Prospects for the Basic Petrochemical Value Chains

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What Is This Light?

The light at the end of the tunnel?

• Short-term price outlook
• All around Asia for olefins & aromatics
• Long term price outlook
• Trends for each key olefin and aromatic products

An on-coming train?
Prices & Margins Have Collapsed

Dollar Per Metric Ton (Olefins Products) vs. Dollar Per Barrel (Crude Oil)

- Naphtha
- Ethylene
- Propylene
- PE
- PP
- Crude Oil

Timeline: January 2008 to August 2009

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The Drop in Aromatics Prices

- Naphtha, C&F Japan
- Benzene, FOB Korea
- PX, CFR Taiwan
- Toluene, FOB Korea
- Styrene, CFR China
- Crude Oil, WTI

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China Supportive Of Chemical Demand & Supply

- Massive new integrated investments in 2008-2011
  - 6.3 MMT ethylene; +63%
  - 5.3 MMT propylene; +57%
  - 4.6 MMT benzene; +80%
  - 4.4 MMT paraxylene; +109%

- Still not self-sufficient for most chemicals, but import needs are not growing as fast or reducing

- Economic stimulus package will support chemical investment and local consumer demand

- Coal chemistry is a viable option
India Still Will Grow, But…

• Projects under construction will start
  o Reliance (Early 2009) refinery
  o Indian Oil (Early 2010) olefins & aromatics
  o ONGC aromatics complex (mid 2011)

• India will be large exporter until local economy grows

• Others major projects being considered:
  o Reliance
  o ONGC
  o IOC
  o ESSAR

• Non-financed projects struggle until economy improves

• Demographics support long-term petrochemical demand growth
Southeast Asia Will Continue to Invest

• Projects under construction, only slightly delayed:
  o Shell & Exxon in Singapore
  o PTT & Siam/Dow in Thailand

• New projects either integrated or have advantaged feedstock

• Others still being considered: Singapore, Vietnam, Brunei, Philippines, Indonesia, Malaysia

• Non-financed projects struggle until economy improves
Japan, Korea and Taiwan
Focus On Competitiveness

- Reducing operating rates in short-term to meet demand
- Little expansion of olefins, some small aromatics projects associated with refineries in Japan and Korea
- Integrating with upstream & downstream facilities
- Adding feedstock flexibility
- Producing specialty products
- Consolidation and closures likely and necessary
Massive Investments In The Middle East Will Compete in Asia & The World

- Massive feedstock advantaged investments in 2008-2011
  - 11.4 MMT ethylene; +60%
  - 5.0 MMT propylene; +80%
  - 0.9 MMT benzene; +30%
  - 1.6 MMT paraxylene; +79%
- Refinery based aromatics complexes starting up in Kuwait and Oman
- Feedstock advantage is greatest in gas chemistry but liquid feeds being used to diversify chemical base
- Exporting large volumes of derivatives (PE, PP, MEG)
- With new capacity in China, China’s thirst for imports no longer large enough to consume Middle East excesses
  - This will impact the rest of the world!
Middle East Has The Lowest Cost Ethylene

Cumulative Ethylene Capacity (Million Metric Tons)

- Middle East Avg.
- Southeast Asia Avg.
- North America Avg.
- Northeast Asia Avg.
- Europe Avg.

Ethylene Production Cost, Dollars Per Metric Ton

- 2008 WTI Crude Oil: 2008 = $103/bbl
Benzene Curve is More Flat Except for On-Purpose Supplies

Benzene Production Cost, Dollars Per Metric Ton

Cumulative Capacity (Million Metric Tons)

North America Avg.

Middle East Avg.

Europe Avg.

Southeast Asia Avg.

Northeast Asia Avg.

WTI Crude Oil: 2008 = $103/bbl
The Profit Cycle Is Still Alive

Olefins Profitability, Dollars Per Metric Ton

Forecast

- Cash Margin
- Ethylene, CFR SE Asia
- Propylene, CFR SE Asia
The Profit Cycle Is Still Alive (Mostly)

Aromatics Profitability, Dollars Per Metric Ton

Forecast

BZ to Naphtha Spread
PX to Naphtha Spread
Benzene, FOB Korea
Naphtha, C&F Japan
PX, C&F Taiwan

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Olefins & Derivatives

- Ethylene
- Propylene
- Butadiene
- Polyethylene
- Ethylene Glycol
- PVC
Ethylene Market Summary

- Demand loss in Q4 was painful to the industry; some recovery in Asia in late Q1 and early Q2
- Middle East and China continues to build large capacity volumes in 2009-2011
- Some shutdowns of high cost crackers in NAM, WEP, and NEA will likely occur
- Gas prices (ethane) in US will likely stay disconnected with crude oil (naphtha), giving US exporters an advantage
- Economic and market crisis will likely cancel or delay projects beyond 2012
- Low utilization rates and profit margins expected to persist until 2012/2013.
Propylene Market Summary

- Demand loss due to economic meltdown a concern, but some improvement in Asia recently
- Middle East investing heavily in LPG cracking and on-purpose capacity
  - PDH, DCC, OCT in Saudi Arabia
  - OCT in Abu Dhabi
- Heavy crackers being added in China, Singapore, & Thailand
- Some on-purpose propylene being added in Asia: PDH and metathesis
- Lower cracker operating rates not significantly impacting supply availability
Butadiene Market Summary

- Record high prices in early 2008 have collapsed with the economic downturn. Producers and consumers started looking at on-purpose sources.

- Most butadiene goes into the synthetic rubber / automotive industry.

- Suffering auto industry causing massive demand loss and limited upward price movement in near term.

- Plenty of new butadiene extraction capacity additions planned for 2009-2010.

- Crude C4 availability will become short again as demand recovers (in 2010) faster than cracker utilization rates rise to high rates (2012-2013).
Polyethylene Market Summary

• Most new ethylene plants tied to PE downstream operations; Very similar supply/demand situation as ethylene:
  - Demand loss in Q4, some recovery in Asia
  - Too much Middle East and Asia capacity coming on-line from 2009-2011
  - Low utilization rates and profit margins until 2012/2013

• Large Middle East export volumes will go to China, new domestic Chinese capacity will limit growth in imports
  - Middle East resin will flow to other parts of Asia, Europe, and even the Americas
Ethylene Glycol Market Summary

- Many large MEG facilities coming on-line in Middle East and Asia
- Middle East producers will dominate trade flow of MEG globally
- Low operating rates and margins for the next 3 to 5 years.
- Higher cost producers in the US, Europe, and part of NE Asia will struggle – rationalizations likely
- The temptation to invest in ethoxylates, ethanolamines, and other EOD’s will be strong, but these are small markets.
PVC Market Summary

- Recent global demand loss unprecedented even in previous economic downturns
- PVC greatly impacted by economic outlook with many durable end-uses (housing and construction).
- When economic stimulus packages develop, this should be very positive for PVC demand recovery
- Significant Chinese coal-based PVC capacity added in 2005-2009, causing excess supply and changing market structure
Aromatics & Derivatives

- Benzene
- Toluene
- Paraxylene
- Styrene
- Phenol
Benzene Market Summary

• Benzene Supply Storm
  o Continued by-product capacity additions due to growth in ethylene and PX
  o More benzene being removed from motor gasoline pools

• Combined with demand loss at end-2008: train wreck – benzene trades below naphtha
• Benzene surplus to stay for many years
• By-product problem: source (from ethylene and PX) growing faster than main demand (styrene)
Toluene Market Summary

- Similar to benzene, by-product supply continues to grow.
- Chemical demand is mainly for making on-purpose Benzene or PX
  - HDA units (on-purpose benzene) rarely needed to meet benzene demand
  - STDP/TDP units run opportunistically based on economics
  - TA units still growing to support PX growth.
- Toluene will trade closer to its floor value of motor gasoline blending for the foreseeable future
Paraxylene Market Summary

• Continues to rapidly grow 6-7%
  o Polyester – preferred fiber
  o PET – rapid growth into bottles

• Short-term recovery in PX market is not sustainable

• Cyclical downturn expected due to capacity build-up in 2009-11

• Demand hurt in many ways
  o Economic downturn at year-end
  o 2007/8 inventory build of fiber
  o 2007/8 PET light-weighting
  o Increased recycle of PET bottles to staple fiber (more economic at high oil, but “being green” long-term)

• Capacity additions will slow, and long-term recovery expected in 2014-2015
Styrene Market Summary

- Demand has suffered in the short-term due to economic downturn
- Longer-term demand prospects are weak because of mature polystyrene industry:
  - Loss of demand to non-plastics or to PP/PET in packaging applications
  - Changing consumer product trends (CRT to flat TV, video/audio cassette to CD to MP3)
- New styrene capacity in Middle East and Asia in 2009-2010
- Capacity rationalizations in US, Europe, and Japan already occurring
- More industry consolidation and restructuring needed to sustain a long-term recovery
Phenol Market Summary

- Like other commodities, phenol demand hurt in economic downturn.
  - Particularly influenced by weakness in the construction and automobile sectors
  - Optical media (polycarbonate) is also showing long-term demand maturity trends
- Middle East and Asia adding significant capacity
- Additional rationalization needed to recover operating rates to strong level
- Acetone by-product continues to be a disposal problem
  - Solvent applications grow slowly
  - Trading near propylene recently
What Is This Light?
Train Wreck or New Light?

Make The Right Choices To Survive the Downturn

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CMAI’s Key Visions: Significant Change Is Underway

You can leverage the resulting opportunities…

- Demand loss is largest concern of current market; demand will recover with economy by 2010, returning to trend-line patterns
- Over-capacity still looms despite demand recovery, causing margins to underperform expectations until next up cycle.
- Industry restructuring likely & necessary
  - Low margins expose marginal performers with high debt loads
  - Capacity closures of old/inefficient facilities will occur
  - Financing difficulties for marginal projects will delay start-ups for 2012+
  - Cost reduction becomes critical for competitiveness
  - Innovation needed: technical, application development, operational efficiency, etc
- “Asia” investments chasing local demand recovery
- “Middle East” investments mitigating margin risk with low-cost feedstocks
- Petrochemical cycle is alive and well: good times will return again; survival is key!