management in refining

- Develop cost competitive carbon capture and sequestration (CCS) technology

Green refining

Reliance Jamnagar



- Refining supersite of the world
- 2 refineries – adjacent & integrated
- Integrated petrochem w/refining
- New refinery is under startup
- Majority product to be exported

Largest refinery complex in the world

Conversion units



Unit	Existing (kbpsd)	New (kbpsd)	Total (kbpsd)
Crude	660	580	1240
FCC	200	200	400
Coker	160	160	320
VGOHT	210	220	430
CCR Platformer	90	90	180
Alkylation	-	84*	84
C4 Isom.	-	42*	42
LCO Cracker	-	55*	55

* Combined for both refineries

Zero fuel oil refinery

Petrochem / product quality units

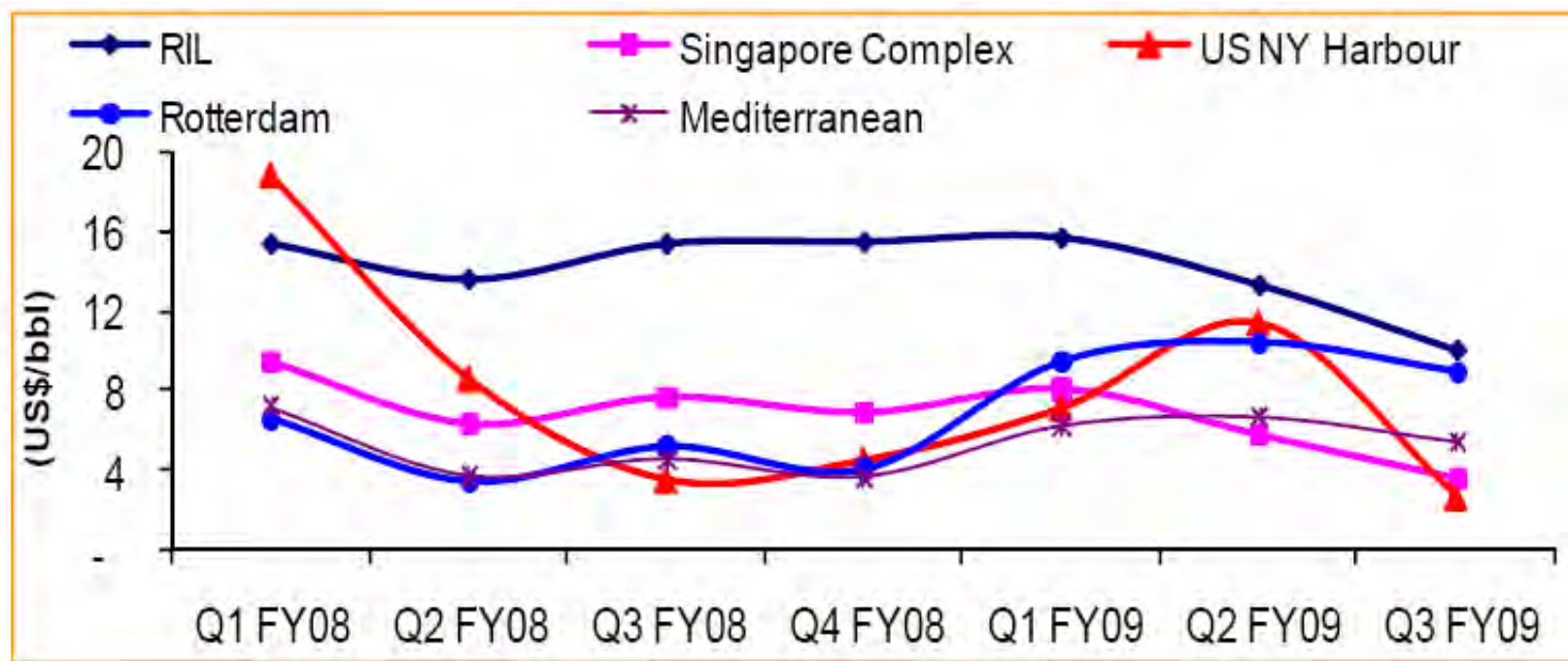


Unit	Existing (kbpsd)	New (kbpsd)	Total (kbpsd)
DHT/DHDS	200	250	450
Diesel PTU	-	60*	60
Kero HT	-	30*	30
Scanfiner	-	55*	55
Naphtha HT	125	90	215
PX, ktpa	1800	-	1800
PP, ktpa	1000	900	1900

* Combined for both refineries

Clean fuels & integrated petrochem

Margin performance



Cracking margins Source: Reuters / Company Data

Outperforming benchmark refining margins

Competitiveness



Reliance Jamnagar	Existing	New
Feedstock	27°API crude	24°API crude
Product	Zero fuel oil	Zero fuel oil
Flexibility	2 crude SPM	1 crude SPM 2 product SPM
Ecology	Zero liq. effluent	Zero liq. effluent 100% ULSD + ULSG
Complexity index	11.2	14.0

Globally competitive

Reliance Jamnagar – Integrated petrochem



- **Paraxylene**
 - 1.9 mmtpa PX (3 trains) (largest in the world)
 - 0.4 mmtpa of OX, as co-product
 - 0.45 mmtpa of benzene, as co-product
 - 90 kbpsd Platformer (largest) – source of PX
 - 60% conversion to PTA @ Hazira
- **Propylene**
 - 1.0 mmtpa (existing) + 0.9 mmtpa (new)
 - 2 x 200 kbpsd FCC (largest) – source of propylene
 - 100% conversion to PP

Integrated refinery + petrochem

Conclusions



- **Utilize the recessionary pause to correct energy/ecology balance in refining**
- **Upgrade refining assets for maximizing middle distillates and petrochem, while minimizing fuel oil & naphtha**
- **Shutdown refineries which do not meet efficiency/ecology benchmark**
- **Refining has a continuing vital role to play in the future**
- **JCCP can take the initiative to develop a roadmap to refining of the future**
 - Stretch crude barrel
 - Max value from crude barrel
 - High velocity refining
 - Innovative refining
 - Green refining

Transform refining business for the future

Challenges in oil refining

Thank you