

# Prospects for the Basic Petrochemical Value Chains



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# What Is This Light?

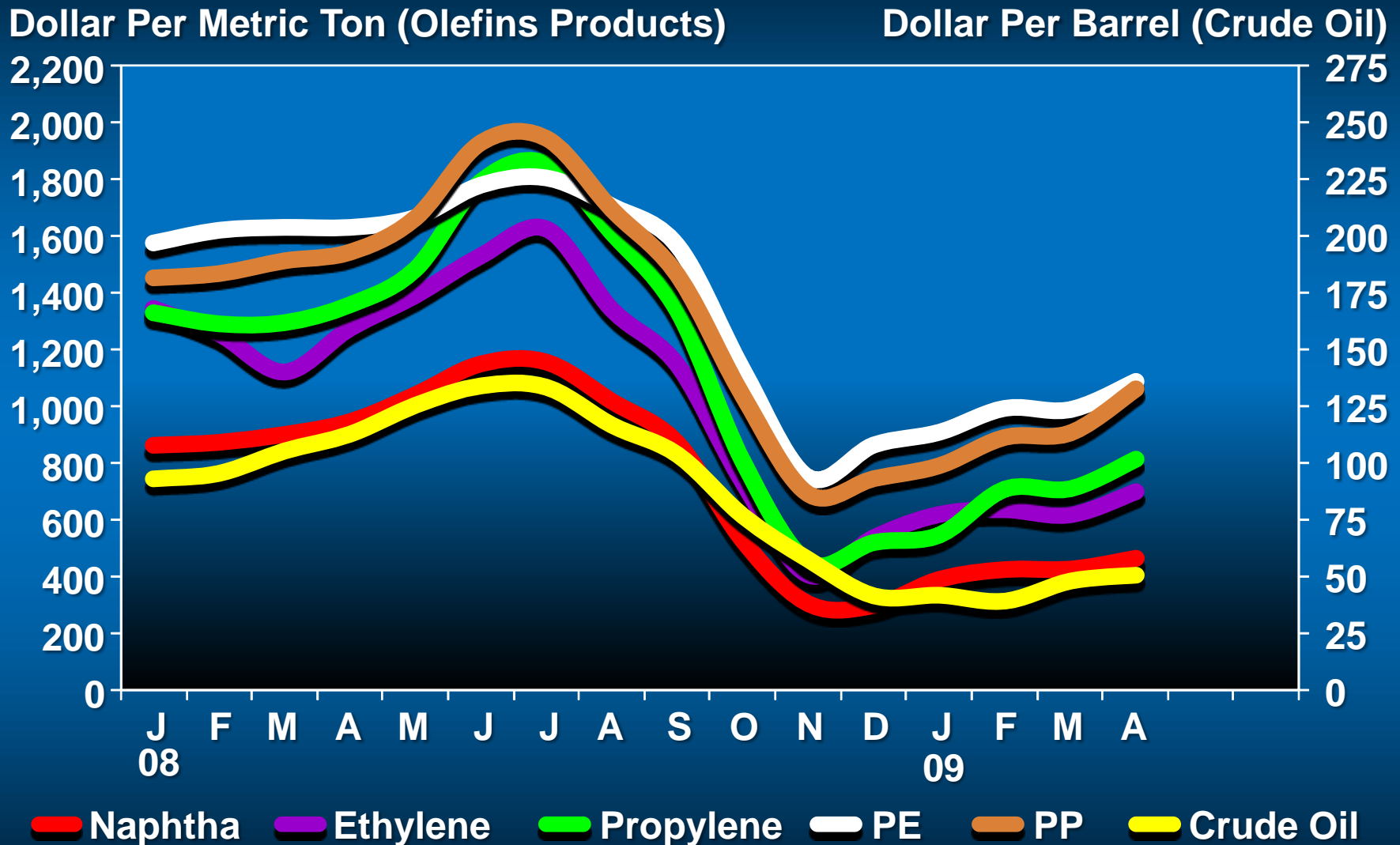
The light at the end of the tunnel?



An on-coming train?

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

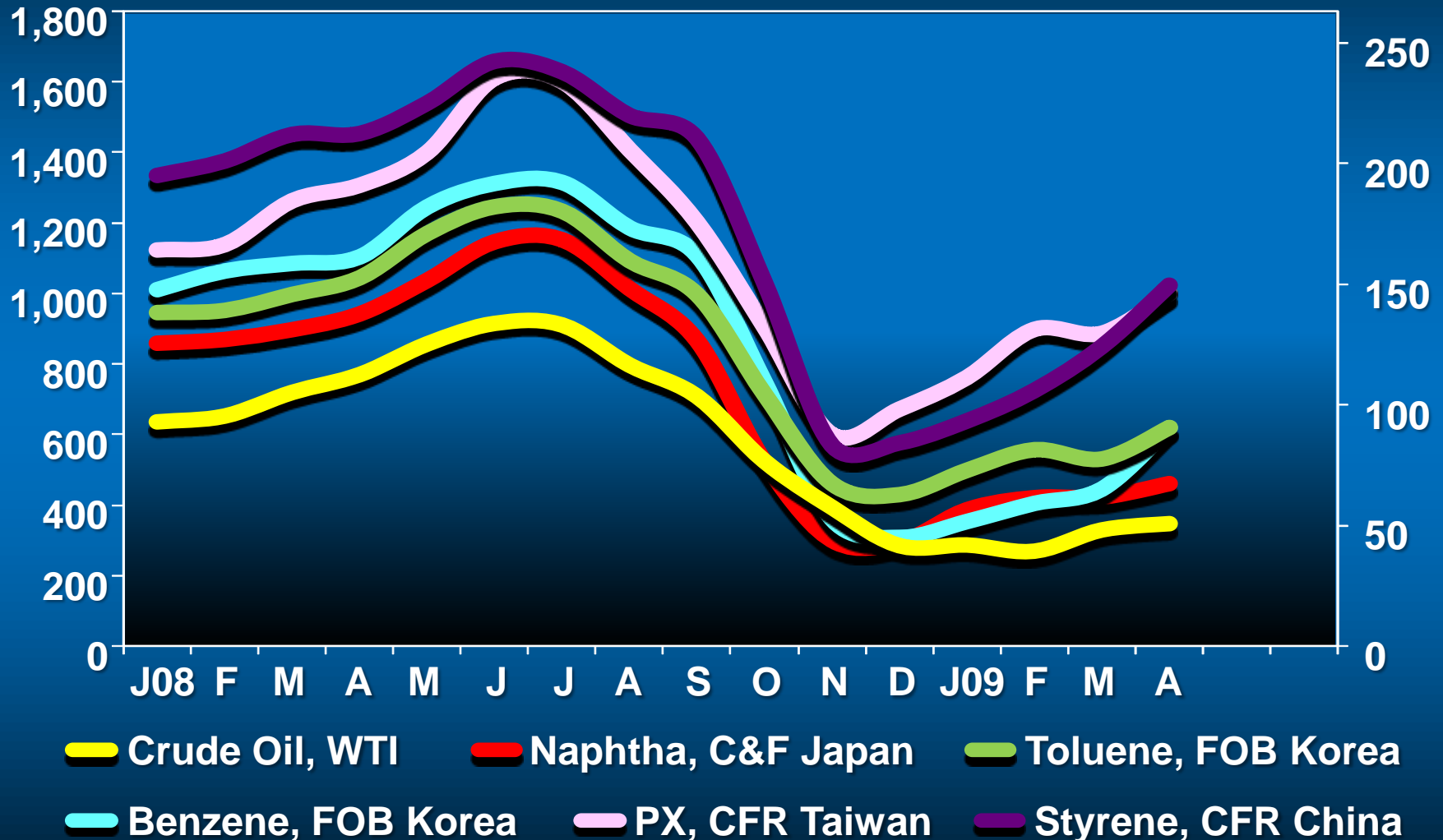
# Prices & Margins Have Collapsed



# The Drop in Aromatics Prices

U.S Dollar Per Metric Ton (Products)

US Dollar Per Barrel (Crude Oil)



2009 APIC – CMAI Seminar





# 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
  - Reliance (Early 2009) refinery
  - Indian Oil (Early 2010) olefins & aromatics
  - ONGC aromatics complex (mid 2011)
- India will be large exporter until local economy grows
- Others major projects being considered:
  - Reliance
  - ONGC
  - IOC
  - 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:
  - Shell & Exxon in Singapore
  - 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



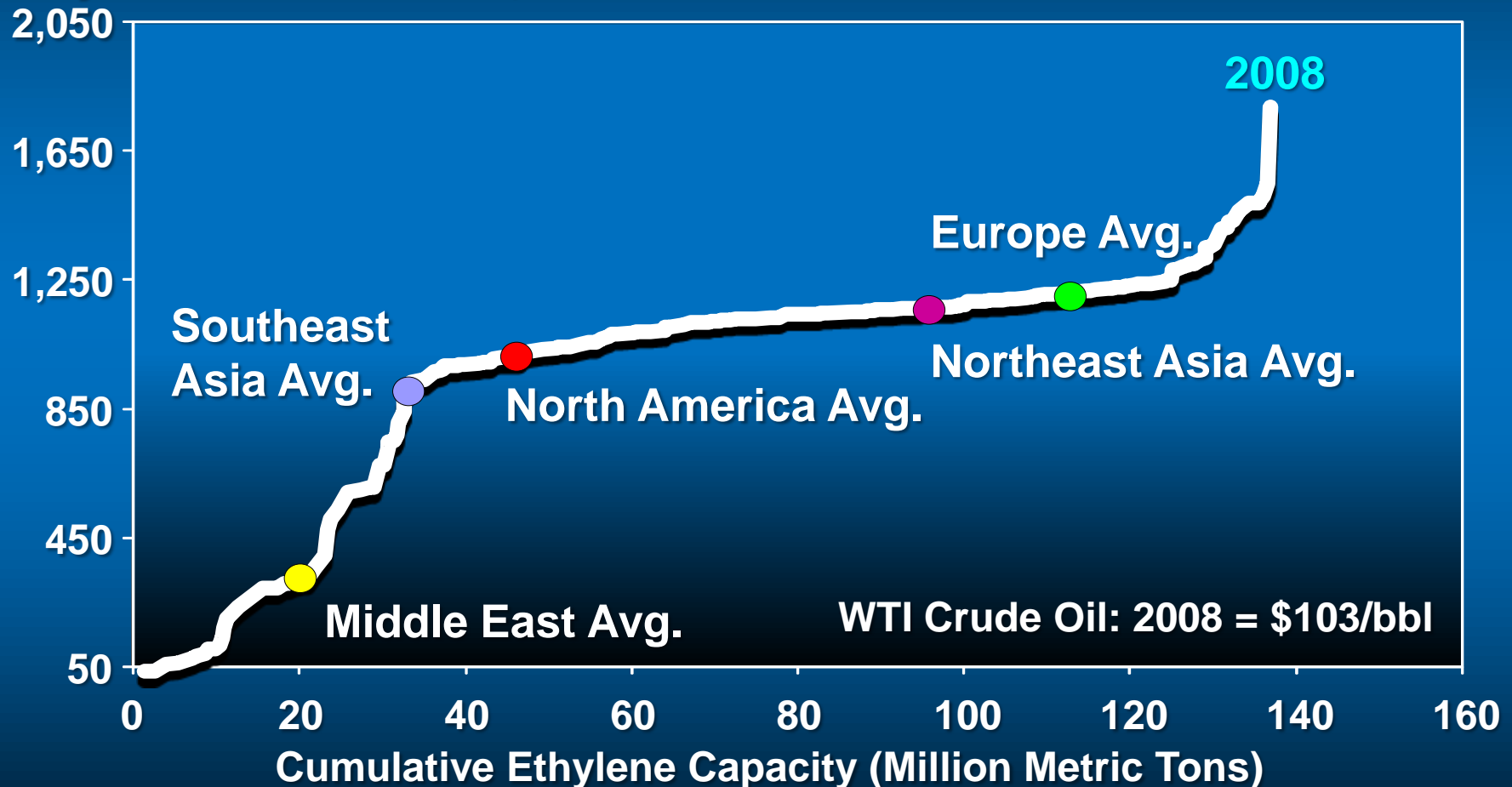
# Massive Investments In The Middle East Will Compete in Asia & The World



- 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!

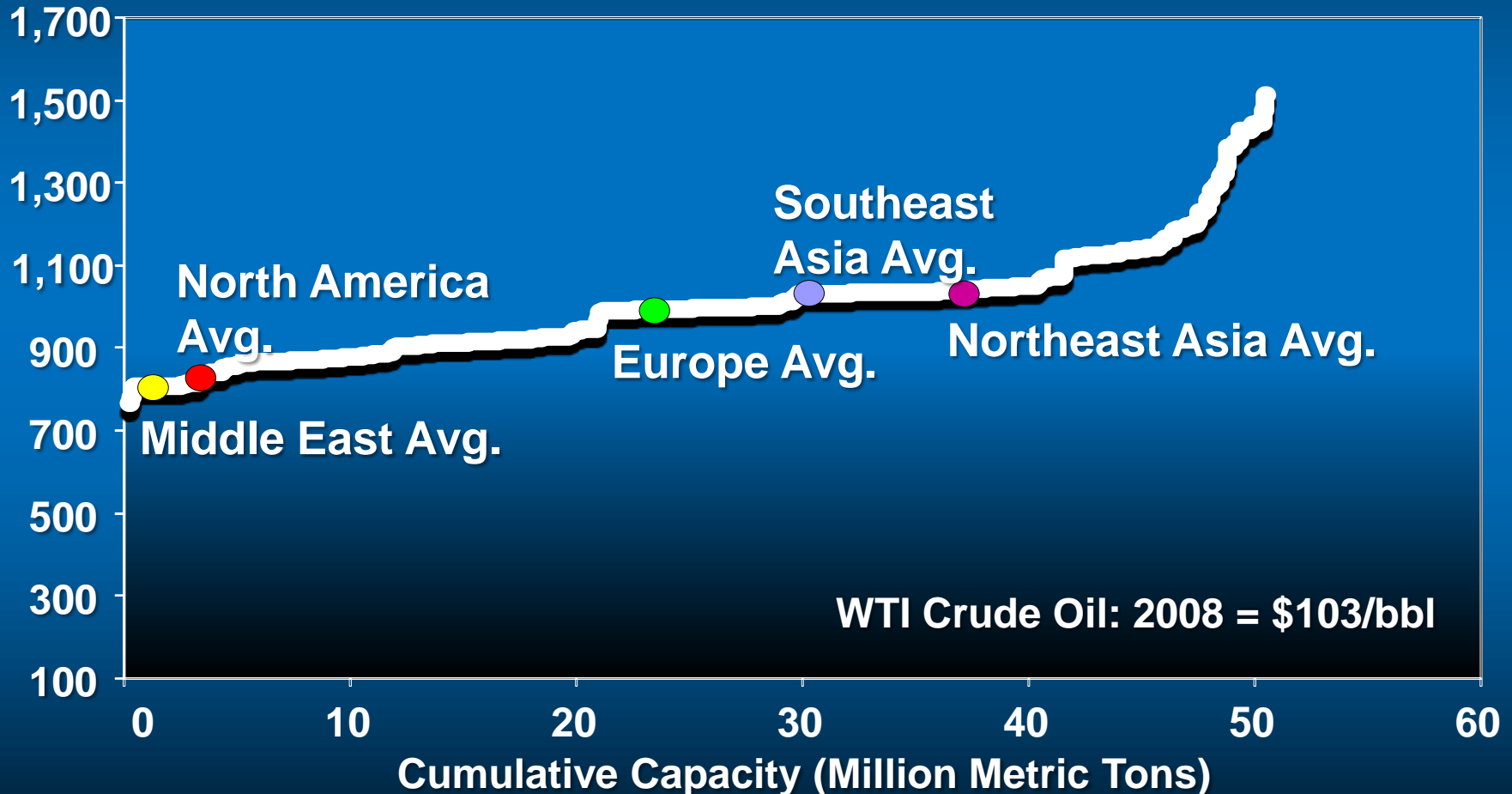
# Middle East Has The Lowest Cost Ethylene

Ethylene Production Cost, Dollars Per Metric Ton



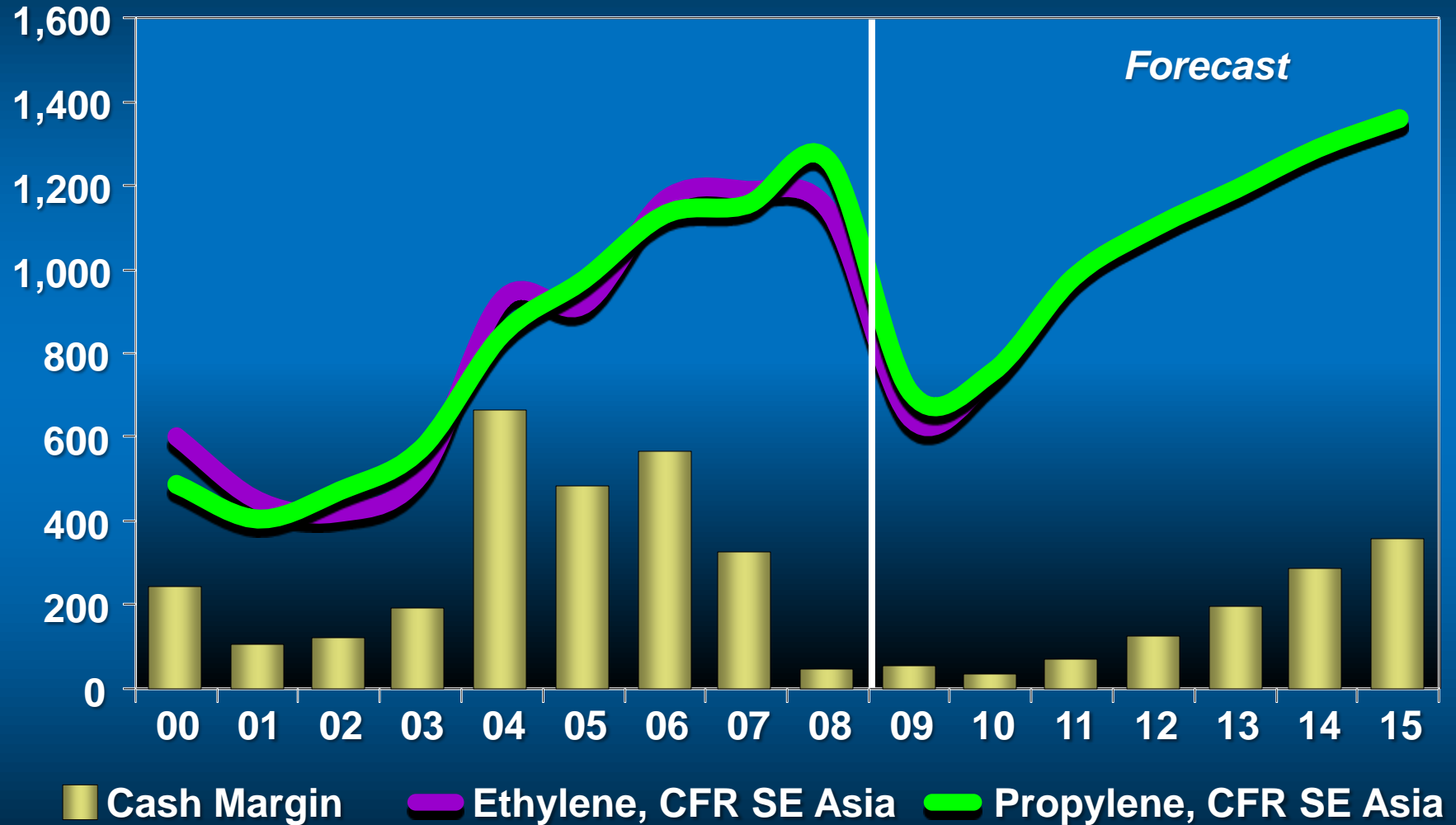
# Benzene Curve is More Flat Except for On-Purpose Supplies

Benzene Production Cost, Dollars Per Metric Ton



# The Profit Cycle Is Still Alive

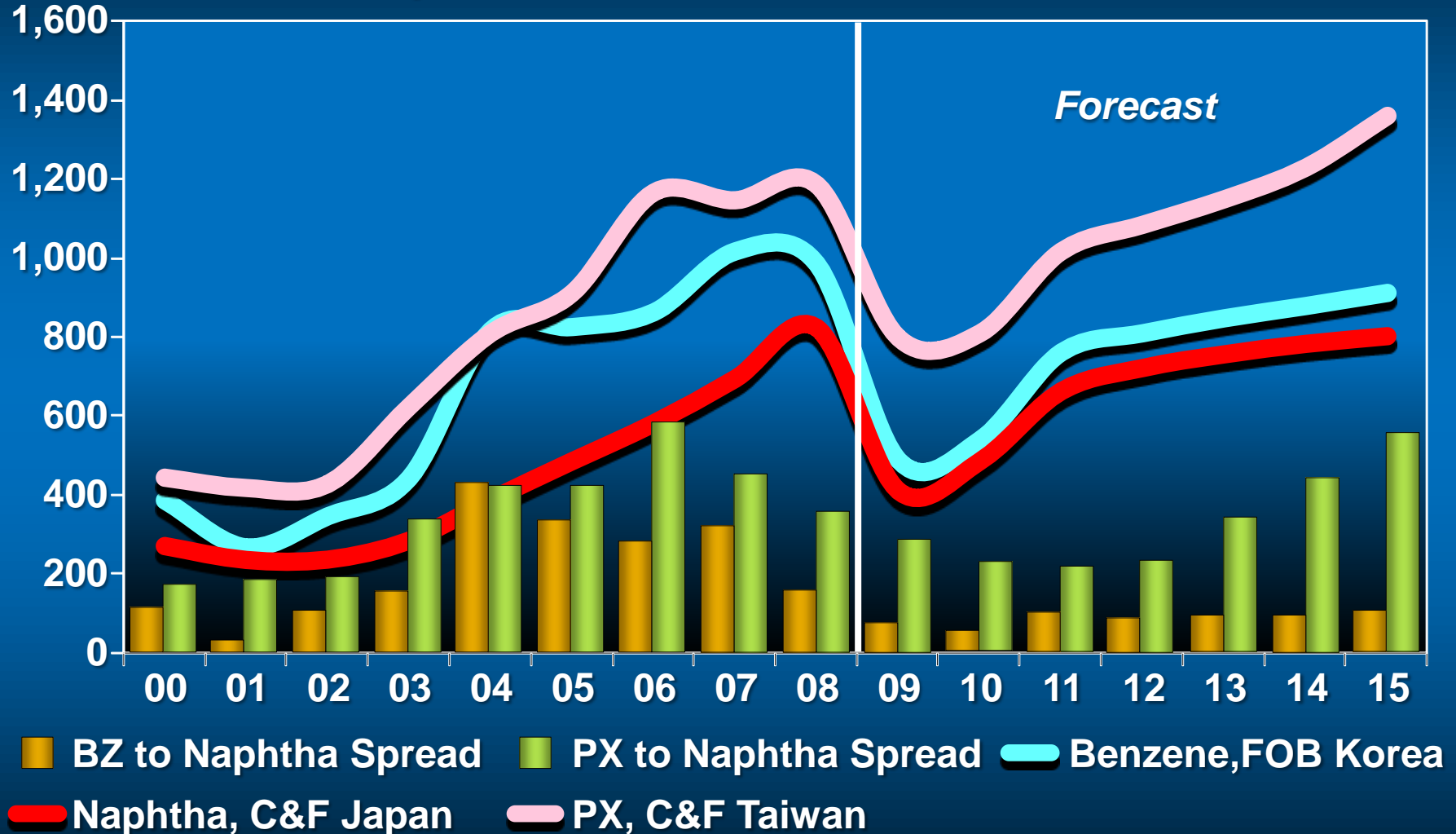
Olefins Profitability, Dollars Per Metric Ton





# The Profit Cycle Is Still Alive (Mostly)

Aromatics Profitability, Dollars Per Metric Ton



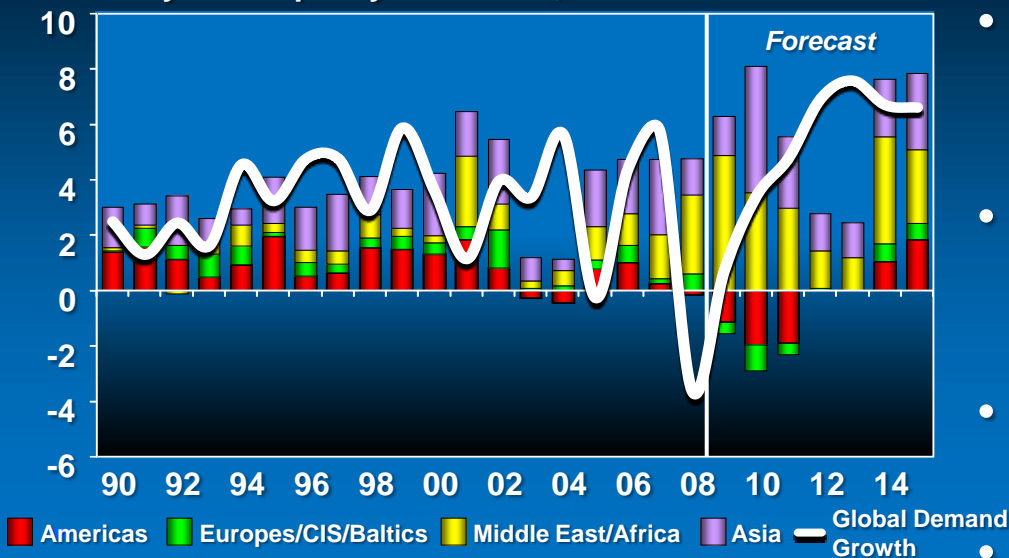
# Olefins & Derivatives



**Ethylene  
Propylene  
Butadiene  
Polyethylene  
Ethylene Glycol  
PVC**

# Ethylene Market Summary

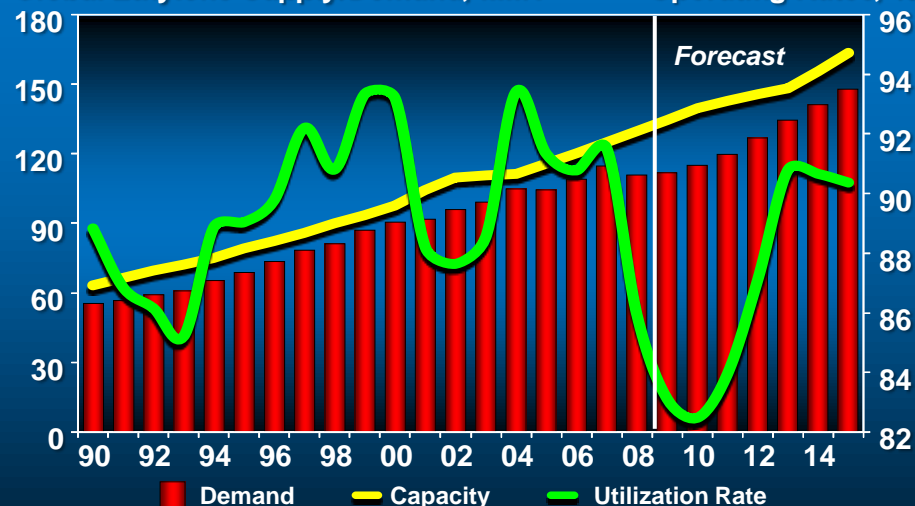
New Ethylene Capacity & Demand, MMT



- 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.

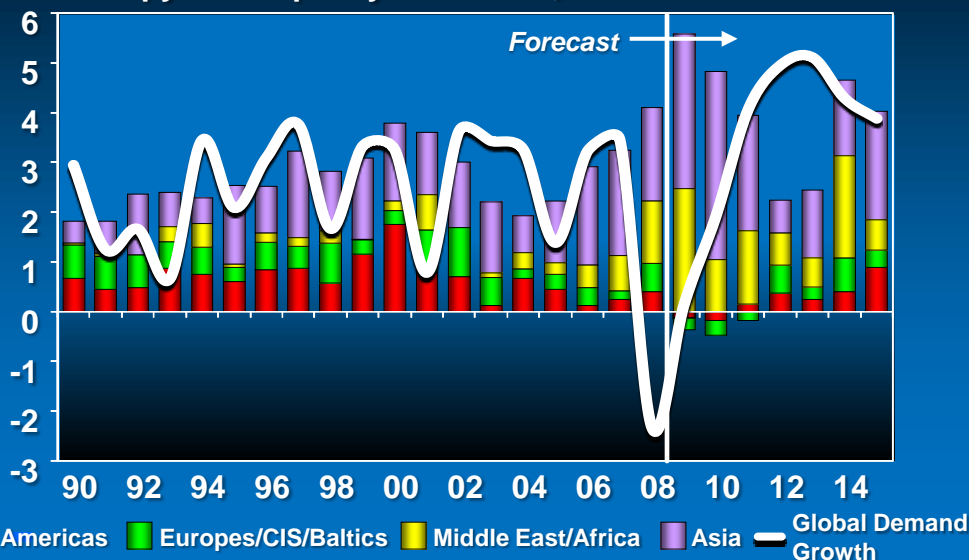
Global Ethylene Supply/Demand, MMT

Operating Rates, %

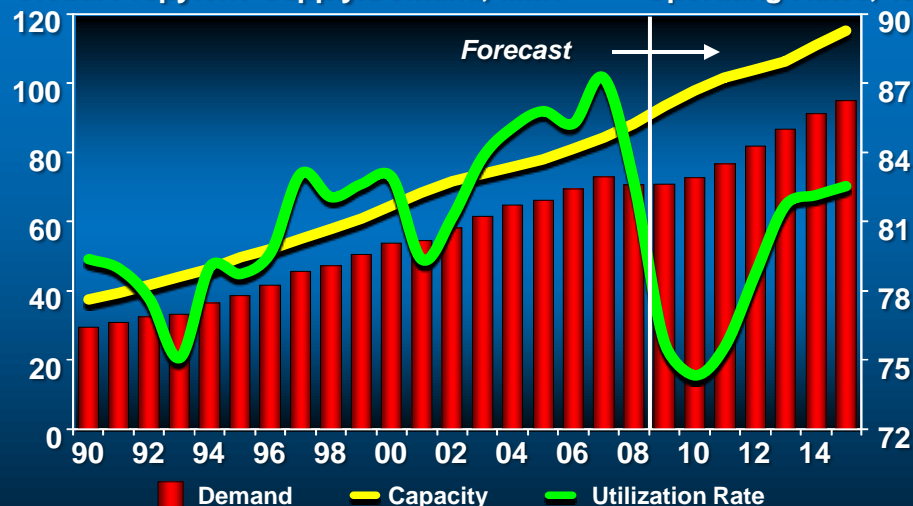


# Propylene Market Summary

New Propylene Capacity & Demand, MMT



Global Propylene Supply/Demand, MMT

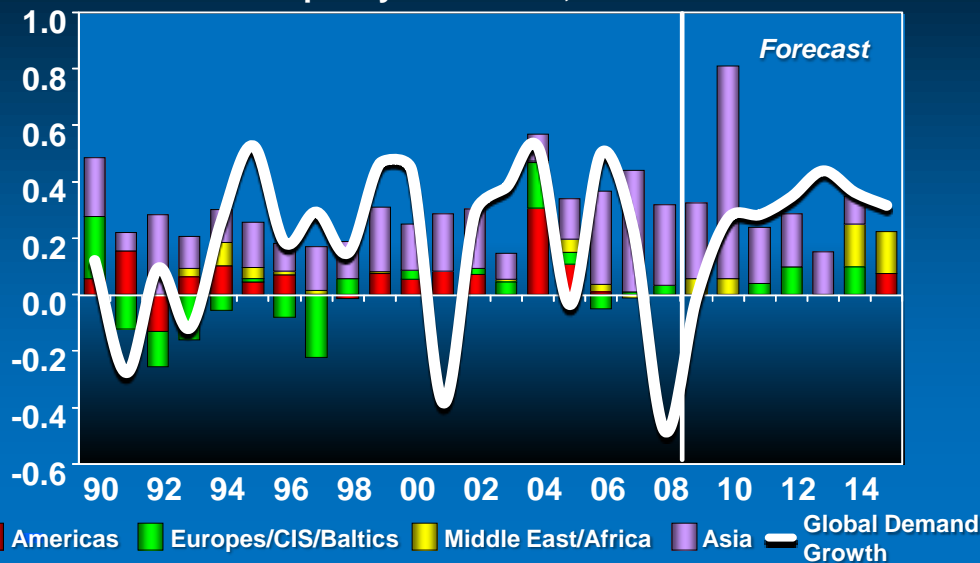


- Demand loss due to economic meltdown a concern, but some improvement in Asia recently
- Middle East investing heavily in LPG cracking and on-purpose capacity
  - PDH, DCC, OCT in Saudi Arabia
  - OCT in Abu Dhabi
- Heavy crackers being added in China, Singapore, & Thailand
- Some on-purpose propylene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

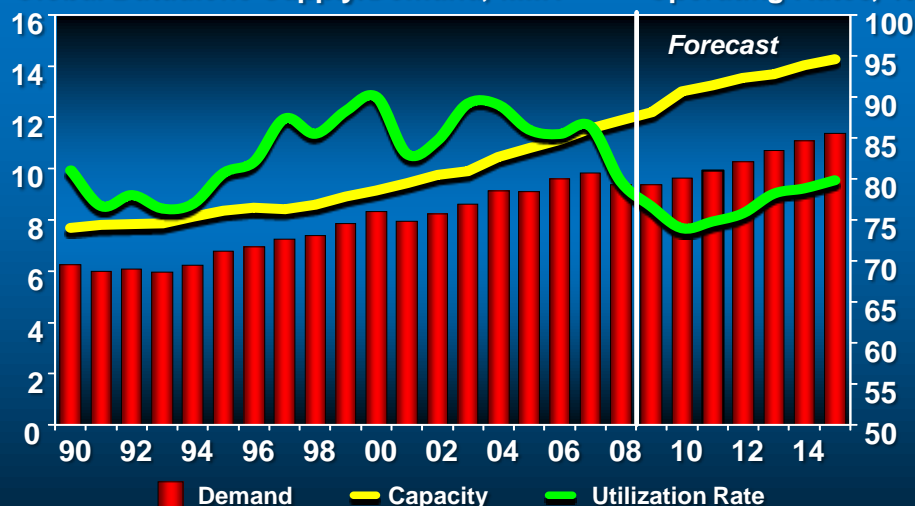


# Butadiene Market Summary

New Butadiene Capacity & Demand, MMT



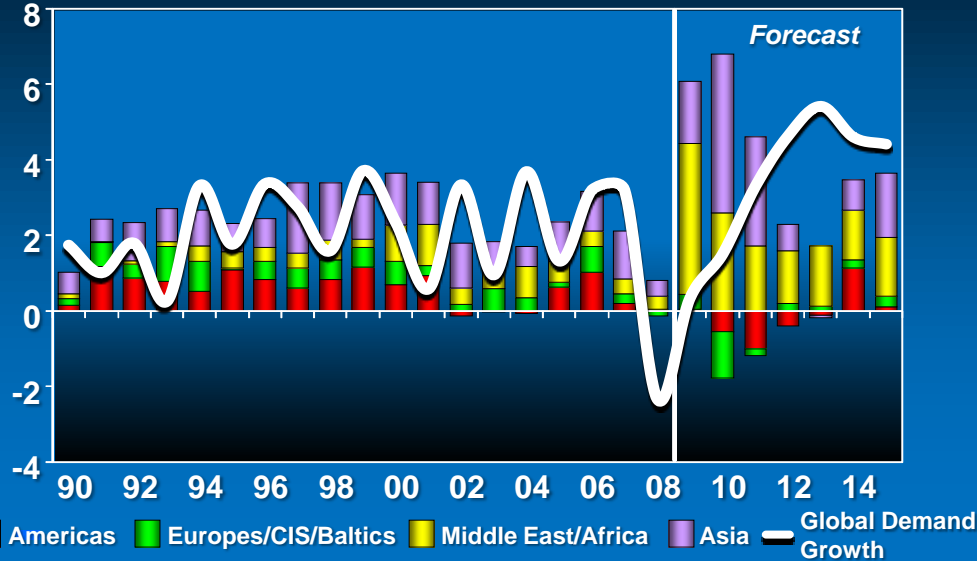
Global Butadiene Supply/Demand, MMT



- 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

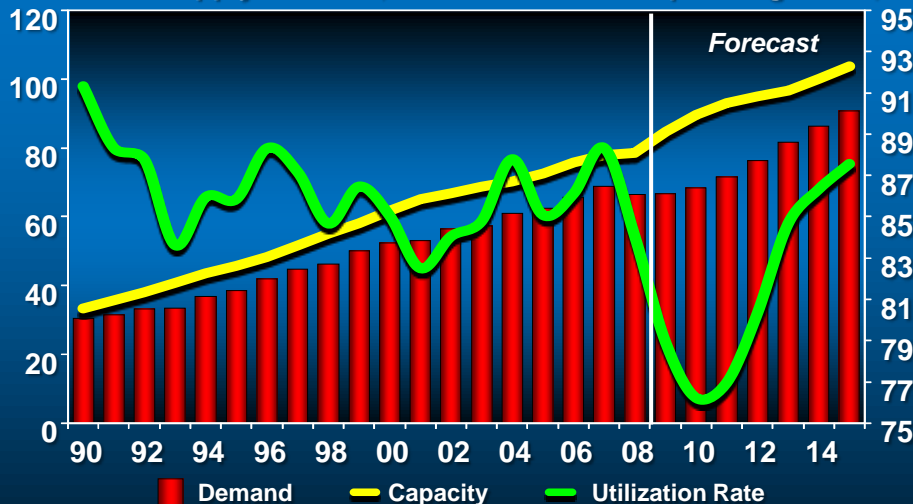
New PE Capacity & Demand, MMT



- Most new ethylene plants tied to PE downstream operations; Very similar supply/demand situation as ethylene:

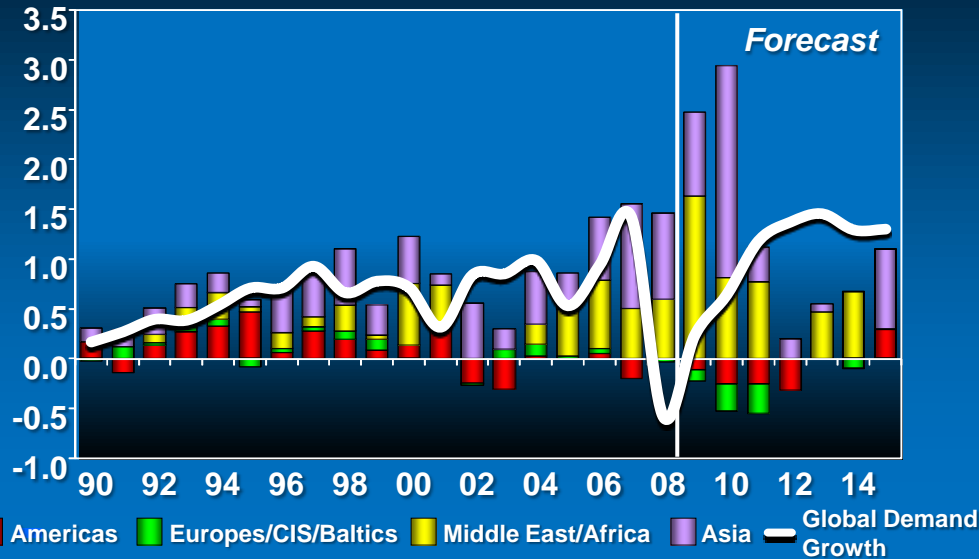
- Demand loss in Q4, some recovery in Asia
- Too much Middle East and Asia capacity coming on-line from 2009-2011
- Low utilization rates and profit margins until 2012/2013
- Large Middle East export volumes will go to China, new domestic Chinese capacity will limit growth in imports
  - Middle East resin will flow to other parts of Asia, Europe, and even the Americas

Global PE Supply/Demand, MMT



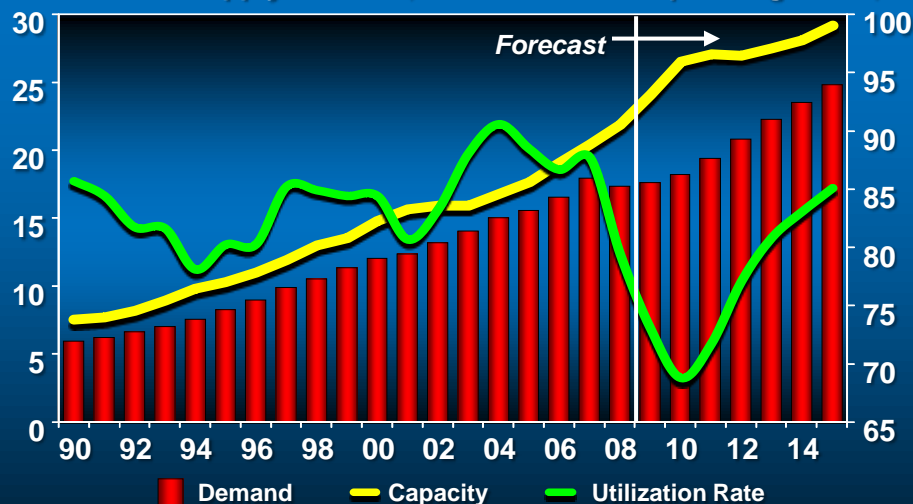
# Ethylene Glycol Market Summary

New MEG Capacity & Demand, MMT



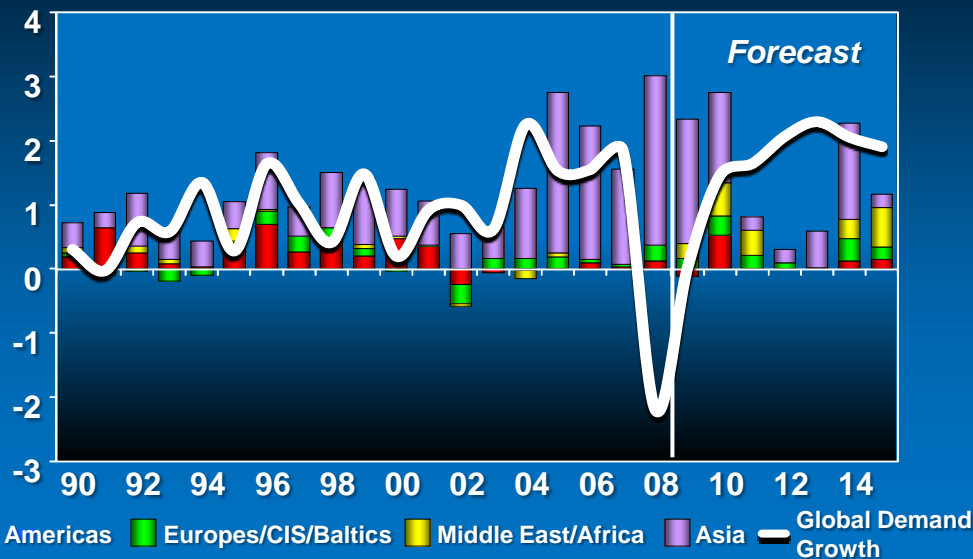
- Many large MEG facilities coming on-line in Middle East and Asia
- Middle East producers will dominate trade flow of MEG globally
- Low operating rates and margins for the next 3 to 5 years.
- Higher cost producers in the US, Europe, and part of NE Asia will struggle – rationalizations likely
- The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

Global MEG Supply/Demand, MMT



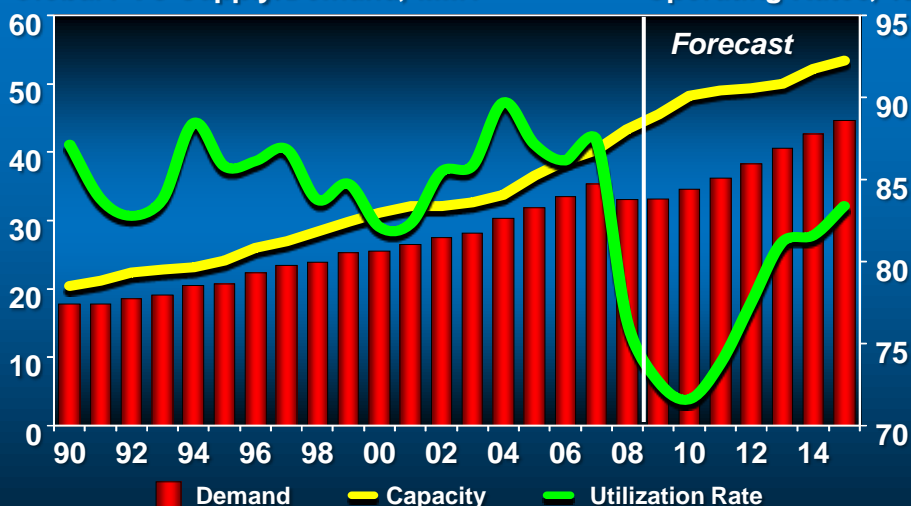
# PVC Market Summary

New PVC Capacity & Demand, MMT



- 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

Global PVC Supply/Demand, MMT



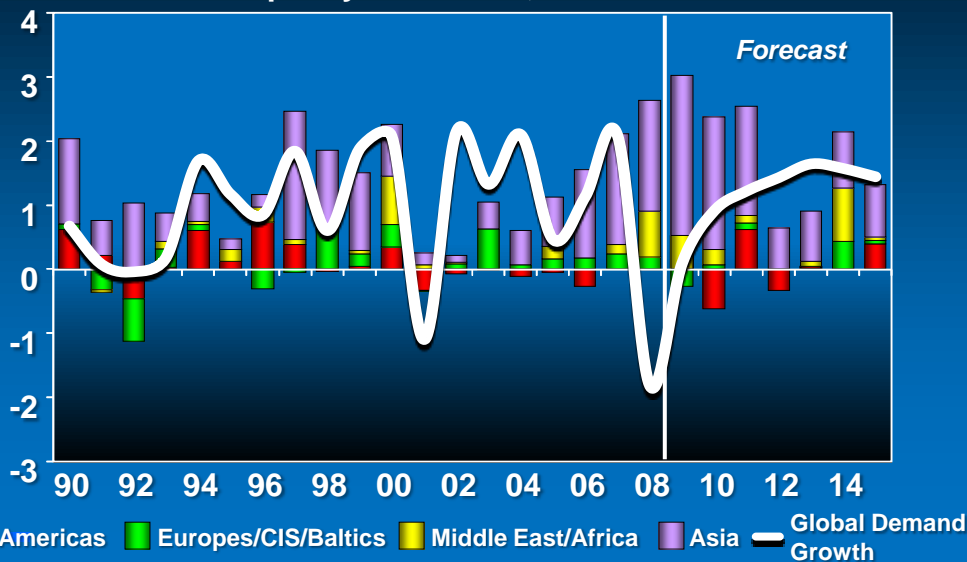


# Aromatics & Derivatives

- 
- **Benzene**
  - **Toluene**
  - **Paraxylene**
  - **Styrene**
  - **Phenol**

# Benzene Market Summary

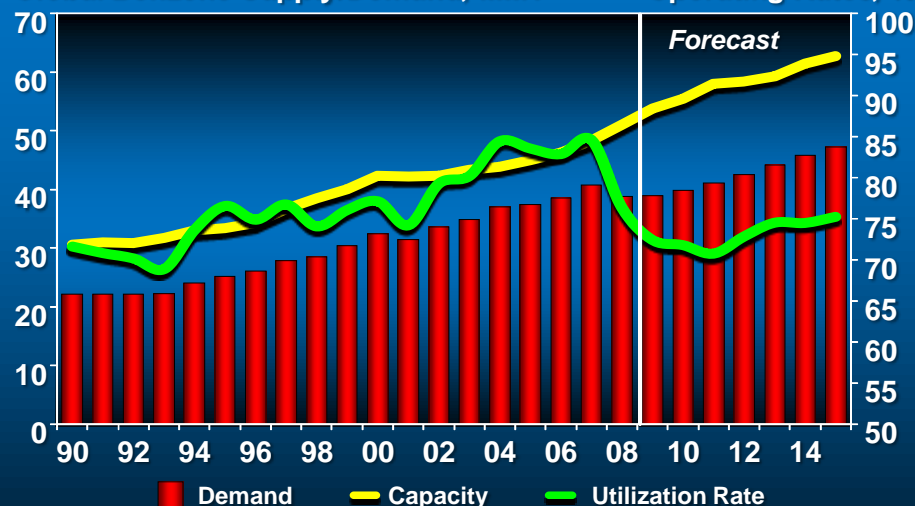
New Benzene Capacity & Demand, MMT



- **Benzene Supply Storm**

- New capacity justified based on strong market in 2004-2007.
- Continued by-product capacity additions due to growth in ethylene and PX
- More benzene being removed from motor gasoline pools

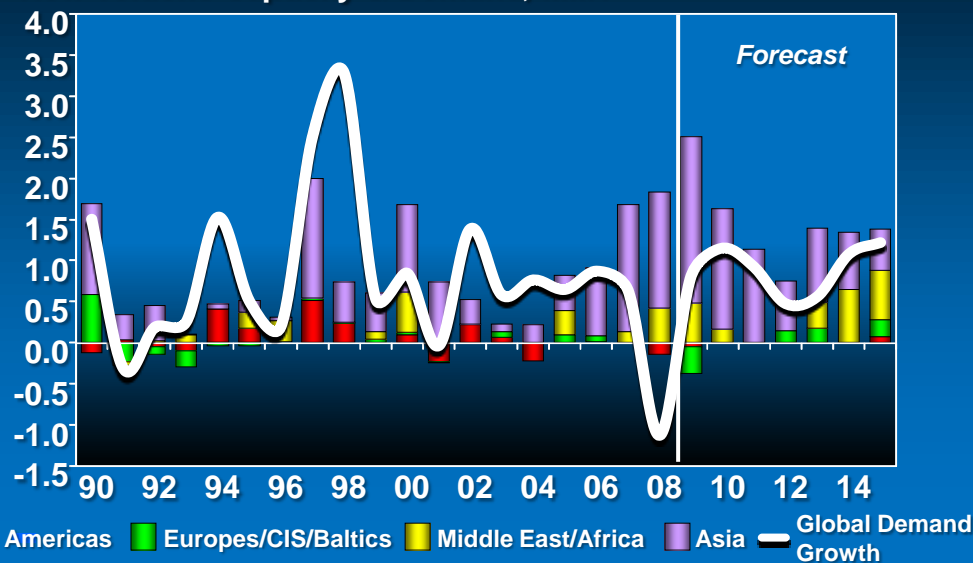
Global Benzene Supply/Demand, MMT



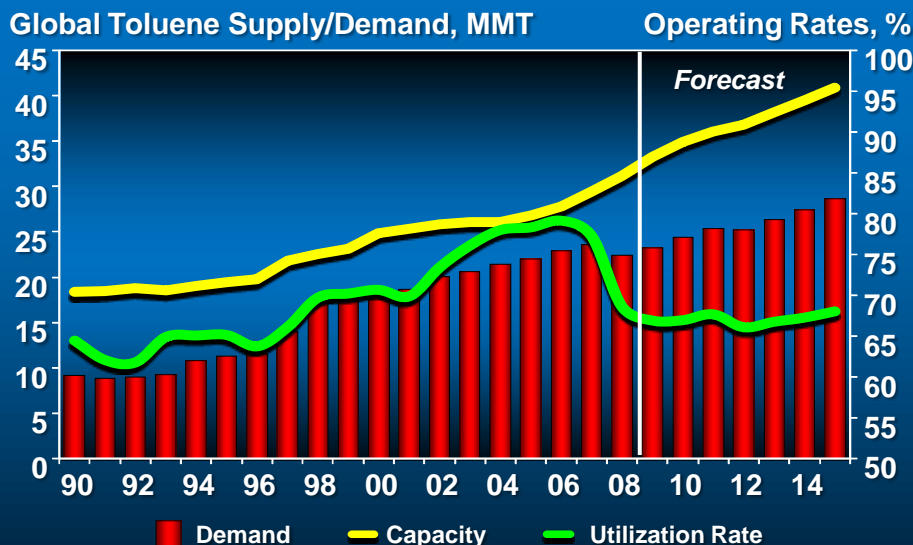
- Combined with demand loss at end-2008: train wreck – benzene trades below naphtha
- Benzene surplus to stay for many years
- By-product problem: source (from ethylene and PX) growing faster than main demand (styrene)

# Toluene Market Summary

New Toluene Capacity & Demand, MMT



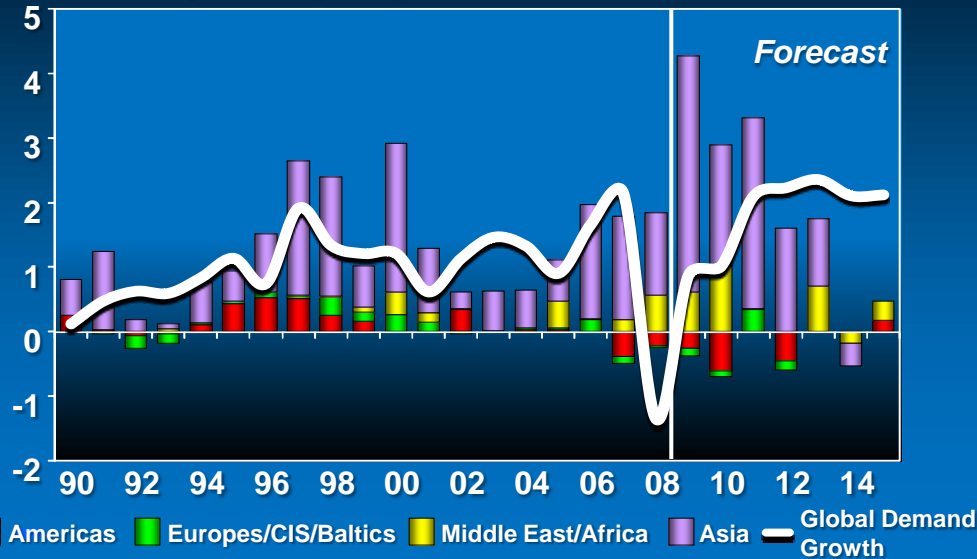
Global Toluene Supply/Demand, MMT



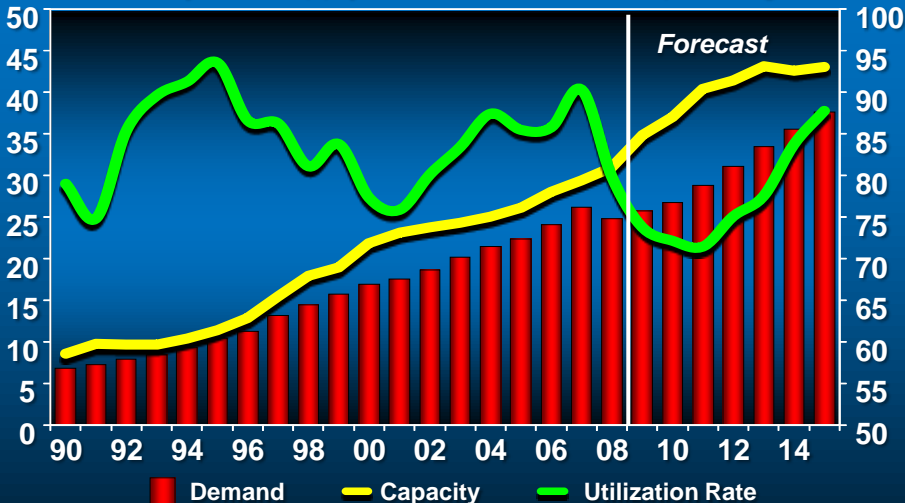
- Similar to benzene, by-product supply continues to grow.
- Chemical demand is mainly for making on-purpose Benzene or PX
  - HDA units (on-purpose benzene) rarely needed to meet benzene demand
  - STDP/TDP units run opportunistically based on economics
  - TA units still growing to support PX growth.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

# Paraxylylene Market Summary

New Paraxylylene Capacity & Demand, MMT



Global Paraxylylene Supply/Demand, MMT

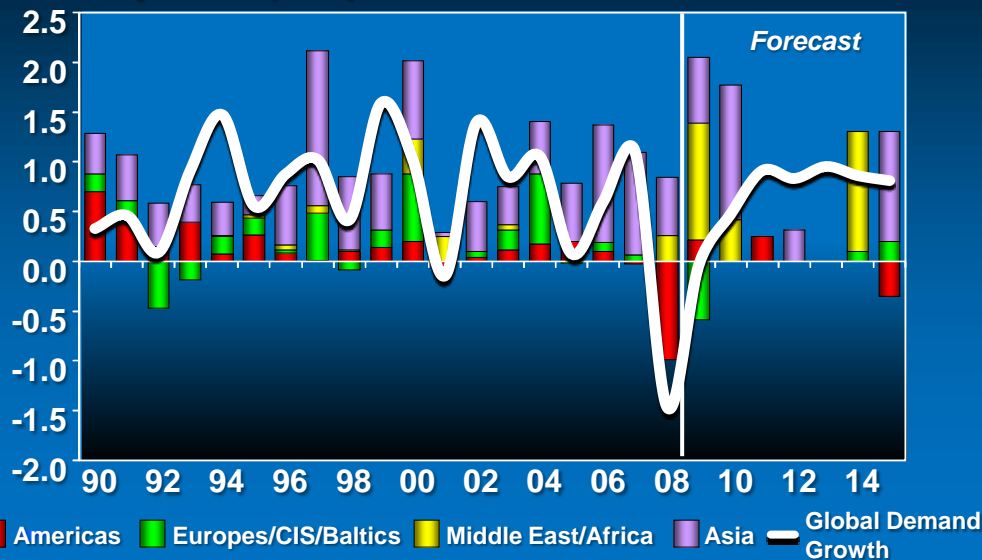


- Continues to rapidly grow 6-7%
  - Polyester – preferred fiber
  - PET – rapid growth into bottles
- Short-term recovery in PX market is not sustainable
- Cyclical downturn expected due to capacity build-up in 2009-11
- Demand hurt in many ways
  - Economic downturn at year-end
  - 2007/8 inventory build of fiber
  - 2007/8 PET light-weighting
  - 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

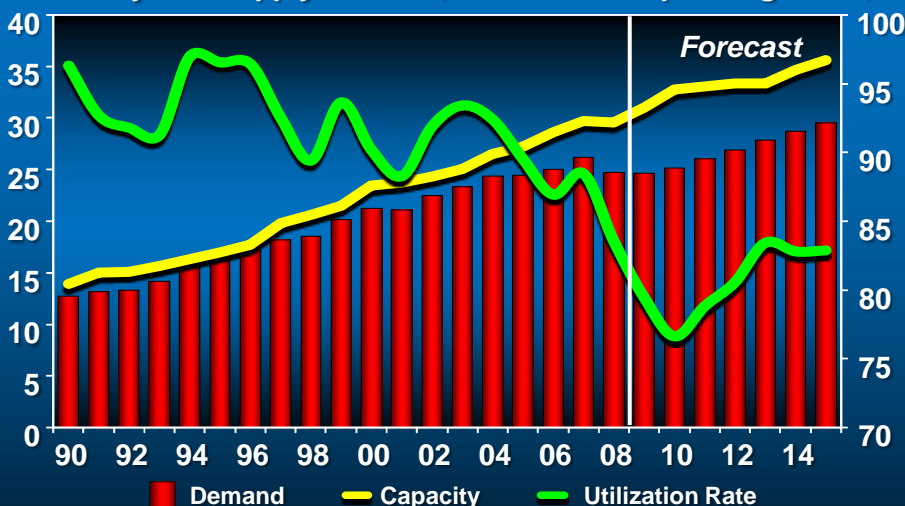
New Styrene Capacity & Demand, MMT



- 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)

Global Styrene Supply/Demand, MMT

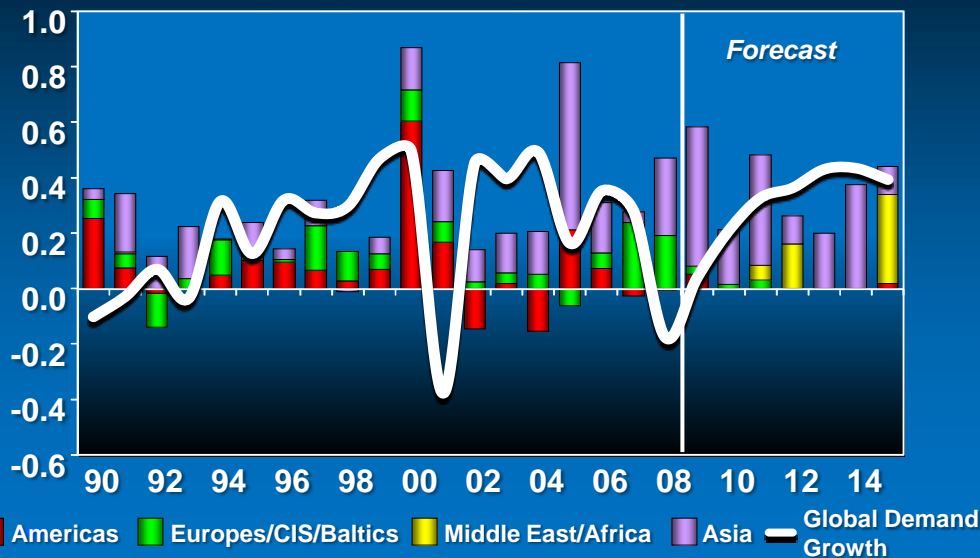
Operating Rates, %



- 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

New Phenol Capacity & Demand, MMT



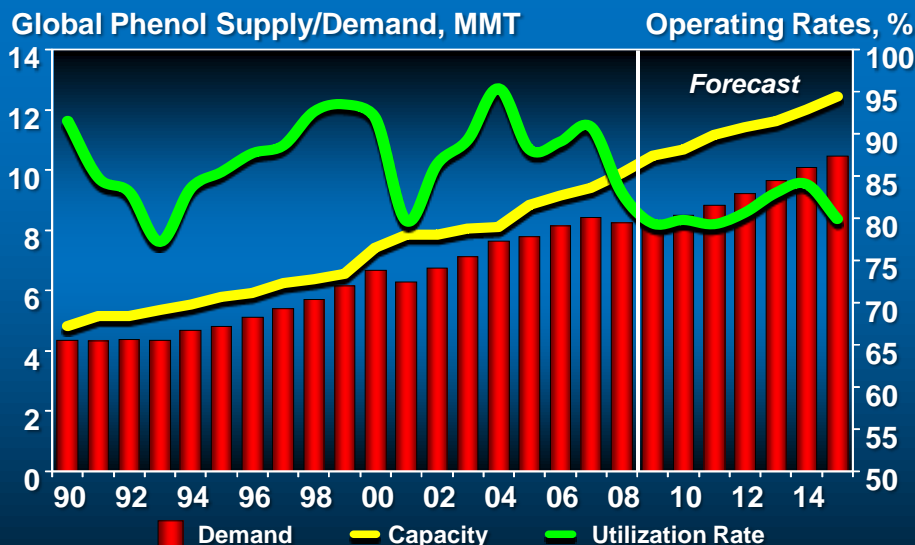
- Like other commodities, phenol demand hurt in economic downturn.
  - Particularly influenced by weakness in the construction and automobile sectors
  - Optical media (polycarbonate) is also showing long-term demand maturity trends

- 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

Global Phenol Supply/Demand, MMT



# What Is This Light?



# Train Wreck or New Light?



**Make The Right Choices  
To Survive the Downturn**

*2009 APIC – CMAI Seminar*

**CMAI**



# **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!