

# Visualizing Energy Market Dynamics

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Our primary focus in this report will be to bring some attention to the powerful dynamics impacting the oil and natural gas markets on a global scale, especially in regards to the potential to alter relative prices. Our perspective is that the current downward momentum in crude oil prices was caused by a confluence of long-term factors ignited by some short-term considerations.

**Chart #1:**

**WTI Crude Oil Price**



The US and Canadian energy production boom started back in 2006-2007 and has kept pace since then. Growing supply though was countered in no small way by continued strong demand from China and other emerging market countries at the start of the production boom, and then later by rising geo-political tensions in Libya, Syria, Iran, etc., that served to mask and downward price pressures. In the last few years, however, China's rate of growth has materially decelerated and growth has slowed dramatically in most other emerging market countries as well, not to mention the economic stagnation that grips Europe.

The production boom in North America and the lessening of factors influencing global demand set the stage for lower oil prices but the catalyst came from elsewhere. When it became clear that despite worrisome developments in the Middle East, oil production was either coming back online (Libya, Iraq) or not being materially impacted, many longer-term investors, such as pensions and endowments, not to mention retail investors, began to shift their asset allocations back to a rising stock market and away from directionally bullish energy funds, including Exchange Traded Funds and Notes (ETFs and ETNs), that were index-linked to a positive view on global energy prices.

The recent fall in oil prices has been quite spectacular. And, with the fall in oil prices it begs the question of whether supply will adjust. Indeed, if one focuses only on the actual production trends set against demand trends based on economic growth, one might be tempted to argue that sooner or later production cutbacks in response to lower prices would halt the current downward momentum. This view has risks in both directions.

- » First, when powerful asset allocation shifts are involved, there is always a strong likelihood that markets can overshoot some hypothetical supply-demand valuation that fails to take into account the behavior of investors.
- » Second, oil production tends not to respond to short-term price movements. A considerable proportion of oil production costs are in the capital investment phase, and these costs are often incorrectly (from an economics perspective) partly included in the perceived marginal cost of producing the next barrel of oil. In fact, production dynamics are much more complex, actual marginal costs are much lower than they might appear, and short-term production cuts are very unlikely.

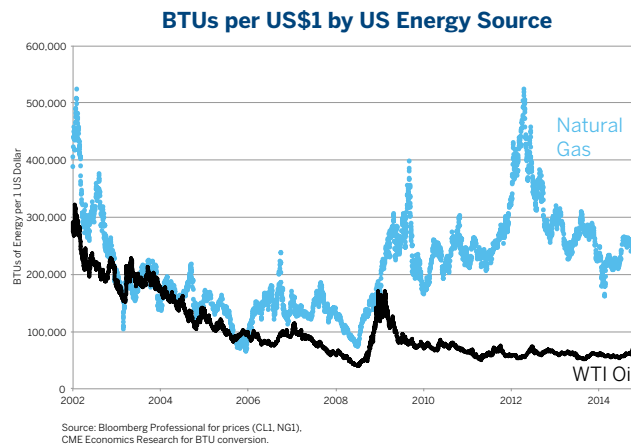
» Third, and in the other direction, while the current situation in the Middle East (and Russia) has produced a relatively benign or grudging consensus that Middle East oil production will stay high despite the tensions in the region, one should not ignore the low probability, but high impact potential, of surprise oil supply shocks.

So, we fully appreciate why all eyes are on the recent decline in crude oil prices, however, we would like to refocus your attention on our perspective that energy market internal dynamics are on the move. There are some powerful long-term economic incentives that are colliding with some short-term realities, and the energy world is changing -- again. In this report, we present our favorite charts designed to make the case that what is happening below the surface in terms of the relative prices of natural gas and oil, the WTI-Brent spread, and global disparities in natural gas prices, among others, may be just as interesting and important as interpreting the current slide in global oil prices.

### Btu Price Disparity

If someone gives you a dollar and asks you to buy Btu's of energy in the US, \$1 will get you over 200,000 Btu if spent on natural gas, while the same \$1 will get you less than 100,000 Btu if spent on crude oil (or related refined petroleum products). This large Btu pricing disparity did not exist prior to the energy boom. One scenario argues that these conditions are here to stay, at least for a very long time, as oil and natural gas fuel different sectors of the US economy and are not fungible in the short-run. Other scenarios point to the billions of dollars being invested in industrial uses for natural gas, the transition of the US power generation fleet from coal to natural gas, and projects to increase exports of natural gas to Mexico by pipeline and eventually, to Asia by ship in liquefied form. It just takes a long-time to bring these huge capital investments to fruition, but they are certainly coming: Cheniere's Sabine Pass is set to lead the US's LNG export market when it begins operation in the fourth quarter of 2015.

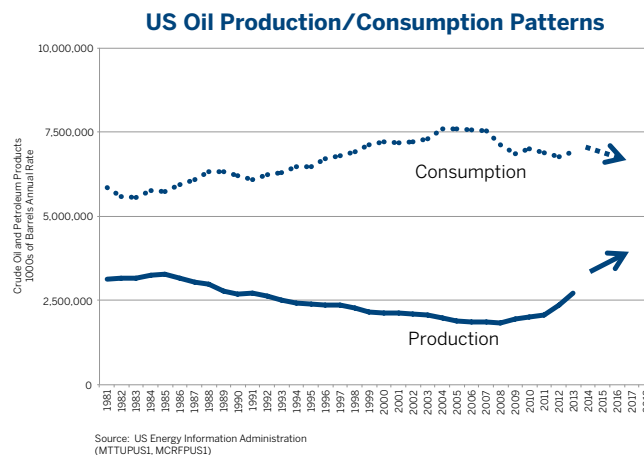
Chart #2:



### Current oil production and consumption in the US

There is an interesting dynamic in the US. Crude oil production is booming, while consumption of refined petroleum products is declining. Crude oil is essentially a transportation fuel, in that 70% of refined product is used in transportation. And transportation is becoming more and more energy efficient with each passing year.

Chart # 3:

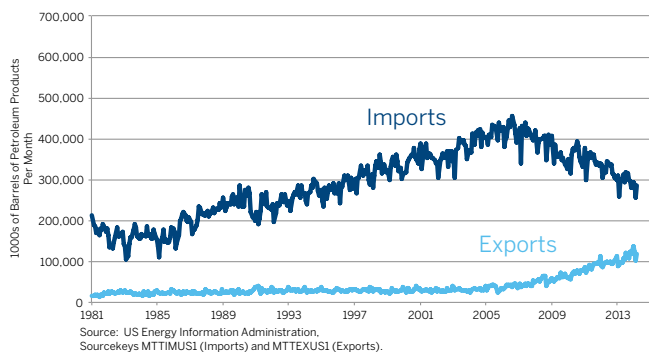


### Rising Oil/Petroleum Exports and Declining Imports

The direct consequence of coupling a US crude oil production boom with a consumption decline is to dramatically decrease US imports of crude and increase US exports of refined petroleum products, which are not restricted by the ban on crude exports. We would even posit that these production/consumption dynamics are likely to lead to pressure being applied to repeal or at least modify the ban on crude oil exports from the US.

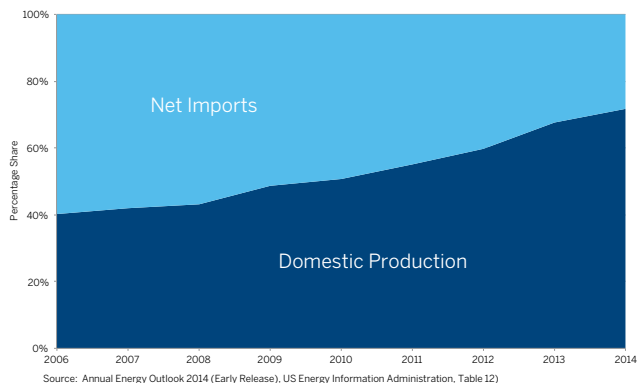
**Chart # 4:**

**US Oil Petroleum Products: Imports and Exports**



**Chart #5:**

**Proportion of US Oil Provided by Domestic Production**



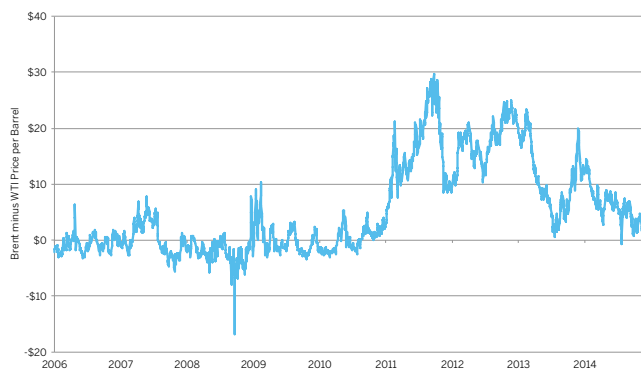
**Reconnecting WTI and Brent**

When the US crude oil production boom accelerated in 2011 and 2012, domestic oil supply overwhelmed US distribution capacity and faced US export restrictions, resulting in the partial disconnection of the WTI-Brent price relationship. This combination of strong domestic production and trade restrictions temporarily and partially detached the physical oil market in the US from that of the rest of the world. This detachment was reflected in an enlarged spread between WTI and Brent. In the few years, the tide has turned back the other way, and the spread has narrowed. In the US, greater volumes of domestically-produced oil are moving to refineries by rail and pipeline, and exports of refined petroleum products are rising while imports of crude oil are falling. In Europe, production in

the North Sea is declining and demand from economically stagnant Europe continues to be weak. If the US were to move to allow crude oil exports, we would postulate that the WTI-Brent spread would revert to a mean of zero, albeit with a large variance and the occasional potential for sharp deviations.

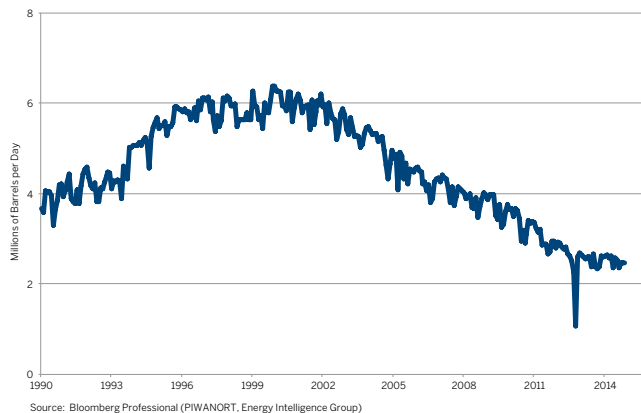
**Chart # 6:**

**Brent-WTI Spot Price Spread**



**Chart # 7:**

**North Sea Oil Production**



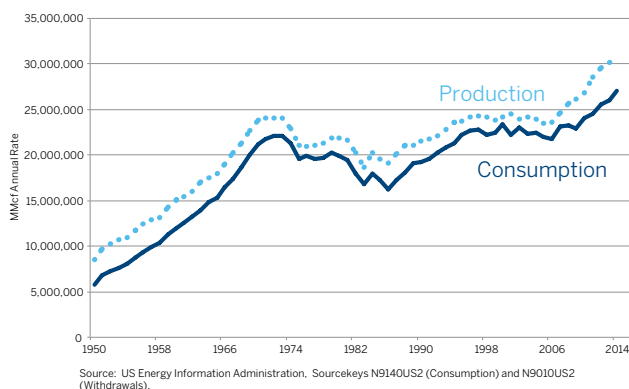
**Natural gas production and consumption dynamics**

Natural gas production is booming in the US, just as crude oil production is booming. But on the consumption side of the ledger, natural gas consumption and exports are also rising, but at a slower rate than production. Since 2008, the start of the current shale boom, annual US production has been growing at 4 percent, while consumption has been growing at 2 percent (EIA). The highly supplied North American natural gas market is driving relatively low natural gas prices, especially in Btu terms. Demand growth is being driven by considerable conversion of electrical

power generation from coal to natural gas. Second, we are seeing an expansion of industrial uses taking advantage of the relatively inexpensive natural gas (in BTU terms, see Chart #2). And, then more and more natural gas is flowing through pipelines from Texas to Mexico, as more pipeline capacity is being built. Mexico is converting its power plant fleet from diesel to natural gas, also to take advantage of the BTU price discrepancy. Over the longer-term as noted earlier, natural gas liquefaction facilities will come online and exports will get another boost. All of these factors suggest that the demand components of the natural gas price equation are likely to expand at an accelerating rate. But, what might happen to production factors?

**Chart # 8**

**US Natural Gas Production & Consumption**

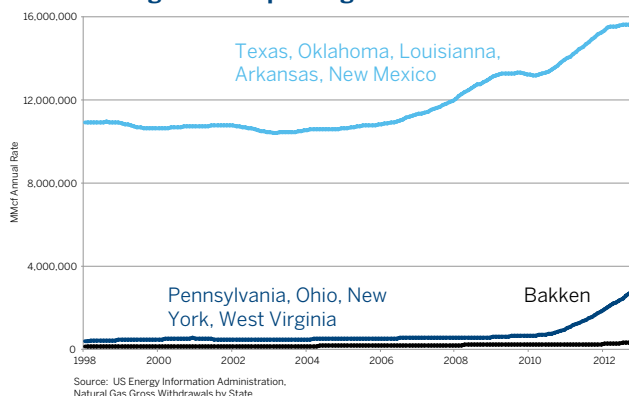


**Possible Deceleration of Natural Gas Production**

On the production side, we may be seeing the beginnings of a deceleration in the growth rate. Major natural gas fields are in decline from the Gulf of Mexico, to Alaska, to Wyoming and Colorado. At the same time, the growth rate of production in Texas and Louisiana and related states is clearly slowing. Only in Ohio and Pennsylvania, the Utica and Marcellus fields, are still seeing strong production growth. Rapid production growth in shale gas is displacing conventional gas: Shale gas made up just 10 percent of production in 2007 and now accounts for about 50 percent of total US natural gas production.

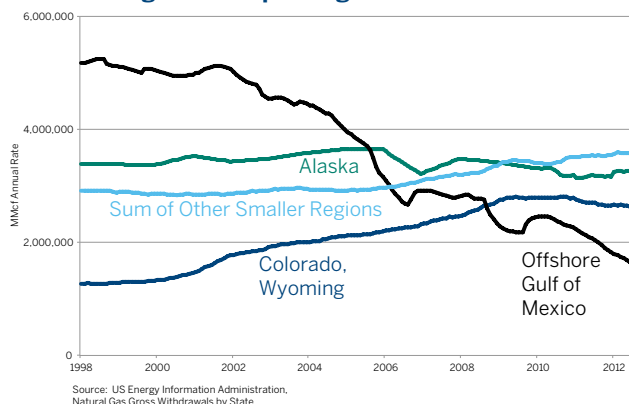
**Chart # 9:**

**Regions of Expanding Natural Gas Production**



**Chart # 10:**

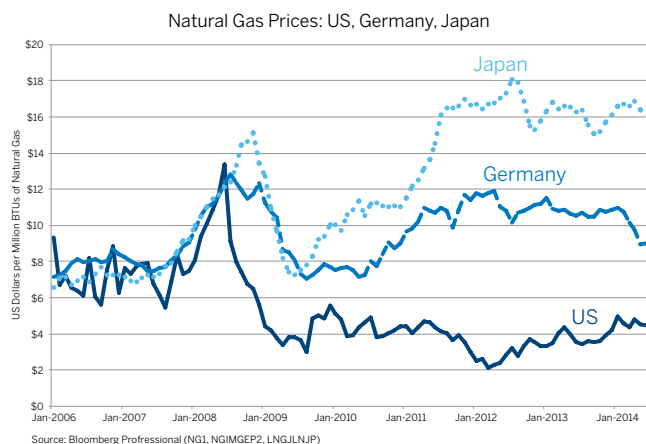
**Regions of Expanding Natural Gas Production**



**Global Natural Gas Price Differentials**

Natural gas prices around the world started to diverge with the production boom in the US, and then the earthquake and tsunami in Japan that shutdown their nuclear power generation and resulted in a switch to generating electrical power with natural gas. Given that building natural gas liquefaction facilities takes years and billions upon billions of dollars, the global price gap has remained large. Nevertheless, facilities to liquefy natural gas and ship it to more expensive locations are coming online every year. This large global price gap will begin to shrink in the coming years as additional liquefaction facilitates the globalization of the natural gas market. Already, Japanese utilities and other Asian buyers are signing long term offtake agreements for US LNG output, priced at Henry Hub plus an adder to account for liquefaction costs. Buying LNG at a Henry Hub-based price represents a major change for Japanese buyers, who presently buy LNG on an oil market index, the Japanese Crude Cocktail (JCC).

Chart # 11:



### Concluding Observations

Our focus in this report has been to bring some attention to the critical dynamics impacting the oil and natural gas markets on a global scale that have the potential to alter relative prices. Our perspective is that the current decline in oil prices is probably 70% supply driven and only 30% demand driven. We also take the view that falling prices will not, at least in the short-run, have much if any impact on production. That is, supply will continue to expand, because the wells have been dug and the infrastructure built, and accounting versions of the marginal cost of producing the next barrel of oil considerably overstate, in our opinion, the very low costs and strong cash flow incentives to keep on producing. Finally, when one couples the current general downward momentum in oil prices with the long-term relative price dynamics which are evolving slowly yet powerfully, our conclusion is that energy price volatility, especially in spreads and relative prices, is likely to increase over the coming months and years as the Btu price gap between oil and natural gas narrows.