



## **Reversal of Fortune - Competitive Advantages Redefining Industrial Investment in the U.S.**

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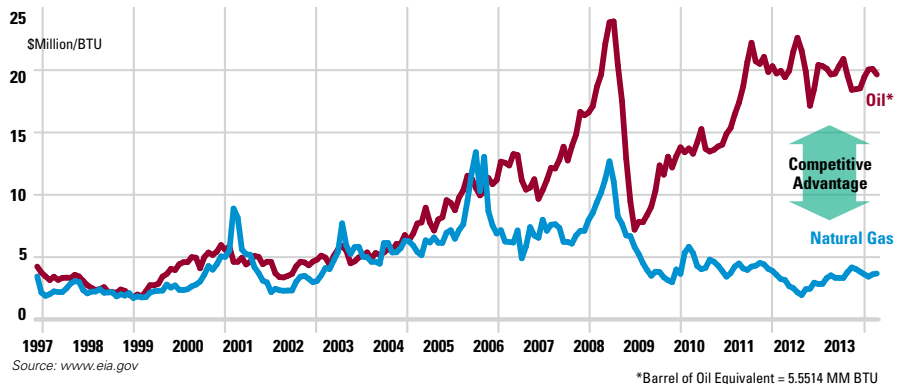
As an investment manager, I seek investments with sustainable growth. I have the freedom to look anywhere in the world. Quietly, the U.S. has developed a competitive advantage in energy costs that is rewriting the history books, see Chart 1. For the first time in generations an abundant energy supply has the potential to improve the air we breathe while creating hundreds of thousands of new jobs. It is creating opportunities where just five years ago energy intensive industrial production was being shuttered in the U.S.

### Reversal of Fortune

Forty years ago the crippling oil dependency of the U.S. was brought home with gasoline rationing during the 1973 Oil Embargo that caused crude oil prices to quadruple. By 1980 the price of crude was 10 times what it had been in 1973. Presidential Commissions looked for alternatives while recommending higher energy efficiency standards. The trending outlook was alarming and U.S. companies in industry were deeply challenged by the rising cost of energy. Higher U.S. energy costs have been a contributing factor to the steady erosion of the U.S. industrial base.

By 2005, the U.S. dependency on imports of petroleum products had grown to 60%. The trend line was going up and the outlook was increasingly dire. Quietly, drillers were implementing new directional drill technology that allowed horizontal drilling through oil-bearing deposits. New seismic sounding and visualization technologies created underground pathways that optimized the horizontal drilling to deep narrow banded shale deposits. High pressure – hydraulic – fracturing is not new. It was used on thousands of gas wells during the 1970's to increase production yields. The fracturing techniques used in shale deposits have been pioneered in the last decade. The rock-like shale formations require proppants and lubricants to keep the fractured channels in the shale rock open. Due to the rocklike characteristics of shale, creating fracture channels and keeping them open with proppants and lubricants is key development that allowed enabled the fracking of shale. To keep the channels open, proppants – silica or ceramic spheres – are injected at enormous pressure into the fracture channels. A combination of water, proppants and lubricants are injected at enormous pressures that range from a staggering 10,000 to 20,000 pounds per square inch. A typical well in the Bakken is 5,000 to 20,000 feet below the surface. There are

**Figure 1: The U.S. Shale Gas Competitive Advantage**



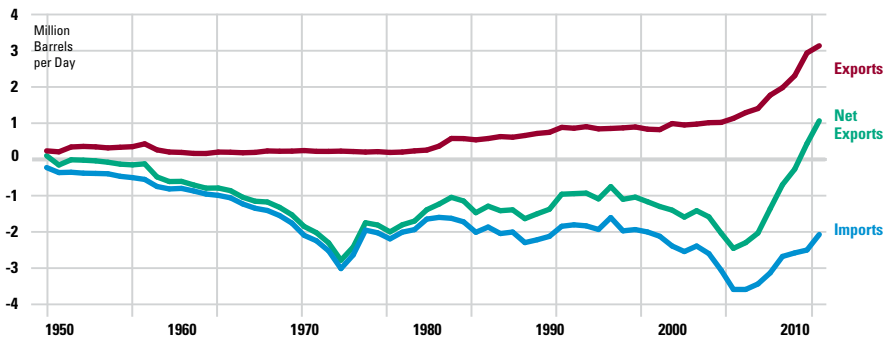
One million (MM) British Thermal Units (BTU) is the measurement standard for natural gas. A 42 gallon barrel of oil contains 5.55 MM BTU which is referred to as the Barrel Oil Equivalent (BOE).

9,000 wells in the Bakken. A significant production well will require 2 million gallons of water, 4 million pounds of proppants and approximately 350 barrels of chemical lubricants.

In 2009, domestic U.S. petroleum production increased for the first time in 17 years. U.S. consumption is running at 18.7 million barrels a day, which is down 10% from 2005. There are a number of factors behind this change, the biggest one was the 2008 financial crisis. Other contributing factors are higher fuel efficiency in vehicles, alternative energy sources, lower electrical demand from LED lights, and lower car ownership among young people.

Since 2008 U.S. domestic crude oil production has increased 50%. In June 2013, the U.S. trade deficit fell more than expected and the biggest contributing factor was that net petroleum imports fell 24% year-over-year. Crude oil imports are the single biggest source of the U.S. trade deficit. From 2003 to 2013 the U.S. paid \$2.4 trillion dollars to import crude oil to meet its import dependency. In the fourth quarter of 2012 the U.S. became a net petroleum exporter for the first time since 1949, (Figure 2).

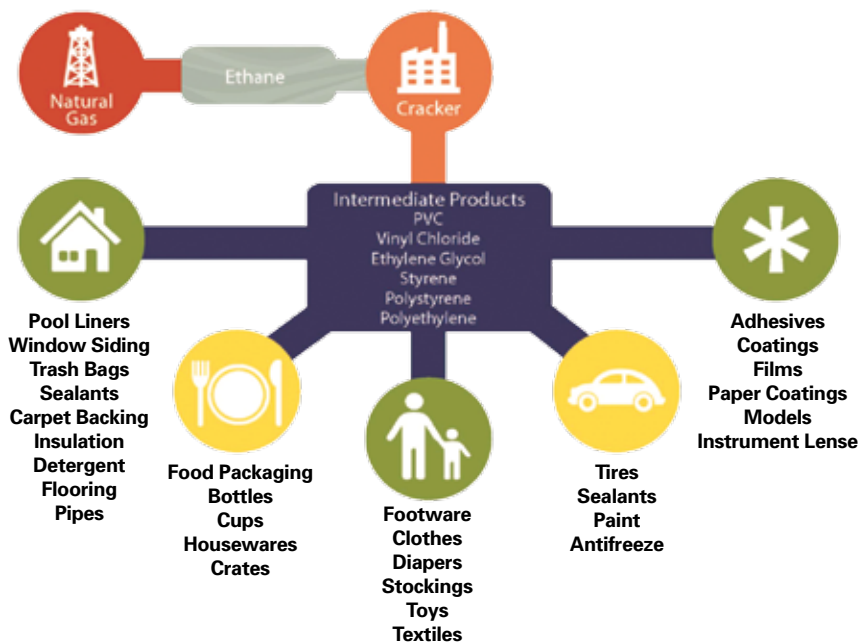
**Figure 2: U.S. Petroleum Product Exports Exceed Imports in 2011 for First Time in Six Decades**



### What is the Shale Gas Advantage?

There are many advantages inherent in shale gas -energy independence, cleaner air – green energy source with less the 50% less CO 2 emissions than coal, see Table 1. The U.S. now offers energy intensive industries a clear energy cost and environmental advantage that is enhanced by their proximity to markets. The competitive advantages on a global basis are reshaping the capital investments of energy intensive industries which include – chemicals, plastics, fertilizers, metal foundries and mills.

**Figure 3: Byproducts for Ethane — a Natural Gas Liquid**



Source [http://www.chicagofed.org/digital\\_assets/others/events/2013/detroit\\_energy/moore\\_830am\\_040913.pdf](http://www.chicagofed.org/digital_assets/others/events/2013/detroit_energy/moore_830am_040913.pdf)

**Table 1: Pounds of CO2 emitted**

**Pounds of CO2 emitted per million Btu of energy:**

Coal (anthracite)	228.6	195.4%
Coal (bituminous)	205.7	175.8%
Coal (lignite)	215.4	184.1%
Coal (subbituminous)	214.3	183.2%
Diesel fuel & heating oil	161.3	137.9%
Gasoline	157.2	134.4%
Propane	139.0	118.8%
Natural gas	117.0	100.0%

Source: [www.eia.gov/tools/faqs/faq.cfm?id=73&t=11](http://www.eia.gov/tools/faqs/faq.cfm?id=73&t=11)

“Wet” natural gas is unprocessed gas that comes directly out of the well head. “Wet” natural gas has a number of naturally occurring by-products that must be separated from the methane or “dry” natural gas. A familiar “wet” natural gas by-product is propane. Other less familiar cousins are butane and ethane; however, once separated as liquids these valuable byproducts are referred to as natural gas liquids. Ethane has a myriad of uses (Figure 3). The by-products from ethane are really quite amazing and include pool liners, tires, to paper coatings. “Dry” natural gas – methane - can be found heating homes and burning on cooktops. Dry natural gas burns cleanly with half the carbon dioxide emissions of coal.

### The Infrastructure Challenge

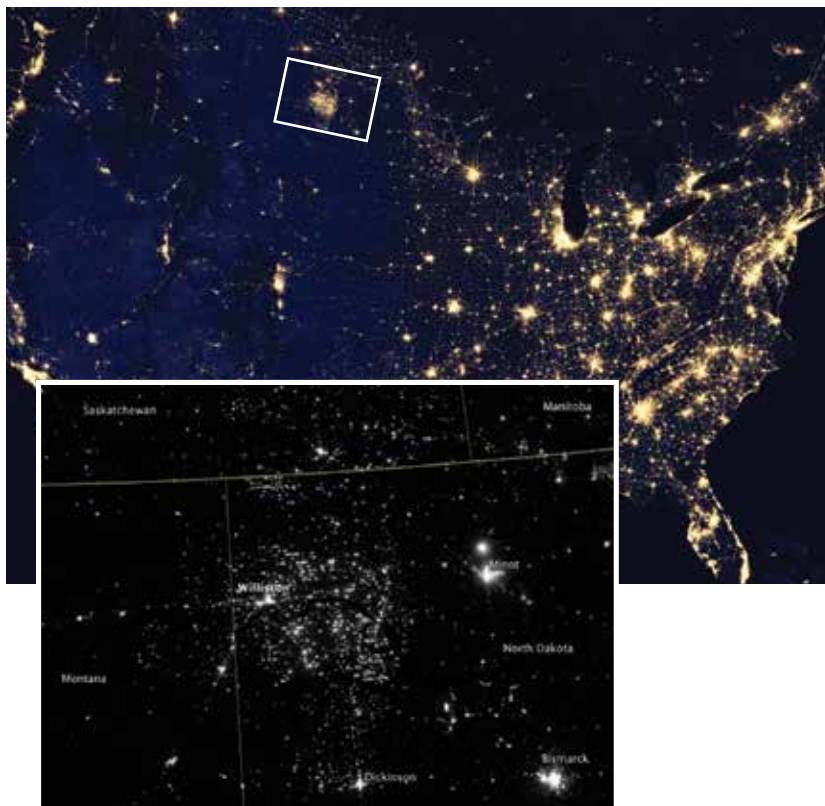
The benefits of the U.S.’s new energy independence are not uniformly distributed. In some cases the benefits have not been distributed at all. Unlike the alternative energy space where aggressive tax subsidies were established for wind, solar and bio fuels, the federal government has not offered adequate incentives for pipeline construction, and the dated use tax credits need to be overhauled. The U.S. needs a long-term national energy plan that matches the scale of the shale gas and oil revolution.

The Environmental Protection Agency (EPA) wants to reduce carbon dioxide emissions but the lack of a federal energy policy that endorses the building of interstate pipelines from the geographically remote Bakken fields in North Dakota leaves producers with no access to storage, process facilities or end markets. It is creating unintended consequences which defy common sense and run completely contrary to the stated goal. During the first seven months of 2013, 50.4 billion

cubic feet of wet natural gas was flared – burned – at the wellheads across the Bakken formation in North Dakota. The burning well flares and production lights can be seen in space. NASA Earth Observatory satellite from hundreds of miles above the earth without image enhancement can clearly capture the light emissions from the Bakken region in North Dakota where no major cities exist (Figure 4). The scale of the wasted energy from no pipeline access to end markets is equivalent to the annual heating needs of 1.3 million homes or 8.6 billion kilowatt-hours of electricity on an annualized basis per the Department of Energy.

To be fair, the speed of discovery and development of shale gas and oil is astonishing and the right-of-way process for pipelines is time consuming. Given the clear example of undesirable unintended environmental consequences, environmental impact studies of new interstate pipelines need to be expedited. The North Dakota state government needs to create incentives that discourage flaring. Amazingly, addressing infrastructure needs for North Dakota's 9,000 wells will only increase the supply side of the U.S.'s new competitive advantages. Federal initiatives are also needed to help build and create domestic demand for the cleaner burning natural gas fuel that will help create demand for this cheaper source of energy. Ultimately, the cost advantage offered by natural gas will diminish and investments and market forces will take advantage of the arbitrage. Chemical industry alone accounted for one-quarter of foreign investment in the U.S. last year. Abundant natural gas and natural gas liquids are improving the air we breathe while creating hundreds of thousands of new jobs. Shale gas and shale oil have also created a healthier balance of payments. The U.S. is becoming a world leader in natural gas technology. While there are winners there are also losers, the dramatically lower natural gas prices have created challenges for companies that bought resource rights at higher price levels. Natural gas drilling activity associated with new wells has steadily fallen while drilling for new shale oil wells has steadily increased.

**Figure 4: Bakken Shale Gas Flares Visible from Space**



Source: <http://www.newscientist.com/blogs/shortsharpscience/2013/01/julia-sklar-reporter.html>

## Environmental Considerations

The EPA has authority under the Clean Water Act to regulate discharge water produced by hydraulic fracturing; however, the EPA does not have authority to regulate subsurface fluids and proppants used for hydraulic fracturing. Each state has the authority to regulate and/or authorize hydraulic fracturing. Water table contamination is a very serious issue and is often not reversible. Well casements must be designed to stand the test of time as well as exposure to extraordinary pressure. A direct benefit of horizontal drilling is that a single well head can be used to drill miles in every direction at depths that are thousands of feet deep. To reduce the amount of water required, drillers are expanding the recycling of drill waste water. A significant concern is the chemical lubricants mixed in with the proppants and hydraulically pressurized with water. There are clearly issues with shallow wells but wells that are one to four miles beneath the surface pose a much more limited threat to the water table.

One area that gets overlooked with these deep wells is the enormous pressures within the well that can create discharge from a well not properly capped. Drillers have the ability to place smart drill caps on wells to monitor and insure well integrity.

### Maryland's Opt Out

The State of Maryland has opted for a three-year study. Rather than proceed with caution, the State has opted to not proceed at all. This does not mean the private sector in Maryland has not found ways to meaningfully contribute to the competitive advantages associated with developing a cleaner energy source. U.S. Silica Holdings, based in Fredrick (ticker SLCA), is a leading supplier of silica proppants to drillers. Silica is found in nature in sand or quartz and used as a proppant. It is used to make glass but silica is known for its hardness. A significant fracking well can use 4 million pounds of proppants to keep the fracture channels lines in shale deposits under enormous pressure. Colfax Corporation based in Fulton (ticker CFX), is a manufacturer of gas and fluid handling equipment. Colfax serves both the oil and gas industry and the chemical industry. The systems manufactured assist with production, storage, refining and transportation. The current valuations of both companies are rich, and are dependent on continued demand. Assuming the price of oil does not collapse, it is reasonable to consider the U.S. energy cost advantage as being sustainable in the near term but the cost differential between oil and natural gas spot prices will likely close as myriad of supply and demand factors come to bear.

### The Future is Happening Now

As a portfolio manager, I turn over a lot of rocks looking for sustainable growth. In October, the U.S. Energy Information Agency announced that it expects the U.S. to become the world's largest producer of petroleum products in 2013. There is an enormous need for infrastructure to support this dramatic change. Selectively, there are sustainable growth opportunities for companies providing the picks and shovels that will enable the U.S. to take advantage of this dramatic reversal of fortune. The air in cities will benefit from the cleaner natural gas emissions. Enormous shale deposits exist in New York and California that have not been developed. The shale deposit in California is nearly four times the Bakken deposit. The estimate of recoverable oil - not including gas - in California alone stands at 15.4 billion barrels of oil. The scale and scope of the energy independence offered by shale gas and shale oil is revitalizing the U.S.'s industrial base while offering cleaner natural gas and energy security. The development of the technology associated creates a new export that goes beyond just petroleum products. Over time, as the infrastructure is built and the technology spreads, natural gas will become a global commodity rather than a regional commodity. Between now and then the U.S. has clear competitive advantages.

#### Resources:

[www.eia.gov](http://www.eia.gov)  
<http://www.eia.gov/tools/faqs/faq.cfm?id=73&t=11>  
<http://ngm.nationalgeographic.com/2013/03/bakken-shale-oil/dobb-text>  
<http://www.census.gov/foreign-trade/statistics/historical/petr.pdf>  
[http://www.eia.gov/environment/emissions/co2\\_vol\\_mass.cfm](http://www.eia.gov/environment/emissions/co2_vol_mass.cfm)  
<http://www.midwestenergynews.com/2011/11/14/the-bakken-north-dakota-oil-field-from-space/>  
<http://nation.time.com/2013/10/16/40-years-after-the-1973-oil-embargo-the-u-s-is-stronger-on-energy-but-so-is-the-middle-east/>  
<http://aleklett.wordpress.com/2013/01/29/gas-flaring-at-bakken-and-eagle-ford/>  
<http://www.newscientist.com/blogs/shortsharpscience/2013/01/julia-sklar-reporter.html>  
<http://www.census.gov/foreign-trade/statistics/historical/petr.pdf>  
<http://energy.gov/articles/producing-natural-gas-shale>  
<http://www.argusmedia.com/pages/NewsBody.aspx?id=862063&menu=yes>  
<http://ngm.nationalgeographic.com/2013/03/bakken-shale-oil/dobb-text>