

CHEMSYSTEMS TRAINING

THE GLOBAL PETROCHEMICAL INDUSTRY:

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

DAY 1

8:40 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

10:00 Coffee Break

10:20 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
- Capex categories
- Economy of scale – why size matters
- Transfer pricing issues – who shows the profit?
- Cost curves – what are they and what they can predict
- The concept of “shut-down” economics

12:00 Lunch

1:00 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
- Detergent Alcohols – synthetic versus natural
- Biodiesel and glycerine – the tyranny of 2 for 1 processes

3:00 Coffee Break

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
- Is ethanol in gasoline a good thing?

5:00 Finish of Day 1

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Special Session: Coal Conversion to Chemicals and Fuels

DAY 2

8:30 The Businesses from Propylene*

Regional Propylene Supply/Demand Dynamics – 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?
- New and developing on-purpose propylene production technologies

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
- Major global players
- Trade flows – who makes it/who uses it
- End-uses and intermaterial competition

10:00 Coffee Break

10:20 The Acrylonitrile Business – Technology Still a Barrier

- Ammoxidation technology is discovered and leads to another patent dispute – settled in a most unusual way!
- HCN by-product – provides a barrier to entry
- Major global players but only a few Asian producers
- Trade – the US maintains a major presence
- End-uses – synthetic wool, ABS, and HMDA

The Acrylic Acid Business – A Nicely Profitable Segment

- Key players – a few players dominate the market
- Polyacrylic acid – superabsorbent polymers (SAPs)
- Acrylates – water based paints and UV curing

12:00 Lunch

1:00 SPECIAL SESSION:

Coal Conversion to Chemicals and Fuels

Overview of Chinese Coal Industry

- Supply & Demand
- Pricing
- Government Policies & Regulations
- Drivers for Coal Conversion

Coal to Chemicals (CTC)

- Chemicals via Coal Gasification Option
 - Gasification Technologies and Coal Properties
 - Ammonia & Derivatives
 - Methanol, DME, Acetic Acid, Formaldehyde & Derivatives
 - Methanol to Olefins (MTO/MTP) & Derivatives
 - Ethanol & Derivatives

3:00 Coffee Break

3:20 Coal to Chemicals (CTC) (continued)

- Chemicals via Coke Production Option
 - Acetylene & Derivatives

Coal to Synthetic Natural Gas (CTG) via Coal Gasification

Coal to Liquids (CTL)

- Indirect Coal to Liquids (ICTL) via Coal Gasification
- Direct Coal to Liquids (DCTL) via Coal Liquefaction

Polygeneration from Coal

Issues and Challenges of Coal Conversion

5:00 Finish of Day 2

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DAY 3

8:30 The Businesses from the C₄'s

Separation of the C₄ 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 C₄ Derivatives

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

10:00 Coffee Break

10:20 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

12:00 Lunch

1:00 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

2:30 Coffee Break

2:50 The Businesses From Methane – A Shift To Low Cost Gas Regions*

- Natural gas sources and terminology
- Routes to synthesis gas
- Gas to liquids (GTL)
- Ammonia
- Methanol
- Formaldehyde
- Acetic acid/Acetic Anhydride
- 1,4-Butanediol/THF (A sad, but true story of how one company did not understand “shut-down” economics)

Review of Key Concepts

4:30 Conclusion of Course