The Critical State of Raw Material Supply

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Introduction

Chemical raw material supply has gotten progressively worse over the last 5 years. This report attempts to explain these changes and implications on supply of raw materials for PSA producers.

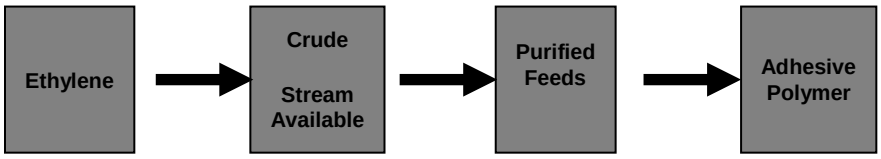
DeWitt & Company now has made three presentations to the PSTC over the last five years. Each presentation escalating the concern over long term raw material supply. Unfortunately, the industry was consumed with survival in the face of a global recession and managing their company's way through the weak recovery. In fact, the recession tended to mask shortages that were apparent just six months prior to the start of the recession.

Much of the changes in the industry have been known for some time. We have often stated that this is the biggest dynamic the chemical industry has ever seen. The good news is that the known dynamic has taken much longer than anticipated to play out. The bad news is there are other factors exacerbating this already bad situation.

Background

Historically, one could look one step upstream and understand supply issues. Today's issues are 3 to 4 steps upstream.

Chemical Supply Chain

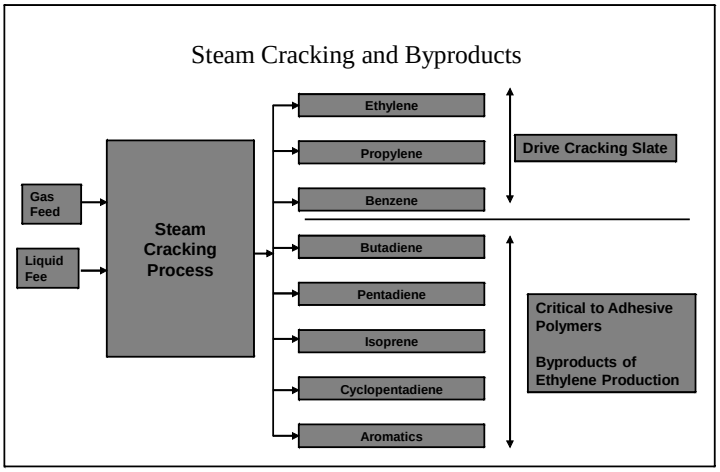


Most of the supply issues are related to ethylene production, which is the wellhead of most chemicals. So the first thing we are going to do is give you some background on ethylene production.

Ethylene units are quite large. A new world scale unit produces in excess of two billion pounds of ethylene and involves an investment over 500 million dollars. As we mentioned earlier, ethylene production is the well spring of all chemicals, but what byproducts it makes depends on the input feed and type of ethylene unit.

Historically, there were only two types of ethylene units. One that feeds gas, or one that feeds liquids. When gas prices dropped relative to liquid feeds in 1980 most US producers adapted their liquid feed

units to accept gas. This was done at some efficiency loss, but gained most of the credits for the lower cost gas feeds.



The basic process takes a gas or liquid feed and heats it up to a very high temperature in a furnace. Then steam is injected to the hot stream. This cracks the molecules to hopefully form only ethylene and propylene. Because of what the units do, they are often referred to as "Crackers".

What is important to know is gas feeds, ethane and propane, are bad and liquid feeds, naphtha and gas oils, are good. Liquid feeds are good because they produce byproducts that are often used in pressure sensitive adhesive applications and gas feeds do not! These are the monomers shown in the lower portion of the diagram above. These are basic building blocks for most synthetic rubbers and hydrocarbon tackifiers.

Overview

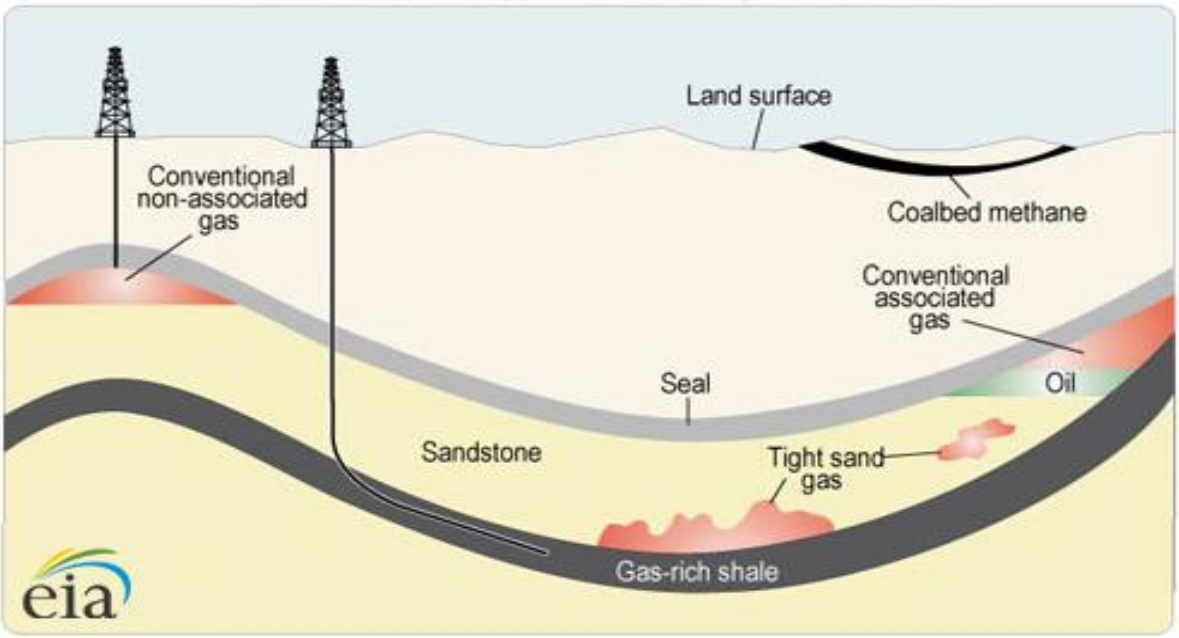
This global dynamic in the chemical industry is being caused by a significant quantity of new, very low cost Middle East ethylene capacity coupled with equally large Asian ethylene capacity additions. This dynamic was made worse by significant find of low cost natural gas in the US, which has substantially changed the cracking slate to the detriment of polymer supply to PSA producers.

Overlay this situation with some other negative factors like: lack of investment in Western World chemicals; industry consolidations and rationalizations; and a shortage of a few natural harvest products. Then cover it up the raw material shortages with a global recession so that the significant supply changes can't be seen until demand returns. Now we have a perfect storm.

This paper will take you through these individual events and discuss their impact on supply for PSA producers.

Major Increase in Natural Gas Supply

US supply of natural gas was expected to be on the decline. Suddenly with new technology, experts predict that US has a 100 year supply. The new technology involves fracturing shale gas and horizontal drilling techniques as shown in the diagram below.



This change happened in early 2008, and the change was very dramatic. Suddenly, natural gas, ethane and propane in N. America were very cheap relative to liquid feeds based on crude oil. Remember, many of the byproducts used in adhesive industry come from making ethylene from liquid feeds.

We estimate the change took place in February of 2008. At that time the cost to produce ethylene was 6-10 cents/lb cheaper to make it from gas feeds. This is 6-10 cents/lb lower on an ethylene price that was in the 40-50 cents/lb range. To look at this another way, if a major ethylene site couldn't switch to gas from liquids, it would cost them $6-$8 million dollars per month.

Ethylene producers that couldn't flex to use gas feeds immediately invested to be flexible. Those producers that were already flexible, invested to be more flexible. This was the biggest supply change in the history of N. American chemicals.

Data that we have shows the amount of liquid cracking was reduced by 45-50%. This directly correlates to a similar reduction in monomers used to produce tackifiers and isoprene for SIS. This manifested itself in some shortages across the supply chain in mid-to-late 2008, but the global recession really covered up this significant change in supply in N. America. It wasn't until the recovery started in 2009 that the industry started to recognize the shortage.

When we moved into 2010, there was some comfort that some PSA applications could be satisfied with acrylate based adhesive systems. Then it seemed that the acrylic supply world collapsed, and there were no other supply options.

To digress a bit, we believe that the chemical industry has a cycle that is fairly predictable in an economic downturn. One of the first items to be cut during a downturn is maintenance. Maintenance

downtimes are deferred, and routine maintenance cycles are extended. And, everyone seems to be surprised that coming out of a recession there are operability issues that affect supply.

You might ask what would change this situation back to the good old days when liquid cracking was king. There would have to be either an environmental issue, like groundwater, to stop shale gas production or a major change in natural gas consumption that would use up the surplus.

Middle East Advantaged Ethylene

The Middle East (ME) found itself with a surplus of gas after recovering crude oil. This gas has an even lower value than the new found gas in N. America. If N. American gas is $4/MBtu's than ME gas was less than $1.00/MBtu's.

This low cost gas set the stage for a major expansion of ethylene production in the ME. Over the period from 2007 through 2015, it is estimated that the ME will add 20 million tons of ethylene capacity based on mostly gas feeds.

Ethylene is produced primarily to make plastics, specifically polyethylene. As you might imagine 20 million tons is a substantial addition to a global industry that is 120 Mtons today. Since the ME is not going to consume that many polyethylene plastic bags, this investment is really for the export market.

Given their cost position, they can make, export to anywhere in the world, and load it into a warehouse similar to local production at a cost that is 10 cents/lb lower than any region in the world. So needless to say, this product is going to make it to market over domestic production.

This is going to limit ethylene production growth in established regions of the world. So one should assume, that there will be limited increase in ethylene or byproduct production. This raises the question for PSA producers. How will they source their growth in demand?

The new ME capacity has had a knock-on effect on domestic N. American producers, who are attempting to get more competitive to withstand advantaged ME capacity. This has taken the form of major petrochemical producers looking for even lower cost feeds in their refineries. Typically, these feeds are gases, which produce very little byproducts of interest to the PSA industry.

Further, there is some belief that some ethylene capacity will get rationalized in the world. At this point, it is hard to predict who and when, but the specter of fewer Western World producers is there.

The good news is that the ME has had some difficulty building and starting up their new capacity. We were expecting to see a major slug of capacity come on in 2010. But there have been various start up and operating issues, that has delayed the impact until 2011.

Asian Ethylene Capacity Additions

Asia is adding capacity that is about equal to the ME. The good news about this capacity is based on liquid feeds. While ME expanding off an advantaged cost position, Asia is expanding to meet their demand growth.

Unlike the ME ethylene units, they have started up on time and run well. This has created a surge in byproduct supply. Asia has responded by installing monomer purification units. This has substantially increased the supply of monomers in the market. For instance, today a large percentage of US SIS is produced with Asian isoprene.

So now we have Asia who is surplus in monomers, which we know and love for PSA production. For now this surplus appears to be matching up with surplus polymerization capacity in N. America. One can immediately see the longer term, where Asia moves to produce the polymers as well. So the situation will be quite fluid for the next 5-10 years as to who makes what, and where.

Natural Product Shortage

With the economic recovery another supply issue has emerged, a shortage of Chinese gum rosin. In 2010, prices for Chinese gum rosin doubled versus historic due to this shortage. The shortage was blamed on high demand growth, weather, and some speculation. One can argue about which factor is more dominant, but the fact remains, the product is short and high priced.

The implications are that it has drawn on the limited supply of hydrocarbon and other natural resins; making a difficult situation even worse.

Also, there is a similar story on natural rubber, which has implications for isoprene and SIS supply, but hasn't really played out yet.

Summary

This is a difficult period for PSA producers and many of you are just starting to recognize the problem. Based on our knowledge we see raw material supply situation for PSA producers being much more broad-based than ever before. By that we mean you will need to stretch to use different polymers in your formulations, local polymer production will be more dependent on higher cost feeds imported from Asia, and lastly, you will be sourcing globally to grow your business. For the PSA producer it is going to be a much more challenging and difficult time, but for those of you that are up for the challenge, you will be successful.