

Outlook for Petrochemical Pricing

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ASHLAND®

Self Introduction

- **Antonio Tong**

- Almost 10 years in Corporate Procurement at Ashland.
- Purchase raw materials and responsible for engaging in both long term contracting and prompt buying.
- Graduated from Ohio State University (96' and 05')
- Amazing things I have seen in my Career
 - Hurricanes Katrina and Rita (2005)
 - The Financial Meltdown (2008)
 - The Rise of Fracking in North America (2010)
 - The Crude Oil Crash (2014)

APM Composites



Ashland Performance Materials- Chemicals Purchased

- Styrene Monomer
- Maleic Anhydride
- Propylene Glycol
- Di-Ethylene Glycol
- Phthalic Anhydride
- Dicyclopentadiene
- Liquid Epoxy Resin
- Methacrylate Monomers

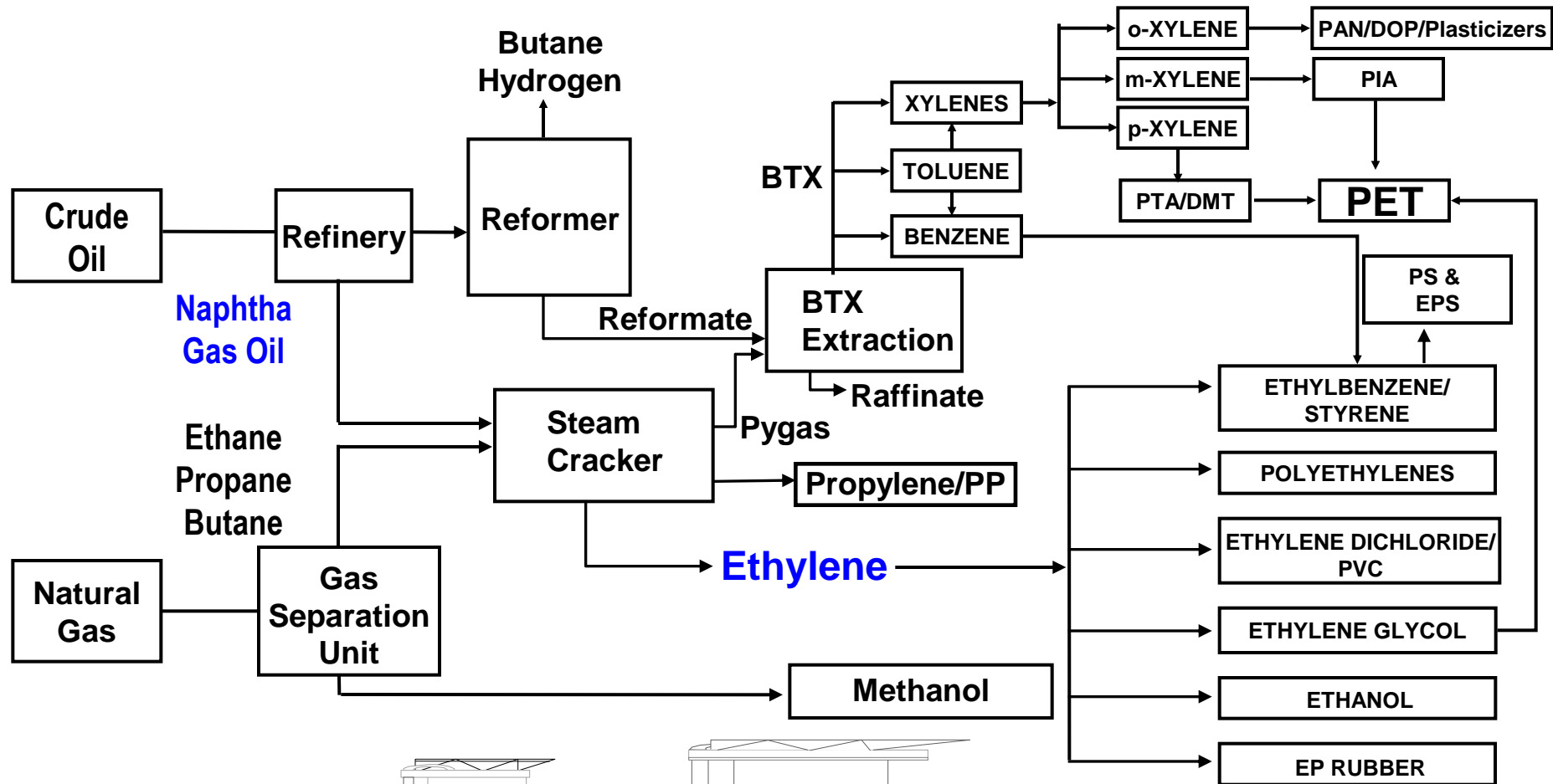


How Things Worked Pre-Shale Revolution

- **North American petrochemical operators heavily favored feedstocks based on Crude Oil.**
 - This type of feedstock is commonly referred to as Naphtha.
- **North American petrochemical operators made high quantities of co-products when favoring Crude Oil**
 - Materials like Propylene, C5, and Benzene were also produced by steam crackers.
 - Derivative producers based their profit plans on plentiful supply of these materials.
- **Price influenced by...**
 - The global price of Crude Oil. Changes were linear down the petrochemical chain.
 - Geo-political issues which influenced Crude
 - Supply and Demand.



Steam Crackers: Can choose to use either from the top group or the bottom group based on yields. The same products come out the other end, but not necessarily the same amounts. For example, approximately 8 times as much propylene is created by Naphtha use, as opposed to using Ethane.



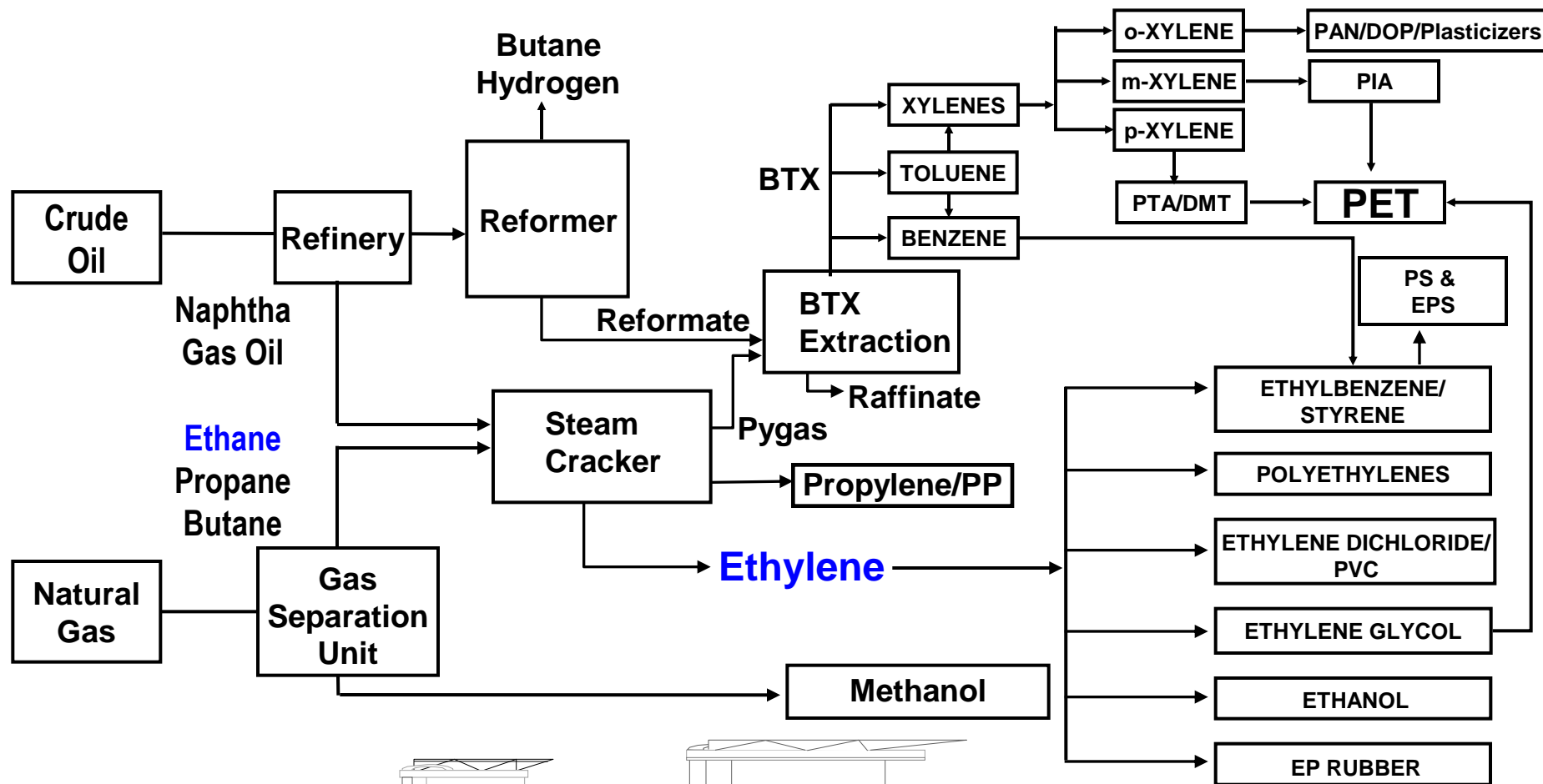
The Fracking Boom- Changes to the Petrochemical Landscape

- In a short period of time, North America went into an oversupply position on wet gas– due to the prevalence of horizontal drilling (fracking) in shale fields across North America. Natural gas prices fell from a level of around \$12.00/ MMBtu to a level of around \$3.50/MMBtu.
- This meant that Steam Cracker operators that previously chose to use Naphtha and other “heavy” (crude oil based) feeds were now given heavy economic incentive to use “lights” (gas-based) feeds.
- The yields changed substantially- with the end products from crackers shifting to almost ethylene entirely. The profits from making Ethylene in this manner were higher than making ethylene (plus all of the co-products) using Naphtha.
- This swing in the cost of running a steam cracker changed the fortunes of several companies. An example is Lyondellbassell, which went from bankruptcy to Operating Income of \$5.7 Billion in 2014.



Source: LBI annual report

Steam Crackers: High incentive to use ethane (in the form of ethylene margin) changed the face of petrochemicals in 2010. Ethylene derivative manufacturers are in a position to export to various other regions given their starting advantages on cost.



State of the Market- Early 2014

- **Costs were still extremely high**
 - Feedstocks for petrochemicals like Benzene, Xylene, Propylene, and Ethylene were all trading at historically high levels. In the case of Benzene, the price had hit an all-time record.
- **Long term forecasts for Crude Oil were still very bullish.**
 - Most market-watchers had a \$100 or so ceiling on its range
 - Supply and Demand were seen as evenly matched.
- **Imports were still prevalent.**
 - Especially from South-east Asia- many alternatives were available.
 - North American suppliers had to compete vigorously with other regions looking to move excess supply.



The Collapse of 2014

- **Crude Oil Prices fell from approximately \$105 all the way down to approximately \$45.**
 - Oversupply was the reason most cited for the freefall in pricing.
 - OPEC members begged Saudi Arabia to cut back on production – but Saudi Arabia refused.
- **Forecasts for Crude Oil typically top off at \$60/ BBL.**
 - Stories continue to pile up concerning a lack of storage space for current inventory.
 - This forecast will continue to be revised downwards if Iran is given access to the market as a result of their recent nuclear deal.
- **Petrochemical Prices fell also**
 - Although not all of them were in complete lockstep with Crude Oil, the overwhelming direction of Petrochemical pricing was down.
 - Currency imbalances worked to counteract some of the benefits, particularly for global manufacturers
 - Supply and Demand were still relevant (unlike the 2008 crash, when both supply and demand crashed together). This means that scarce materials could still command high prices and grow margins.

Future Scenarios

- **Stability**

- One train of thought is that the current status quo will hold for several years.
- The basis is the long supply situation on Oil and Saudi Arabia's unwillingness to scale back their supply position.
- This also implies that demand for Crude Oil and its products will remain stable.

- **Rising Prices**

- This suggests a disconnect between feedstocks and their derivatives. The theory here is that the supply and demand in the derivatives market will trump any increases to the base costs of Crude Oil.
- There is already evidence that several markets have begun to act this way.



The Role of Bio-Chemicals in the Petrochemical Market

- **Historically**

- We have witnessed Bio-based players from various regions make entrances on specific raw materials.
- In many cases, these players made these entrances with the express backing of government entities. Other times, they were direct investments made by large corporations.
- The record of success is mixed.

- **In the Future**

- There is always a place at the table for a well- priced alternative to Oil/Gas based chemistry.
- The largest challenge for Bio-based suppliers remains being able to price against a market that has operated under one set of rules for a long period of time.
 - In a market where the manufacturing process is uniform, margins can be compared uniformly also.
 - Bio-based materials are often welcome disruptor to the status quo.
 - However Bio-based operators must be able to price against existing methods of supply and do so for the long haul.

Success Story

- Ashland does manufacture a product based on Soy Beans to a specific buyer who values the green aspect of the chemistry. (Envirez 1807)
- In this case the complete supply chain from buyer to seller to user was on board with the use and everyone supported the outcome.
- Ashland will look to find more situations like this in the future– complete win-wins.



Buyer Concerns

- **Will the price of a bio-based material swing hard versus the price to buy incumbent products?**
 - Are we being pegged to an agricultural product rather than a chemical?
 - Are you as a supplier ready to compete on the basis of current market pricing?
- **Will we always have this source or will it be pulled back if there is better money in a different field?**
- **Is this product an exact duplicate of the product based on petrochemicals?**



QUESTIONS?

Ashland's Businesses

Specialty Ingredients



Performance Materials



Valvoline



Leadership Positions

#1 global producer of cellulose ethers and global leader in vinyl pyrrolidones

#2 global leader in pressure sensitive adhesives

#1 global leader in unsaturated polyester resins and vinyl ester resins

#3 passenger car motor oil

#2 franchised quick-lube chain in the United States

Major Markets Served

- personal care
- pharmaceutical
- food & beverage
- paints & coatings
- building & construction
- energy
- packaging, converting & printing

- manufacturing
- building & construction
- transportation
- power generation
- marine

- automotive lubricants
- quick lube services
- automotive chemicals & coolants
- detailing & appearance products
- commercial & industrial lubricants

Sales¹

\$2.5 billion

\$1.6 billion

\$2.0 billion

Ashland Performance Materials

How Our Products Are Used

Composites

1 globally in unsaturated polyester and vinyl ester resins



Lightweight



High Strength



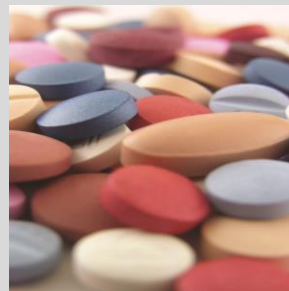
Corrosion Resistance



Durability

Intermediates & Solvents

*#1 BDO merchant market supplier in EU
#1 THF merchant market supplier globally
#2 Largest NMP producer globally*



(Reaction) Solvency



*Chain Extension &
Chemical Resistance*



Process Efficiency



Flexibility