# 2015 MAPA Asphalt Conference Asphalt/Binder Update

Randy Canfield
Ergon Asphalt & Emulsions
Kansas City, KS

# Welcome to MO Asphalt Conference

# Next Stop…

# Types of Asphalt

- Trinidad Lake
- Pen Graded – 60/70, 120/150, 200/300
- Viscosity Graded – AC 30, 20, 15, 5
- AR Graded – AR1000, 2000, 3000
- Superpave – SHRP Program – 1987-1992 – PG Graded
- Polymer Modified Asphalts

# Types of Asphalt

- Crumb Rubber Modified
- Acidized
- Oxidized – primarily roofing
- More RAP & RAS – blends of AC
- Additives
- Rejuvanators
- Future Innovations

# Trivia

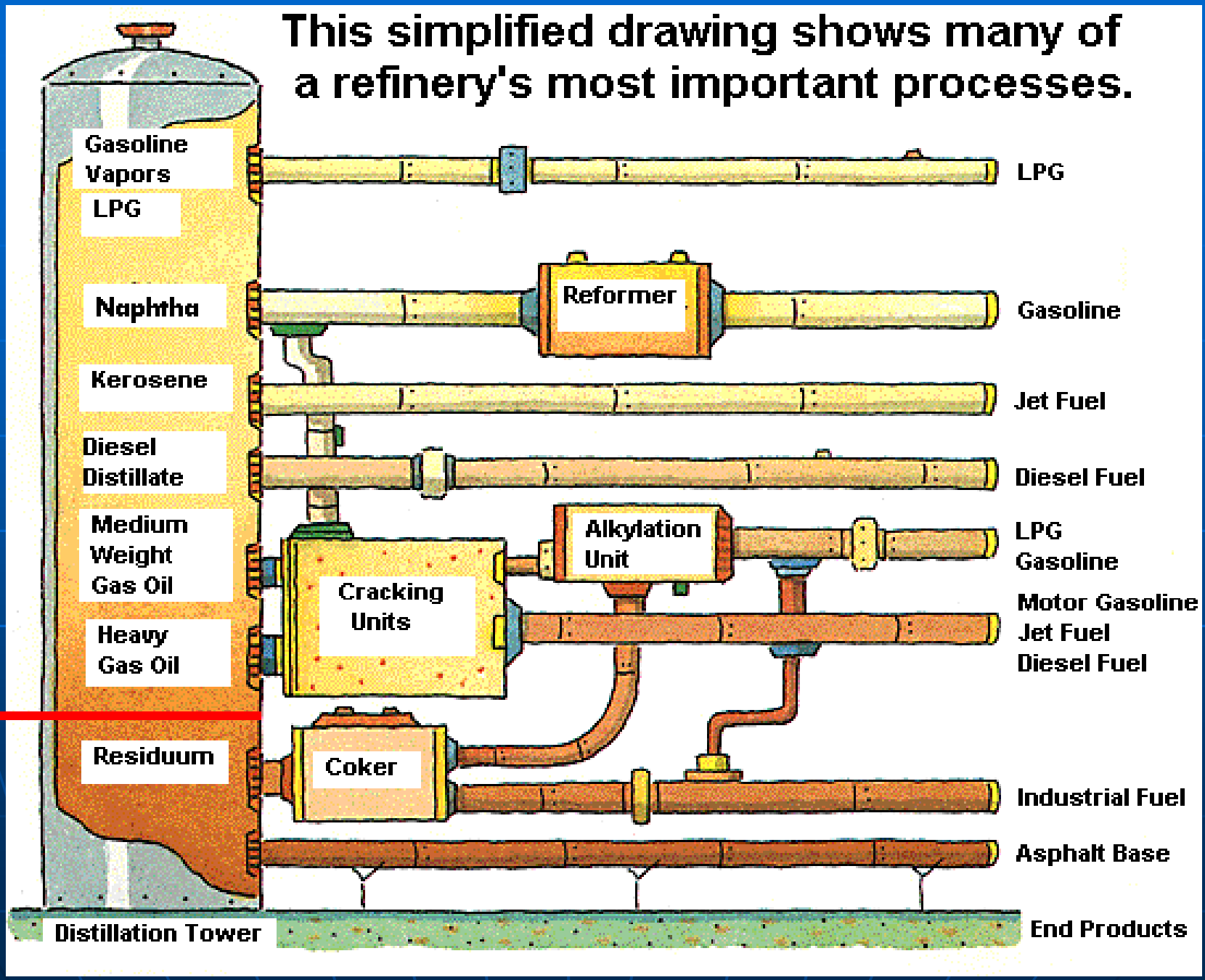
- 1975 – Crude price $7.50/BBl
- 1980 – Crude price $21.50/BBL
- 1990 – Crude price $20.00/BBL
- 2000’s – Crude price $26-$94/BBL
- 2010’s – Crude price $74-$105/BBl
- 2015 – Crude price $44.70/BBL

# Average Asphalt Prices

- 1990 - $105 - $120
- 2000 - $250 - $450
- 2010 - $450 - $600

# US Supplied Asphalt & Rd Oil

- 1980 – 123,982,000 BBLS
- 1990 – 176,340,000 BBLS
- 2000 – 199,580,000 BBLS
- 2010 – 132,274,000 BBLS
- 2013 – 118,045,000 BBLS (21MMtons)
- 2017 Demand will increase 3.7% annually to 27MMtons - prediction


This simplified drawing shows many of a refinery's most important processes.
Gasoline Vapors
LPG
Naphtha
Kerosene
Diesel Distillate
Medium Weight Gas Oil
Heavy Gas Oil
Residuum
Distillation Tower
Reformer
Alkylation Unit
Cracking Units
Coker
LPG
Gasoline
Jet Fuel
Diesel Fuel
LPG
Gasoline
Motor Gasoline
Jet Fuel
Diesel Fuel
Industrial Fuel
Asphalt Base
End Products

# Basic Crude Premises

- The world is not running out of crude oil
- The world is also not running out of demand for crude oil
- Differences in growth rates of crude and products supply/demand will "drive" prices

# Factors Influencing Asphalt Pricing

- Crude Oil Price
- Crude Oil Differential
- Refining Margins
- Refining Capacity
- Asphalt Supply & Demand
- Alternate Disposition
  - Coking
  - 6 oil market

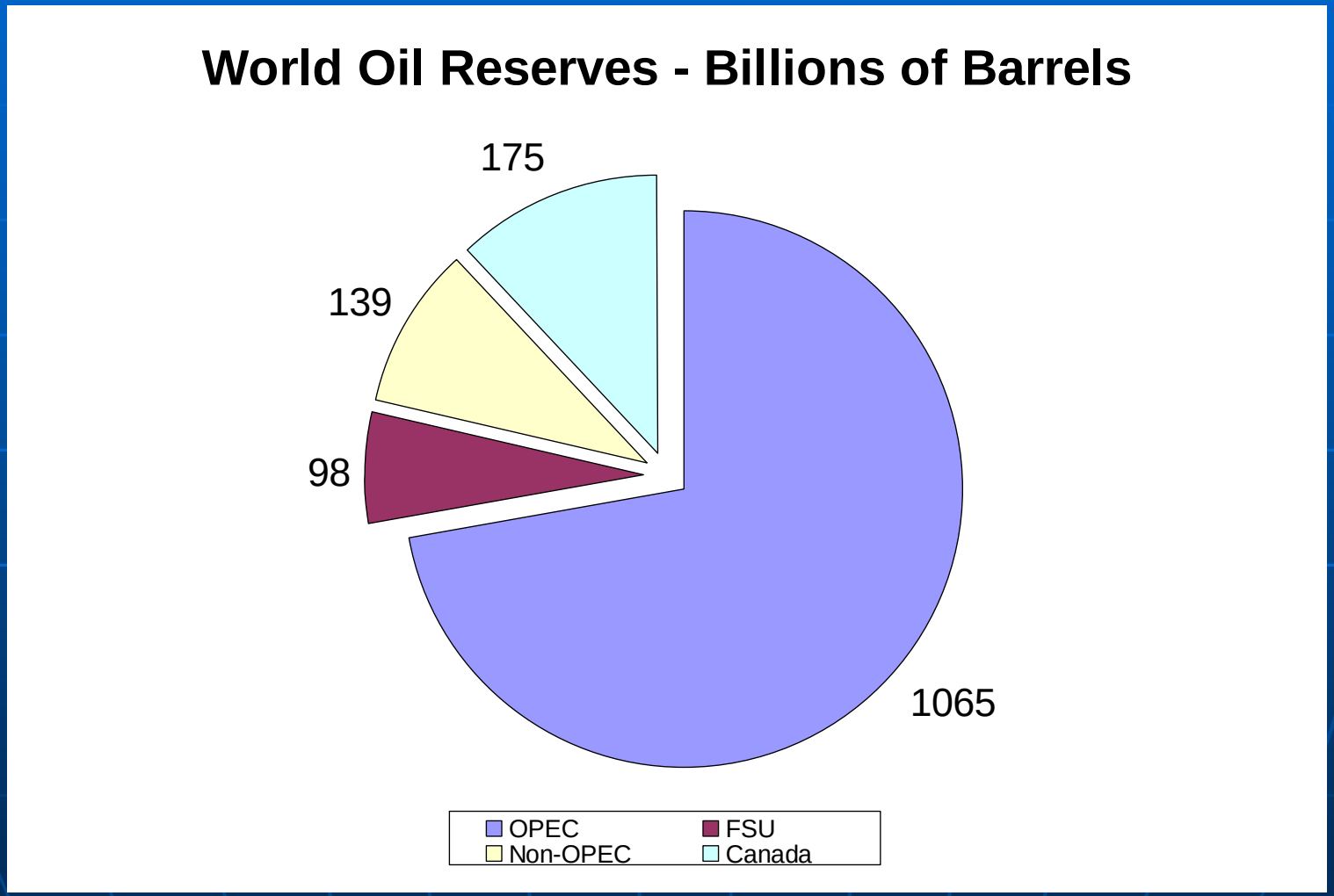
# Crude Oil Price

- Supply
- Demand
- Financial Markets???

# Factors Effecting Oil Prices last 25 Years

- Oil Embargo – 73'-74'
- Iranian Revolution
- Iran/Iraq War
- OPEC 10% Quota increase & Asian Fin Crisis
- PDVSA strike, Iraq war, Asian Growth, Weaker dollar
- Recession, Libyan uprising, etc??

# Crude Oil Supply




Source: CIA Fact book

# 2010 World Oil Reserves by Crude Type

- Heavy – 38%
- Medium – 20%
- Light Sour – 25%
- Light Sweet – 16%
- OPEC – 1,200 Billion BBLS

# Domestic Crude Oil Supply

- Domestic Production has increased the last 5 years from 5mmb/d to 6.4mmb/d in 2012, & in 2013 ~ 7.0mmb/d. The highest level since 1993.
- The # of US drilling rigs reported in 2011 was 777 and is at 1,400 today, so a lot of exploration.
- Net crude oil imports has declined from 60% in 2005 to an estimated 39% in 2013, if that holds true it will be the first time it has dropped below 40% since 1991.

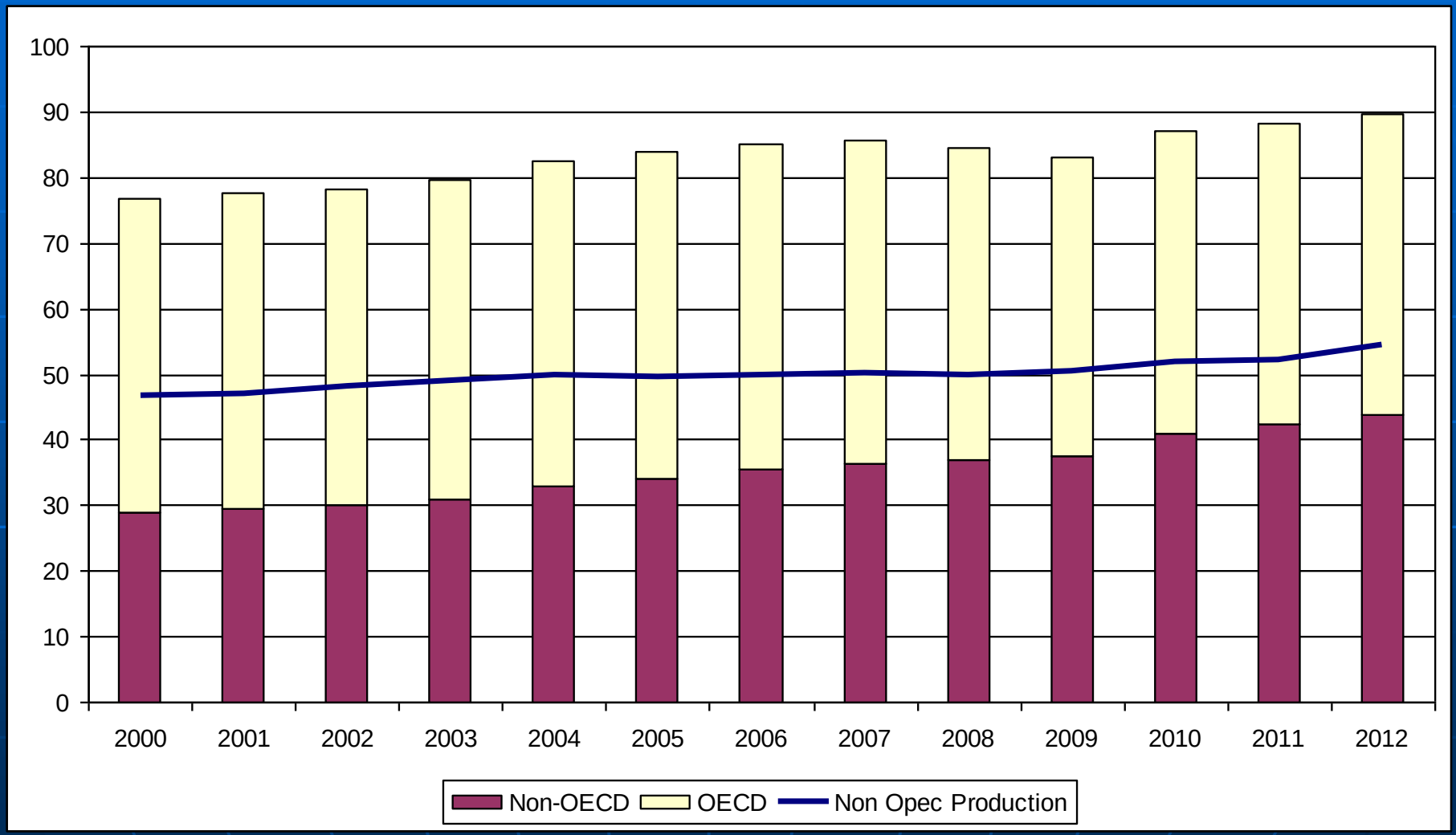
# Crude Production Forecast

- Crude production will increase by over 9 MMBPD from 2010 to 2021
- The Middle East will produce over half of the growth while Europe and Asia Pacific will decline in production
- Canada, Brazil, Columbia, and Kazahkstan will show the most growth in non-OPEC countries
- Type of crude – 1.9 Heavy, 3.4 Medium, 1.5 Light Sour, 2.5 Sweet = 9.4MMBPD

# Regional Production Growth by Grade

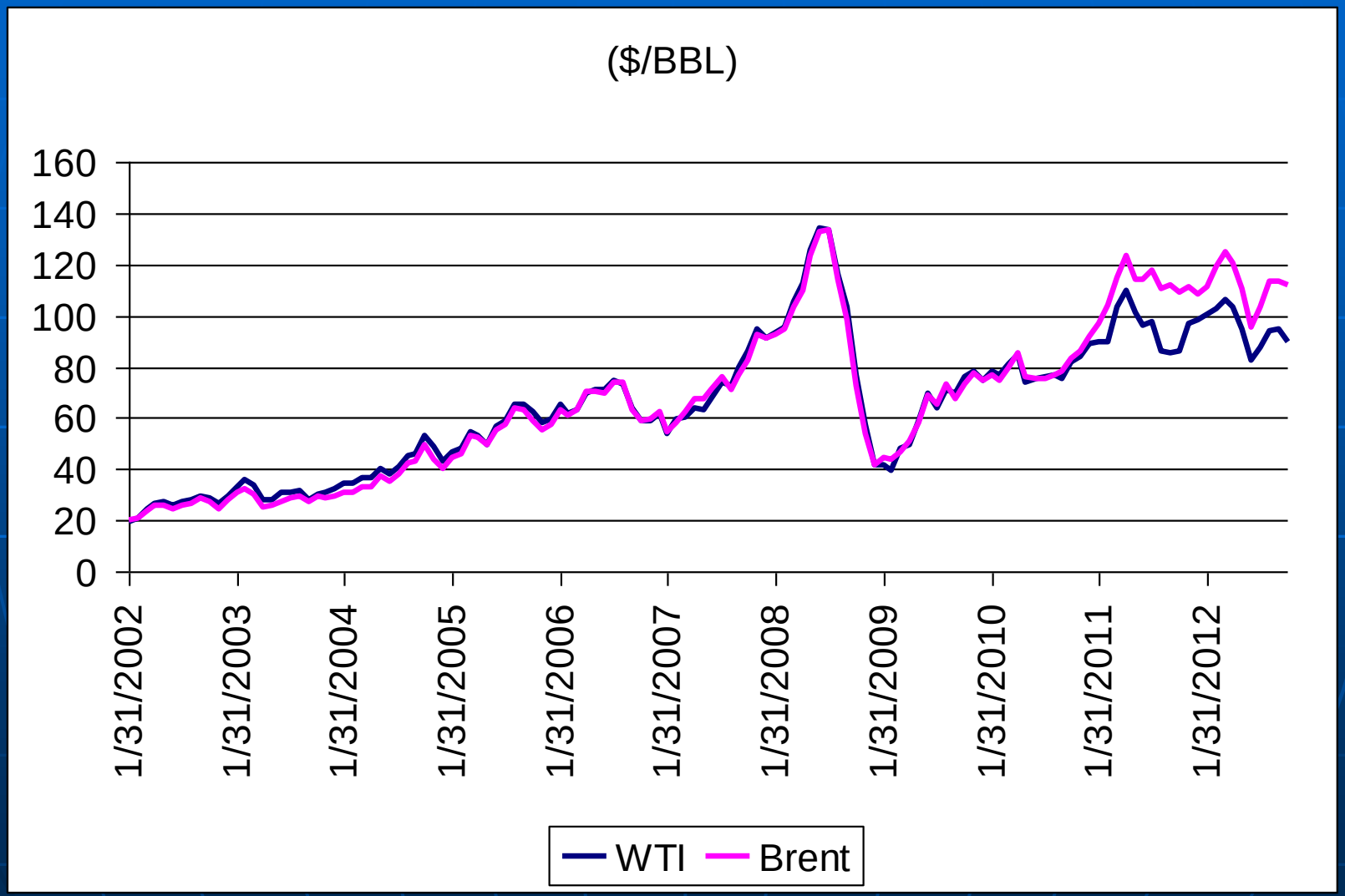
- The grade increases are not distributed proportionally; Western Hemisphere produces nearly all the incremental Heavy crude
- Western – 3.7 MMBPD, Eastern – 5.7 MMBPD
- Over 60% of Eastern increase is expected to come from Iraq and Saudi Arabia

# Crude Oil Demand




Source: DOE

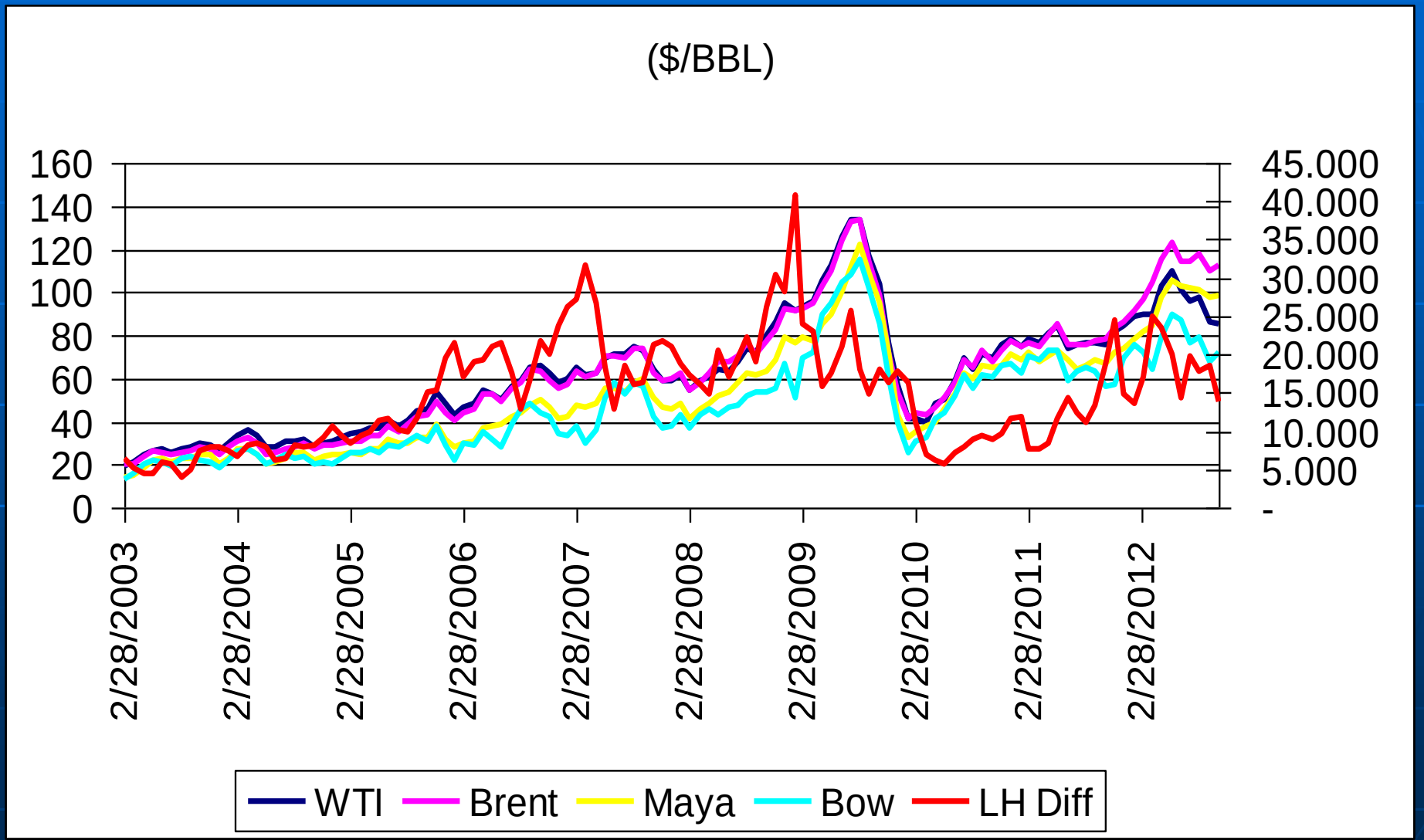
# Crude Oil Prices



# Crude Oil Price Differentials

- Anomaly going on in the market related to Brent/WTI pricing
  - Lower mid-continent crude costs
  - Higher mid-continent refining margins
- Expansion of crude pipelines out of western Canada has compressed the light-heavy crude differential

# Crude Oil Price Differentials



# Heavy/Light Crude Differential Drivers Going Forward

- The difference in growth between heavy crude supply (production) and demand (heavy capable refining capacity) will determine heavy/light spread
- Western Hemisphere will continue to be where all the action is on heavy
- Short to mid-term tightness in supply vs. demand will limit discount until mid-decade
  - Primarily driven by demand factors as significant new heavy crude comes on line in the next 2-3 years

# Crude Price Outlook – Through 2020

- Ceiling – Demand Factors / Surplus Capacity - $110
- Trading Range – Short Term Volatility Drivers
  - Geopolitical Events
  - Catastrophic Weather Events
  - Economic News
  - Inventory Fluctuations
- Floor – Production Cost of Marginal Barrel/Demand -$75

# What Impacts Asphalt Supply?

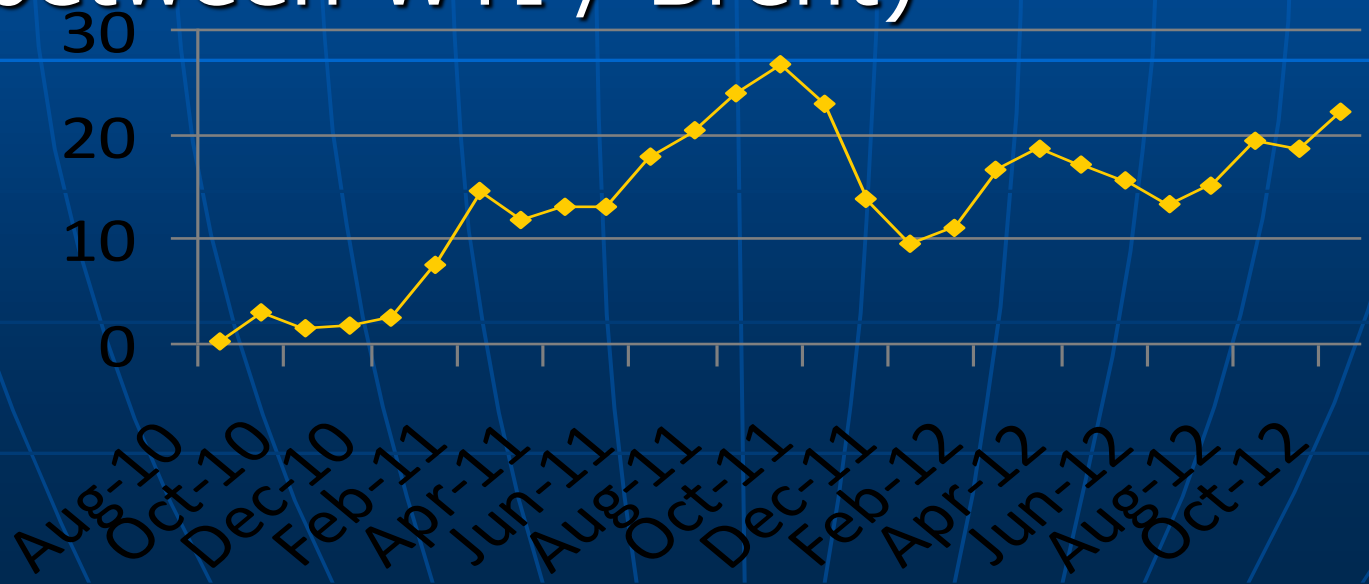
- International Markets (USA no longer main driver for crude and product prices)
- BRIC GDP vs. USA GDP
- BRIC = Brazil, Russia, India, China
- Gross Domestic Product (GDP) is the total market value of all final goods and services produced in a country in a given year
- 2000 – US GDP was 10,000 billion / BRIC GDP was 3,000 billion (20% of US)
- 2011 – US GDP was 15,000 billion / BRIC was 11,200 (75% of US)
- 2013 – Will BRIC GDP meet or exceed the US's GDP?

# Economic & Demand Assumptions

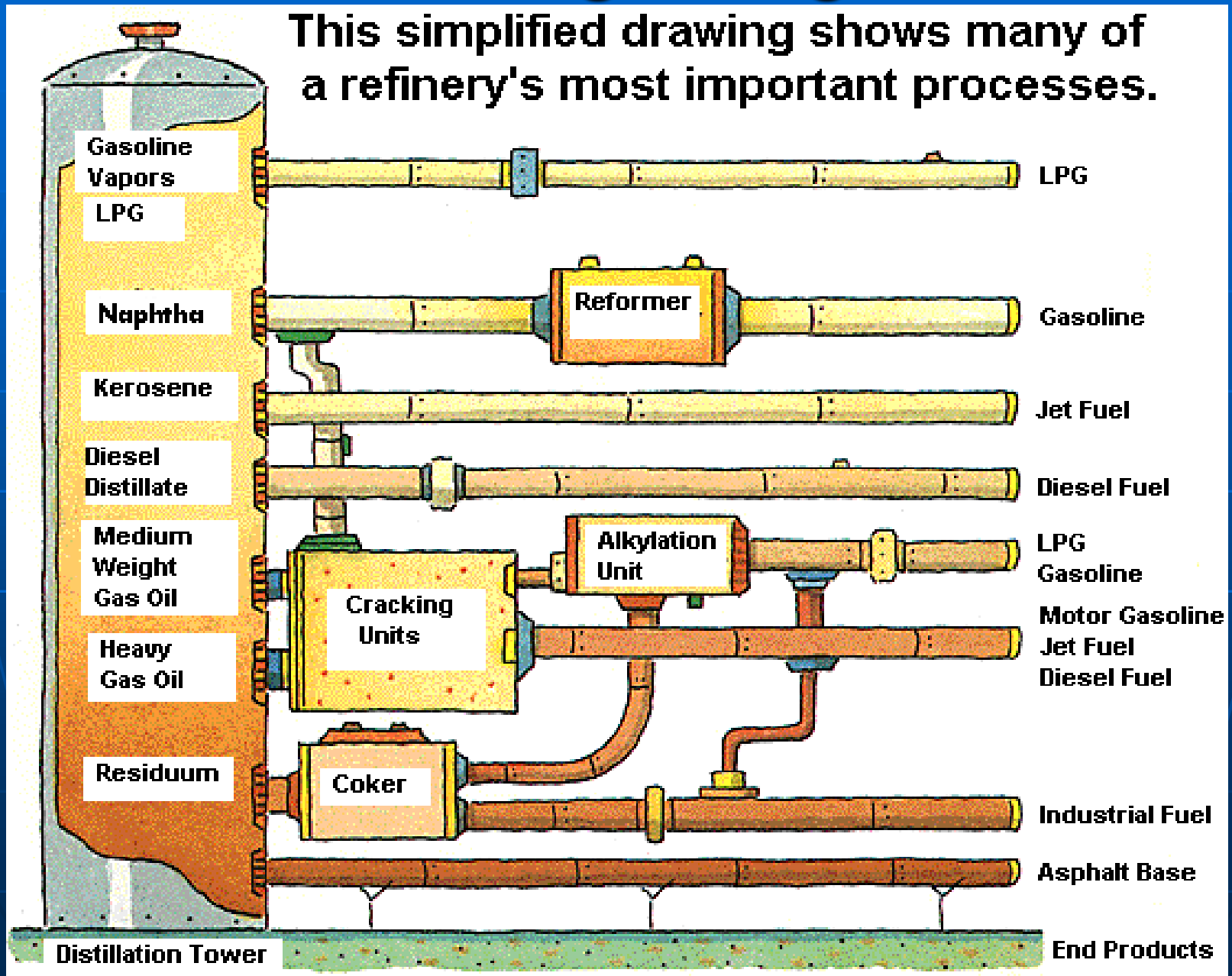
- GDP Growth
  - Despite uncertainties, recovery to continue in 2013
  - Worldwide GDP to average 3.7% through 2020
  - US GDP growth will average 2.6%
- Petroleum Product Demand
  - Worldwide growth to average 1.5%/year through 2020, led by developing countries
  - US demand growth to average 0.3%
  - Alternatives will be 11% of total growth

# What Impacts Asphalt Supply?

- Crude Oil prices vs. Gasoline/Diesel prices
- WTI price vs. Brent Crude price (Chart below illustrates $ Spread between WTI / Brent)



# Refining Margins



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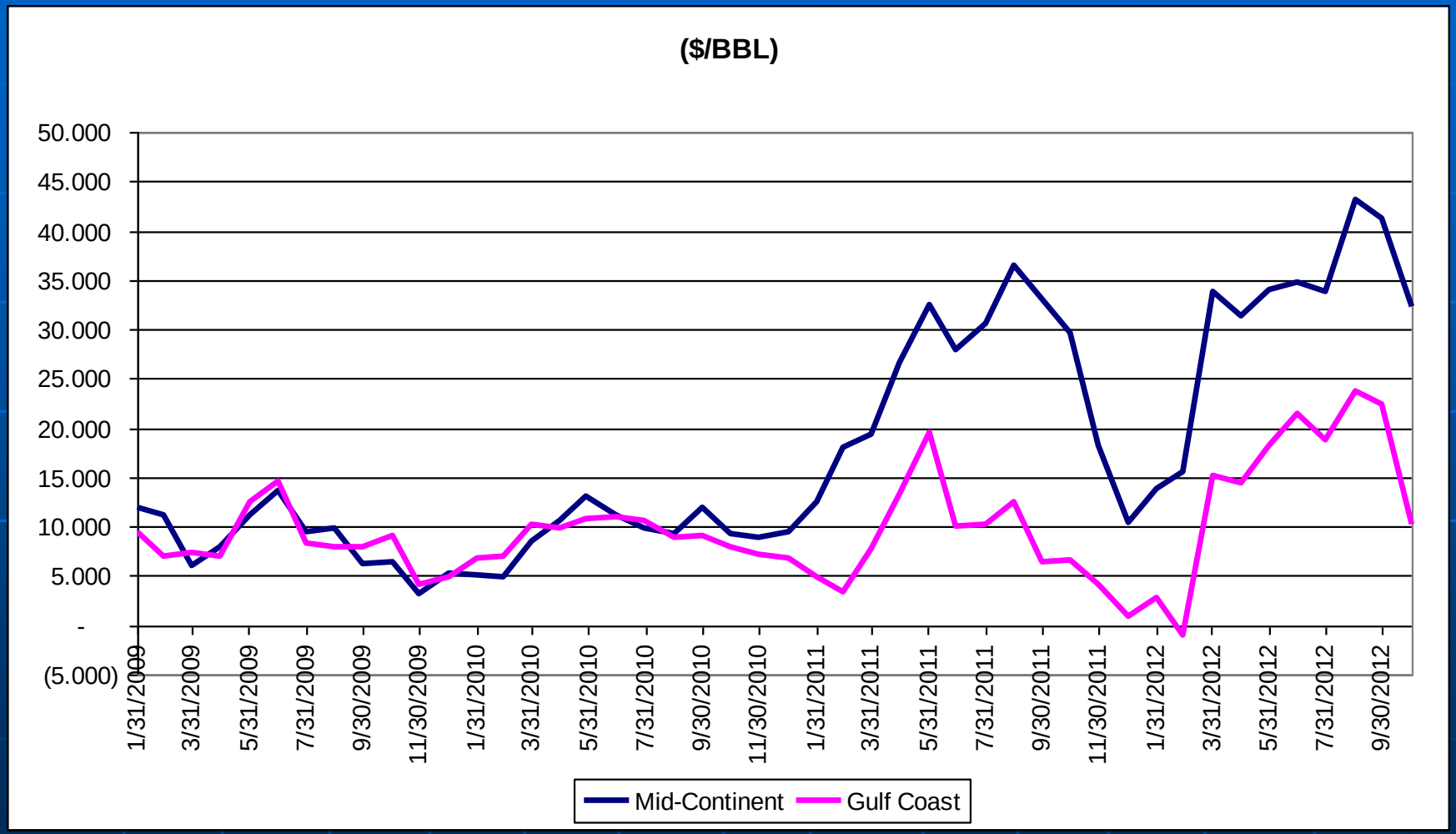

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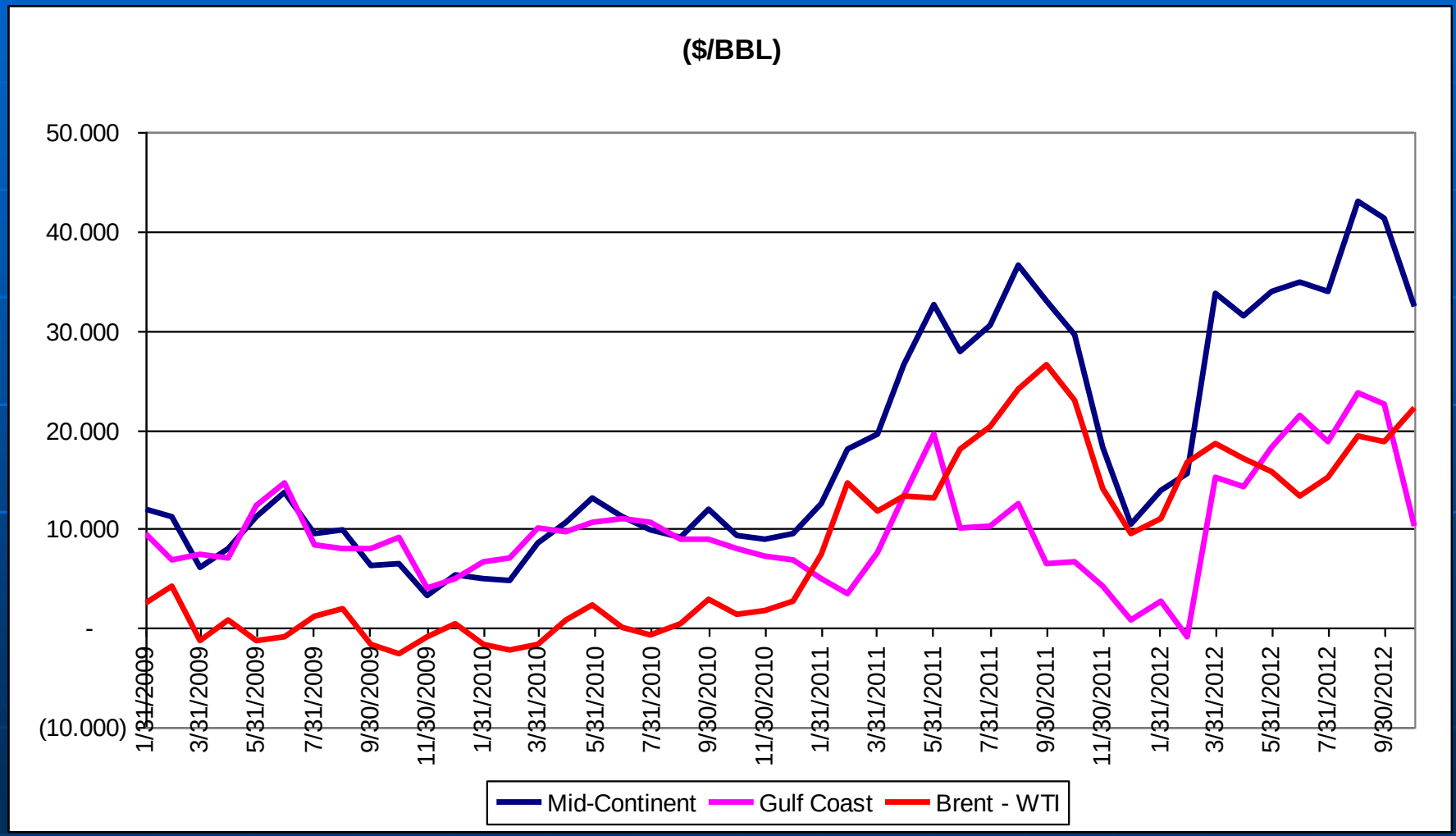
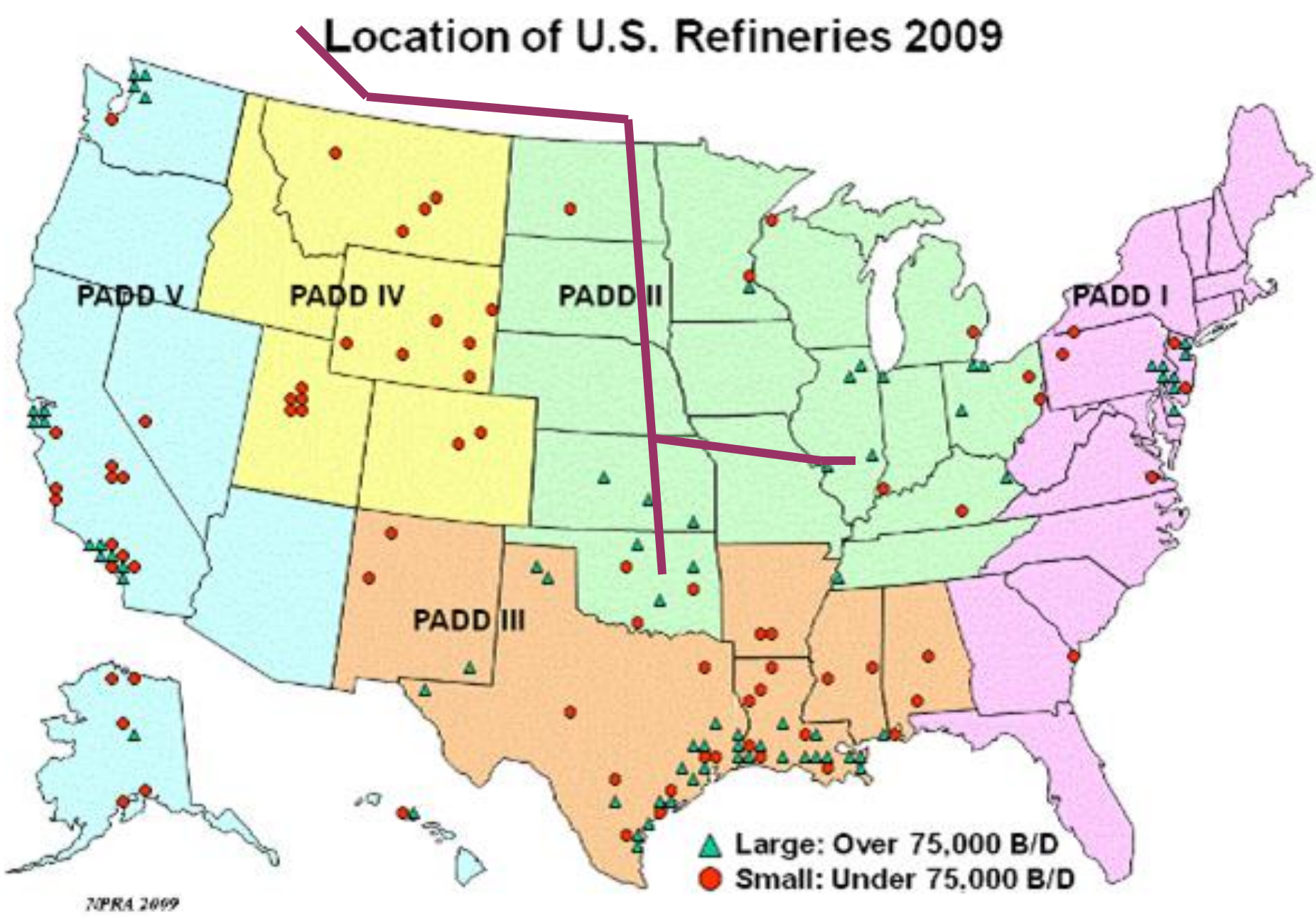
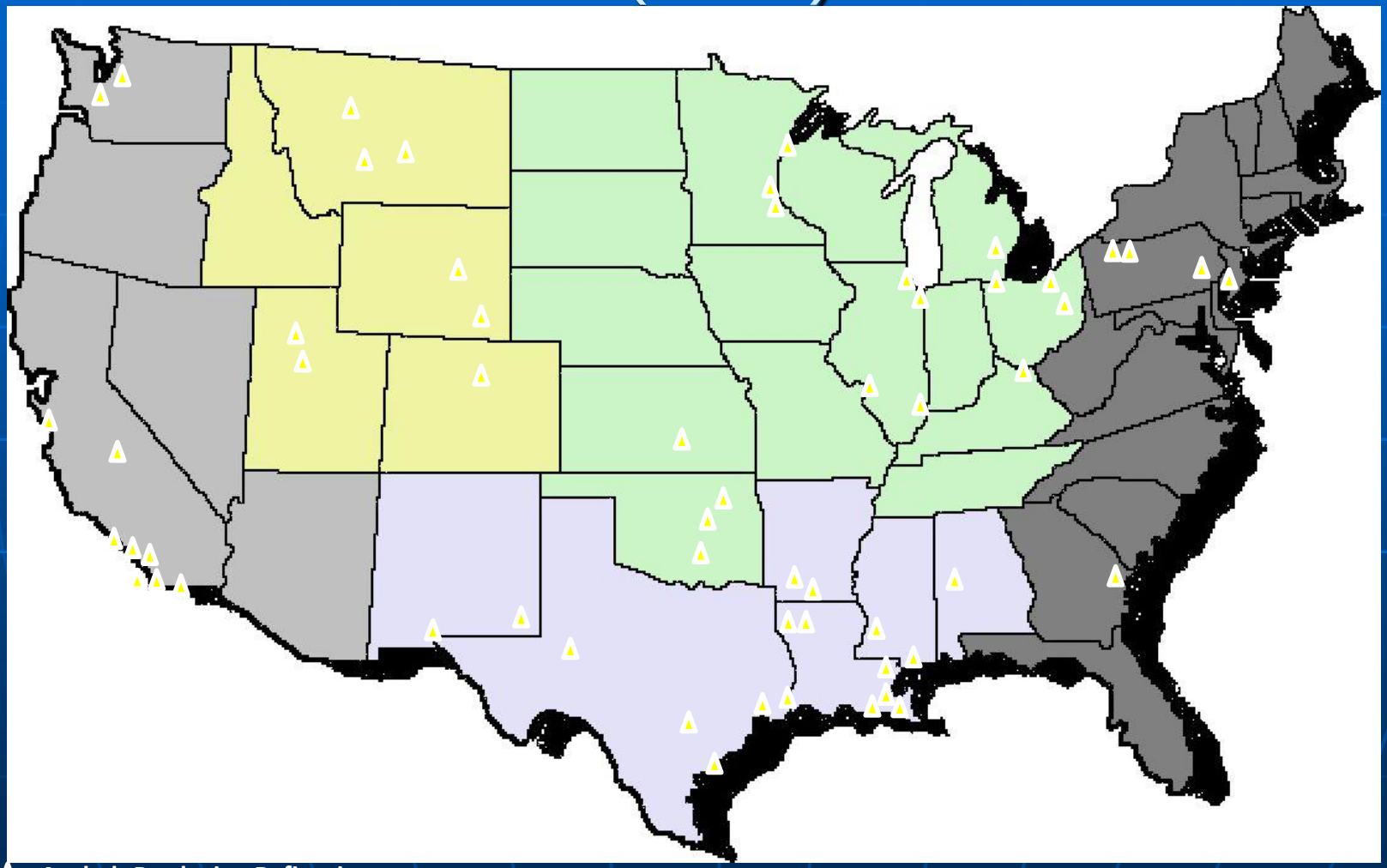


# US Refineries

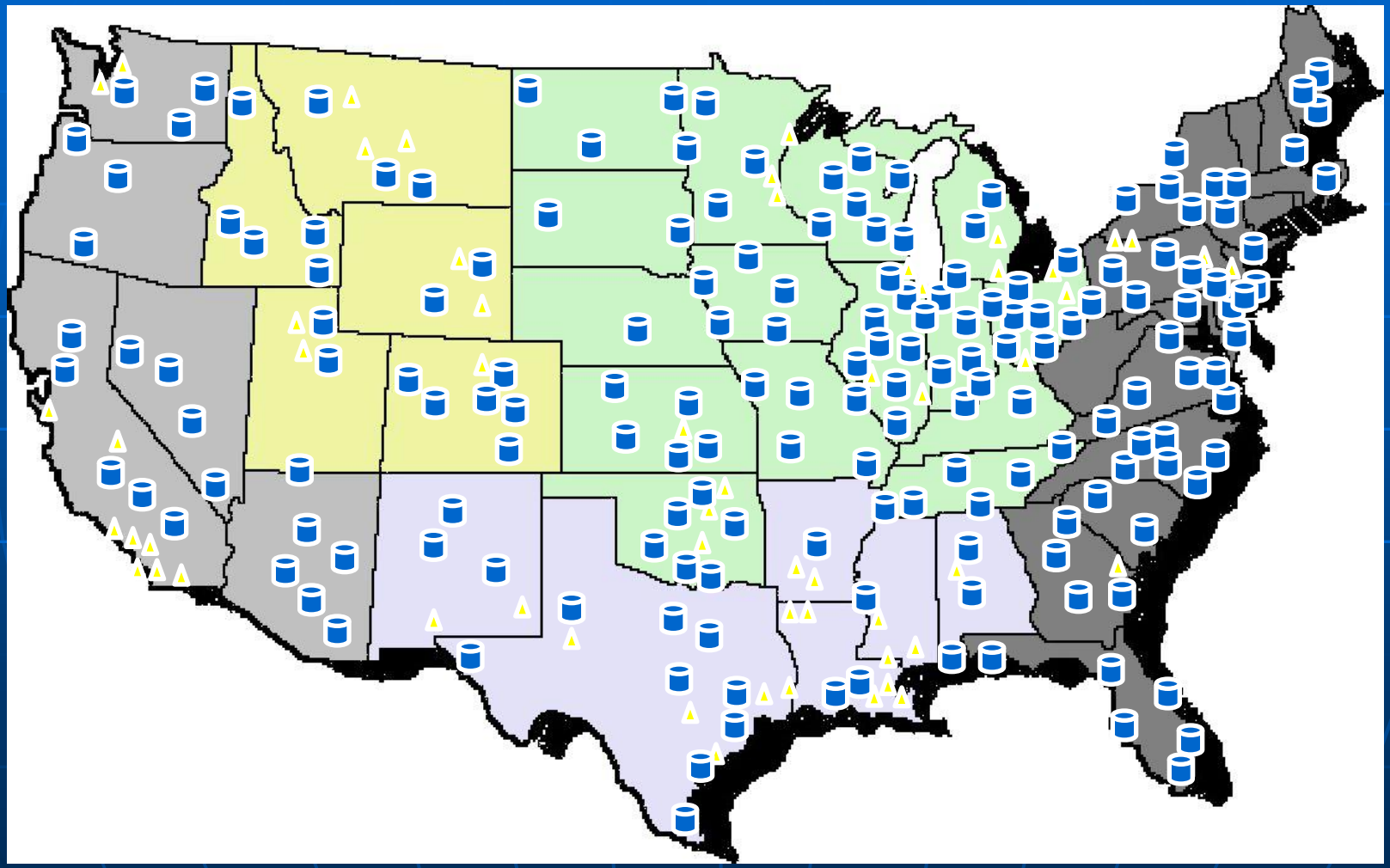


# Map of U.S. Asphalt Producing Refineries (2010)



Asphalt Producing Refineries

# Map of U.S. Asphalt Producing Refineries and Asphalt Terminals (2010)



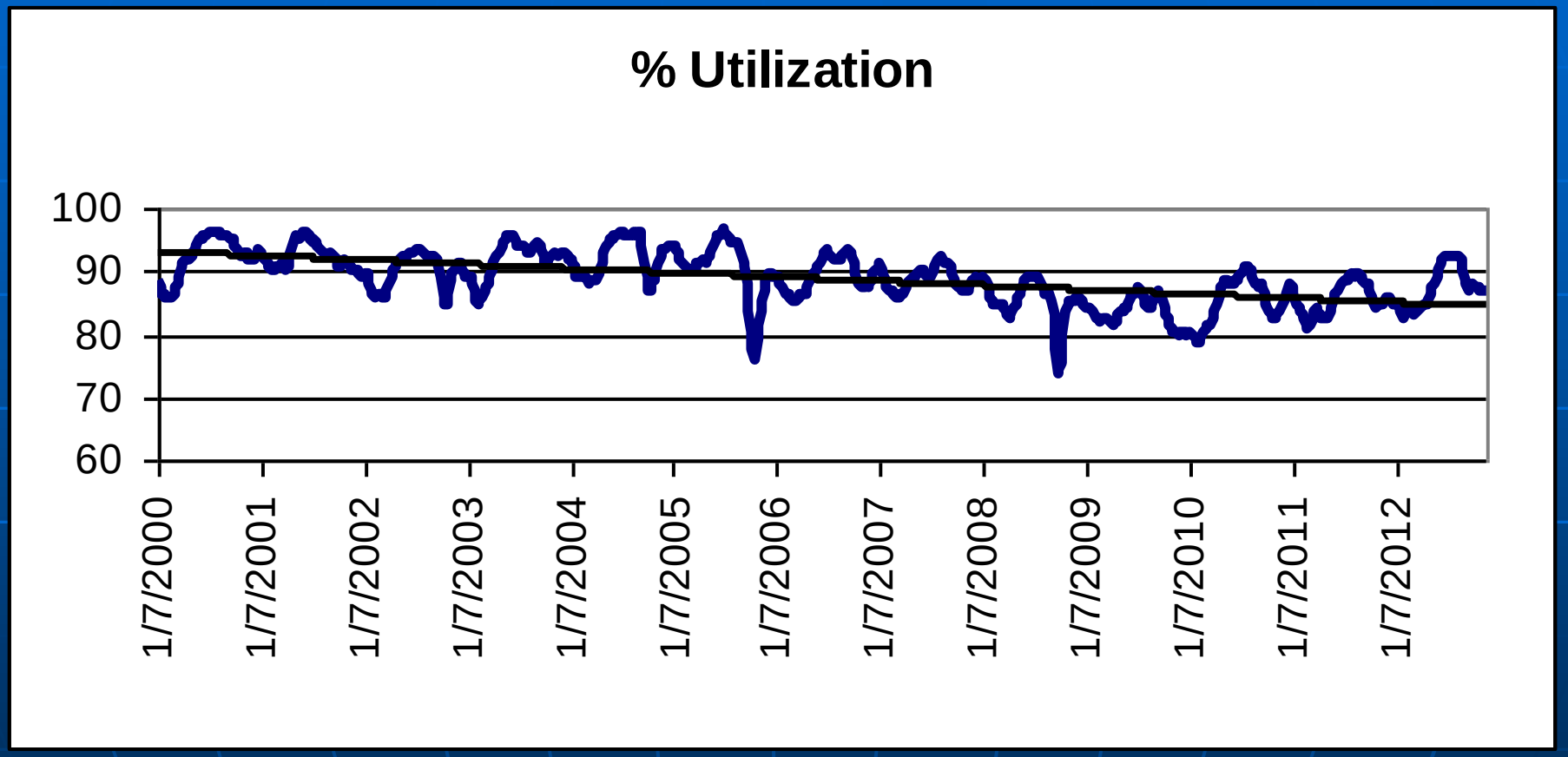
Asphalt Producing Refineries

Asphalt Terminals

# Refinery Facts

- 1982 – 301 operating refineries
- 2011 – 148 operating refineries
- 1982 – 17.9 million barrels of crude oil input capacity
- 1994 – 15 million barrels of crude oil input capacity
- 2001 – 17.2 million barrels of crude oil input capacity
- 1982 – Asphalt Production approx 750,000 bbls/day
- 2011 – Asphalt Production approx 500,000

# Refining Capacity

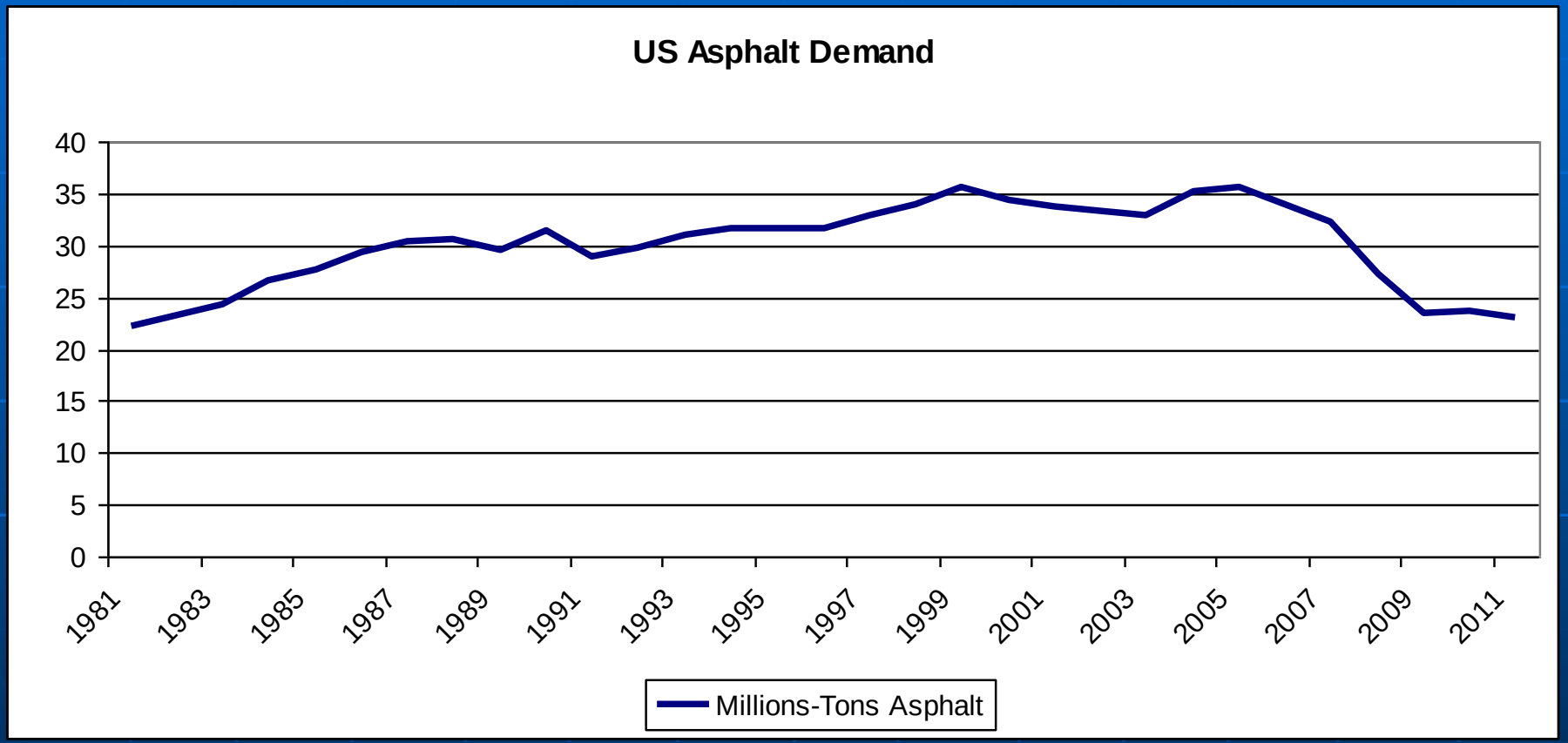



Source: DOE

# What Impacts Asphalt Supply?

- Utilization Rates - % utilization is calculated as gross crude inputs divided by latest reported monthly operable capacity
- Annual Utilization Rates:
  - 2006 – 89.7%
  - 2007 – 88.5%
  - 2008 – 85.3%
  - 2009 – 82.8%
  - 2010 – 85.4%
  - 2011 – 85.4% (thru 8/31/2011)

# Asphalt Demand




Source: DOE

# Asphalt Supply

- Once all these cokers get built, there will be no asphalt!

# What Impacts Asphalt Supply?

- Cokers = Units of Mass Destruction
- Coking capacity has increased from 1990 – 2011 by 1 million bbls / day
- A few examples:
  - ConocoPhillips – WoodRiver, IL – 65,000 b/d – Completed in 2011
  - Total Petrofina – Pt Arthur, TX – 50,000 b/d – Completed in 2011
  - Motive – Pt Arthur, TX – 95,000 b/d – To Complete in 2012
  - Marathon – Detroit, MI – 28,000 b/d – To Complete in 2012
  - BP – Whiting, IN – 102,000 b/d – To Complete in 2013

# Alternative Disposition

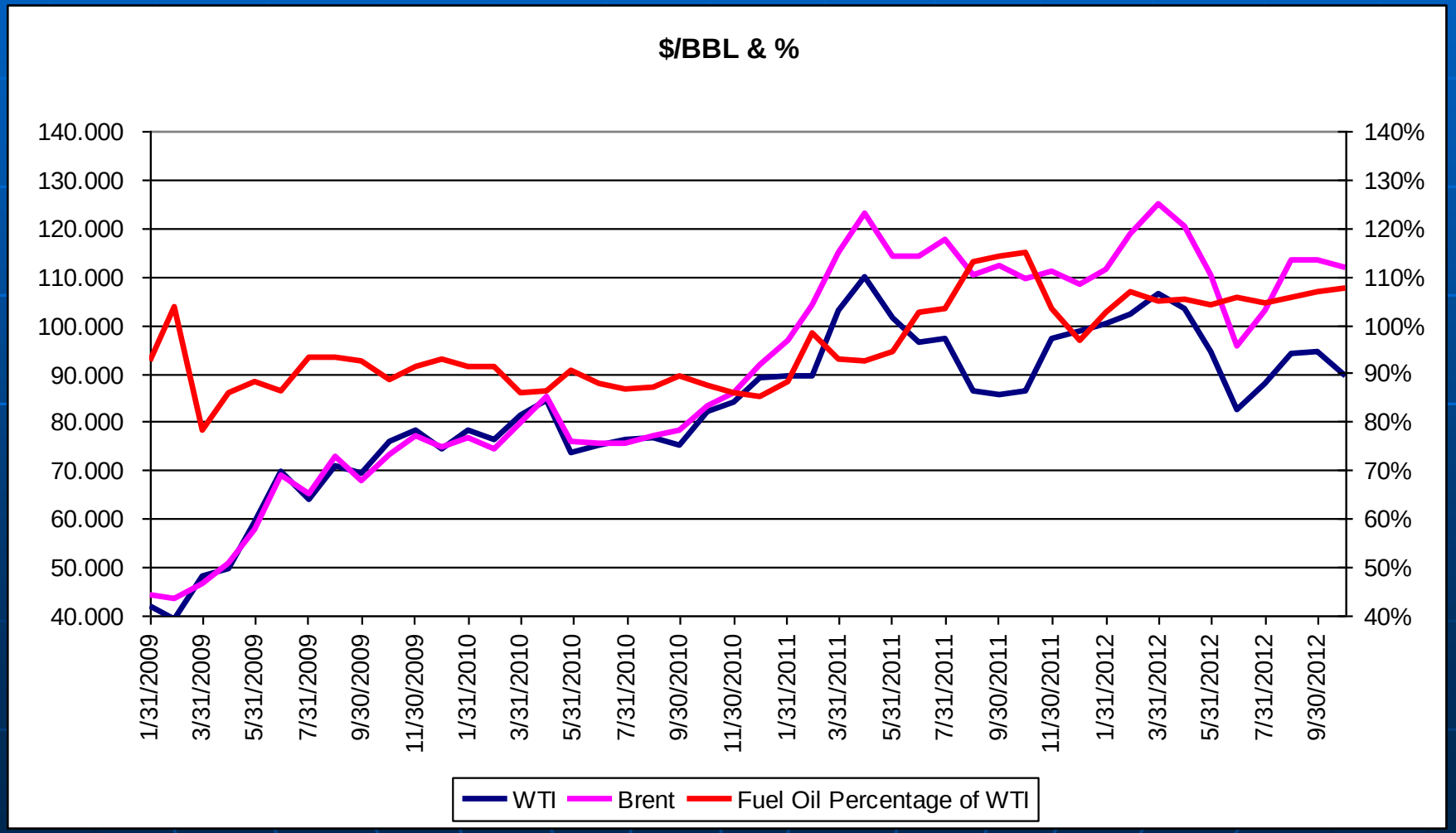
- Coking
  - Over 160 MBPD of new coking capacity coming online in Padd II from 2011 through 2013.
  - Increased heavy crudes runs will minimize the asphalt lost to cokers, but the net impact will still be negative.

# Heavy Oil Refining Expansion

- Additional heavy crude refining capacity – 705 MMBPD
- Loss of light crude capacity – 500MMBPD
- 2013 – BP Amoco – Whiting, IN, Marathon – Detroit, MI, and Valero/Norco, Meraux, LA

# Alternative Disposition

- Fuel Oil
  - Strong demand in Eastern markets
  - Pricing will trend with world crude (Brent) pricing

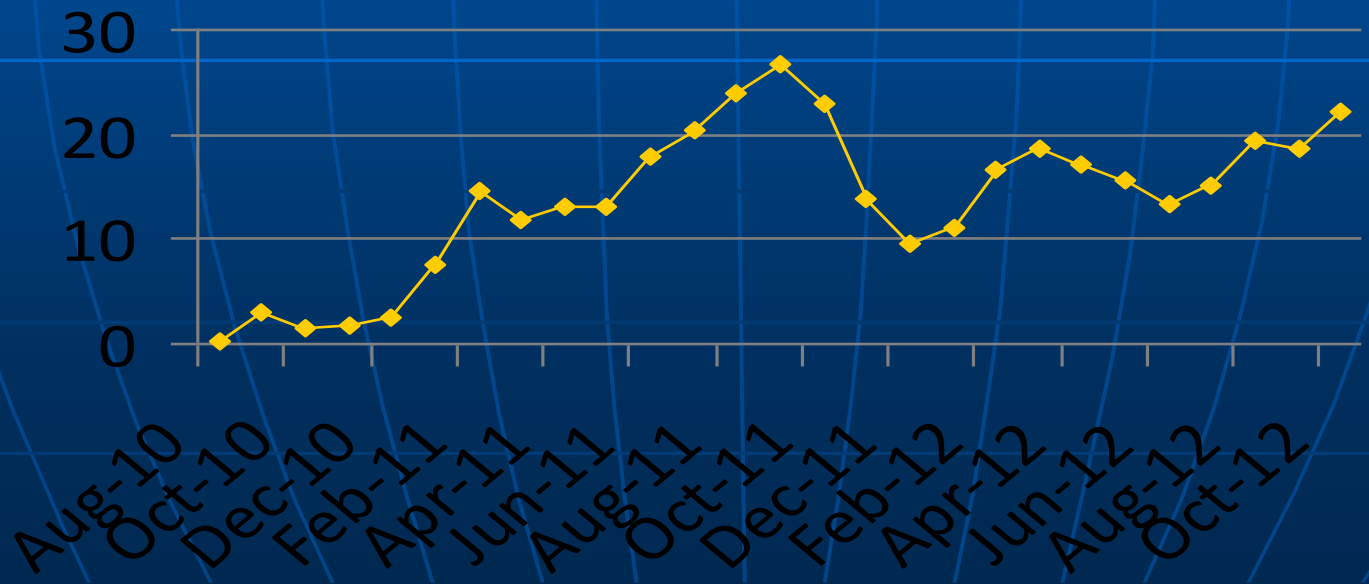


# Factors Influencing Asphalt Pricing

- Crude Oil Price
- Crude Oil Differential
- Refining Margins
- Refining Capacity
- Asphalt Demand
- Alternate Disposition
  - Coking
  - 6 oil market

# What Impacts Asphalt Pricing?

- Roofing Demand
- Residual Fuel Oil
- Crude Prices/Refinery Economics/Cokers/Bunkers
- Asphalt Demand
- Natural Disasters
- International Markets
- Transportation – Trucks, Rail, Barge
- Bunker Fuel (WTI vs Brent Graph Below)



# Conclusion

- Supply Side / Refineries
  - Watching margins and production costs
  - Willingness to reduce runs, shutdown refineries, or consolidate operations to focus on markets with better returns
  - Fewer refineries
  - Crude slates impact on quality and quantity of asphalt
  - Movements towards flexible pricing
  - Demand for asphalt bottoms for alternative uses

# Conclusion

- Technology-
  - Existing and new technologies for emulsion/applications, continuing the effort to make roads last longer and to do more lane miles with less asphalt.
  - Recycled asphalt pavements (largest volume recycled material in the world)
  - Recycled shingles (grinding and extracting)
  - Tire rubber products

# Conclusion

- Last 3 years US has been a net exporter of asphalt
- What's Known vs. Unknown????
  - Politics & Economics
  - Production
  - Technology – for crude recovery

# Impact of Domestic Light Crude

- Bakken, Eagle Ford, and Permian – all of which yield light sweet crudes
- Problem – Refiners have just completed huge capital expenditures to run heavy Canadian
- Diesel yields – Bonny light from Nigeria  yields 21-24%, for Bakken it's around 14% ????

# Outlook ????

- As a result of the complexity and volatility there are a lot of unanswered questions in the future.

# Current Asphalt Supply Information

- What is the current supply situation?
- What is the outlook?
- What is the price going to do?

“In the business world, the rearview mirror is much clearer than the windshield.”

- Warren Buffet

Questions?