

THE GLOBAL PETROCHEMICAL INDUSTRY:

Understanding the Complex Interactions between Technology, Economics, and Markets

DAY 1

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

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

2:30 Coffee Break

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?

4:30 Finish of Day 1

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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 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

2:30 Coffee Break

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

4:30 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

4:00 Conclusion of Course

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



CHEMSYSTEMS TRAINING

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ABOUT THE PRESENTERS

DR. JEFFREY S. PLOTKIN

Jeffrey Plotkin is Vice President of Nexant ChemSystems Training Programs and the Process Evaluation/Research Planning (PERP) program. Managing these activities often involves working closely with technology developers, including operating companies and engineering contractors. Jeff's interests are in all phases of process research and development with special emphasis on gas to chemicals, selective oxidations, alkane activation and biocatalyzed routes to chemicals.

Jeff is co-editor of the American Chemical Society's Patent Watch website at Chemistry.org, co-author of "Industrial Organic Chemistry, 2nd Edition" (Wiley Interscience), and is a frequent contributor of technology-oriented articles to ICIS Chemical News. Jeff holds more than thirty U.S. patents and is author of 25 publications in peer reviewed academic journals.

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.