

Chemical Feedstock & Raw Materials: What's Next? (a Chemical Buyer's Perspective)

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Introduction

This paper focuses on the production of ethylene and how it affects the supply and cost of key raw materials used to make products for the PSA industry. (The actual presentation at PCTC's TECH 33 conference will include a raw material cost forecast, as well as a summary of macro-trends impacting the chemical industry.)

As a chemical buyer for an organization that produces synthetic lattices and polymers, I have found the past few years very challenging. Prior to the global recession, we saw strong global product demand coupled with high crude oil prices driving up the costs of virtually every chemical to unprecedented levels. Shortages of certain chemicals were not uncommon.

By the first quarter of 2009, the global recession brought chemicals down to price levels that had not been seen in many years and supply was not an issue as product demand had fallen dramatically. In response to the downturn, companies took aggressive actions. During 2009, high cost capacity was idled and other assets reconfigured to match existing cost and demand parameters. Plans to install new capacity were cancelled or delayed.

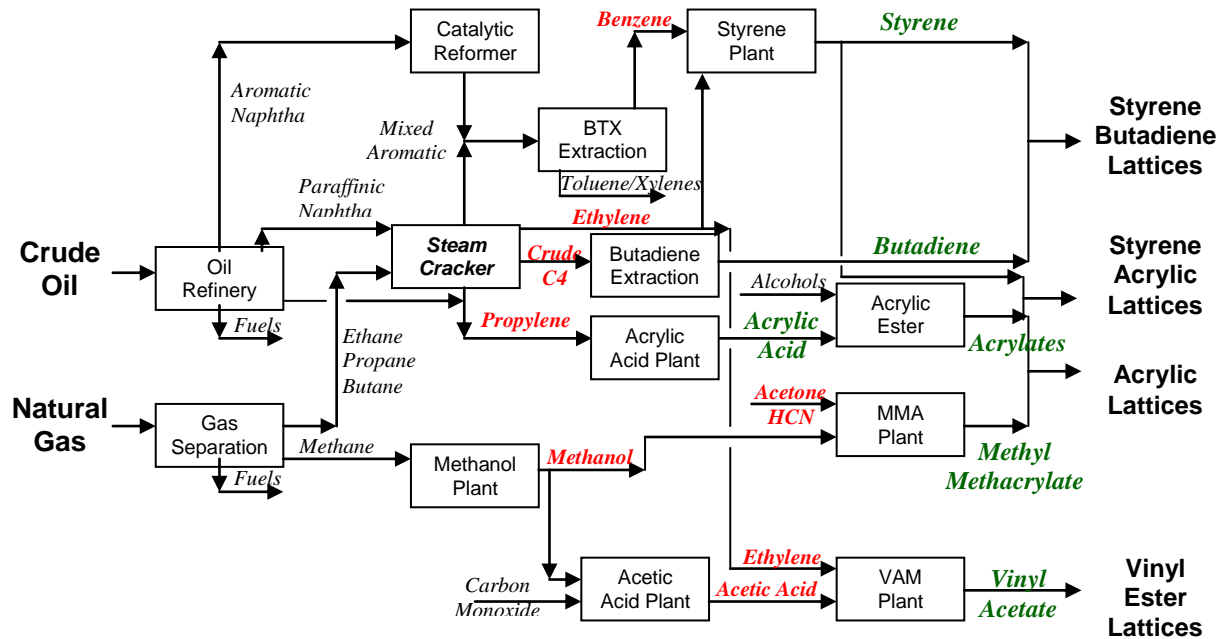
Since the first half of last year, the prices for most chemicals have been on a steady climb back up the cost curve. As we enter the last month of the first quarter of 2010, we have shortages of a few key monomers, depending on the supplier, and more price increase announcements in the face of modestly improved polymer demand and strong customer push back to any price increases.

One underlying explanation for the short-term and long-term trends which we are experiencing in the chemical industry can be found by looking at ethylene production operating rates and feedstock selection.

Why Ethylene

So, why is so much of my attention drawn to the production of ethylene? It is because the majority of the monomers used to produce our products are tied directly to an olefin plant and the selection of the feedslate into that steam cracker.

Synthetic Latex Feedstock Production Flow



The olefin plant is the source of our industry's basic building blocks, such as ethylene, propylene, butylenes, butadiene, and benzene.

In most cases, the value of ethylene (C_2) is greater than the value of the other co-products made in the olefin plant. Therefore, to the ethylene producers, the value of co-products may not be great enough for changes in a co-product's market to impact any decision about steam cracker operating rates or feedstock selection. This is especially true for butadiene, made from crude C_{4S} , and used to produce SB Latex, as well as for isoprene or piperylenes, made from crude C_{5S} , and used to produce SIS and C_5 Aliphatic Tackifiers, respectively.

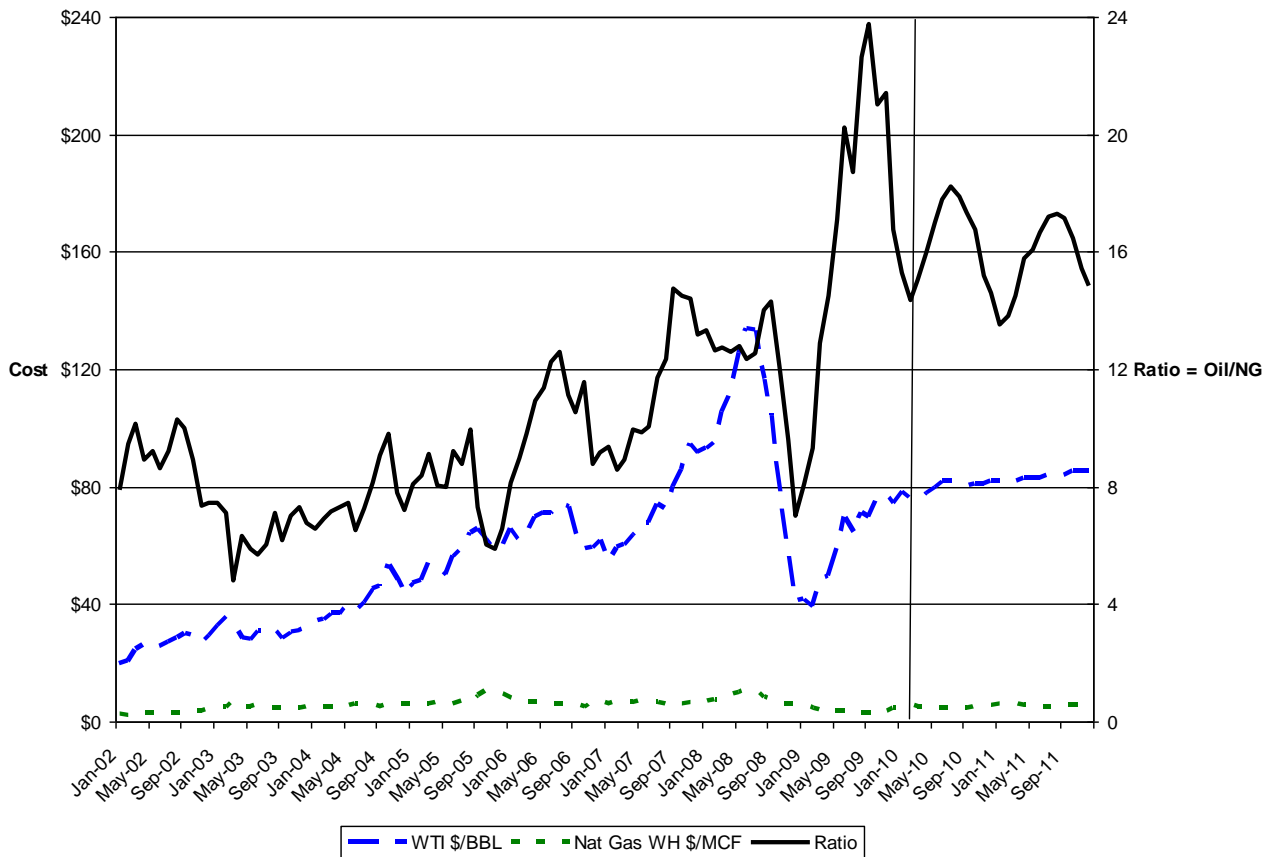
Even during 2008, when butadiene prices increased dramatically from \$0.59 to \$1.22 per lb, the impact of butadiene prices on the steam cracker feedstock choices remained minimal. So, while the butadiene (or isoprene) market is highly dependent on the ethylene market, the two markets can behave as if they are completely decoupled.

Steam cracker feedslates are influenced predominately by the relative price of natural gas and crude oil, along with ethylene, propylene and, at times, benzene prices. Ethylene operating rates are set generally by demand for polyethylene, which is influenced by the packaging market.

The olefin plant operator in North America uses a sophisticated computer model to determine the better feedslate mix for the coming week to optimize the cost of producing ethylene, based on the availability and cost of various feedstocks, ethylene and co-product demand, and the margin contribution of each product.

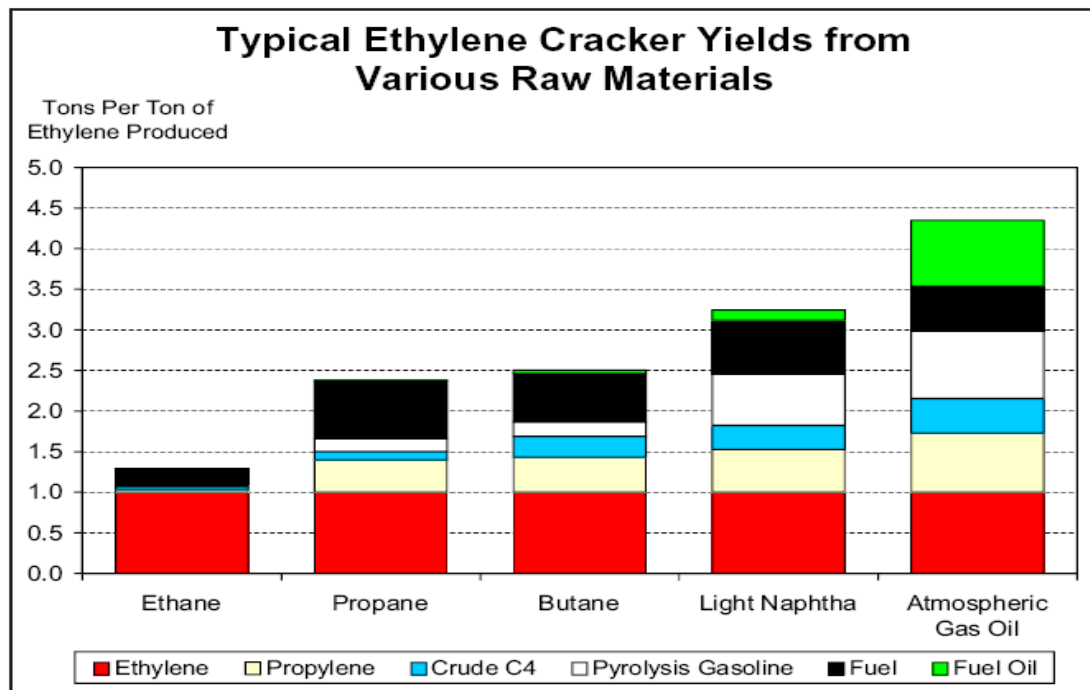
However, you do not need access to these computer models to get a general indication of what can be driving the base cost in the North American olefin industry, as well as whether light versus heavy feedstocks are favored. You can look at the ratio of the cost of crude oil and the cost of natural gas, because six Mcf (thousand cubic feet) of natural gas is equivalent to one Bbl (a 42 U.S. gallon barrel) of crude oil. So, parity is at 6:1, or for example, crude oil at \$36 a barrel and natural gas at \$6 per Mcf.

The historical oil-to-gas price ratio has ranged from 6:1 to 10:1, but for the second half of 2007 and most of 2008, it was greater than 12:1. Since the middle of 2009, the ratio has changed dramatically and is expected to remain greater than 12:1 for the foreseeable future.



With natural gas at \$4.50 to \$5.00 per Mcf and crude oil at \$80 per barrel, the lighter feedstocks will be favored, especially ethane. Today, nearly 70% of North America's ethylene production is derived from natural gas, which is a record level for the industry and a level that conventional wisdom of a few years ago would have thought impossible. This feedstock advantage in North America over heavier feedstocks, such as naphtha, is projected to remain in place due to the abundant natural gas production occurring with shale gas.

The impact of this shift in the oil-to-natural gas ratio on the PSA industry, and your specific cost and supply situation, will depend on the monomer and polymer involved. For example, this graph from CMAI depicts the yield impact of the different steam cracker feedstocks on the co-products of propylene and crude C₄s at a constant ethylene production level.



Since ethylene produced from crude oil-based feedstocks is expected to be disadvantaged versus natural gas-based feedstocks, then ethylene producers, regardless of their location globally, would be expected to lighten feedstocks in order to remain competitive. This lightening of the feedslate will result in a decrease of co-product production of propylene, aromatics and butadiene from steam crackers. Therefore, it is reasonable to assume that the supply and cost impact of this feedstock shift to ethane will be lower for VAM and PVC (ethylene derivatives polymers) than it is for SBL or SIS.

As a participant in the PSA industry, you need to understand your individual exposure to each type of olefin derivative – is it based on ethylene, propylene, butadiene, isoprene, or a combination of more than one? While all “boats” should rise and fall with a change in crude oil or natural gas, the actual cost movement of some chemicals or polymers may be decoupled from the general trend. From a supply standpoint, you need to be flexible and develop broad, strong and global relationships to minimize the impact of any imbalance in a particular region,

especially for the ethylene co-product based chemicals and derivatives produced in an olefin plant.