

## THE GLOBAL PETROCHEMICAL INDUSTRY:

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

### DAY 1

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#### 8:30 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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#### 10:00 Coffee Break

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#### 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

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#### 12:00 Lunch

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#### 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

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#### 2:30 Coffee Break

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#### 2:50 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?

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#### 4:30 Finish of Day 1

## THE GLOBAL PETROCHEMICAL INDUSTRY:

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### DAY 2

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#### 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

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#### 10:00 Coffee Break

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#### 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

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#### 12:00 Lunch

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#### 1:00 The Propylene Oxide Business – New Technologies Changing Industry Dynamics

- Technology evolution – from chlorohydrin to PO/SM
- New co-product free routes driving change
- How to analyze a business – a brief case study

##### The Styrene/Polystyrene Business – Will New PO-Only Routes Help?

- Feast or famine business
- PO/SM versus conventional EB dehydro
- General purpose, HIPS, expandable
- The Huntsman story
- 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
- Will a co-product free route emerge?
- Phenolics – thermosets - thermoplastics
- Bisphenol A – toxicity issues at the forefront

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#### 2:30 Coffee Break

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#### 2:50 The Phenol Value Chain (continued)

- Epoxy resins – a business in transition
- Polycarbonate – will the growth abate?
- Acetone/Methyl Methacrylate (MMA)

##### The Oxo Alcohols Business – Regulation and Biofuels Affecting this Segment

- Technology – the power of homogeneous catalysis
- *n*-Butanol – Is biobutanol a threat?
- 2-Ethylhexanol and plasticizer business – health and safety concerns impacting demand

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#### 4:30 Finish of Day 2

## THE GLOBAL PETROCHEMICAL INDUSTRY:

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### DAY 3

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#### 8:30 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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#### 10:00 Coffee Break

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#### 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

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#### 12:00 Lunch

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#### 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

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#### 2:30 Coffee Break

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#### 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

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#### 4:00 Conclusion of Course