Egyptian Petrochemicals Industry

A Prospect for the Future

M. SAMY ABDELHADY

DECEMBER, 2012
Egyptian Petrochemical Industry 2002-2015

Constrains & Challenges

Future Vision

Q & A
Petrochemical industry plays a vital role in the economic development and growth. In recognition of the importance of petrochemicals industry in Egypt’s economy, along with the existence of successful drivers, petrochemical development strategy has settled to accelerate the implementation of such industry.
Egypt’s Petrochemical Development Strategy

Step 1
Assigning an International experienced consultant to set a Master Plan for the Petrochemicals industry.

Step 2
Establishing a Petrochemical authority to support the implementation of a Master Plan for the Petrochemical projects.
The Petrochemical Master plan presents a vision of the industry which could be established in Egypt over the next 20 years (2002-2022) taking into consideration:

- Feedstock Availability
- Global and Local Market
- Existing Projects (EPC, SIDPEO)
- Financing
- Land Availability

Master Plan Backbone
KEY FEATURES OF PETROCHEMICAL VISION

US $ 20 Billion Investment in 20 Years

Achieve
US $ 15 Billion Revenues

14 Complexes
24 projects
50 Production Unit

Produce
15 million TPA of Intermediate & Final Products

100,000 job
Opportunity (direct & indirect)
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)
PHASE 1 ACHIEVEMENTS
### Phase 1- Achievements (2002-2012)

<table>
<thead>
<tr>
<th>Company</th>
<th>Products</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELAB</td>
<td>100 KTA Linear Alkyl Benzene (LAB)</td>
<td>Alexandria</td>
</tr>
<tr>
<td>EPP</td>
<td>400 KTA Propylene</td>
<td>Port Said</td>
</tr>
<tr>
<td>EMETHANEX</td>
<td>400 KTA Polypropylene</td>
<td>Port Said</td>
</tr>
<tr>
<td>MOPCO</td>
<td>1.3 Million T/Y Methanol</td>
<td>Damietta Port</td>
</tr>
<tr>
<td>ESTYRENICS</td>
<td>600 KTA Urea</td>
<td>Damietta</td>
</tr>
<tr>
<td></td>
<td>50 KTA Ammonia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>200 KTA Poly-Styrene</td>
<td>Alexandria</td>
</tr>
</tbody>
</table>

Phase 1 projects assure our commitment and success to achieve a national Petrochemical Master Plan strategy, consequently, **five plants were successfully operated, and two projects are currently under construction.**
The Project aims at producing Urea to replace imports and increase exports.

**Plant Capacity**
- 1380 Million T/Y Urea
- 100 KTA Excess Ammonia

**Feedstock**
- Natural Gas

**Total Investment Cost**
- 1800 Million USD

**Location**
- Damietta
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.
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
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
EGYPTIAN PETROCHEMICAL INDUSTRY: (2002-2015)
Production in 2002

Total Production: 600

- Poly-Propylene: 165
- Ethylene: 300
- Poly-Ethylene: 225
- PVC: 80
- Caustic Soda: 72
- Others: 30

OPC

SIDPEC

LAB

EPC
Petrochemicals Production in 2009

Total: 1400 KTA

- MOPCO: 600 Urea, 50 Ammonia (650 KTA)
- ELAB: 100 LAB
- Acrylic Fiber: 54 Acrylic Fiber
- OPC: 165 PP
- LAB: 50
- SIDPEC: 230 Ethylene, 225 PE
- EPC: 80 PVC
Petrochemicals Capacity in 2012

- **EPC**: 80 KTA PVC
- **SIDPEC**: 225 KTA PE
- **LAB Unit**: 50 KTA LAB
- **OPC**: 165 KTA PP
- **E-Methanex**: 1 150 KTA Methanol
- **EPP**: 400 KTA PP
- **E-Styrenics**: 200 KTA PS
- **MOPCO**: 600 KTA Urea
- **50 KTA Ammonia**
- **Acrylic Fiber**: 54 KTA AF
- **E-LAB**: 100 KTA LAB
- **2009**: 1 400 KTA
- **2012**: 3 100 KTA
Expected Petrochemicals Capacity in 2015

- **Capacity**
  - 600: MOPCO (EXP.)
  - 1400: Ethylene 400
  - 3150: Polyethylene 300
  - 5370: PET 420
  - 17200: Styrene 300

- **Company**
  - MOPCO (EXP.)
  - Ethylene Styrenics

- **KTA**
  - 2002: 600
  - 2009: 1400
  - 2012: 3150
  - 2015: 5370

- **Job Opportunities in 2015**: 17200

- **Chemicals**
  - Urea 1300
  - PET 420
  - Ethylene 400
  - Polyethylene 300
  - Styrene 300
  - MOPCO (EXP.)
  - Ethylene Styrenics
WHAT ABOUT FUTURE
Constrains & Challenges

- Investment / Financing.
- Competition.
- Feedstocks.
Outlines of Future Vision

i. Master Plan
ii. Value Chain Approach
iii. Petrochemical / Refinery Integration
iv. Liquid Feedstocks “Naphtha Cracking”
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
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
- Polypropylene (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
The Aromatics Complex is one of the main projects in the Egyptian Master Plan. This project aims at producing (PX & Bz) to serve several downstream petrochemical projects (PTA, PET, PS, ...etc) in Egypt, by utilizing Naphtha obtained from existing refineries in Suez. The surplus of this production will be exported.

**Plant Capacity**
350 KTA Benzene, 530 KTA Para-Xylene

**Feedstock**
1.7 KTA Naphtha

**Total Investment Cost**
1750 MMUSD

**Location**
Suez
Crude Oil

- Refinery gases
- Bottled gas
- Gasoline (Petrol)
- Fuel for cars
- Naphtha
- Aircraft fuel
- Kerosene
- Fuel for cars, lorries, buses
- Diesel Oil
- Fuel for cars, lorries, buses
- Fuel Oil
- Fuel for ships, power stations
- Residue
- Bitumen for roads and roofs

Naphtha

- Raffinate
- Paraxylene (PX) 530 KTA
- Benzene (BZ) 306 KTA

Light Naphtha

- LN 305 KTA
- LPG 55 KTA
- Hydrogen (H₂) 118 KTA

Aromatics Complex
4. Steam Cracking

Steam Cracking Process:
- Gas Feed
- Liquid Feed

Products:
- Ethylene
- Propylene
- Benzene
- Butadiene
- Pentadiene
- Isoprene
- Cyclopentadiene
- Aromatics

- Produced by both Gas and Liquid Feed
- Only a by-product of cracking Liquid Feeds
Other steam cracker feedstocks

- Ethane ⇒ ethylene only (Middle East, USA)
- Propane/LPG ⇒ ethylene and propylene
- Condensates ⇒ more olefins and less aromatics
- Gas oil ⇒ less olefins and more aromatics

World steam cracking feedstock breakdown, 2011
Source: ICIS consulting
## Typical yields in wt% for various steam cracker feedstocks

<table>
<thead>
<tr>
<th></th>
<th>Ethane</th>
<th>Propane</th>
<th>Butane</th>
<th>Naphtha</th>
<th>Gas oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethylene</td>
<td>79-84</td>
<td>42-45</td>
<td>30-40</td>
<td>28-38</td>
<td>23-26</td>
</tr>
<tr>
<td>Propylene</td>
<td>1-3</td>
<td>14-18</td>
<td>16-20</td>
<td>13-18</td>
<td>13-14</td>
</tr>
<tr>
<td>Butadiene</td>
<td>2</td>
<td>2</td>
<td>2.5-3</td>
<td>4-5</td>
<td>4.8-5</td>
</tr>
<tr>
<td>Butenes/Butanes</td>
<td>1</td>
<td>1</td>
<td>6.5-6.8</td>
<td>4-5</td>
<td>4.5-5.3</td>
</tr>
<tr>
<td>Aromatics</td>
<td>0.4</td>
<td>3.5</td>
<td>3.4</td>
<td>7-14</td>
<td>10-13</td>
</tr>
</tbody>
</table>

Source: G. Margaret Wells, Handbook of Petrochemicals and Processes
## Comparison of Naphtha and Gas crackers

<table>
<thead>
<tr>
<th></th>
<th>Gas Cracker</th>
<th>Naphtha Cracker</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment cost</td>
<td>Standard</td>
<td>More than gas cracker due to higher number of equipments and variety of products</td>
</tr>
<tr>
<td>Product Yield</td>
<td>Ethylene and propylene yield is high</td>
<td>Ethylene and Propylene yield is low and is the reason for more by products</td>
</tr>
<tr>
<td>Operational difficulties</td>
<td>Easy to operate</td>
<td>Operation is difficult due to handling pour point problems and stripping of Heavy Fuel Oil</td>
</tr>
<tr>
<td>Integration with refinery</td>
<td>No advantage</td>
<td>Economic if integrated with a refinery</td>
</tr>
</tbody>
</table>
Selection Basis of cracking process

- Feed availability and costs at producer location
- Yield of each feed.
- Demand for each product.
- Alternatives to buy versus manufacture that product
- Economic Model Assessment
- Evaluate netback of all products.

Most of the Middle East; is gas cracking
Most of Asia; is liquid or Naphtha cracking
Steam cracking process

Source: Linde Engineering
Q & A

THANKS

M. SAMY ABDELHADY