Asphalt & Polymer Supply Outlook

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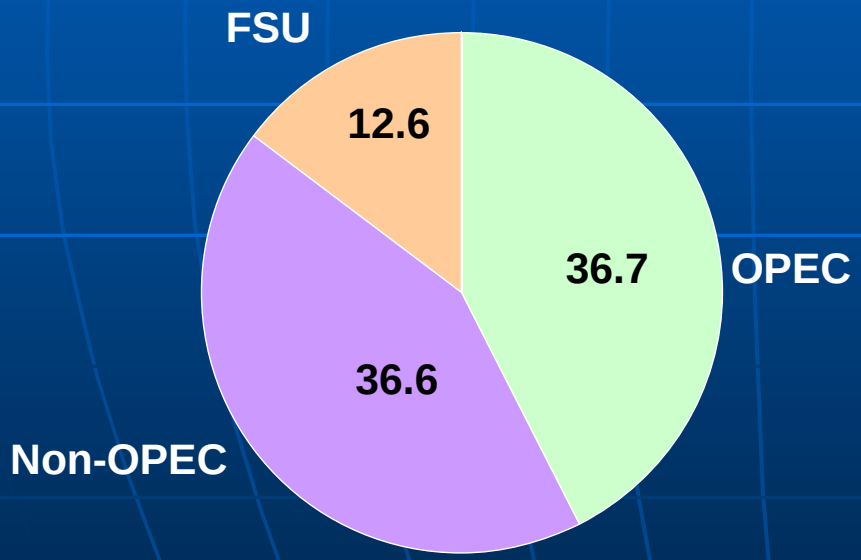
Acknowledgements

- Asphalt Supply Information
  - Bill Haverland
  - ConocoPhillips Company
- Polymer Supply Information
  - Tom Brewer
  - De Witt & Company

Crude Oil Supply/Demand

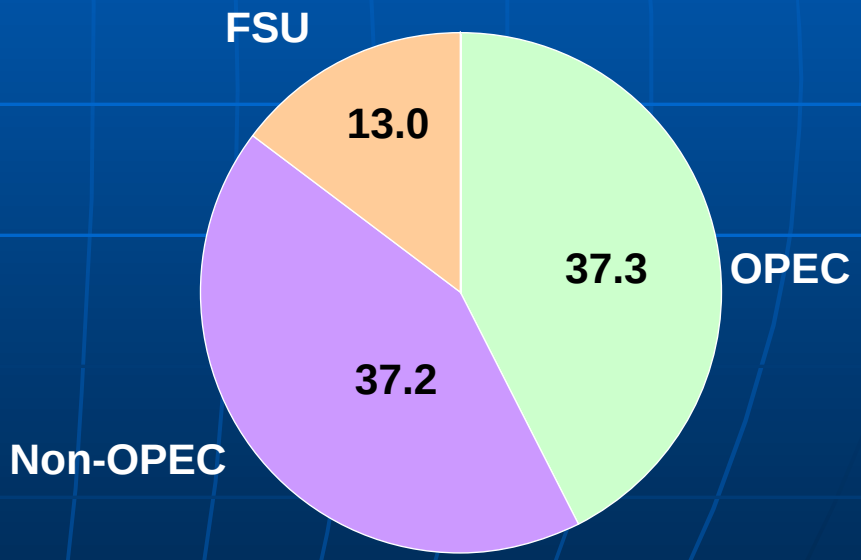
Crude Oil Supply

2007 World Crude & Gas Oil Production Millions of Barrels Per Day



Total: 86 MMB/D

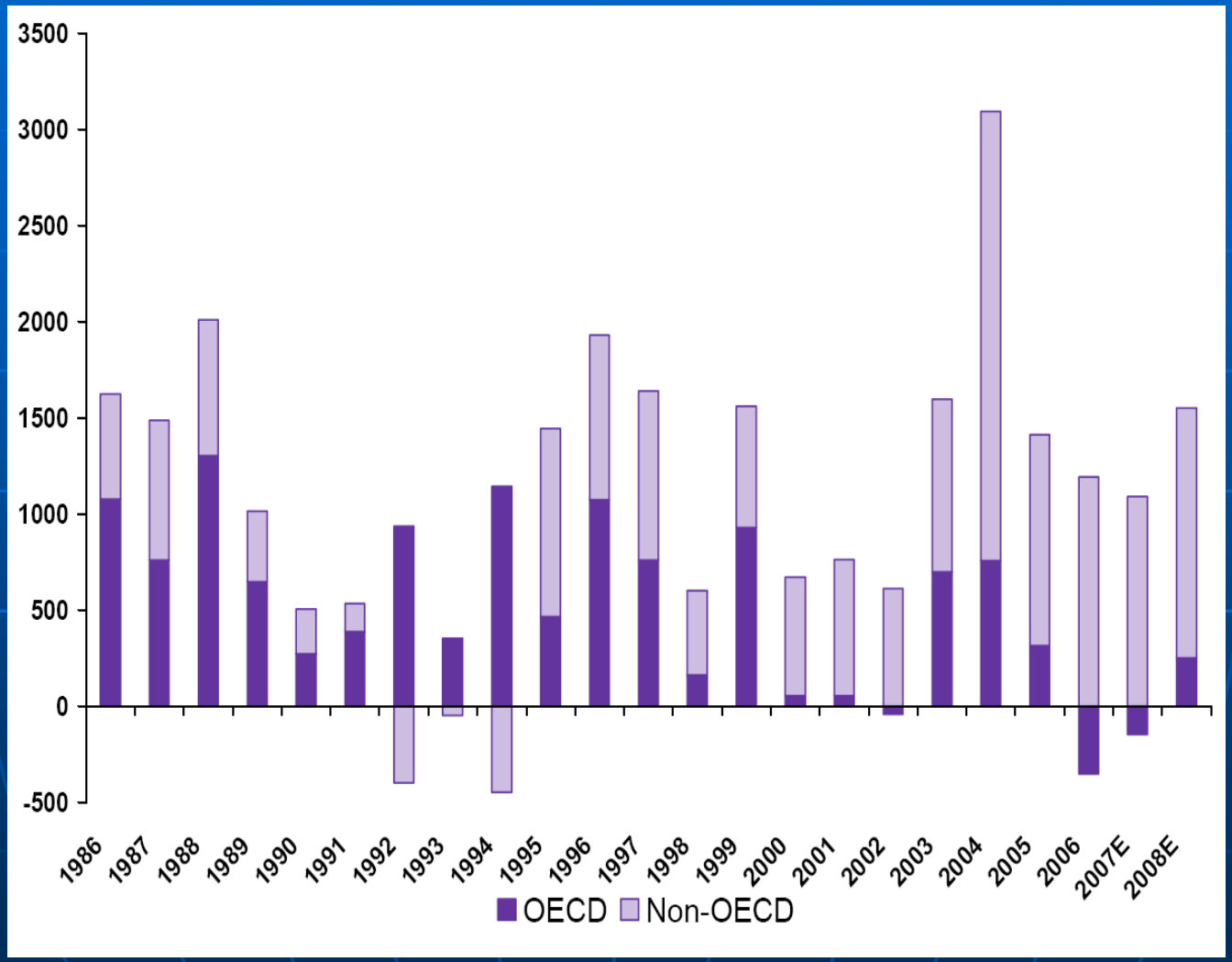
2008 Forecasted World Crude & Gas Oil Production Millions of Barrels Per Day



Total: 87.5 MMB/D

Source: US DOE

Crude Oil Demand
Annual Increase (MBPD)

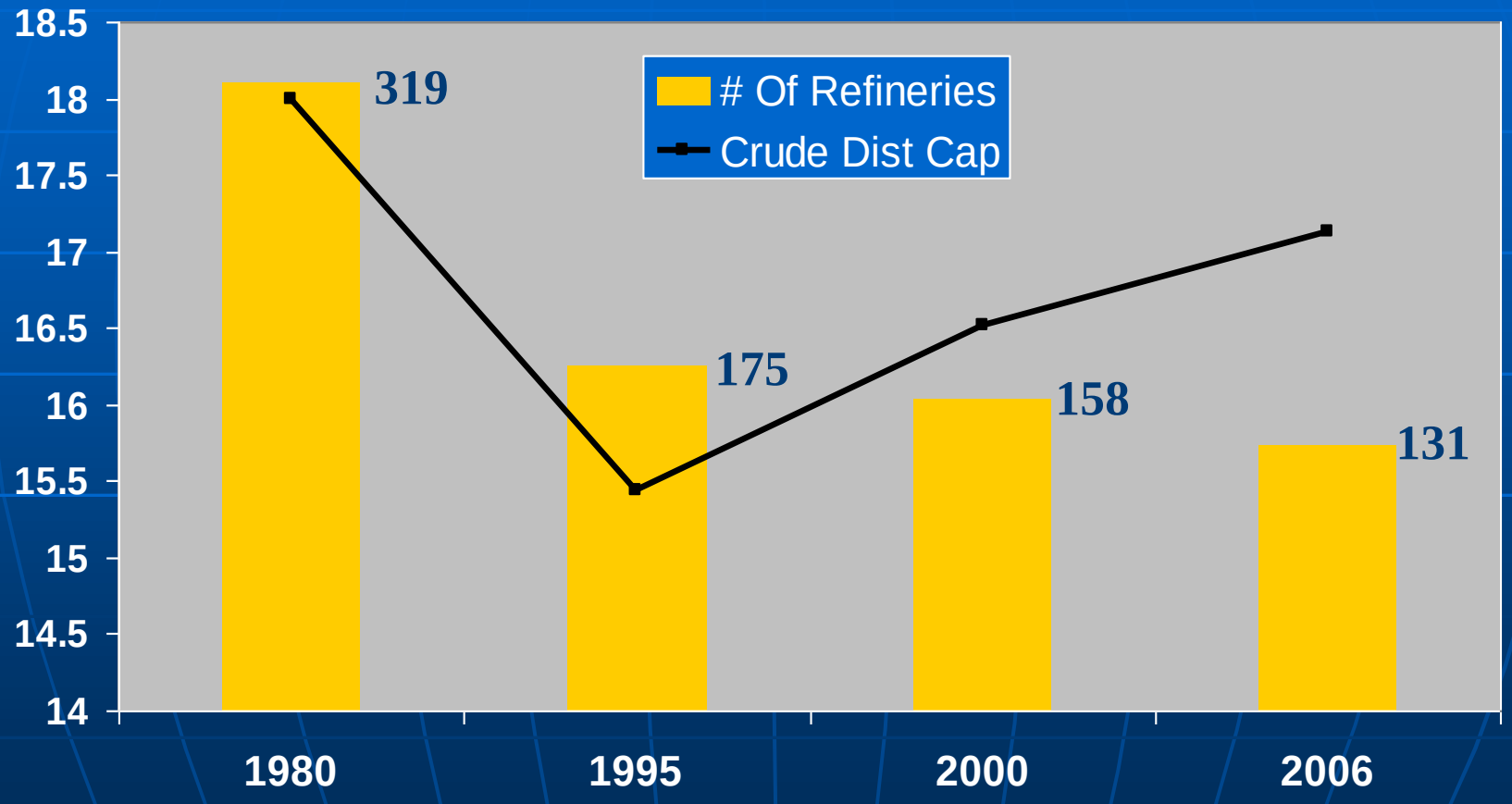


Source: Goldman Sachs/IEA

OECD - Organization for Economic Cooperation And Development
US, Canada, Western Europe, Japan, Australia & New Zealand

Refining

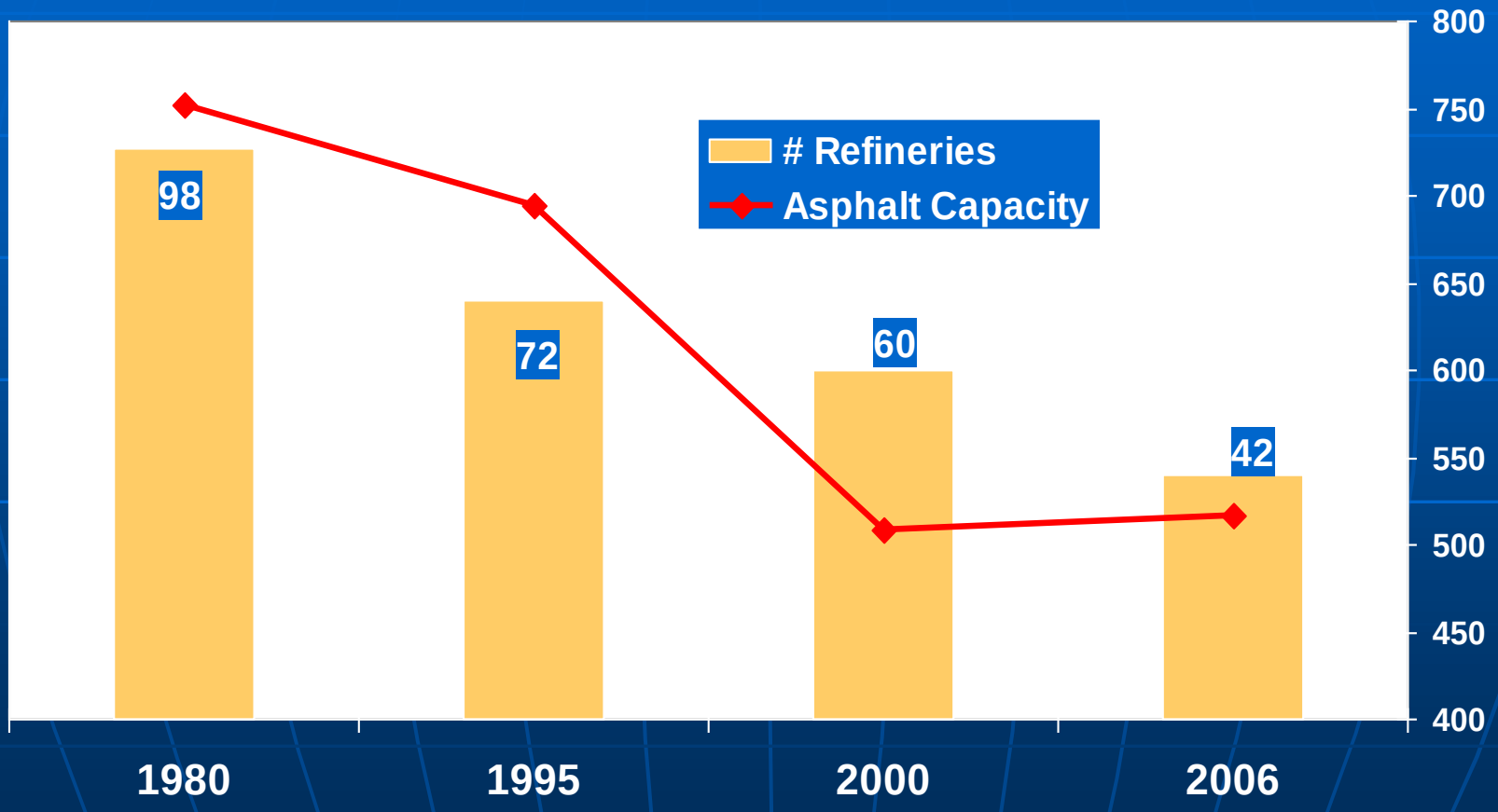
U. S. Refining Capacity



Last New U. S. Refinery Built in 1976

Source: Oil & Gas Journal

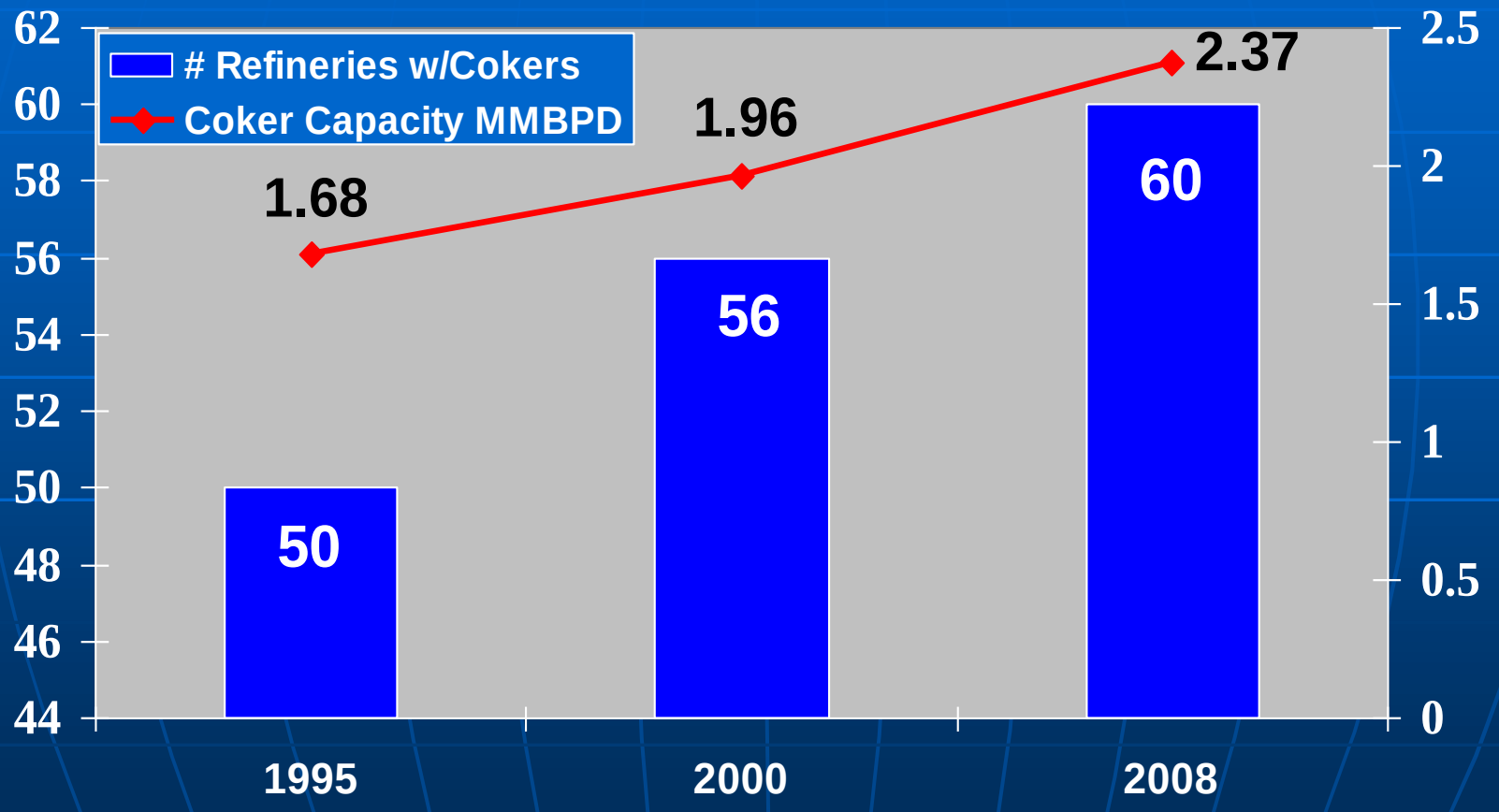
U. S. Asphalt Refining Capacity



Production Range: 600 B/D to 60,000 B/D

Source: Oil & Gas Journal

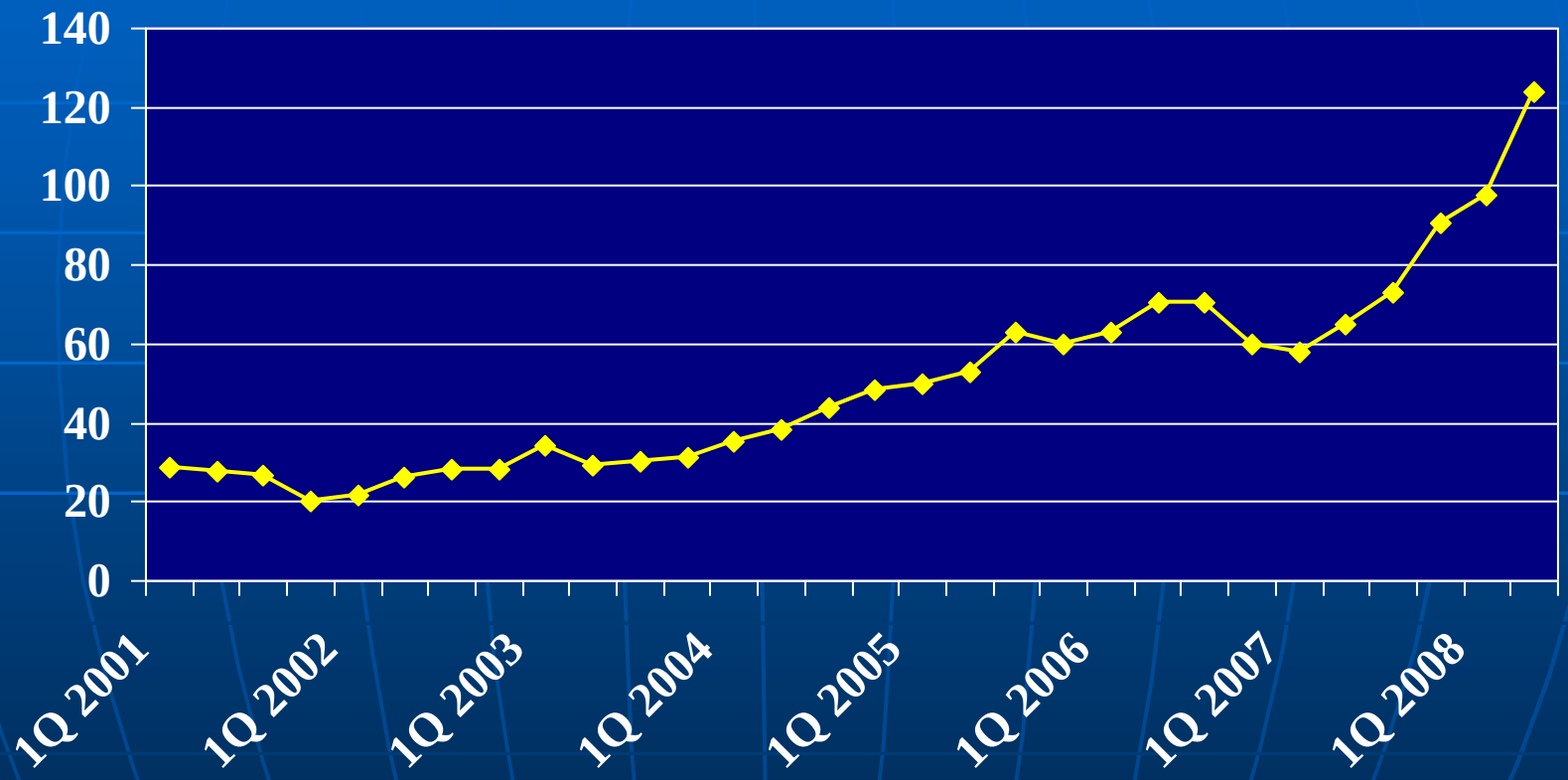
U. S. Refining Coking Capacity



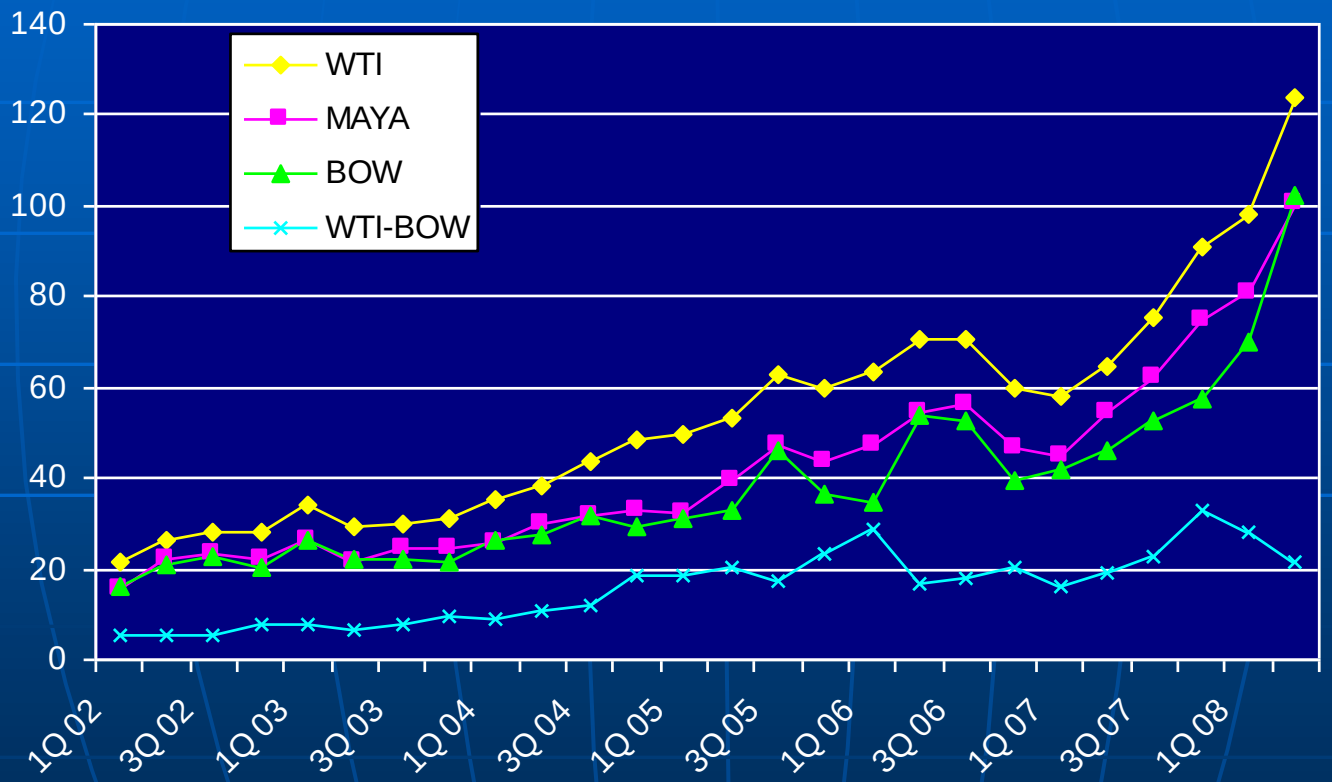
Source: Oil & Gas Journal & EIA

Crude Oil Prices

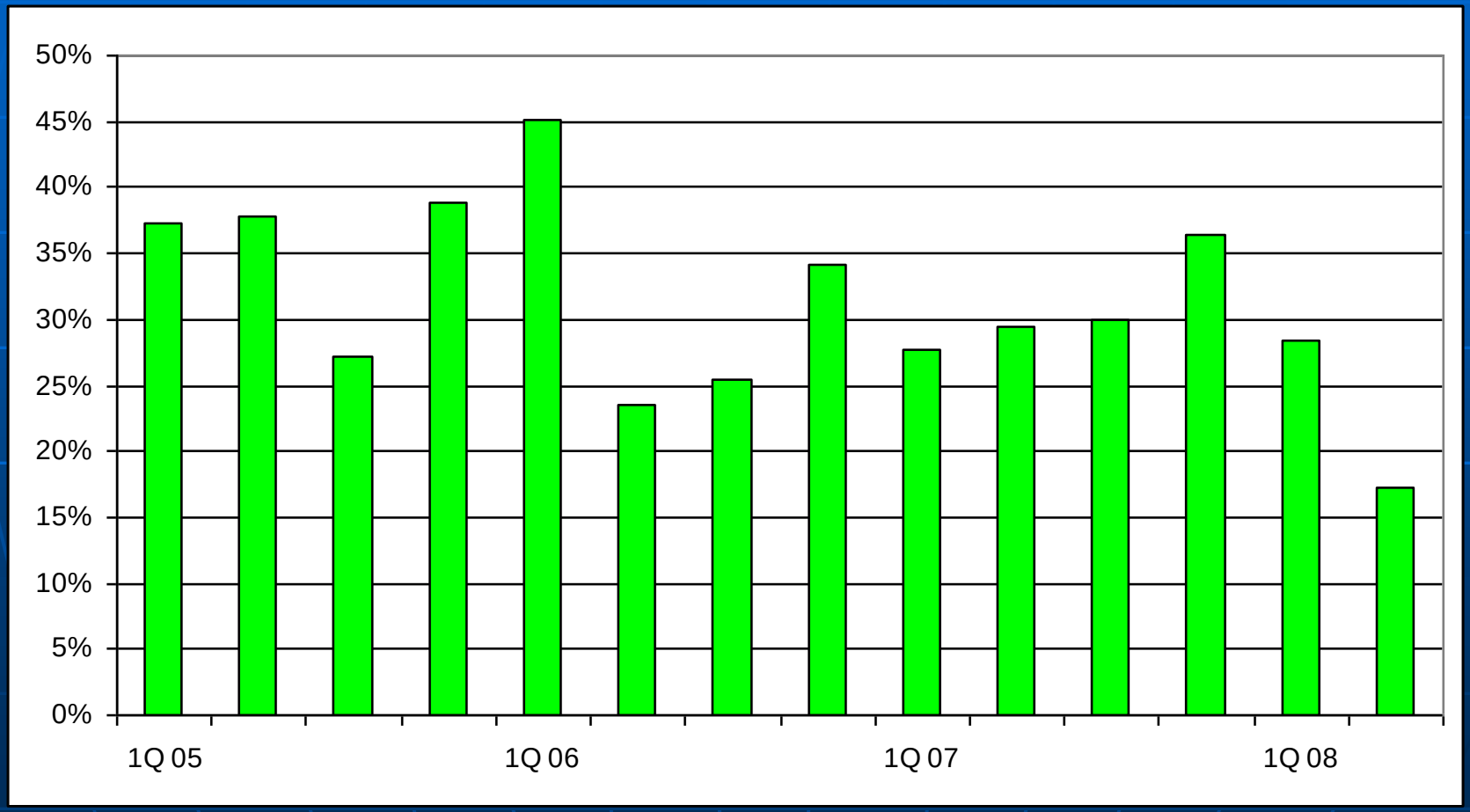
WTI Price by Quarter



Light-Heavy Crude Prices

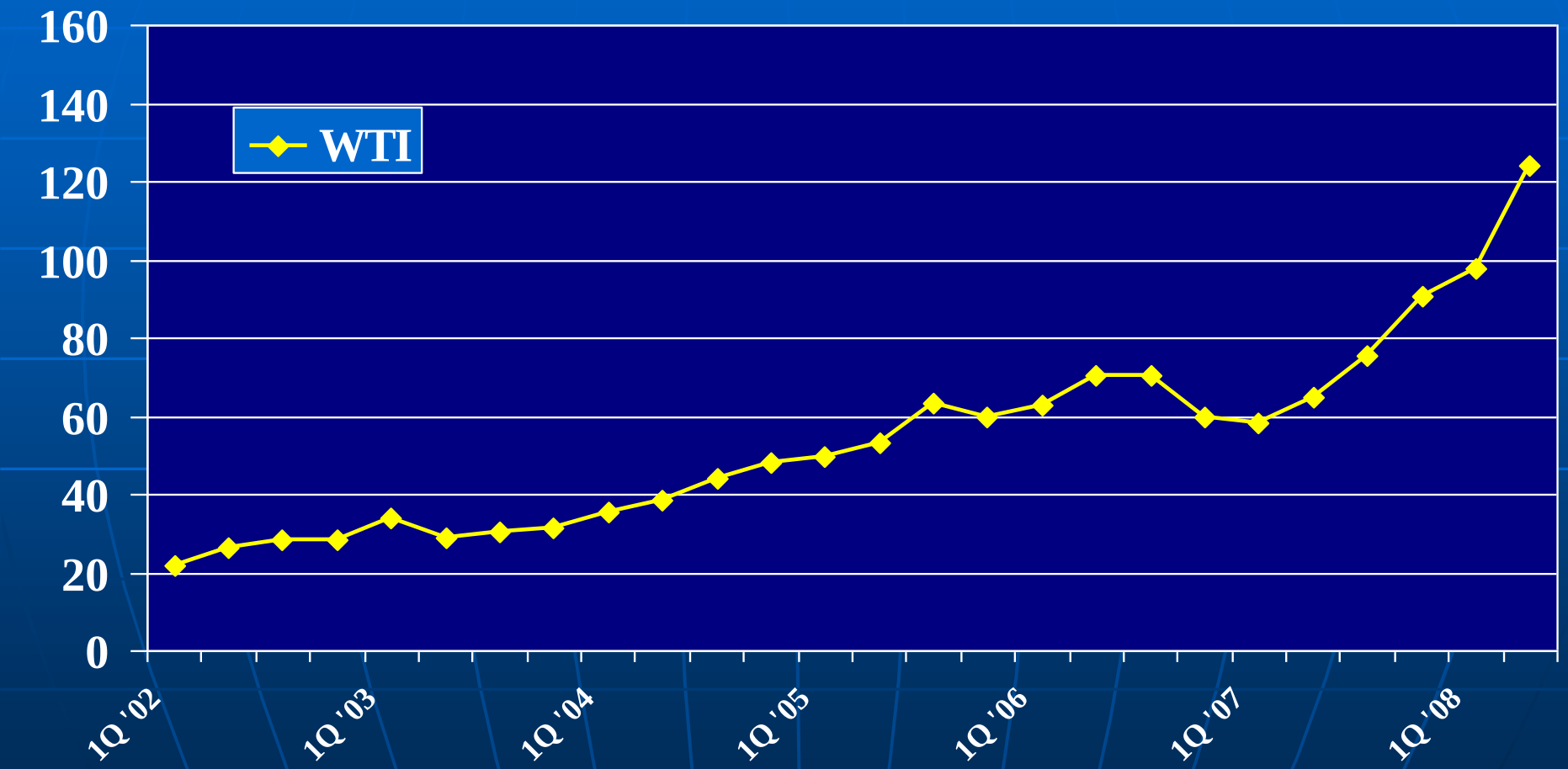


Light / Heavy Differential As A Percentage of WTI

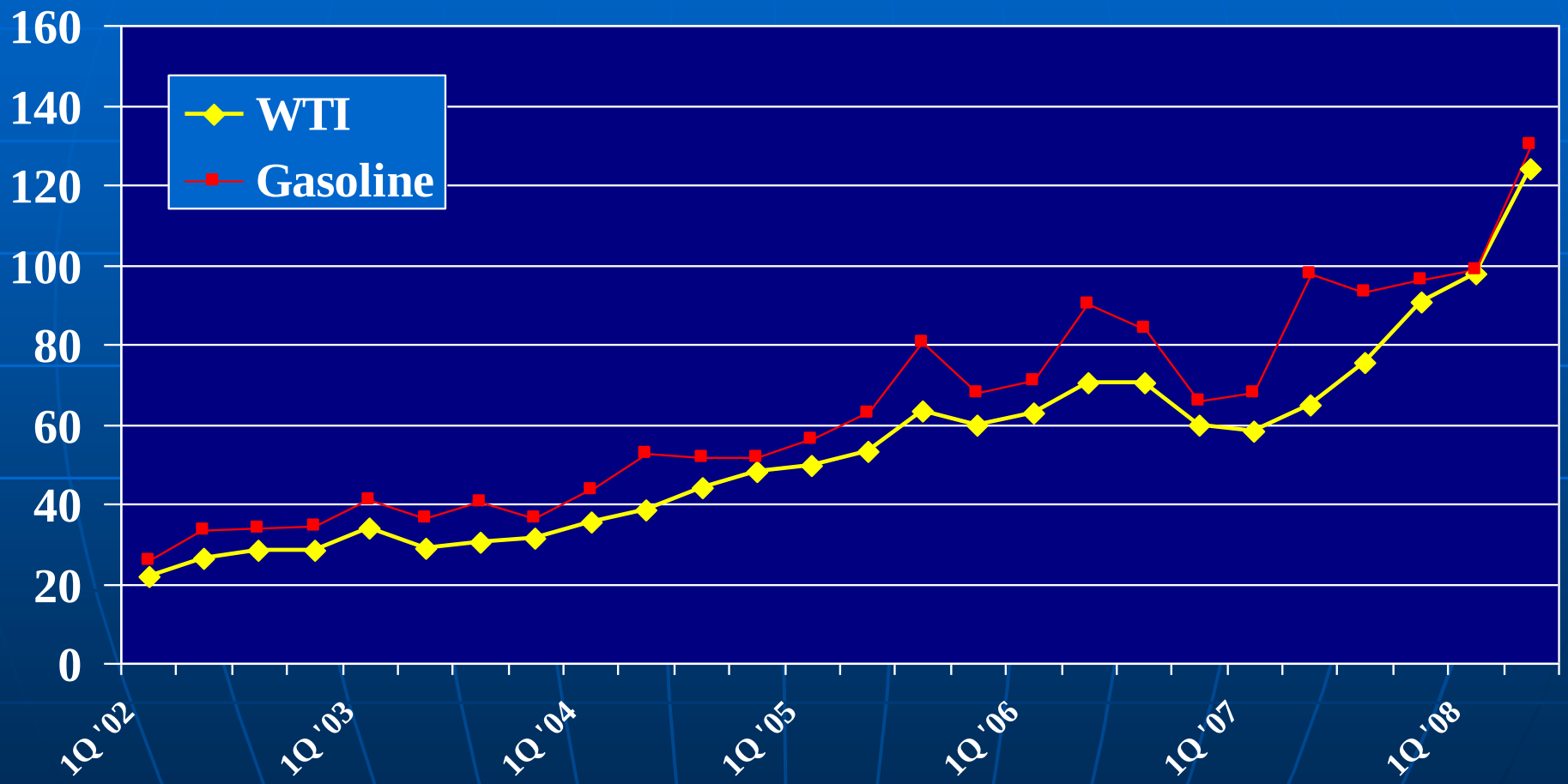


Products Pricing

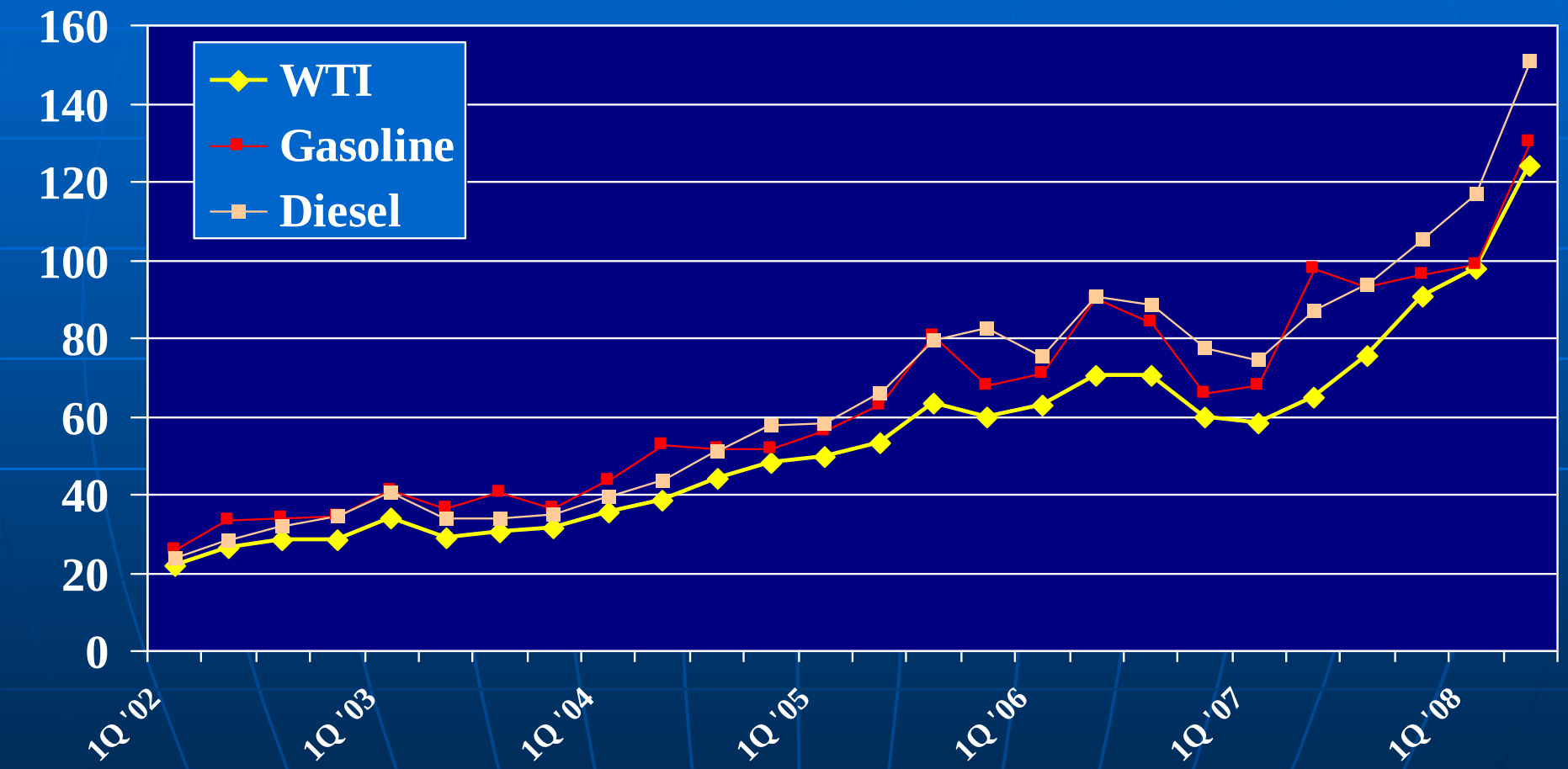
Crude/Product Prices



Crude/Product Prices



Crude/Product Prices



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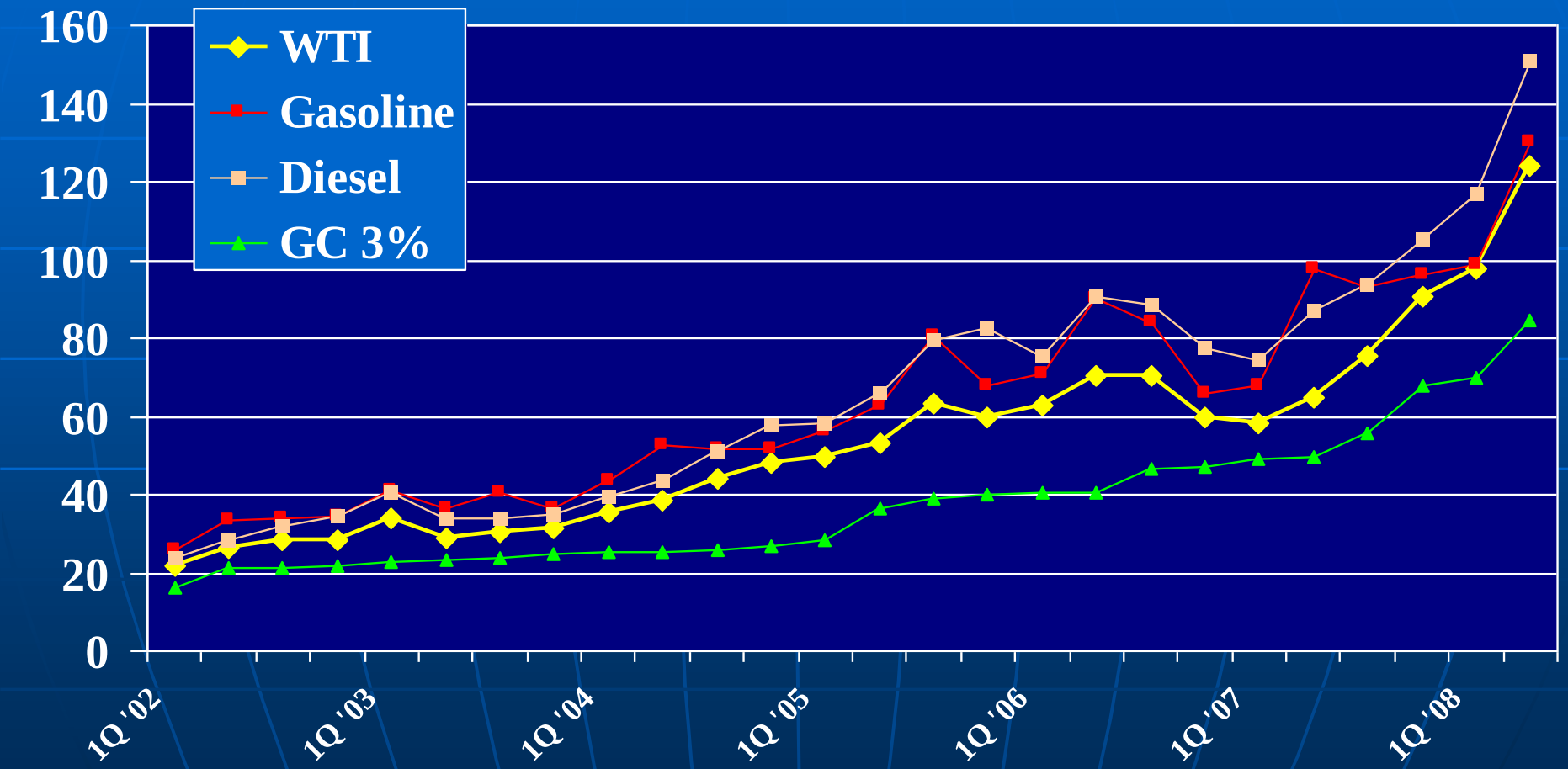
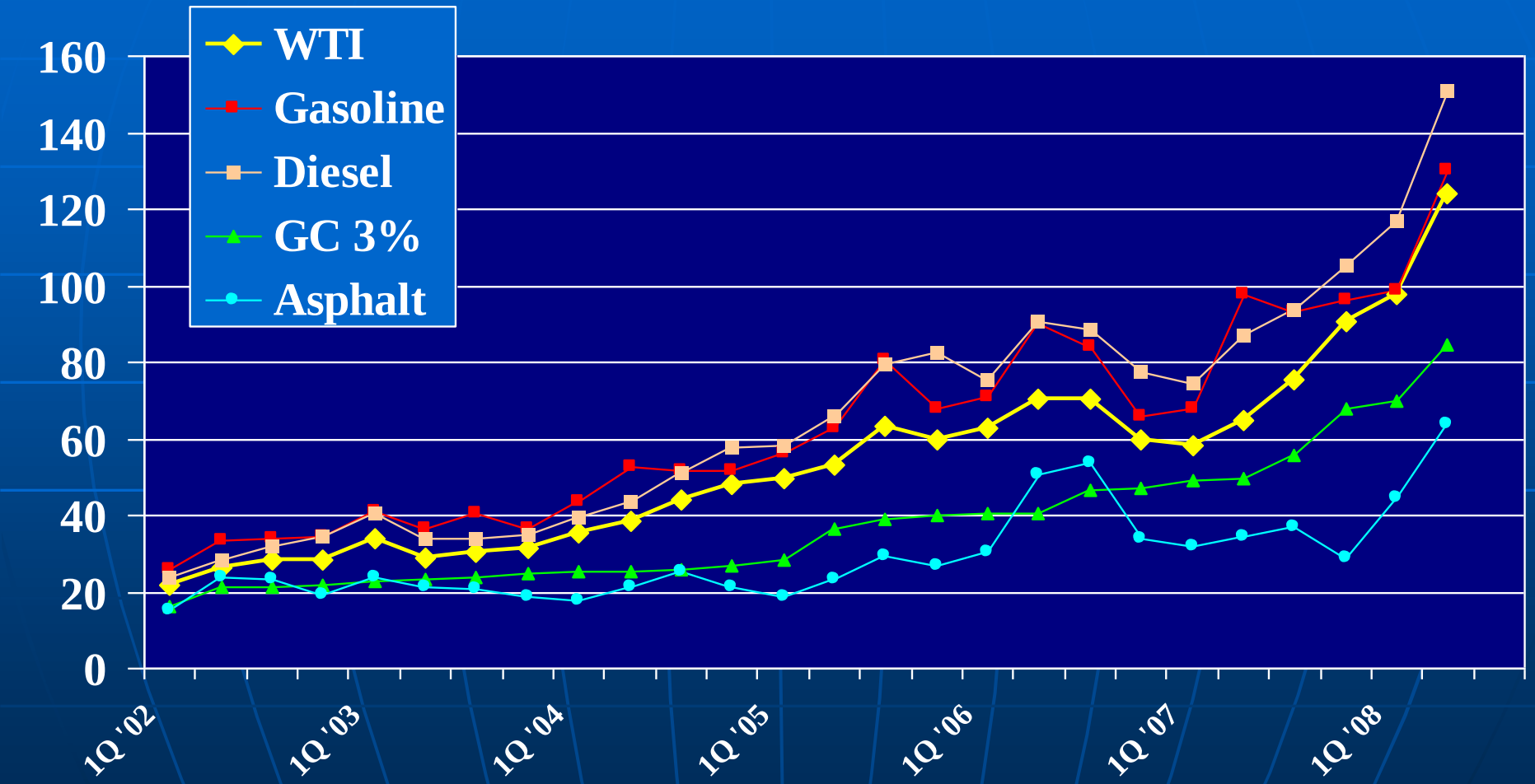
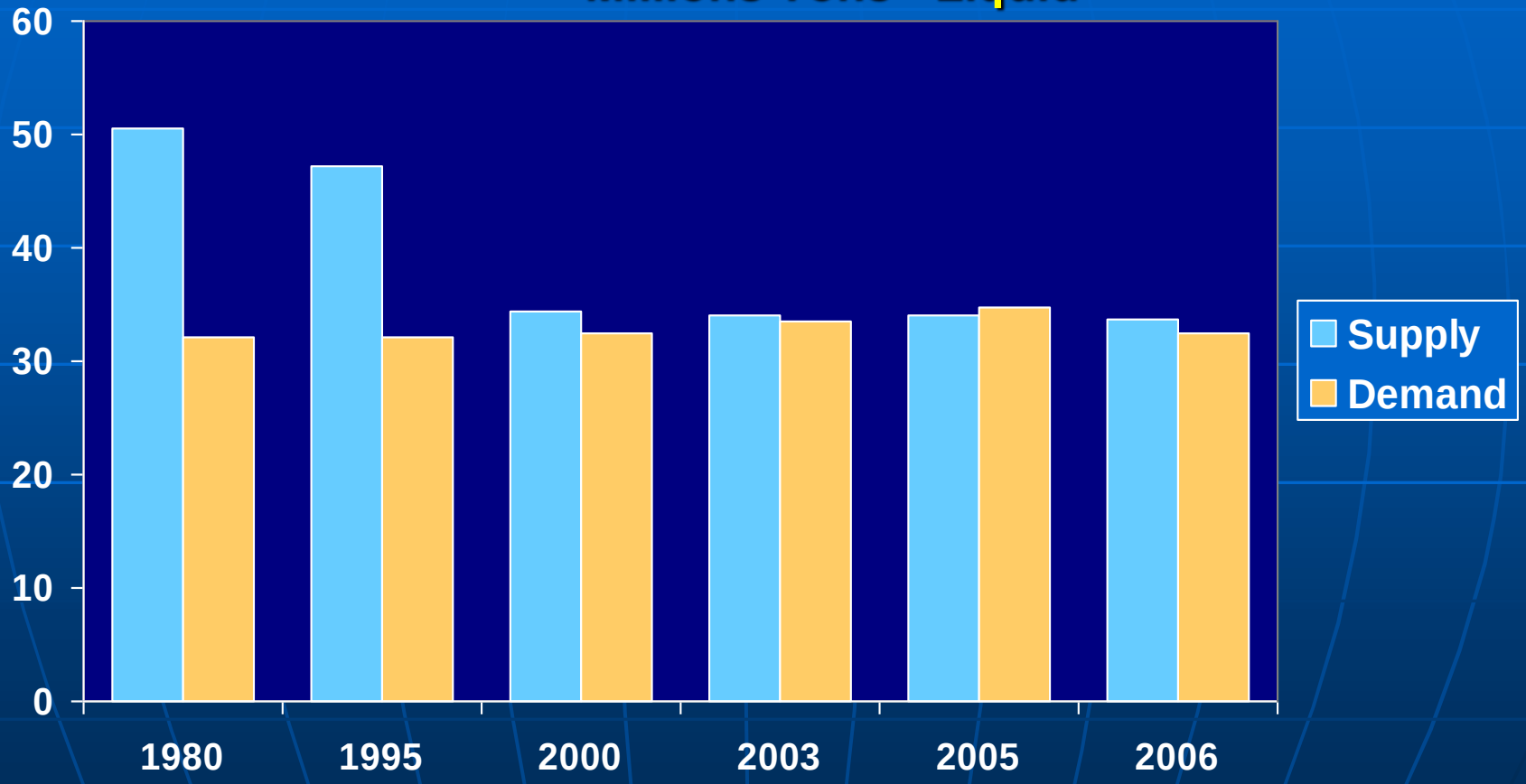


Crude/Product Prices



Asphalt Supply

Historical Asphalt Supply/Demand



Source: Oil & Gas Journal/Asphalt Institute

Asphalt Supply Reductions

- Refinery closures
- Temporary shut-downs (economics)
- Reduced imports
- Coker start-ups
- Refinery Upsets
- Crude run cuts
- Fall turnarounds

Supply Outlook (2008)

- East Coast – Tight
- Gulf Coast – Snug
- Midwest – Adequate
- Rockies – Snug
- West Coast - Tight

Supply Outlook (2009)

- Asphalt will have to carry its weight in crude cost.
- Increased refining margins will encourage higher crude runs.
- Will vary by region based on crude and product economics.
- Larger light/heavy crude differential will produce more asphalt (??).
- Currently - asphalt economics are very favorable compared to GC 3% (High Sulfur Crude Oil) and gasoline – SHOULD FAVOR AMPLE ASPHALT SUPPLY

Polymer Asphalt Supply Outlook

Presented by:

The Association of Modified Asphalt Producers

DeWitt & Company

Predominate Modifier

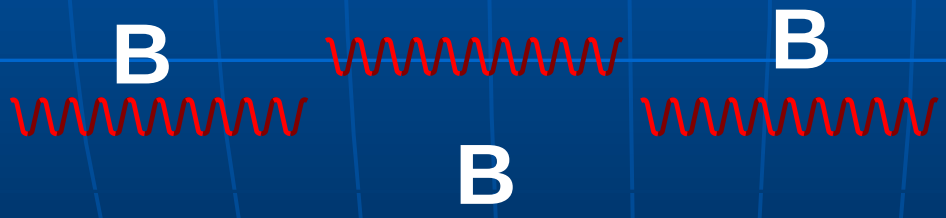
- Styrene-Butadiene-Styrene (SBS) is most widely used in US and around the world
  - Excellent performance – case studies
  - Long history of success – since 1970's in Europe
  - SBS produce a stable, compatible system easily used in today's construction practices

Styrenic Polymers (Elastomers)

Disposable fork

POLY-STYRENE

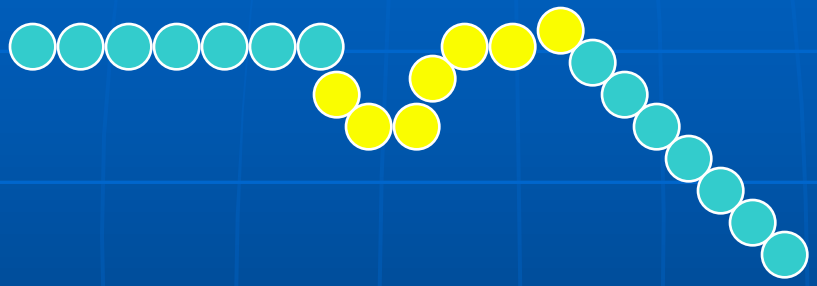
Rubber band



POLY-BUTADIENE

- Polystyrene is hard and brittle
- Commonly co-polymerized with butadiene

SB and SBS



Block Copolymer (SB & SBS)

Butadiene

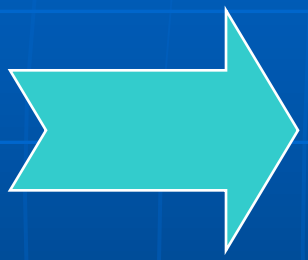
Styrene

Why is SBS Currently in Short Supply?

- Styrene-Butadiene-Styrene (SBS) polymer capacity is not short
- Shortage of raw materials - Butadiene
- Ethylene production is the problem

Why is Ethylene Production the Problem?

Ethylene

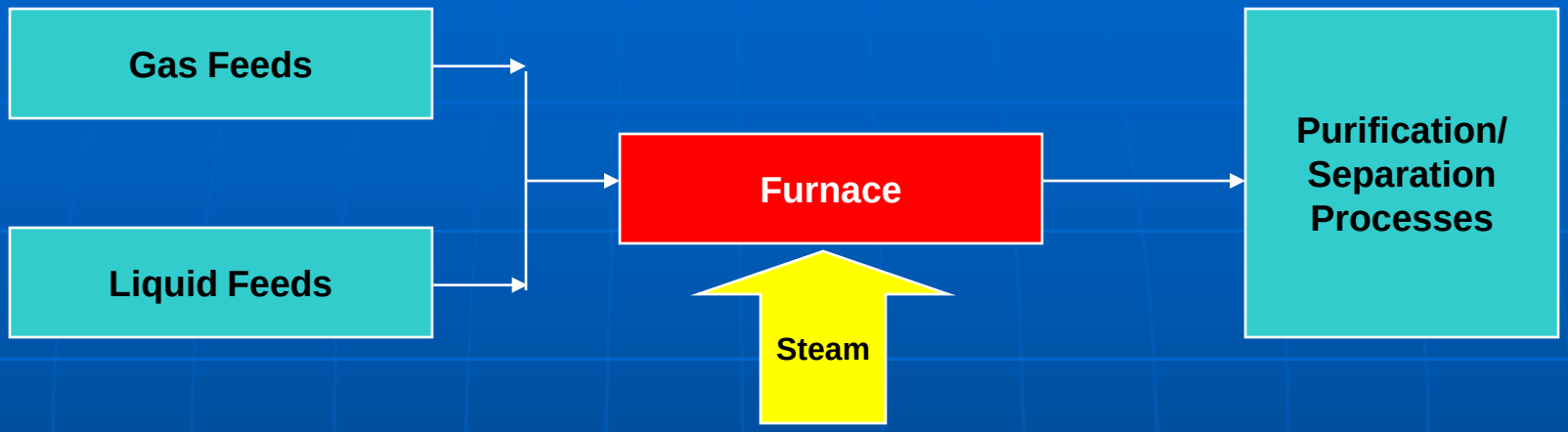


- By-products of Ethylene Production
  - Styrene
  - Propylene
  - **Butadiene**
  - Isoprene
  - Pentadiene
  - Cyclopentadienes
  - Aromatic Resin Formers
  - Isobutylene
  - Amylenes
  - Hydrogen
  - Benzene

Ethylene & Butadiene Market Comparison

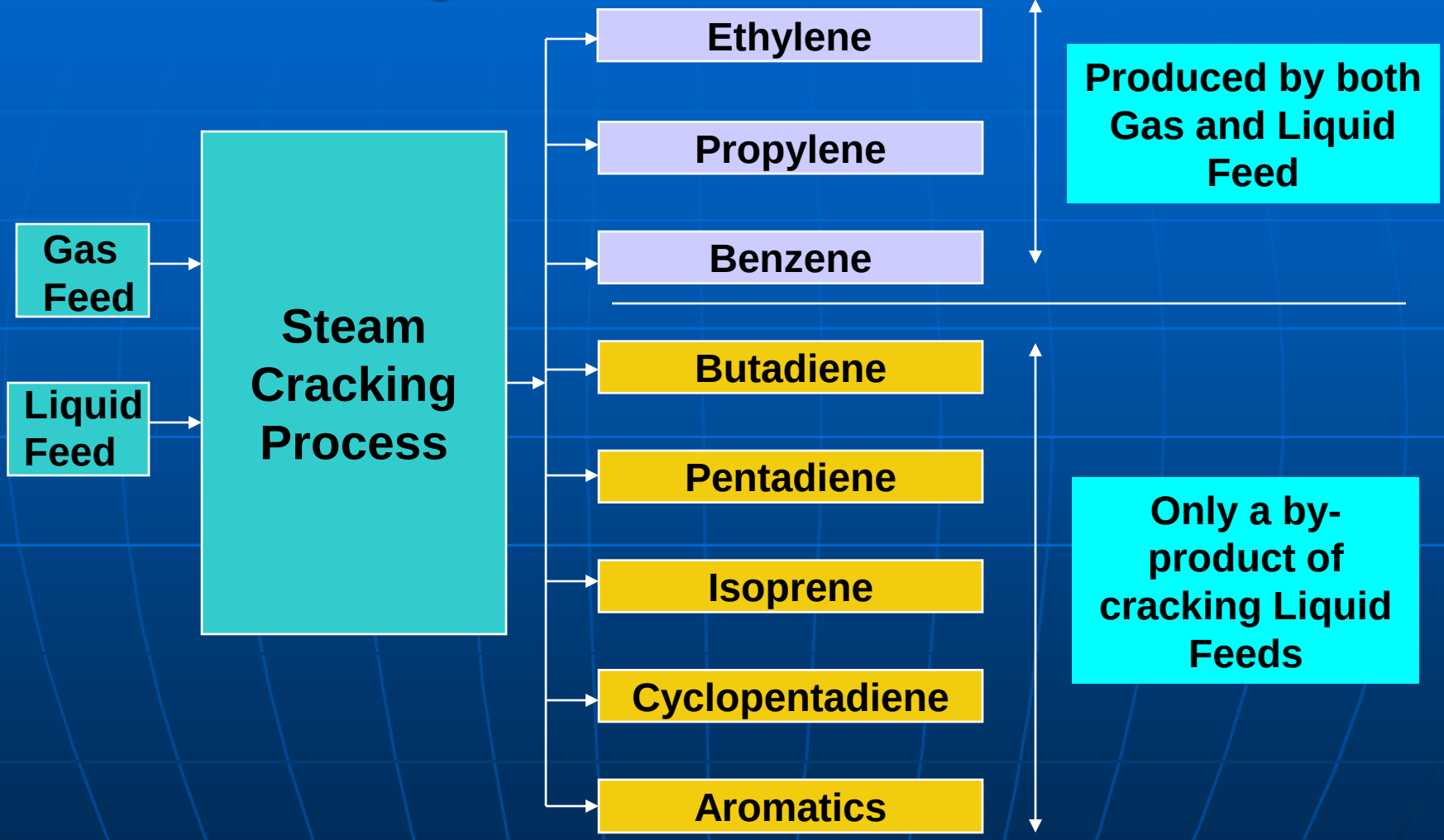
- **Ethylene Market**
  - 120 million tons per year
  - Primary use – packaging materials
    - Plastic wrap
    - Trash bags
    - Milk jugs
- **Butadiene Market**
  - 14 million tons per year
  - Primary use – tires (70%)
  - Multiple other automotive and durable good uses
  - SBS polymer for asphalt (6%)

How Is Ethylene Made?



- **Basic ethylene production technology is called a steam cracking process**
  - Process heats feed up to 1700 degrees, then injects steam that cracks the molecules
  - Cracker unit cost $2 billion
- **Choice between gas feeds like ethane, propane and butane and liquid feeds like naphtha and gas oils.**
- **Output is a mixture of ethylene and other products**
- **Requires a downstream purification processes to separate products**

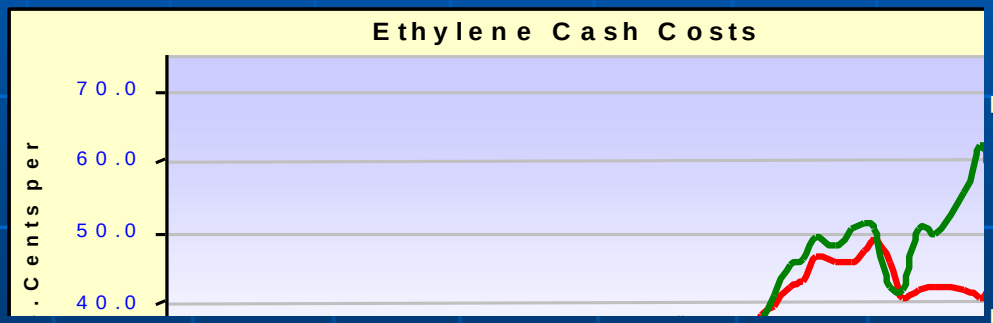
What's Important to Know About Ethylene Production



Choosing Feeds to Produce Ethylene

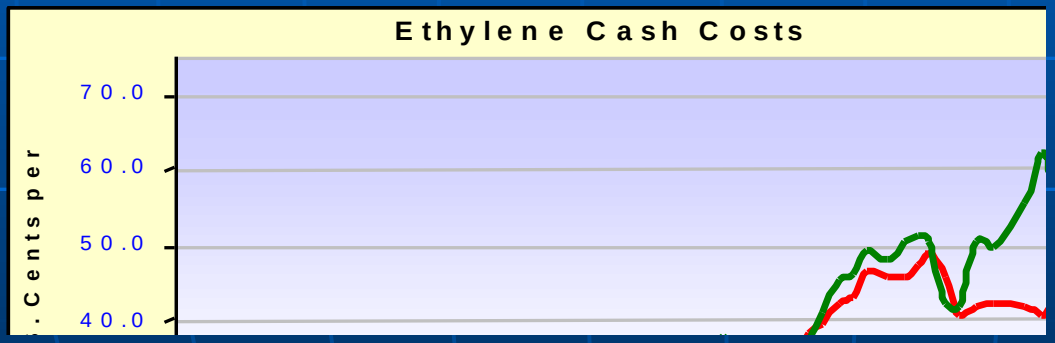
- Each producer runs an economic model
- Feed availability and costs for the producer at their location
  - Yield of each feed – varies considerably
  - Demand for each product
  - Alternatives to buy versus make that product
- Ethylene and propylene are the prime products
  - Evaluate netback of all products
  - Liquid feeds generally produce 15:1 ethylene to butadiene
  - Economic impact of butadiene is not large
  - Based on the conditions producers set a feed slate for the "Cracker"
  - Butadiene shortage is not a primary consideration for feed slate

Model Output



- Liquids are always in the slate due to the facilities being built to be liquid crackers
- Crackers modified in the 80's to be flexible
- Flexibility depends on producer, but varies from ~10% to ~50%
- Producing 3-5 million pounds a day a few pennies makes a big difference

What's Changed

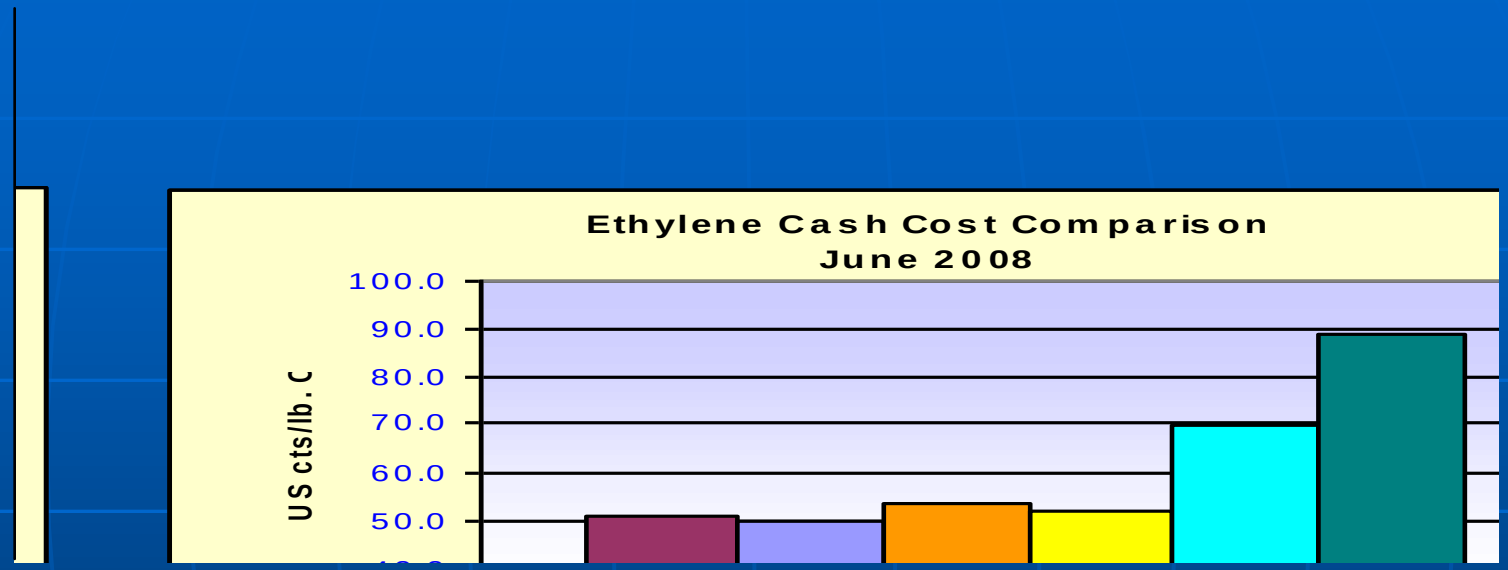


- **Structural change - natural gas producers installed facilities to separate ethane**
  - Ethane higher value than natural gas

Ethane prices didn't increase with the crude oil run-up

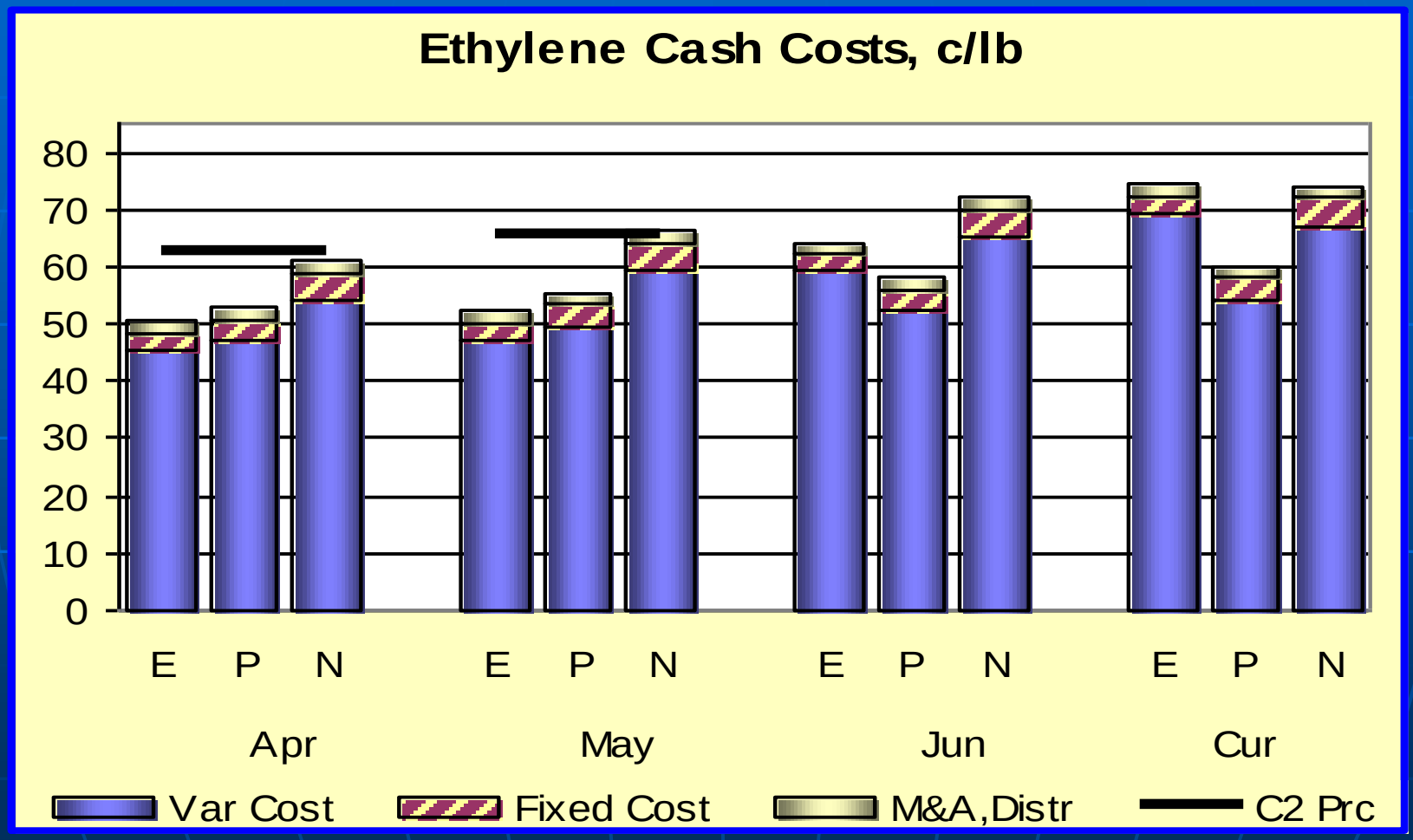
Economic incentive to run more ethane feed

What's Changed



- DeWitt estimates that the 1Q cracking slate went 10% lighter vs 2007 starting in February
- 2Q2008 slate has moved even lighter; possibly another 10-20%
- Incentives so great that teams of engineers are working on putting more gas into the cracking slate on a crash basis

July 2008


Ethylene Cash Costs, c/lb
80
70
60
50
40
30
20
10
0
E P N E P N E P N E P N
Apr
May
Jun
Cur
Var Cost
Fixed Cost
M&A,Distr
C2 Prc

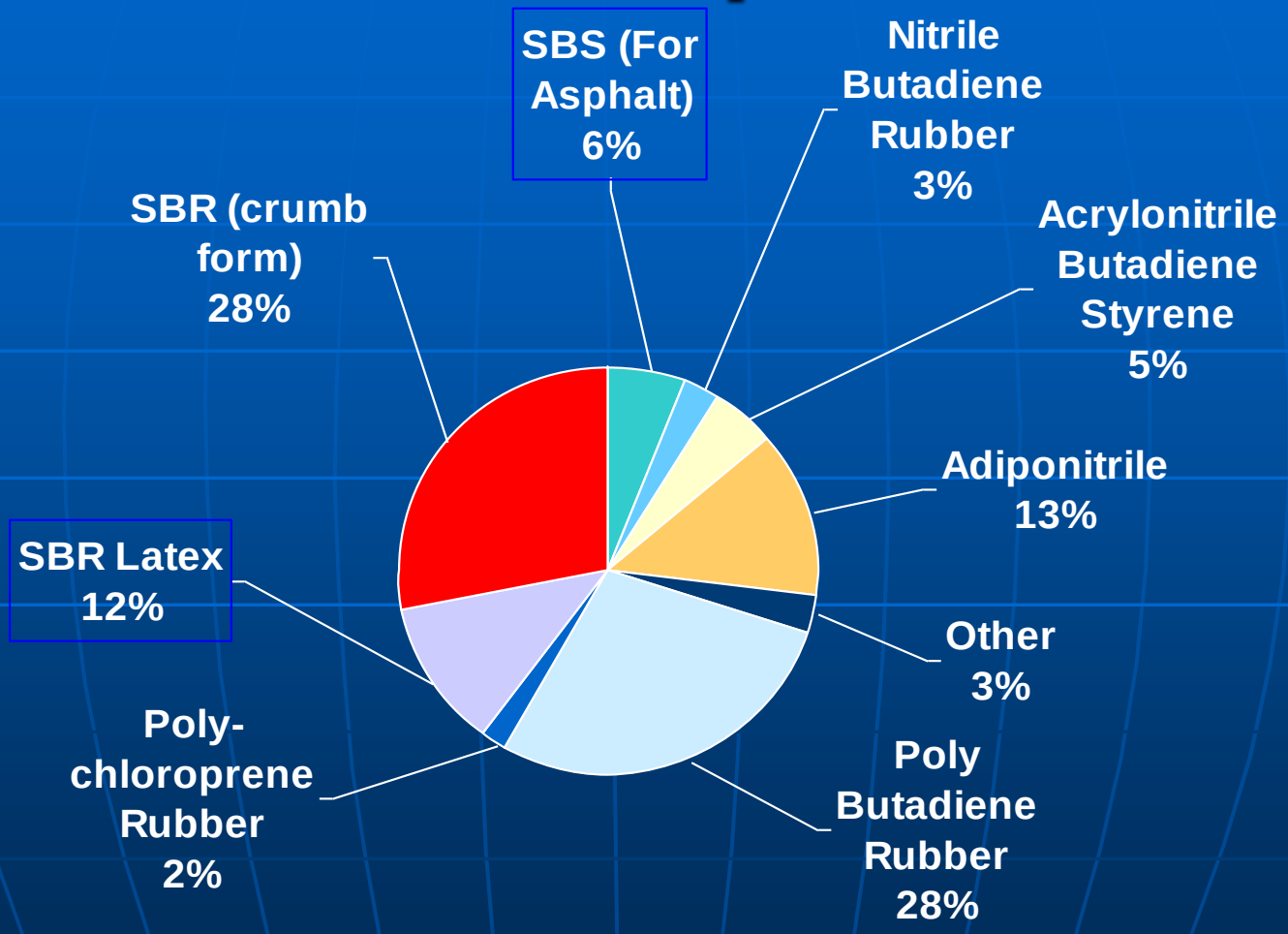
Ethylene General Trends

- Significant ethylene capacity additions in Middle East and Asia
  - Most of the Middle East is gas cracking
  - Most of Asia is liquid or naphtha cracking
- Little to no capacity additions in Western World
- New trend for ethylene units outside of US to be more flexible to be able to run more gas feeds
  - Historically have been naphtha crackers
- Expect more flexible cracking; hence, more variable Butadiene supply

Butadiene (Bd) Supply

- Globally tight due to lighter cracking and higher demand
  - 2008 Bd supply estimated at 75-85% of 2007
- New Bd and ethylene capacity due on-stream in Asia
- Expected capacity utilization to be lower than 90% for the foreseeable future
- Regional differences
  - US crude Bd supply tight due to light cracking in first half
  - US has excess purification capacity and buys crude Bd from Europe to fill capacity
  - Europe tight on supply due to somewhat lighter cracking; thus, less crude Bd to export to US
  - New Asian capacity needs to catch-up with demand

North American Butadiene Consumption



What Factors Will Influence Supply?

Positive

- New capacity
- Bd pricing itself out of some applications
- High gas prices:
  - Less driving mean fewer replacement tires
  - Smaller vehicles/smaller new car tires
- Slowing economy; less growth

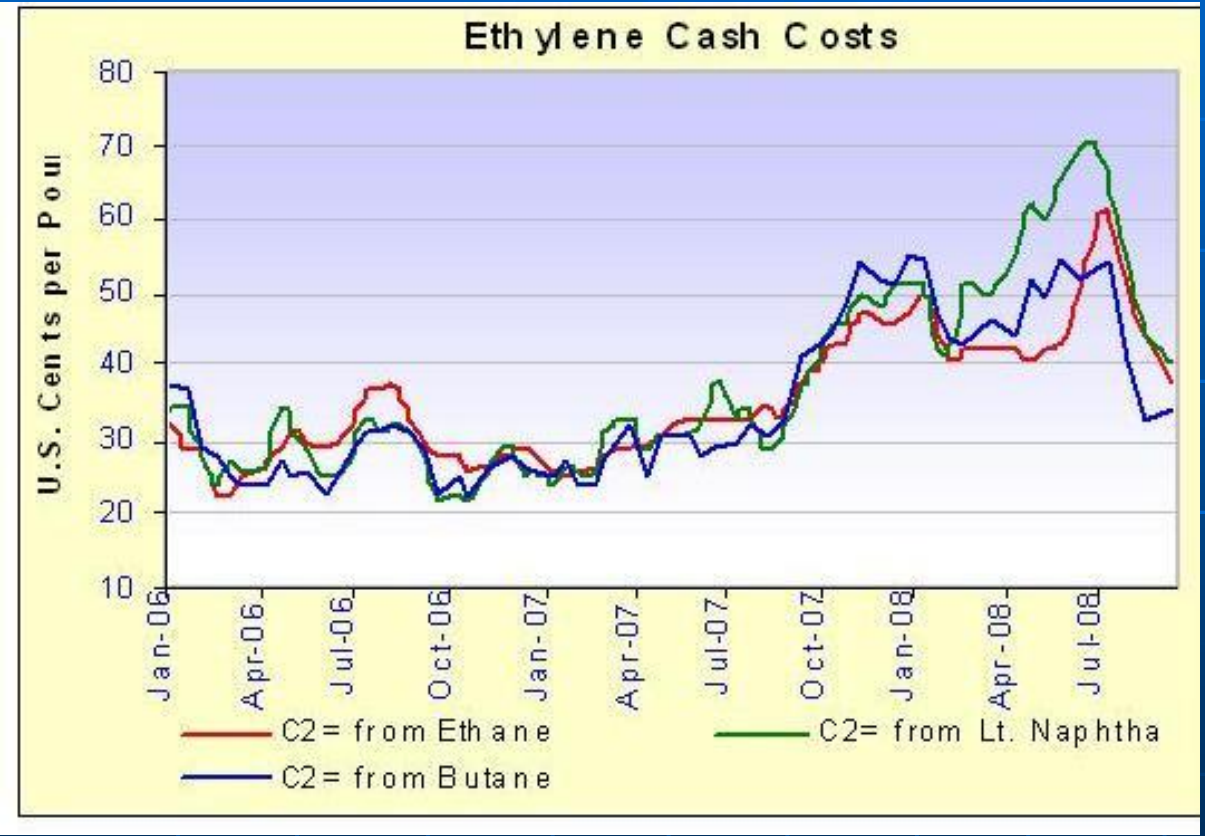
Negative

- Higher natural rubber prices driving consumers to synthetic rubbers based on Bd
- Lighter cracking
  - Higher naphtha prices
  - Structural change in US ethane market
- Low cost gas-based ethylene capacity coming on-stream in Middle East.

Tire Demand Data

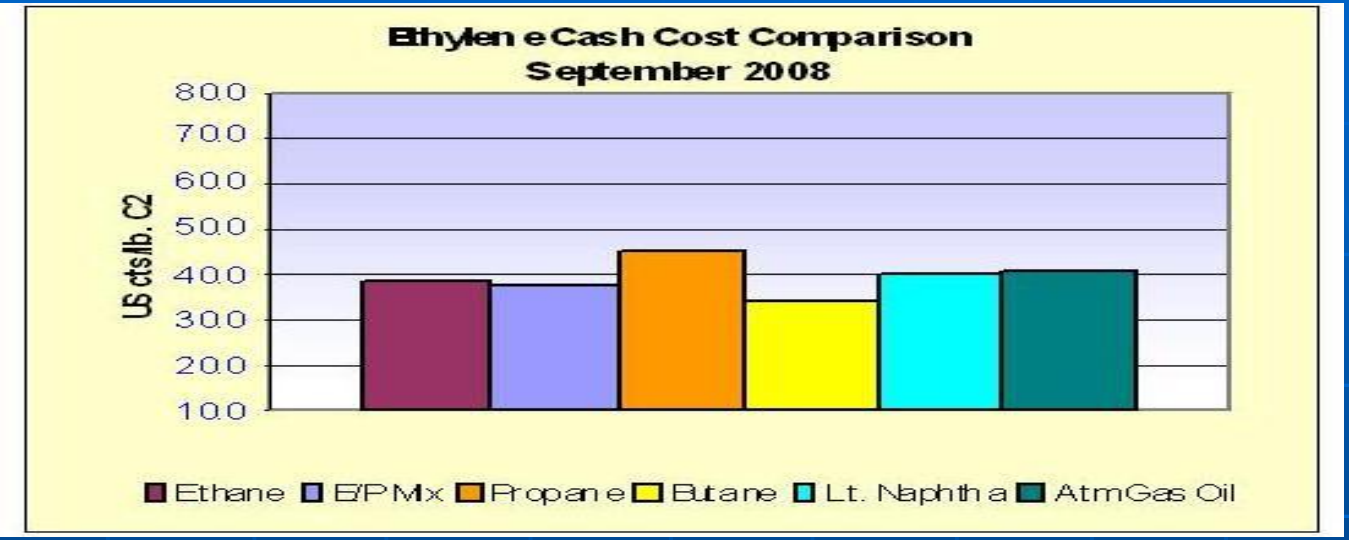
- **New Tire Demand**
  - June vehicle production down 8% and falling
  - Vehicle production skewed towards smaller vehicles
  - Tire demand could be down over 12%
- **Replacement Tires**
  - Higher gas prices are reducing miles driven
  - Expect reduced tire demand over time
  - May take 3-6 months to play out.

October 2008



- Spread between gas and liquid feeds now down to $.05
- Demand is shrinking – tire demand is down
  - Asian market price drop of $0.10- $0.15 per lb

October 2008



- **Hurricanes Gustav and Ike – temporarily shut down Gulf Coast crackers**
  - **Expected Bd price increase of $0.10 per lb**
  - **Reduced demand caused spike of only $0.04 per lb**
- **Crackers are back on line, but tire compound plants are not**
- **Tire Demand is way down – Frees up Butadiene for SBS Suppliers**
  - **Result – 100% Bd available to SBS producers for now**
  - **SBS suppliers will be able to build up substantial inventory this winter**

Alternatives to SBS Polymer

- **SBS polymer-modified asphalts are typically cross-linked systems**
  - Contractor friendly
    - Terminal blend supply
    - Do not require agitation
    - Storage stable
    - No major changes to HMA plant operation
    - No major changes to HMA laydown and compaction
- **Alternative modification systems should exhibit similar qualities**

Alternatives to SBS Polymer

- **SBR Latex – butadiene based polymer that is not in short supply at this time**
  - Not storage stable
  - Must be blended at HMA plant
  - Contractor now becomes asphalt modifier and must test and certify product
- **Non- butadiene polymers**
  - Reactive Ethylene Terpolymer (Elvaloy)
  - Ethyl Vinyl Acetate (EVA)
    - Used in warm climates
    - Blended with SBS in cold climates
- Polyphosphoric Acid (PPA)
  - An extender, not an alternative
  - Can be blended with SBS to reduce SBS content

Alternatives to SBS Polymer

- **Ground Tire Rubber (GTR) – wet process**
  - 15-20% GTR melted and swelled into asphalt
  - No cross-linking occurs
  - Not storage stable
  - Not a terminal blend process
  - AR binder cannot be PG graded in a meaningful way
  - Recipe specification

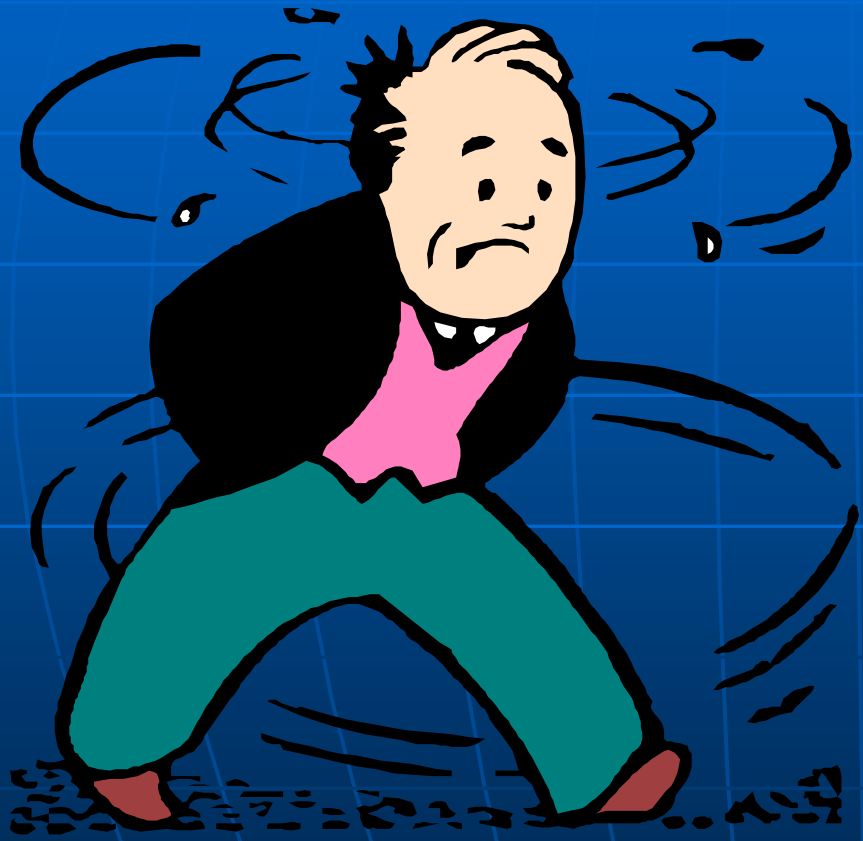
Alternatives to SBS Polymer

- **Ground Tire Rubber (GTR) – terminal blend**
  - Typically proprietary process
  - 10-12% GTR added at high temperature and processed with high shear milling
  - Chemical stabilizer added
  - 70% of GTR is non rubber material
    - Carbon black
    - Calcium carbonate
  - Settlement may be an issue
  - SBS is sometimes used to stabilize the system
  - Cannot be PG graded under current DSR test procedures

Alternatives to SBS Polymer

- **Hybrid Binders**
  - Blend of SBS and GTR
  - Cross-linked system
  - Storage stable
  - Terminal blend system
  - Current research sponsored by FL DOT at University of Florida

Alternatives to SBS Polymer



- **'NOTHING' is not an option**
  - PG Grading system is based on climate and traffic
  - Using the wrong grade will lead to poor performance
  - We have enough historical data to prove that PMA does improve pavement performance
  - Flexibility and creativity are needed to come up with answers

DON'T SHOOT THE MESSENGER