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RAW MATERIAL SUPPLY IN THE WESTERN WORLD

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Nellie A. Perry worked for The Procter and Gamble Company for 8 years, where she held variety of Management positions in their Global Purchasing Organization. These positions included North America Strategy Owner for Stretch Diaper Components, Global Strategy Owner for Hygiene Hot Melt Adhesives; and Strategy Owner for Polypropylene and Polyethylene Resins used in Hygiene Consumer Products. She graduated from the University of Florida with a M.S. in Decision and Information Sciences, Supply Chain Concentration; B.S. in Biochemistry; B.E. in Chemical Engineering. Nellie joined T.A. Brewer Consulting in 2011 and Argus Media Inc. in 2013 to broaden their knowledge and enhance their ability to service their clients in the area of C5 Monomers and Polymers.

Emerging Raw Material Supply for the Western World Market

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Introduction

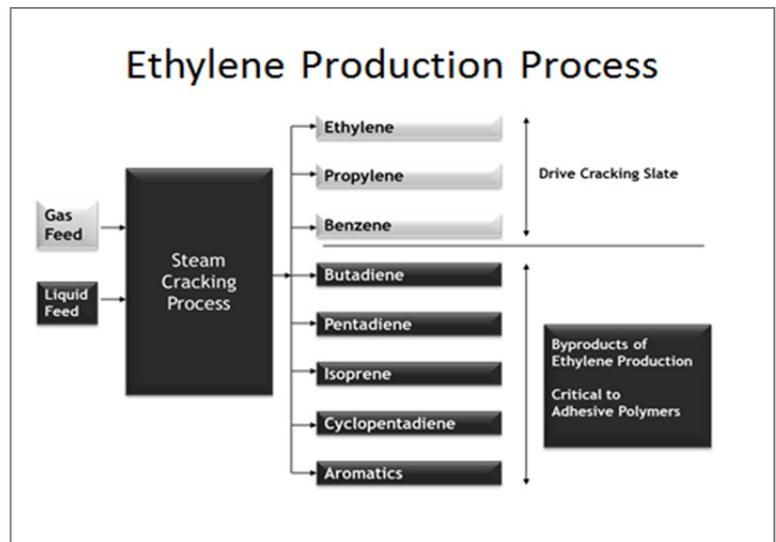
For years N. America has had an abundance of raw materials. With advent of shale gas there has been a significant reduction in feed supply to make the polymers of interest to the pressure sensitive adhesive (PSA) industry. The significance of the reduction has been masked by various economic downturns, but in general has raised the costs of raw materials. If and when, normal demand growth returns we would expect there to be supply problems. This presentation explains the key drivers leading to the reduction in feed supply; the regional economic factors that continue to influence supply/demand; and the importance the emerging raw material supply from China is playing to ensure the PSA industry is supplied with key monomers and polymers.

N. American Reduction in Feed Supply

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.

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 and this cracks the molecules to hopefully form only ethylene and propylene. Because of what the units do, they are often referred to as “Crackers”. The optimization of the production of ethylene is what drives the decisions to take in a gas or liquid feed into a cracker.



What is important with regards to the adhesive industry, 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 (HCR).

What Led to the Reduction in N. American Feed supply?

Ethylene units began to switch to gas feeds 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.

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.

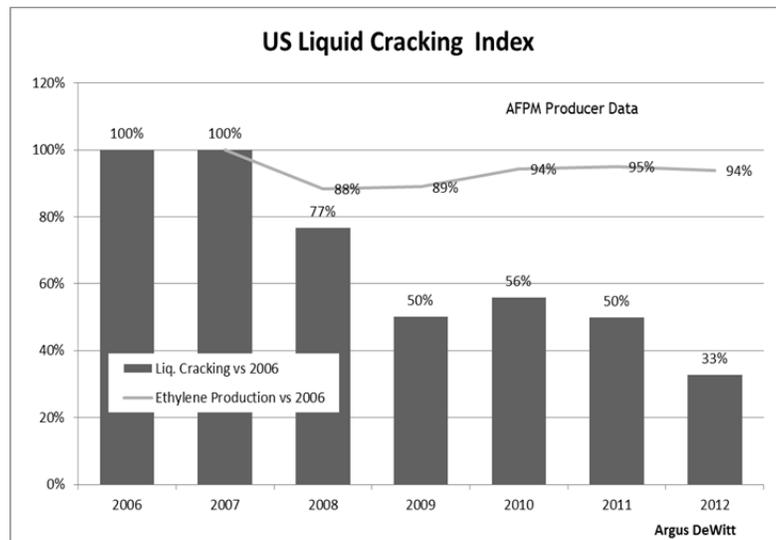
Ethylene producers that couldn't flex to use gas feeds immediately invested to be flexible. Those producers that were already flexible invested to be more flexible. This was the biggest supply change in the history of N. American chemicals.

The reduction of liquid cracking 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 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.

Monomer supplies continued to decline in 2010 and 2011 as favorable economics for gas continued to drive the cracking slate lighter. Today it is +20 cents/lb advantage per pound of

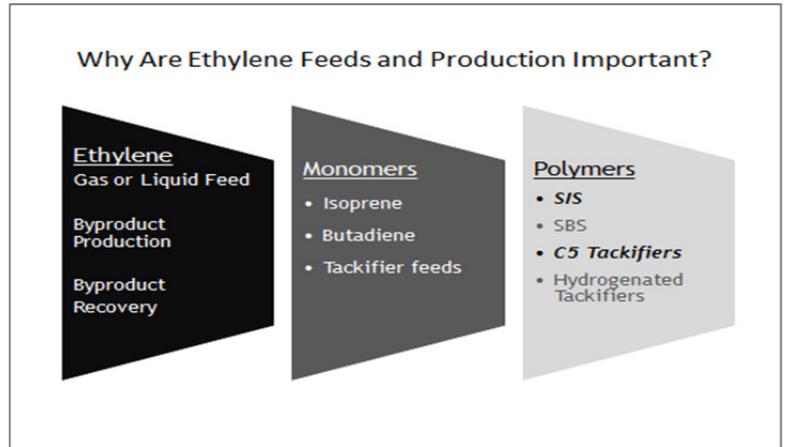
ethylene produced to use gas feeds over liquids. This is especially true in N. America where gas feeds are lower cost and more available, but has equally impacted Europe due to their dependence on monomer supply from N. America.



In 2012, we saw the lowest amount of liquids fed to the crackers. AFPM producer data above shows that the amount of liquid cracking was reduced by 60-70%.

So why have we not felt this drastic drop in the supply of monomers needed to make SIS and tackifiers? Why does the market seem to be adequately supplied? What region is at more risk than the other? Where will we get the monomers?

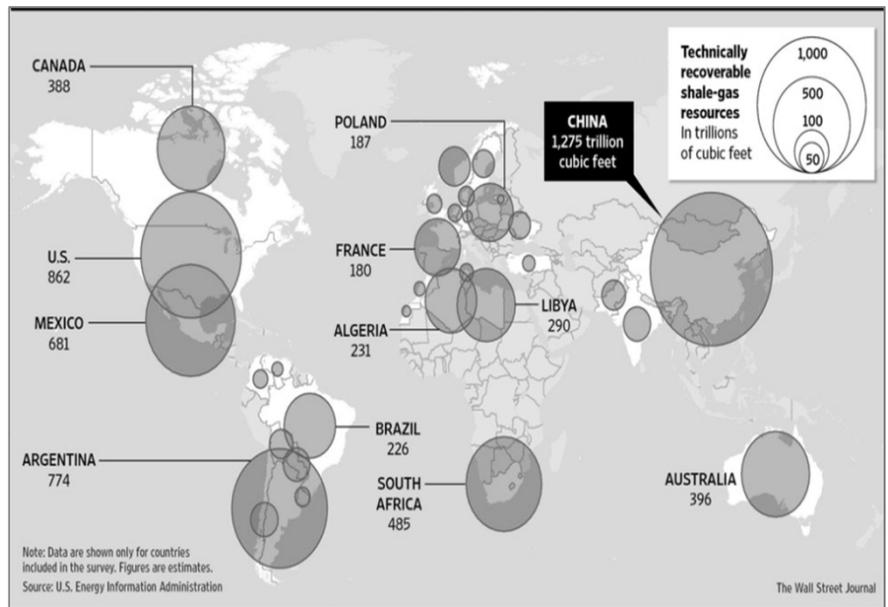
This presentation will help answer these questions and highlight the effects by region.



Where Else Can We Expect to See Reduced Feed Supply?

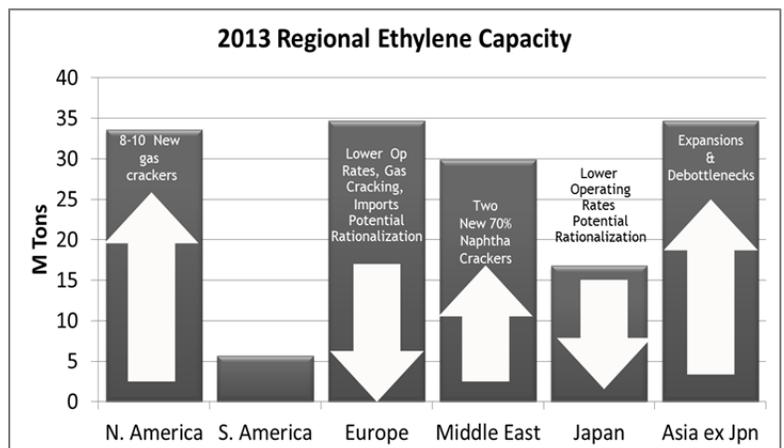
Before we address the demand side of the equation and address the lurking monomer supply issues, we want highlight that the benefits of shale gas is just not a N. American phenomena. The availability of current crude streams and monomers could be influenced by the shift to gas feeds in that region or country.

There has been a global push to understand global shale gas reserves and the potential to reapply what is being seen in N. America.



As discussed above, N. America is now is a cost-advantaged situation when it comes to ethylene and ethylene-derived polymers. Ethylene producers are positioning themselves to produce in regions where low cost feeds are available and rationalize in those that can no longer compete in the global market. The chart highlights current ethylene capacity expansions.

The chart shows that N. America is taking a dominant lead in gas-based expansion and Asia (excluding Japan) is continuing to expand liquid (naphtha) fed units.



What is Keeping Critical Polymer Supply in its Current State of “Balance”?

Most of the market in which PSA’s play a significant role are heavily influenced by the current state of the economy and tend to grow with GDP. The current global economic situation is what is keeping our supply situation in balance.

According to International Monetary Fund (IMF), the prognosis for 2013 continues to support a market where suppressed end-use demand will remain prevalent. The table below provides a snap shot of current GDP projections. Not all countries are highlight in the table shown, but the regional number is highlighted.

Source: IMF - International Monetary Fund

	Year over Year			
	Actual		Projections	
	2011	2012	2013	2014
World Output	3.9	3.2	3.5	4.1
Advanced Economies	1.6	1.3	1.4	2.2
United States	1.8	2.3	2	3
Euro Area	1.4	-0.4	-0.2	1
Italy	0.4	-2.1	-1.0	0.5
Japan	-0.6	2	1.2	0.7
Other Advanced Economies	3.3	1.9	2.7	3.3
Newly Industrialized Asian Economies	4	1.8	3.2	3.9
Emerging Market and Developing Economies	6.3	5.1	5.5	5.9
Developing Asia	8	6.6	7.1	7.5
China	9.3	7.8	8.2	8.5
India	7.9	4.5	5.9	6.4
Brazil	2.7	1	3.5	4

This suppressed demand and expected growth is the one of the main factors driving the current state of supply balance in developed regions for tackifiers and SIS polymers. GDP growth is masking the monomer supply issue and we believe that once we begin to see positive growth (back to historic levels of about 5%) the feed and monomer problem in N. America and Europe will be revealed.

The presentation will focus effect on Isoprene, piperlyenes, polymerization capacity (tackifiers and SIS) by region.

North America Monomers and Polymers

As described earlier in the presentation, the shift to gas cracking has reduced the supply of key monomers in the N. American market.

In 2005, isoprene was the first monomer to go short, with Katrina, demand growth and operational issues worsened the supply situation. It took until 2010 for piperylene supply to see the effect of the lighter cracking slate. In 2012, N. America began to import dicyclopentadiene (DCPD). Just recently, lighter cracking has caused producers of C9 aromatic feeds to produce off-spec feed causing C9 tackifier producers to look for feed in other regions. In 2013, we expect the C9 situation to worsen and DCPD to go short in N. America.

In conclusion, the current C5 feed supply issues lurking in the background did not just arrive overnight. A few years ago, N. America was long, a net exporter, now we are now a net importer of molecules. This import/export balance is linked to the extent of local demand.

The table below shows how N. America is categorized by excess purification/polymerization capacity. It is a region that has become highly dependent on isoprene imports to produce SIS and local tackifier production has been feed limited.

Monomer	Market Dynamics	Tackifier Producer
Piperylenes	Weak end-use demand has softened market. Ample supply.	C5 HCR producers not expanding. Market is seeing effect of off-shore material.
C9 Aromatics	Feed off-spec due to lighter cracking. One of two producers coming off-line in 2013. Supply Tight.	C9 producers are looking to other regions for feed. Capacity is being converted to high margin products. Contracting.
Dicyclopentadiene	N. America used to be an export region, now importing. Market currently balanced.	No capacity growth for the last 3 years. Hydrogenated HCR producers capitalizing on current idle capacity to produce higher margin products.
Isoprene	30-40% of isoprene demand dependent on imports. 80%	Majority of imports go to the production of SIS for adhesives.

European Monomers and Polymers

We believe Europe is the region under the most risk of ethylene rationalization. The European market is dependent on imports region for most of its C5 monomers. It is a region characterized by its lack of purification capacity to produce the monomers of interest. Like N. America, it is has excess polymer capacity and dependent on imports.

European situation has worsened with the N. American shift to lighter cracking as it used to depend on N. America for its monomer imports. Now you have two regions out on the spot market competing for the same pool of molecules.

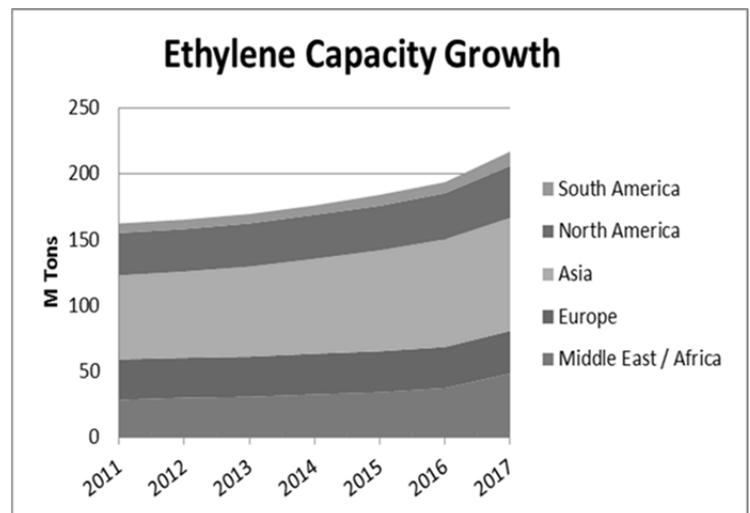


Asia (excluding Japan) Monomers and Polymers

Asia has been adding ethylene capacity. The good news about this capacity is that is based on liquid feeds. 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, Europe and Japan.



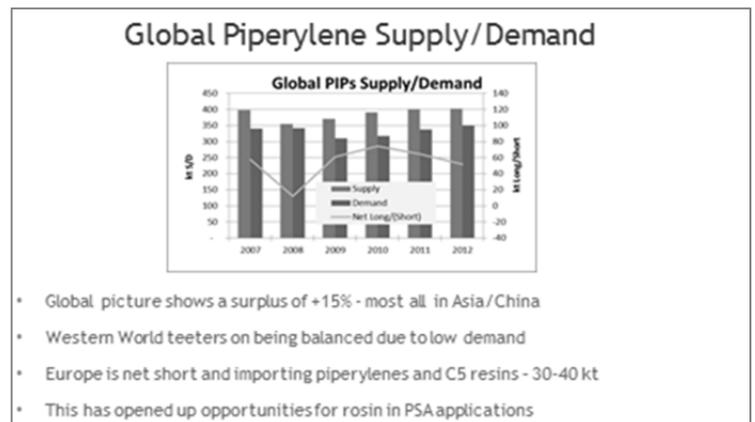
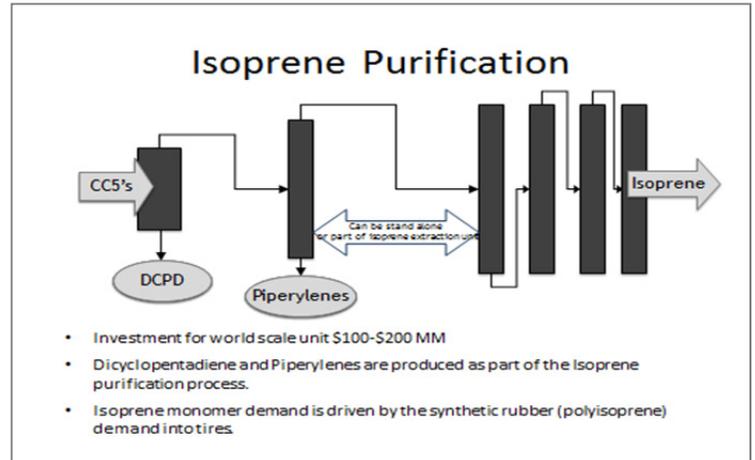
Importance of the emerging raw material supply from China

Throughout the presentation we have been asking the question, who will feed the polymerization capacity in the Western world? Currently it is Asia, predominantly China. It is the country with excess crude C5s streams that feed purification capacity.

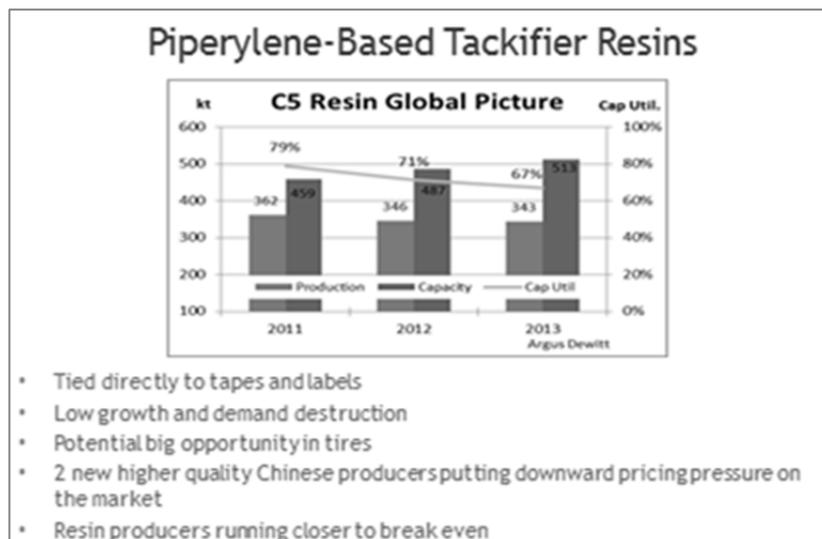
Chinese Isoprene purification is the key to the availability of Isoprene, DCPD and Piperylenes.

These key monomers are used in the production of tackifiers and SIS polymers. This region is responsible for the feed the Western World its key monomers.

The globe has become dependent on China for its feeds as they help drive global supply balances into the positive.



The availability of monomers has also driven the installation of C5 tackifier capacity in China.



In addition to western world quality tackifier producers developing in China, there is also SIS producers starting to import into N. America. Exports from China into N. America are increasing and developed regions have become dependent on these imports. We expect this trend to continue China's role in the global market to increase.

Summary

- Fundamental structural changes on the production of monomers in NA and Europe continue to affect polymer supply and prices
- PSA market growth follows GDP
- Reduction in monomers has been masked by various economic downturns and GDP
- Lurking monomer supply issues, if and when demand returns
- Importance of China for feed, tackifiers and SIS
- What opportunities are there for you to supply from China?