

# CHEMSYSTEMS TRAINING

## THE GLOBAL PETROCHEMICAL INDUSTRY:

*Understanding the Complex Interactions between Technology, Economics, and Markets*

### DAY 1

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#### 9:00 Industry Cyclicity – Are We Doomed to Ride this Cycle Forever?

- The “Old (and current?) Paradigm”
- Industry restructuring
- The impact of private equity
- Some thoughts on profitability

#### The Chemical Industry

- Size
- Commodity versus specialty
- Historical beginnings of the industry
- Emergence of a true global business
- Key success factors
- The importance of the Middle East and China
- Major players

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#### 10:30 Coffee Break

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#### 10:50 How to Organize the Industry – The 7 Basic Building Blocks

- Ethylene
- Propylene
- Butadiene/Butylenes
- Benzene
- Toluene
- Xylenes
- Methane

#### The Petroleum Refinery/Petrochemical Interface

- Catalytic Cracking
- Catalytic Reforming
- Steam Cracking

#### Economics

- Cost of production calculations
- Economy of scale – why size matters
- Cost curves – what are they and what they can predict
- The concept of “shut-down” economics

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#### 12:30 Lunch

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#### 1:30 The Businesses from Ethylene\*

#### Polyethylenes – The Single Largest Segment in the Industry

- LDPE – the accidental discovery
- HDPE – Ziegler’s invention revolutionizes the business
- LLDPE – the best of both worlds!

#### Linear Alpha Olefins – A Diverse and Challenging Segment

- Full range processes – make one, make them all
- Sasol – coal to comonomers
- New On-purpose technologies – changing the LAO landscape

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#### 3:00 Tea Break

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#### 3:20 VCM and PVC Business

- Value chains and integration
- How technology saved the day
- China – going back to the future with acetylene
- Vinyls – fraught with environmental, health and safety issues

#### Ethylene Oxide/Ethylene Glycol Business

- Why the Middle East dominates production
- Why Asia dominates demand
- Who controls the technology

#### Ethanol

- Synthetic versus natural
- Fuel use versus industrial use
- “Green” Ethylene and Polyethylene

#### The Businesses from Propylene\*

#### Propylene- No Longer Ethylene’s Step-Child

- Introduction to the propylene value chain
- Historical, current, and forecast demand by region
- Supply sources and limitations – where will all the propylene come from?
- On-purpose propylene technologies

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#### 5:00 Finish of Day 1

# CHEMSYSTEMS TRAINING

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*Special Session: Adding Value to Natural Gas*

### DAY 2

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- 9:00 Polypropylene – The Versatile Plastic Driving Propylene Growth**
- Natta and Phillips discover polypropylene catalysts at the same time and a patent fight ensues
  - Evolution and massive restructuring in the polypropylene business in an effort to maintain profitability
  - End-uses and intermaterial competition
- The Acrylic Acid Business**
- Key players – a few players dominate the market
  - Polyacrylic acid – superabsorbent polymers (SAPs)
  - Acrylates – water based paints and UV curing
- The Acrylonitrile Business – Technology Still a Barrier!**
- HCN by-product – provides a barrier to entry
  - End-uses – synthetic wool, ABS, and HMDA

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**10:30 Coffee Break**

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- 10:50 The Propylene Oxide Business**
- Technology evolution – from chlorohydrin to PO/SM
  - New co-product free routes driving change
- The Styrene/Polystyrene Business – Will New PO-Only Routes Help?**
- PO/SM versus conventional EB dehydro
  - General purpose, HIPS, expandable
  - How a Donald Duck cartoon became prior art
- The Phenol Value Chain – The Other 2 for 1 Process**
- Phenol and acetone – the magic of chemistry
  - Bisphenol A – toxicity concerns
  - Epoxy resins
  - Polycarbonates

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**12:30 Lunch**

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**1:30 SPECIAL SESSION:**

**C1-based Chemicals, Fertilizers and Fuels**

**Overview of Middle East Gas Supply**

- Supply & Demand
- Pricing
- Government Policies & Regulations

**Impact of Chinese Coal Based Technology**

**Options for Adding Value to Gas: Energy**

- LNG
- Gas to Liquids (GTL)
- DME
- MTBE

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**3:00 Tea Break**

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**3:20 Special Session (Continued)**

**Options for Adding Value to Gas: Chemicals**

**Ammonia and Derivatives: Markets, Technology and Economics**

- Urea
- Ammonium Nitrates
- Ammonium Phosphates

**Methanol and Derivatives: Markets, Technology and Economics**

- Formaldehyde
- Acetic acid
- Vinyl acetate (VAM)
- Acetic Anhydride

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**5:00 Finish of Day 2**

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### DAY 3

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#### 9:00 The Businesses from the C<sub>4</sub>'s

##### Separation of the C<sub>4</sub> Olefins

##### Natural and Synthetic Elastomers

- Historical development of the rubber industry
- Charles Goodyear finds the key to curing rubber but dies penniless
- Why rubbers are elastomeric
- WW II spurs development of synthetic rubbers
- Polybutadiene rubber (BR)
- Styrene butadiene rubber (SBR)
- Butyl rubber, EP, EPDM
- Thermoplastic elastomers – a neat trick

##### Other C<sub>4</sub> Derivatives

- ABS – the Chi Mei story
- MTBE and alternatives
- Maleic Anhydride

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#### 10:30 Coffee Break

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#### 10:50 Sources of Aromatics – A Question of Balance

- Primary sources – pyrolysis gasoline, reformat, coke oven oil
- Secondary sources – hydrodealkylation, toluene disproportionation, transalkylation
- Regional differences

##### Businesses from Benzene\*

- Styrene (already covered)
- Cumene/Phenol (already covered)
- The Nylon business – how DuPont invented it and how BASF got around their patents
- The Isocyanate and Polyurethane business – a versatile and protected business

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#### 12:30 Lunch

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#### 1:30 The Businesses From Toluene – TDI\*

##### The Business from Xylenes\*

- Separating the xylenes
- PTA/Polyester business – the fastest growing segment in the industry
- Polyester film, fiber, bottles
- 1,3-PDO and PTT – A new monomer and polymer
- Phthalic anhydride – a mature product
- Unsaturated Polyester Resin (UPR)
- Alkyd Resins

##### Review of Key Concepts

##### Awarding of Certificates of Completion

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#### 3:30 Course Ends

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\*Technology, economics, major players, regional end-use patterns, trade flows, key success factors, and current trends for all product areas will be discussed.



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## ABOUT THE PRESENTER

MANUEL ASALI

Manuel Asali recently joined Nexant's Bahrain office as Principal, Middle East, where he is undertaking strategy and business development work related to various petrochemical value chains. Manuel has a degree in chemical engineering from the National University of Mexico and an MBA from London Business School in the U.K. He has more than 20 years of experience in the petrochemical industry in the areas of strategic planning, marketing and consulting. Previously he has worked in Mexico and the U.K. and he spent the last 5 years working for SABIC in Saudi Arabia, focusing on Business Strategy. Manuel's experience also includes part-time lecturing, delivering papers at several conferences and more recently teaching ChemSystems Training Courses.