OUTLOOK OF GLOBAL PETROCHEMICAL INDUSTRY – CHALLENGES AND OPPORTUNITIES

STAR 2017 ROTOMOULDING CONFERENCE
January 29, 2017 – Jaipur, India

Philippe Montagne
VP PolyOlefin Orient @ TOTAL PETROCHEMICALS
GLOBAL SCENARIO OF PETROCHEMICALS INDUSTRIES
OIL, ETHANE & COAL COMPETE AS POLYMERS FEEDSTOCK

- Crude Oil
- Ethane
- LPG or Light Naphtha
- Steam-cracker
- Ethane cracker
- Gas
- Polyethylene
- Polypropylene
- Butadiene
- Styrene
- Polystyrene
- Ethylene
- Propylene
- Benzene
- Toluene
- Xylenes
- Paraxylene
- Pyrolysis
- Gasolines
- Heavy Naphtha
- FCC
- REFORMER
- Aromatic extraction
- Coal
- Methanol
- CTM
- MTO

STAR 2017 ROTOMouldING CONFERENCE - Ph. Montagne - TOTAL PETROCHEMICALS
• the world consumption increases by about 1%/y (2016 ~ 96 Mb/d)
• the USA have become the #1 Oil Producer in the world because of Shale Oil
• Investment by Oil Industry have been cut by 50% since 2014 (700 Bn$)
• IRAN sanctions have been lifted
NATURAL GAS STAYS ABUNDANT AND CHEAP

West Texas Intermediate (WTI) vs the Henry Hub Natural Gas spot price

$/BL

$/MMBTU
COAL IS VERY CHEAP BUT... EMITS 2 X CO2 VS NG

CTO Production Capacity in China

<table>
<thead>
<tr>
<th>MTPA</th>
<th>2016</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>PE</td>
<td>2.5</td>
<td>6.5</td>
</tr>
<tr>
<td>PP</td>
<td>4</td>
<td>8.5</td>
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</tbody>
</table>

5 Mt Coal ➔ 1 Mt Polyolefin
IN A CONTEXT OF CRUDE OIL @ 70$/BL, ETHANE-BASED POLYOLEFINS ARE THE MOST PROFITABLE

Source: IHS
IRAN PETROCHEMICAL INDUSTRY IS ABOUT TO BOOM

• Iran currently produces 60 million tons of petrochemicals a year. This capacity will increase by 8.5 million tons in 2017 when a number of new projects become operational.

• The petrochemical industry is the biggest source of foreign earnings for Iran after oil. In 2015, Iranian companies exported about $13 billion of petrochemical products.

• Iran needs $55 billion for 60 projects in the petrochemicals sector over a period of 10 years.

• Non-US IOC have tabled “serious” proposals for building petrochemical plants in Iran.
GROWTH DRIVERS
URBANIZATION: KEY DRIVER FOR THE POLYMER DEMAND

Above ratio = Demand from convertors divided by population (exports of plastic finished goods are included but imports are not)
WORLD DEMAND KEEPS BEING PULLED BY ASIA

World oil products demand by region (low Brent) Mb/d

- Europe
- Middle East
- Rest of Asia
- China
- Asia OCDE
- NAM
- Rest of the world

Annual Growth 2008-2015: +1.3%
Annual Growth 2016-2026: +1.0%

World polymers* demand by region Mt/year

- Europe
- Middle East
- Rest of Asia
- China
- China OCDE
- NAM
- Rest of the world

Annual Growth 2005-2015: +4.5%
Annual Growth 2016-2025: +4.2%

Soft growth of refining
Tonic growth of Polymers driven by GDP and Urbanization

* : PE, PP, (E)PS, PVC, Polyester (incl. PET)
BY 2020 MIDDLE-EAST AND NORTH AMERICA WILL BOTH EXPORT POLYETHYLENE TO EUROPE AND ASIA

Polyethylene market

<table>
<thead>
<tr>
<th>Region</th>
<th>'14 Demand</th>
<th>'20 100$</th>
<th>'20 60$</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>15.9</td>
<td>18.0</td>
<td>18.0</td>
</tr>
<tr>
<td>Capacity</td>
<td>20.1</td>
<td>28.2</td>
<td>27.2</td>
</tr>
<tr>
<td>Op. rate</td>
<td>90%</td>
<td>87%</td>
<td>88%</td>
</tr>
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<th>Region</th>
<th>'14 Demand</th>
<th>'20 100$</th>
<th>'20 60$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>12.7</td>
<td>12.6</td>
<td>12.6</td>
</tr>
<tr>
<td>Capacity</td>
<td>16.1</td>
<td>15.8</td>
<td>15.8</td>
</tr>
<tr>
<td>Op. rate</td>
<td>78%</td>
<td>65%</td>
<td>81%</td>
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<td>21.8</td>
<td>28.9</td>
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<tr>
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<td>22.4</td>
<td>21.6</td>
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<tr>
<td>Op. rate</td>
<td>84%</td>
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Polyethylene (PE) at 100 $/b
PE 2020 regional balances at 100 $/b
( +/- x ) PE tradeflow ('14/100$/$60 $)

China will represent 65% of ME PE export
PETROCHEMICALS KEYS DRIVERS OF THE FUTURE

- CTO will produce cheap PolyOlefins in China and will represent 25-30% of the Chinese capacity. Their future development will depend on Oil Price.

- Middle-East and USA will export competitive PolyOlefins based on Ethane (NG and Shale Gas).

- Within 5 to 10 years, China will be self-sufficient in PP. There will be peak period with heavy Chinese PP exports.

- Urbanization will continue in China, India, Indonesia, … and will pull more PolyOlefin consumption.

- Oil price should increase (less investment ➔ oil field not replaced in a still growing demand) and so doing, should cause rationalization of Naphtha-based cracking capacities.
FOCUS ON INDIA
INDIA LLDPE DEMAND OUTLOOK REMAINS VERY STRONG

Source: IHS
INDIA HDPE DEMAND OUTLOOK REMAINS ROBUST

Source: IHS
INDIA LDPE DEMAND OUTLOOK IN LINE WITH THE PAST

Source: IHS
INDIA PP DEMAND OUTLOOK REMAINS STRONG

Source: IHS

India: Polypropylene Supply & Demand

India Demand by End Use

Source: IHS
SPECIALTY PRODUCTS TO MAKE THE WORLD BETTER
THE METALLOCENE PE = BREAK-THROUGH IN PE

Technological progress


1933 ICI, UK

LDPE

Linear PE
Cr, Z-N

Gas phase

Bimodal

Metallocene

Boosted PE properties

MDPE/HDPE development

LLDPE development

Dual reactor

Bimodal Metallocene

1st autoclave process commercialized by ICI in 1938
1st tubular process commercialized by BASF in 1953

1938 ICI, UK

THE METALLOCENE PE = BREAK-THROUGH IN PE
THE WORLD ENTHUSIASM FOR MET-PE IS AMAZING

Exponential World met-PE Demand (ktpa)

Source: TOTAL
METALLOCENE PENETRATION INTO LLDPE MARKET IS DEEP

Source: TOTAL/NEXANT
THE BIO-PLASTIC POLYMERS VOLUME INCREASES BUT WILL NEVER MATCH THE HYDRO-CARBON BASED POLYMERS

WW plastics capacity 2014
~350 Mt/y

WW bioplastics capacity 2014
~1.5 Mt/y

Main sources for bioplastics markets:
- Nova Institute (Bio-based building blocks and polymers in the world – 2015)
- IHS Chemical (Chemical Economics Handbook – Biodegradable Polymers – 2015)
- Smithers Pira (The Future of Bioplastics for Packaging to 2023 – 2015)
- Ceresana (Market Study Bioplastics – 2014)
- Markets&Markets (Global Biopolymers/Bioplastics Market – 2014)
TOTAL – A KEY PLAYER IN PROVIDING SPECIALTY PRODUCTS
TOTAL: A LEADING ENERGY GROUP

An Oil & Gas Company
- 2.3 Mb/d
- 2nd global player in LNG
- Net Income of 22 billion $ (2015)
- Operations in 130 countries, with 96,000 employees

A Leader in Refining & Marketing
- 16 refineries worldwide. 2.2 Mb/d of refining capacity
- Network of 17,000 service stations (Europe + Africa + Asia)

A Global Petrochemical Integrated Player
- One of top 10 Producers of PP, PE and PS

A Leader in Renewable Energy
- Top 3 Solar Player with SunPower. 6GW+ already deployed worldwide
- Developing Energy Storage with Saft Acquisition (1bn $)
- World-Class BioRefinery (La Mede, France) in construction to produce 500KT/y of bio-fuels
TOTAL'S POSITION AMONG GLOBAL PLAYERS

Refining capacities
\[ \text{Mb/d} \]

#9 world refiner
(#1 in Europe)

Petrochemical capacities
\[ \text{Mt/y} \]

#10 world Petrochemical producer
(#2 in Europe)

- Global capacities at 12.31.2015
Improving the Carbon Intensity of Our Production Mix

Become the responsible energy major "More than 60% gas in our hydrocarbon production mix in 20 years' time."

- Deploying an assertive strategy in gas, while limiting methane emissions
- Selecting and developing safe, environmentally responsible, competitive oil and gas projects
- Expanding carbon capture, use and storage technologies
- Publicly supporting the implementation of carbon pricing mechanisms
- Exiting the coal business: We ceased coal production following the sale of our affiliate Total Coal South Africa in August 2015. We will also be withdrawing from coal marketing by the end of 2016.
- Encouraging sector initiatives and collectively engage to address climate issues

Integrating Climate into our Strategy

Developing Renewable Energies

"20% low-carbon businesses in 20 years’ time"

- Growing as a top three solar player by expanding our activities across the photovoltaic chain, including distribution
- Adding energy storage to our businesses
- Developing bioenergies
- Promoting access to energy

Improving Energy Efficiency

Promote responsible energy use in our operations and by our customers

- Continuing our efforts to reduce greenhouse gas emissions at our facilities
- Providing solutions (products and services) to encourage responsible energy use by our customers
UNIQUE APPROACH FOR ROTO-MOULDING INDUSTRY