Ethane downstream in Middle East & Egypt
Prospects to the future

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ETHANE TO ETHYLENE & DERIVATIVES 2013
Global Petrochemicals Markets Summit
October 29-30, 2013 | Houston | Texas
Outlines

1- Ethylene demand / supply

2- Crackers competitive position

3- Polyethylene the main downstream

4- MENA in numbers

5- Egyptian Petrochemicals master plan
1- Ethylene supply / demand

Ethylene demand growth is forecast to require 50-75 world-scale crackers by 2025
– The Middle East and China will continue to see development
– Development of global shale resources will also drive new petrochemical investment

Source: CMAI / IHS
Ethylene supply / demand

Global Ethylene Supply & Demand

World Effective Operating Rate (LYB View)

Capacity / Demand (billions of pounds)

Effective Operating Rate (EOR)

Global balance begins to shift in favor of producers in 2013 / 2014

Source: LYB estimates and third party consultants.
Ethylene supply

ETHYLENE NET CAPACITY ADDITIONS 2012-2020
(Includes Speculative Additions)

Over 70% of additions in ME and Asia!
About 24% in ME

Source: Nexant
MIDDLE EAST HAS BROUGHT ON STREAM A NUMBER OF ETHANE CRACKERS, BUT THE REGION’S DIMINISHING NGL RESOURCES MAY BE A CONSTRAINT FOR NEW PROJECTS

From 2001 to 2011 21 mnt of new ethylene capacity,

share of ethane in feedstock has climbed from roughly 50% to 70%

one of the reasons for extending valued-added downstream chain. E.g., in 2010-2011 Saudi Arabia’s NGL production was sufficient to supply 75% of ethylene capacity

18% of gas production

Sources: EIA, ICIS, IHS Chemical, SIBUR estimates

New crackers in the Middle East will be based on mixed feedstock that will put them further to the right of the cost curve. E.g., the new $20 bn cracker Sadara in Saudi Arabia is expected to feed on naphtha (70%) and NGL (30%)

Ethane prices in the Middle East are expected to rise. In Saudi Arabia, there have been discussions for several years to increase the price to $1.25/MMBTU (potentially to 2-3/MMBTU)

cheapest polyolefins producer on the cost curve fixed at this level since 1998, when oil price was $13/bbl

Ethane to Ethylene & Derivatives Global Petrochemicals Markets Summit October 29-30 Crowne plaza | Houston
## 2-Crackers Competitive position

### Average Regional Steam-Cracker Profitability

**Summary for Q1 2013 versus Q4 2012 (US$/tonC2)**

<table>
<thead>
<tr>
<th>Region</th>
<th>WE</th>
<th>CE</th>
<th>NA</th>
<th>ME</th>
<th>China</th>
<th>Asia</th>
<th>World</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Q1 2013</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Feed Cost</td>
<td>546</td>
<td>561</td>
<td>-19</td>
<td>357</td>
<td>406</td>
<td>495</td>
<td>524</td>
</tr>
<tr>
<td>Variable Cost</td>
<td>550</td>
<td>552</td>
<td>281</td>
<td>52</td>
<td>610</td>
<td>604</td>
<td>391</td>
</tr>
<tr>
<td>Fixed Cost</td>
<td>112</td>
<td>120</td>
<td>71</td>
<td>34</td>
<td>37</td>
<td>52</td>
<td>57</td>
</tr>
<tr>
<td><strong>Ethylene Cost</strong></td>
<td>1,209</td>
<td>1,233</td>
<td>333</td>
<td>443</td>
<td>1,053</td>
<td>1,152</td>
<td>973</td>
</tr>
<tr>
<td>Margin</td>
<td>303</td>
<td>353</td>
<td>749</td>
<td>866</td>
<td>362</td>
<td>171</td>
<td>326</td>
</tr>
<tr>
<td>ROI (%)</td>
<td>10.4</td>
<td>10.7</td>
<td><strong>36.2</strong></td>
<td><strong>41.6</strong></td>
<td>11.9</td>
<td>5.6</td>
<td>12.8</td>
</tr>
<tr>
<td><strong>Q4 2012</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Feed Cost</td>
<td>579</td>
<td>646</td>
<td>87</td>
<td>338</td>
<td>402</td>
<td>471</td>
<td>586</td>
</tr>
<tr>
<td>Variable Cost</td>
<td>571</td>
<td>530</td>
<td>267</td>
<td>53</td>
<td>597</td>
<td>586</td>
<td>386</td>
</tr>
<tr>
<td>Fixed Cost</td>
<td>112</td>
<td>124</td>
<td>67</td>
<td>35</td>
<td>36</td>
<td>52</td>
<td>56</td>
</tr>
<tr>
<td><strong>Ethylene Cost</strong></td>
<td>1,262</td>
<td>1,300</td>
<td>421</td>
<td>425</td>
<td>1,035</td>
<td>1,109</td>
<td>1,029</td>
</tr>
<tr>
<td>Margin</td>
<td>200</td>
<td>231</td>
<td>567</td>
<td>830</td>
<td>308</td>
<td>130</td>
<td>197</td>
</tr>
<tr>
<td>ROI (%)</td>
<td>6.7</td>
<td>6.6</td>
<td><strong>28.3</strong></td>
<td><strong>39.1</strong></td>
<td>10.3</td>
<td>4.4</td>
<td>7.8</td>
</tr>
</tbody>
</table>

Asia includes China. Note that the Middle East includes liquid cracking in Iran and Saudi Arabia.

**Source:** Association of Petrochemical producers in Europe
The Middle East, even with some increase in gas price, will remain the world’s low cost supplier

Source: Nexant
N American products likely to mainly stay in the Americas, replacing imports. Higher margins leading to renewed innovation budgets.

Again, the Middle East’s position as the world’s low cost supplier will not be challenged.

Source: Nexant
3- Polyethylene the main downstream

Here the market did not foresee potential of the new crackers based in shale gas in U.S. N.America was forecasted to add only roughly 1 mnt of PE capacity by 2016
IF U.S. IMPLEMENTS 50% OF THE ANNOUNCED ETHANE-BASED PROJECTS, THERE WILL BE A SIGNIFICANT PE SURPLUS GLOBALLY IN 2016-2017

If U.S. launches 50% of the announced ethylene capacity (expansions + 3 new world-class ethane crackers), there will be a global PE surplus of 4.1-4.5 mnt in 2016-2017
• Under this scenario, by 2020 global PE demand will catch up with supply and there will be a room for new capacity additions elsewhere
• If U.S. launches 100% of the announced ethylene capacity (expansions + 7 new world-class ethane crackers), the surplus will rise to 6.5 mnt in 2017-2018 and the market will remain long through 2020
• This may call PE producers in the U.S. to revise down their capacity expansion plans and delay new projects. Less cost advantaged PE players in Europe and Asia, located on the right side of the cost curve, may be forced to exit the market. More competitive regions with access to cheap feedstock, such as Middle East and Russia, may also revise down their plans to add new PE capacity.
A number of market drivers exist but sector has become dominated by China.
4- MENA in numbers

The Middle East and North Africa is a dynamic growth region

Chemical production has grown 200% since 2005
Manufacturing and services account for 83%

Chemical Production Investment has reached $51 Billion

Non-oil Growth 4.5%
Non-oil expansion accounts for ¾ of total GDP growth

High growth sector RENEWABLE ENERGY
Start-up companies are growing at 60% per year

Concentrated Solar Power plants could generate 100 times the combined electricity consumption

Construction sector in Qatar $12 billion

5.5% GDP growth

Projected 6.9% growth projected for the hospitality industry

Retail expected to grow at 13%

Building and Construction are central to MENA growth
BOOMING YOUTH population growth

Access to stable GCC market
GCC countries predicted to grow at an average of 8% in 2012-13

GDP per capita, Qatar will be the richest country in the world by 2013.

Regional Trade Agreements for ease of business

African combined spending power of $1.3 trillion

Consistent UPWARD GROWTH since 2000 of 4.8%
Polyolefins supply/demand in the Middle East has an opposite trend to Africa.
Over the past 5 years, the GCC plastic industry doubled its capacity resulting in the GCC global position being large and growing rapidly.
GCC Thermoplastic Domestic Demand

- **2007**
  - LDPE 8%
  - PS 7%
  - EPS 1%
  - HDPE 18%
  - LLDPE 16%
  - PVC 22%
  - PP 18%

- **2012**
  - LDPE 8%
  - PS 5%
  - EPS 1%
  - HDPE 20%
  - LLDPE 16%
  - PVC 18%
  - PP 19%

- **CAGR 9%**

GCC Petrochemicals Capacity Additions by Country and Polymer, 2012-2015

- **5 Million Tons**
  - UAE 48%
  - Oman 3%
  - Saudi Arabia 49%

- **5 Million Tons**
  - PE 40%
  - PP 23%
  - PET 27%
  - ABS 4%
  - BR 2%
  - SBR 2%
  - SAP 2%
Significant growth of commodity resins … globally and in MEA
5- Egyptian Petrochemicals master plan

1- Expansion Plan for Egypt
2- Master Plan
3- Sector Drivers
4- Market balance
5- New builds
1- Expansion Plan for Egypt

The goal for Egypt is to be self-sufficient in this arena by 2022. There is an Egyptian plan to increase domestic production to reach 20 million tons.

The annual growth rate for this sector is 6-7%.

Egypt’s Petrochemical Development Strategy:

**STEP1:** Assigning an International experienced consultant to set a Master Plan for the Petrochemicals industry.

**STEP2:** Establishing a Petrochemical authority to support the implementation of a Master Plan for the Petrochemical projects (E-Chem).
Way forward:

20 Years Master Plan for The Petrochemical in Egypt.

Master plan vision of the industry which could be established in Egypt over the next 20 years (2002-2022)

taking into consideration:

• Global and Local Market
• Feedstock Availability
• Existing Projects (EPC, SIDPEC, E-LAB, EPP, E-Styrenics, Mopco, E-METAHNEX)
• Land Availability
• Financing
20 YEAR MASTER PLAN

El-Beheira
3.1 MM sq.m

Kafr El-Sheikh
4.2 MM sq.m

El-Dakahlia
7.65 MM sq.m

Damietta
2.4 MM sq.m

Ismailia
0.67 MM sq.m

Suez
6.3 MM sq.m

6 Locations 8000 Feddans
1 Feddan = 4,200 sq. m

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Petrochemicals Master Plan (2002 - 2022)

PHASE (1)
(2002 - 2008)
US $ 6 billion

- Methanol (I)
- Ammonia / Urea (I)
- Ammonia / Urea (II, III)
- Polypropylene (I)
- Polystyrene
- LAB
- Acrylic Fibers
- PVC (I)
- 1st Olefins Complex

PHASE (2)
(2009 - 2015)
US $ 7 billion

- Styrene
- Polyester (I)
- Aromatics Complex
- Ethoxylates
- 2nd Olefins Complex
- Methanol (II)
- PTA
- SB Latex (I)

PHASE (3)
(2016 - 2022)
US $ 7 billion

- Propylene /
  Polypropylene (II)
- 3rd Olefins Complex
- Styrenic Complex
- Vinyl's Complex
- Butadiene
- Detergents (II)
- SB Latex (II)

In Operation
Under Construction
Under Development
Phase 3
Production in 2002

Total Production: 600

- Poly-Propylene: 165
  - OPC: 165

- Ethylene: 300
  - SIDPEC: 300

- Poly-Ethylene: 225
  - LAB: 50
  - PVC: 80
  - Soda: 72
  - Others: 30
### Petrochemicals Production in 2009

<table>
<thead>
<tr>
<th>Product</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOPCO Urea</td>
<td>600 KTA</td>
</tr>
<tr>
<td>MOPCO Ammonia</td>
<td>50 KTA</td>
</tr>
<tr>
<td>MOPCO Total</td>
<td>650 KTA</td>
</tr>
<tr>
<td>ELAB LAB</td>
<td>100 KTA</td>
</tr>
<tr>
<td>Acrylic Fiber</td>
<td>54 KTA</td>
</tr>
<tr>
<td>OPC PP</td>
<td>165 KTA</td>
</tr>
<tr>
<td>OPC Total</td>
<td>165 KTA</td>
</tr>
<tr>
<td>LAB Total</td>
<td>50 KTA</td>
</tr>
<tr>
<td>Sidpec Ethylene</td>
<td>230 KTA</td>
</tr>
<tr>
<td>Sidpec PE</td>
<td>225 KTA</td>
</tr>
<tr>
<td>EPC PVC</td>
<td>80 KTA</td>
</tr>
<tr>
<td>EPC Total</td>
<td>80 KTA</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1400 KTA</strong></td>
</tr>
</tbody>
</table>
Petrochemicals Capacity in 2012

- EPC: 80 KTA PVC
- SIDPEC: 225 KTA PE
- LAB Unit: 50 KTA LAB
- OPC: 165 KTA PP
- Acrylic Fiber: 54 KTA AF
- E-LAB: 100 KTA LAB
- MOPCO: 600 KTA Urea
- 50 KTA Ammonia

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Ethane to Ethylene & derivatives Global petrochemicals Markets Summit October 29-30 Crowne plaza Houston

Expected Petrochemicals Capacity in 2015

<table>
<thead>
<tr>
<th>Product</th>
<th>Capacity</th>
<th>Job Opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Styrene 300</td>
<td></td>
<td>17200</td>
</tr>
<tr>
<td>Ethylene 400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polyethylene 300</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PET 420</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ammonia 100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urea 1300</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MOPCO (EXP)</td>
<td></td>
<td>5370</td>
</tr>
</tbody>
</table>

KTA

2002: 600
2009: 1400
2012: 3150
2015: 5370
## 3- Sector Drivers

<table>
<thead>
<tr>
<th>Sector Drivers</th>
<th>Egypt’s Value Proposition</th>
<th>Investor Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Resources</td>
<td>In addition to abundant natural gas reserves, Egypt has reserves of many raw materials needed for the manufacture of any number of petrochemical products.</td>
<td>Locally available raw materials reduce the costs of manufacturing.</td>
</tr>
<tr>
<td>Feeder and Support Industries</td>
<td>Egypt has numerous feeder industries to support the petrochemicals sector.</td>
<td>Presence of locally based feeder and support industries facilitates doing business and reduces outsourcing costs.</td>
</tr>
<tr>
<td>Proximity to Customers</td>
<td>Egypt is close to major petrochemical consumers in Europe, Africa and the Middle East.</td>
<td>Strong regional markets and proximity to major export markets decreases the time it takes to get products to customers.</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Egypt has 15 commercial and 44 specialized ports, including 11 for petroleum. Egypt also has international ports, airports and highways, as well as an in-country rail system. Egypt also boasts world-class telecom and internet infrastructure. All major urban centers have cutting-edge telecommunications technology.</td>
<td>Flexible export options, ease of transport, excellent infrastructure to support communications and research.</td>
</tr>
<tr>
<td>Built-in Market</td>
<td>With a population over 80 million, Egypt’s domestic consumption of petrochemical products is expected to increase in the coming years. In addition, Egypt supplies petrochemical products to about 50 countries worldwide.</td>
<td>Large built-in market provides a steady consumer base.</td>
</tr>
</tbody>
</table>
## Market balance

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Thousand tons</td>
<td></td>
</tr>
<tr>
<td><strong>Polyethylene (PE)</strong></td>
<td>620</td>
<td>600</td>
</tr>
<tr>
<td><strong>Polyethylene Terephthalate (PET)</strong></td>
<td>265</td>
<td>420</td>
</tr>
<tr>
<td><strong>Polypropylene (PP)</strong></td>
<td>590</td>
<td>400</td>
</tr>
<tr>
<td><strong>Polyvinyl Chloride (PVC)</strong></td>
<td>270</td>
<td>80</td>
</tr>
<tr>
<td><strong>Polystyrene (PS)</strong></td>
<td>125</td>
<td>200</td>
</tr>
</tbody>
</table>
5- New builds

Egyptian Indian Company for Polyester

Egyptian Indian Polyester Company "EI-PET", an Egyptian Joint Stock Company. This project aims at producing the Polyester used for food and beverage packaging, so as to meet local market's demands as well as fulfilling export surplus.

**Plant Capacity**
420 Thousand Tons/Year.

**Feedstock**
PTA (Purified Terephthalic Acid)
MEG (Mono Ethylene Glycol)

**Total Investment Cost**
253 Million USD.

**Location**
Economic Zone – North West Gulf of Suez.
The Egyptian Ethylene and Derivatives Company - ETHYDICO

As a part of the National Petrochemicals Master Plan, the complex aims at producing Ethylene and Ethylene Derivatives to maximize the value added to Ethane/Propane mixture - produced by The Western Desert Gas Complex in Alexandria. Ethylene is esteemed to be important for many intermediate petrochemical industries, such as PE, Styrene and PVC, etc...

**Plant Capacity**

460 Thousand Tons/Year Ethylene.
400 Thousand Tons/Year Poly Ethylene.

**Total Investment Cost**

1900 Million USD.

**Location**

Al-Amerya - Alexandria
Egyptian Styrenics Company (E-styrenics)- Styrene Project

The Project aims at producing Styrene in order to satisfy the feed requirements of the Polystyrene plant and export the Styrene surplus.

**Plant Capacity**
300 KTA Styrene

**Feedstock**
80 KTA Ethylene from Ethydoco

**Total Investment Cost**
460 Million USD

**Location**
Al Dekheila Port - Alexandria

Licensor and basic Engineering packages have been settled.
1. Gas to Olefins Complex (GTO)

This project targets optimizing the Egyptian natural gas usage, satisfying the market’s needs of Olefins (Ethylene & Propylene) and Poly-olefin (Polyethylene & Polypropylene), and exporting the surplus. The project will use the state-of-the-art technology to convert the lean natural gas (mainly C1) into methanol, thus, convert the latter into olefins (ethylene and/or propylene).

**Plant Capacity**

1 million T/Y of olefins (Ethylene and Propylene) to produce 1 million T/Y of Poly-olefins (polyethylene & polypropylene)

**Total Investment Cost**

4 Billion USD.

**Location**

Not Yet determined
2. Petrochemicals Downstream Clusters

Developing world-class industrial downstream clusters based on the basic petrochemical products that are produced from phase one projects.

**Feedstock**

Petrochemicals products with different grades: (PVC), Poly propylene (PP), Polyester (PET), Polyethylene (PE), Polystyrene (PS), Acrylonitrile Butadiene Styrene (ABS).

Set of small and intermediate petrochemical industries integrated with each other in utilities and services to produce final products.
Selected Clusters

1- Plastic Packaging Cluster

Feedstock
- HDPE
- LLDPE
- PP
- PS
- PVC
- PET

Process
- Blow Film
- Cast Film
- Extrusion
- Form Fill Seal
- Injection Molding
- Blow Molding

End Use
- Packaging
- Laminate/Pouches
- Cups/ Bottles
- Food Serving Caps
- Containers/Tanks
- Agriculture film
2- Construction Cluster

Feedstock
- HDPE
- LLDPE
- PP
- PVC
- ABS

Process
- Extrusion
- Roto-molding
- Injection Molding
- Blow Molding

End Use
- Tanks/Pipes
- Containers
- Flexible tubing
- Profiles
- Siding shutters
- Decking/Outdoor furniture
3- Automotive Cluster

**Feedstock**
- HDPE
- PS
- SBR, SBL
- PP
- ABS
- Butadiene
- PET

**Process**
- Film
- Extrusion
- Injection molding
- Blow Molding
- Compounding
- Thermoforming
- Fiber

**End Use**
- Car bumper
- Seats
- Interior parts
- Battery cases
- Carpets/ Gaskets
- Tyres/ Hoses
Thank you

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