Energy, Refining and Petrochemical Feedstocks
New Demand Trends: COP21 Points to Climate Change Mitigation Efforts

Energy Related CO2 Emissions (*)

by Geography

China
US
EU
India
Russia
Japan
Others

>55%

Fastest Growing

(*) CO2 represents the majority of GHG, and energy related accounts for 2/3 of it

Source: ICIS Elaboration from IEA, BP, ExxonMobil, Industry data

Progress
US and China
IOCs
It will take time...
New Demand Trends: COP21 Points to Climate Change Mitigation Efforts

Energy Related CO2 Emissions (*)

(*) CO2 represents the majority of GHG, and energy related accounts for 2/3 of it
Demand growth for Oil, Gas and Coal to be affected, but subject to different drivers

Fuels Contribution by Selected Sectors (million TOE)

Source: ICIS Supply and Demand Database, ICIS Elaborations from IEA, BP, ExxonMobil, Industry data
Demand growth for Oil, Gas and Coal to be affected, but subject to different drivers

Fuels Contribution by Selected Geographies (million TOE)

Source: ICIS Supply and Demand Database, ICIS Elaborations from IEA, BP, ExxonMobil, Industry data
Peak Coal Demand is approaching, but Peak Oil Demand may take more time...

Incremental Energy Demand (million TOE) 2015-2025

- China is Big...
- …But More countries (India!)
- Coal demand already down (except for India!)
- Efficiency

Source: ICIS Supply and Demand Database
Peak Coal Demand is approaching, but Peak Oil Demand may take more time…

*In a “New Demand Scenario”*
- Renewables up
- Coal down.
- Gas remains a lower carbon enabler.
- Petrochemicals will capture a growing share of oil demand
- More oil and gas required,
- Steady feedstock supply
- NGLs

Source: ICIS Supply and Demand Database
A “Lower Oil” Price Environment Reinforces Petrochemicals’ Role!

“Proxy Trends” in Earnings (not comparable in absolute terms)

Exxon Mobil

Shell

Total

Q1 2014  Q1 2015  Q1 2016

Q1 2014  Q1 2015  Q1 2016

Q1 2014  Q1 2015  Q1 2016

Upstream (O&G)  Downstream  Chemicals  Downstream & Chemicals

Upstream vs Refining and Petrochemicals

Source: Elaborations from Company web sites, ICIS Pricing
A “Lower Oil” Price Environment Reinforces Petrochemicals’ Role!

“Proxy Trends” in Earnings (not comparable in absolute terms)

- Exxon Mobil
- Shell
- Total

Q1 2014 Q1 2015 Q1 2016

Upstream vs Refining and Petrochemicals

The Saudi vision

More Refining and Petrochemicals

Oil is an enabler

Oil & Gas Prices

- Brent $/bbl
- Henry Hub $/MMBTU

Source: Elaborations from Company web sites, ICIS Pricing

www.icis.com
Agenda

The New Demand Scenario: Energy & Oil

Oil in Petrochemical Feedstocks: NGLs & Naphtha

What about Refining?
US Shale developments in a lower oil price scenario

- Surplus of light NGLs,
- Ethane at natural gas value
- New Ethylene
- Ethane Exports:
  - Deep sea, Pipeline

Source: ICIS Supply and Demand Database
US Shale developments in a lower oil price scenario

Source: ICIS Supply and Demand Database

- Surplus of light NGLs,
- Ethane at natural gas value
- New Ethylene
- Ethane Exports:
  - Deep sea, Pipeline
- Rejection
- Lower crude prices
- Propane Export & PDH
US Ethane Balances may get tighter, and prices likely to rise above Natural Gas
US Ethane Balances may get tighter, and prices likely to rise above Natural Gas

Source: ICIS Supply and Demand Database
Global LPG: Key Trade Flows (2015)

- The US is by now the largest country exporter of Propane in the World. It was a net importer of LPG just a few years ago.
- Fuel related demand is not increasing, and demand for Petrochemicals is not keeping pace with supply.
- Exports are now flowing to Asia.
- The Middle East remains the largest region in terms of exports.
- Ample avails in international markets have promoted Asian PDH developments.
- China imports are now exceeding those of Japan.

US LPG will remain long: flows to International Markets rapidly increasing

*Volumes in Million tonnes

VCMStudy.ir
Naphtha is expected to remain comfortably available in the future.
Agenda

The New Demand Scenario: Energy & Oil

Oil in Petrochemical Feedstocks: NGLs & Naphtha

What about Refining?
Recent Refining Capacity Growth seems not enough…

Delays, technical problems and repositioning have slowed refining capacity expansions.

Lower crude oil prices benefitted demand, particularly for gasoline.

It seems paving the way for improved refinery utilizations and margins.

Global net Preliminary Changes 2014-2016

- Expected Refining Capacity: 3.0
- Revised Refining Capacity: 2.2
- Net Demand: 2.7

Million Barrels/day

Source: ICIS Supply and Demand Database
A tighter refining capacity supported runs and healthy margins until Q3 2015

Demand has supported margins until Q3 2015, but these are fading

Even without accounting for energy cost advantages, US competitive positioning is resilient.

As Brent-WTI spread declines, interest for heavier grades increases

Higher Middle Eastern Oil output increases Brent-Dubai differentials, benefitting Singapore (and Middle Eastern) margins
As refiners increase runs to profit from Gasoline, Middle Distillates get long…

Gasoline versus Gas Oil “Cracks” ($/bbl)

- Gasoil Cracks have dropped below those of Gasoline
- Gasoline Cracks remain the driver, but the weakness in Middle Distillates affects margins

Data source: ICIS Consulting, Supply & Demand Database
Flexibility for Gasoline is cut, new Conversion Capacity is focused on Diesel, at the wrong time…

The largest Gasoline exporter (EU) and the largest Gasoline market (US) are rationalizing FCC capacity
Flexibility for Gasoline is cut, new Conversion Capacity is focused on Diesel, at the wrong time…

- The largest Gasoline exporter (EU) and the largest Gasoline market (US) are rationalizing FCC capacity
- Non OECD Diesel demand is affected by a slow down in industrialization growth, particularly in China
- Lower oil prices stimulate private car usage, globally, supporting gasoline
- But this will not last… Gasoline demand growth will ease in the US and continue to fall in Europe: efficiency!

Source: ICIS Consulting, Supply and Demand Database
Gasoline Pools vs Reformate use: the Asian thirst for PX increases Competition with Fuels

Million tons

Source: ICIS Consulting, Supply and Demand Database

www.icis.com  89

VCMStudy.ir
Gasoline Pools vs Reformate use: the Asian thirst for PX increases Competition with Fuels

Source: ICIS Consulting, Supply and Demand Database
Asian reformate is widely dedicated to Aromatics: the need of higher volumes and octane in gasoline is creating competition.

Asia has invested in condensate splitters to ensure heavy naphtha feedstock to reformers for PX.

The strength in gasoline and weakness in middle distillates is affecting condensate splitters not integrated with refinery operations and/or steam crackers: light naphtha and middle distillates are not optimised.

Will aromatics feedstocks and gasoline components start flowing from US and Europe to Asia?
Condensate Splitters are added throughout the World: which merchant Feedstock?

Asia is not the only place…

Major additions in Middle East, targeting large gasoline output (Iran!)

Source: ICIS Consulting, Supply and Demand Database
Condensate Splitters are added throughout the World: which merchant Feedstock?

- **Asia is not the only place…**
- **Major additions in Middle East, targeting large gasoline output (Iran!)**
- **US is also adding (shale). Some of the original condensate splitter projects where repositioned as “Stabilizers” after Crude Exports Allowances, but about 200 mb/d are already on line**
- **Condensate splitters based on merchant supply will need to ensure volumes and quality (max heavy naphtha, min mid distillates?)**
- **More light naphtha in international markets? Good for naphtha crackers**
Refinery Projects’ Pipeline likely to exceed demand: Easy naphtha availability?

Even cancelling 50% of Asian projects in 2017-2018, global additions would approach 1.5 Million b/d in each year.

Data source: ICIS Consulting, Supply & Demand Database

Additions to Global Refining Capacity

<table>
<thead>
<tr>
<th>Year</th>
<th>Cumulative Total (million b/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>0</td>
</tr>
<tr>
<td>2016</td>
<td>+2.2</td>
</tr>
<tr>
<td>2021</td>
<td>+7.8</td>
</tr>
</tbody>
</table>

Incremental by Region (‘000 b/d)

- 1.1 million b/d annually
- 1.5 million b/d annually

1.1 million b/d annually
1.5 million b/d annually
Refinery Projects’ Pipeline likely to exceed demand: Easy naphtha availability?

Even cancelling 50% of Asian projects in 2017-2018, global additions would approach 1.5 Million b/d in each year.

Delays, rather than cancellations are expected in the Middle East.

Unless incremental closures are implemented, recent margins unlikely to be maintained.

Once gasoline export opportunities fade, European runs and capacity are at risk.

Option for naphtha diversion from gasoline pool should remain.
Summary Conclusions:
Petrochemical Feedstocks will be well supplied in the next few years

- Efficiencies needs are accelerated in the “New Demand Scenario”. Demand for oil will increasingly be for petrochemicals, the material of choice for improving quality of life.
- As more oil and gas will be required, more NGLs will be available. A lower oil scenario may still leave US with wide light NGLs availability and LPG exports, whilst ethane balances could get tighter.
- Despite some recent tightness in gasoline, fuel efficiencies and rapidly growing refining capacity will ensure comfortable naphtha supply in international markets.
Final Wrap-up

The economic Supercycle is over. One reason for the end of the Supercycle is the retirement of the Babyboomers. Another reason is China’s economic reforms. These reforms have major implications for the country’s petrochemicals supply and demand patterns. The petrochemicals industry thus needs a new global business approach, aligned with the real needs of changing social, political and economic drivers. These challenges are opportunities for the petrochemicals industry, given its ability to efficiently deliver the products needed to improve our lives in the future.

Non-traditional routes to olefins production have gained importance, and shale developments have provided surplus ethane. This has an impact on polymer trade and on relative economics, but naphtha cracking will still be needed. A lower crude oil scenario has moved naphtha cracking economics into more positive territory.

The aromatics industry is confronted with uncertain supply trends, recent gasoline strength and a high dependency on China. The need for heavy naphtha feedstock for incremental PX demand has promoted numerous dedicated condensate splitter projects. Integration with fuels refineries and steam crackers will enhance viability.
Final Wrap-up

The new demand scenario will require a shift in the energy mix towards a lower carbon intensity, and growing efficiencies. Gas will be a key enabler, whilst oil use as a raw material for petrochemicals will steadily increase. Low oil prices are further promoting refining and petrochemical integration. Peak Oil Demand will take some time to reach. Incremental volumes of oil and gas will be produced, and more NGLs will be available.

A prolonged scenario of low oil prices may affect shale developments. This could gradually reduce the current surplus of US ethane. Relative competitiveness for domestic ethylene may be reduced, but remains in place. The LPG surplus will remain for a prolonged period of time, enabling its role as an alternative feedstock for ethylene production. Delayed expansions in refining capacity and low oil prices have resulted in a temporary gasoline tightness. This will change in the near future. New refining capacity and growing fuel efficiencies will ensure comfortable naphtha supply in the future.
Tailored consultancy services to support your business goals

BUDGETING AND FORECASTING
We can support you throughout the budgeting process from historical analysis to long-term forecasting, helping your organisation remain competitive, efficient and profitable.

STRATEGIC PLANNING
Whether you are benchmarking performance, adopting new delivery models or planning a specific project, ICIS Consulting can provide the strategic direction to strengthen your business case.

MARKET ADVISORY
Our consultant's industry knowledge, coupled with our wealth of market data makes ICIS Consulting uniquely placed to offer crucial insight into the markets that matter most to your organization.

COST AND VALUE MODELLING
Valuations, cost modelling, efficiency evaluation and capital and resource planning. When you are making major changes to your current business, ICIS Consulting offers the guidance and practical support needed for a smooth transition with minimal risk.

OUR PEOPLE

OPERATE AS EXTENSION OF CLIENT'S TEAM

SENIOR INDUSTRY EXPERTS, NOT 'GENERIC' CONSULTANTS

PREVENTING FUTURE PROBLEMS AS WELL AS SOLVING EXISTING ONES

20 YEARS INDUSTRY EXPERTISE ON AVERAGE

LET'S TALK
Contact ICIS Consulting today for a confidential discussion on how we can help you address your business challenges and support your decision-making.

www.icis.com/consulting
enquiry@icis.com

ICIS Consulting
VCMStudy.ir