RECURRENT
INVESTMENT ADVISORS

The Impact of US Shale – Changing the Shape of Energy Cycles

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EXECUTIVE SUMMARY

As investors in the energy sector, one of the most important variables to success is understanding energy cycles. Many investors appropriately look to the past to understand the future. Since the data of the computer and digital era became part of investors' tool kit in the 1980s, investors readily analyze the digital era for comparisons to the present.

With regards to the energy industry in this context, OPEC was established in 1973, and the oligopoly was forced to manage oil supply/demand balances since oil market production was defined by large, long-cycle projects. However, the development of shale, which is naturally higher cost, quick to turn on/off, and is produced in small batch sizes, serves to use market forces to balance global oil markets, thereby reducing the relevance of OPEC. Therefore, the pre-OPEC era prior to 1973 is more relevant to understanding today's energy cycles.

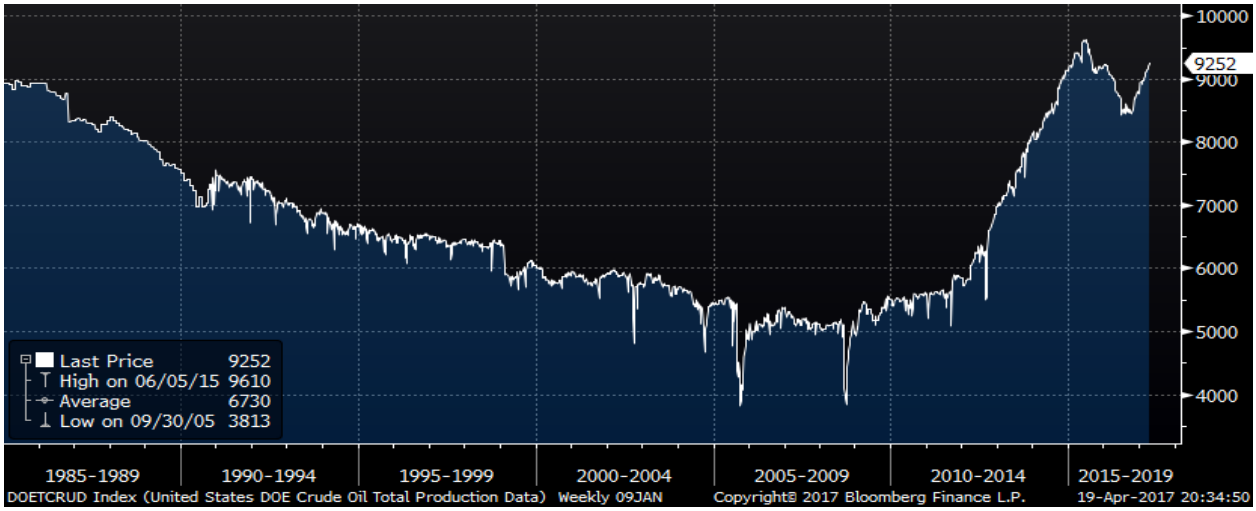
During this period, the Texas Railroad Commission mandated production limits of Texas oil producers on a monthly basis. As a result of a single influential decision maker retaining decision-making capability on a monthly basis, energy cycles remained closer to supply/demand balance, and cycles were shorter in duration and lower in amplitude when compared to the OPEC era.

To further compare and contrast the differences and similarities in the shape and structure of energy cycles during the two "eras" (pre and post 1973), we first explore the impact of US shale production on global oil supply/demand balances. While US shale production provides only 5% of global oil supplies, its unique attributes make the structure of global oil markets act more like other commodity markets – most notably the market for deregulated power.

ANALYSIS

The onset of US shale production in the mid-2000s clearly reinvigorated the US oil market. After US oil production declined from over 9 million barrels/day since the mid-1980s to a sustained low of 5 million barrels/day in the mid-2000s, the development of shale nearly doubled production to almost 10 million barrels/day by 2015 **(Exhibit 1)**.

Exhibit 1 – US Crude Oil production, in thousands of barrels/day

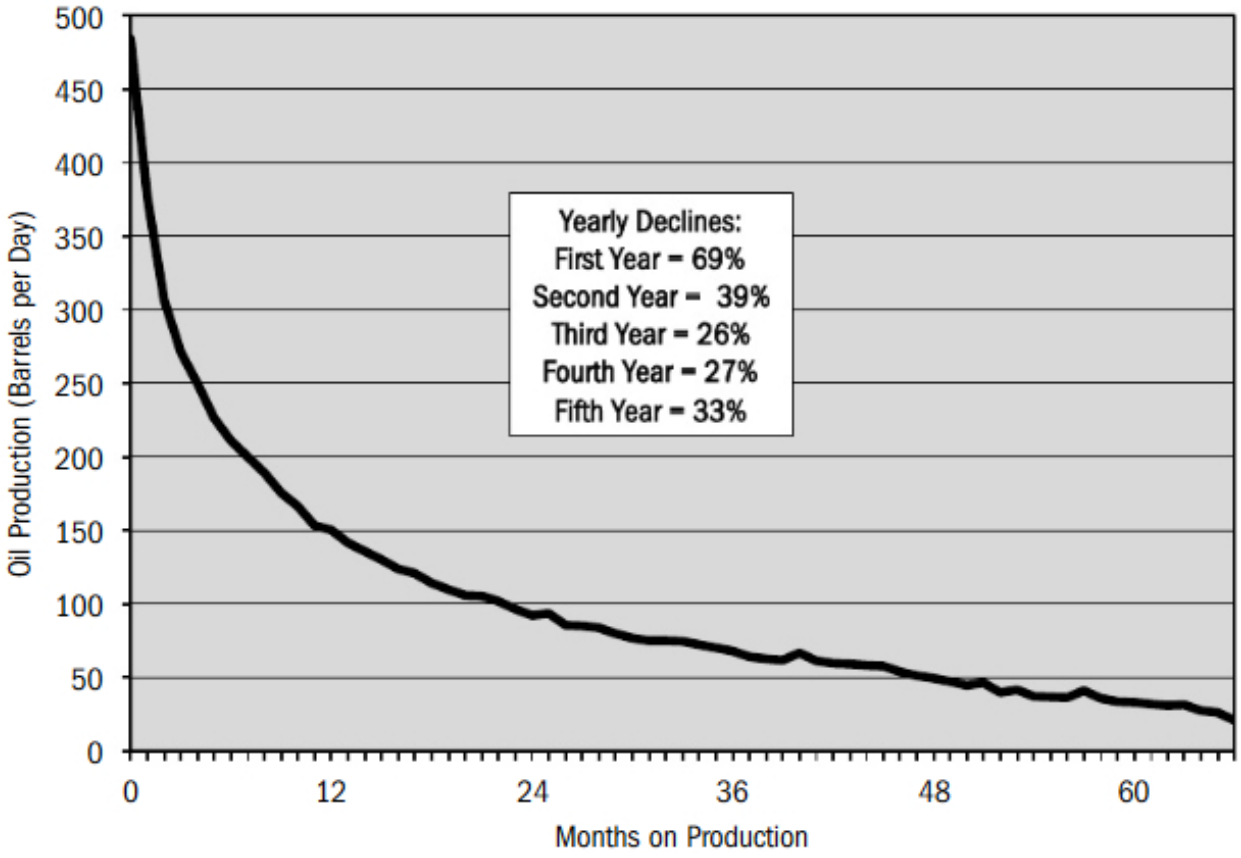


Source: Bloomberg

While conventional production growth is generally the result of significant new finds with large production volumes, individual shale oil wells produce much smaller amounts of oil than most conventional onshore and offshore wells. Additionally, shale production is unique in that once a shale's commerciality is confirmed, production can generally be increased as drilling activity increases. Importantly, a shale well's production declines at a much faster rate than a conventional well, so in the absence of drilling activity, the aggregate production falls at a much faster pace than has traditionally been the case in the oil industry.

In taking a broader view, shale plays a role that no other oil production has been able to play since OPEC took control of the global oil market in 1973. Conventional oil production traditionally has required years and significant resources, and once production commences, remains at relatively stable levels for years. Shale production has a very different production profile, with lead times measured in months and production declines of approximately 70% in the first 12 months **(Exhibit 2)**.

Exhibit 2 – Typical Bakken Shale Oil Well Production



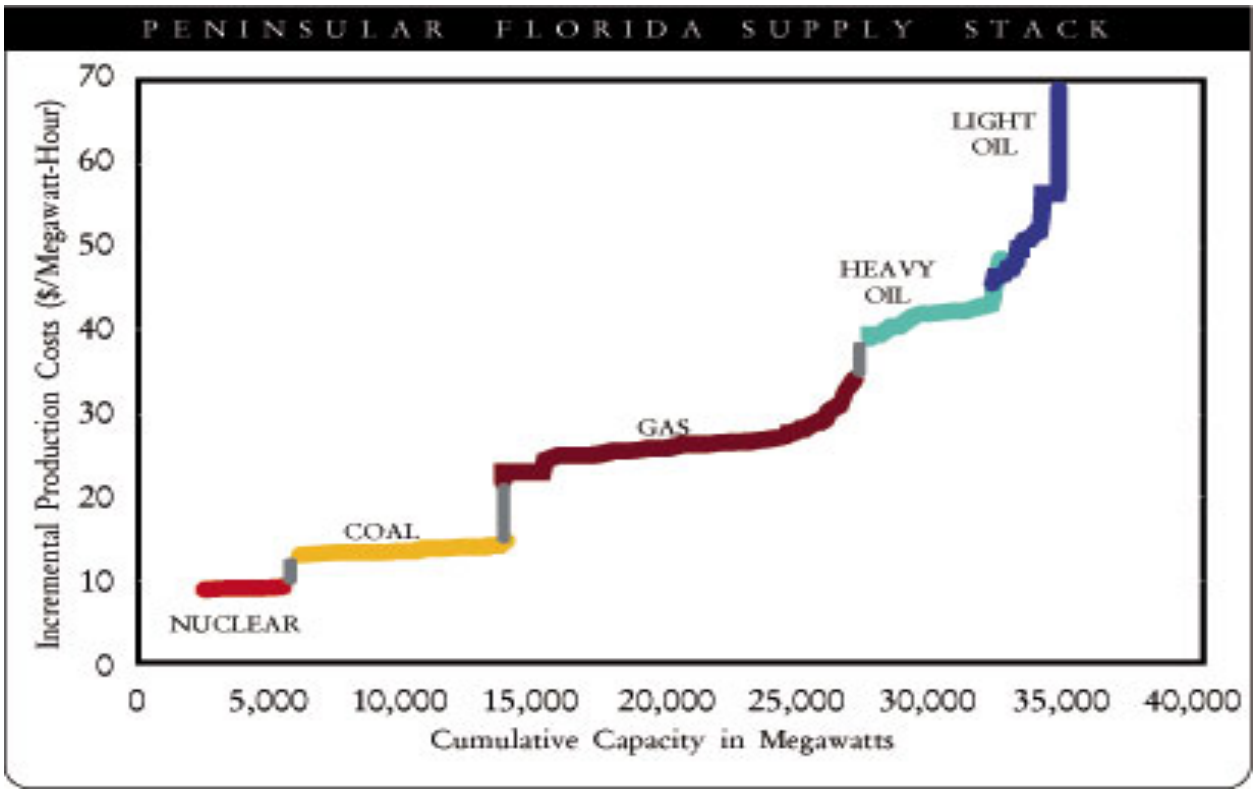
Source: Hughes GSR Inc, 2012

From a global oil market perspective, the result is that for the first time in the last 40 years, shale producers are using market price signals to increase or decrease production in a matter of months. This contrasts with OPEC, whereby price signals cause a group of countries to negotiate a course of action which may or may not be adhered to. This is a much more cumbersome process involving non-economic forces, which may cause significant market dislocations.

COMPARISON TO DEREGULATED POWER MARKETS

The increase in US shale production has created an interesting nuance to global oil markets, such that they can now be compared to the deregulated power markets. In deregulated power markets in each region, two elements determine the hourly price. First, power plants are ranked by their cost, which creates what is known as a dispatch curve **(Exhibit 3)**.

Exhibit 3 – Prototypical Electricity Dispatch Curve



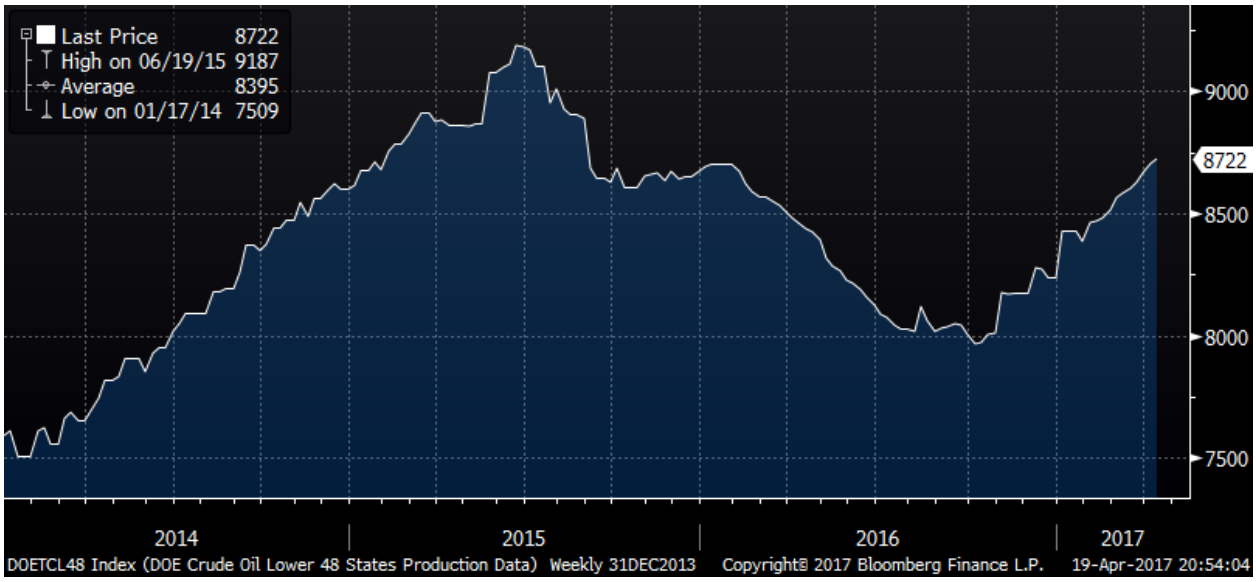
Source: Prof Liza Moyer, University of Chicago

In any given hour, the price of power is set by the cost of the power plant which serves to match supply and demand for that hour. Every plant that is "dispatched" in a given hour is economically incentivized to run at full capacity, because the price is by definition higher than the cost to the plant. Every hour, as demand changes, the "marginal" power plant changes, and the price accordingly changes. While the cost of each plant is critical to the success of the economic construct, the other important element is the fact that there is generally an **inverse relationship between the marginal cost of the plant and the speed with which the plant can turn off or on**. These attributes are important because they mean that the lowest-cost plants (usually nuclear plants) turn on and stay on, as they naturally should, and the high-cost plants (usually natural gas) can match demand changes without impediment. As a result, the power market is able to efficiently match changes in demand while pricing increases or decreases accordingly.

How does this relate to the global oil market? The introduction of shale production creates an economic structure similar to that of the dispatch curve in deregulated power markets. The low-cost OPEC providers (Saudi Arabia, for example) should remain as consistent producers, like the nuclear or coal plants in the electricity example, at close to full capacity utilization. At the high

end of the cost curve sit US shale producers, particularly those in high-cost shale regions like the Bakken shale in North Dakota. In this way, high cost shale plays a similar role to that of natural gas power plants. As global oil supplies exceeded demand, the price of oil fell in the 3rd quarter of 2014, and within 12 months, oil production peaked and started to fall in the continental US, particularly in the higher-cost shale basins. In the 1st quarter of 2016, the oil price troughed, and some 6-8 months later, US production bottomed and has continued to rise since the 3rd quarter of 2016 **(Exhibit 4)**. From peak to trough, US production fell by approximately 1 million barrels/day due to unfavorable price signals – to which shale was able to adjust. The marginal barrels in the US were able to turn on and off to help balance the market, reducing global oil market oversupply.

Exhibit 4 – Continental US Oil Production, in thousands of barrels/day



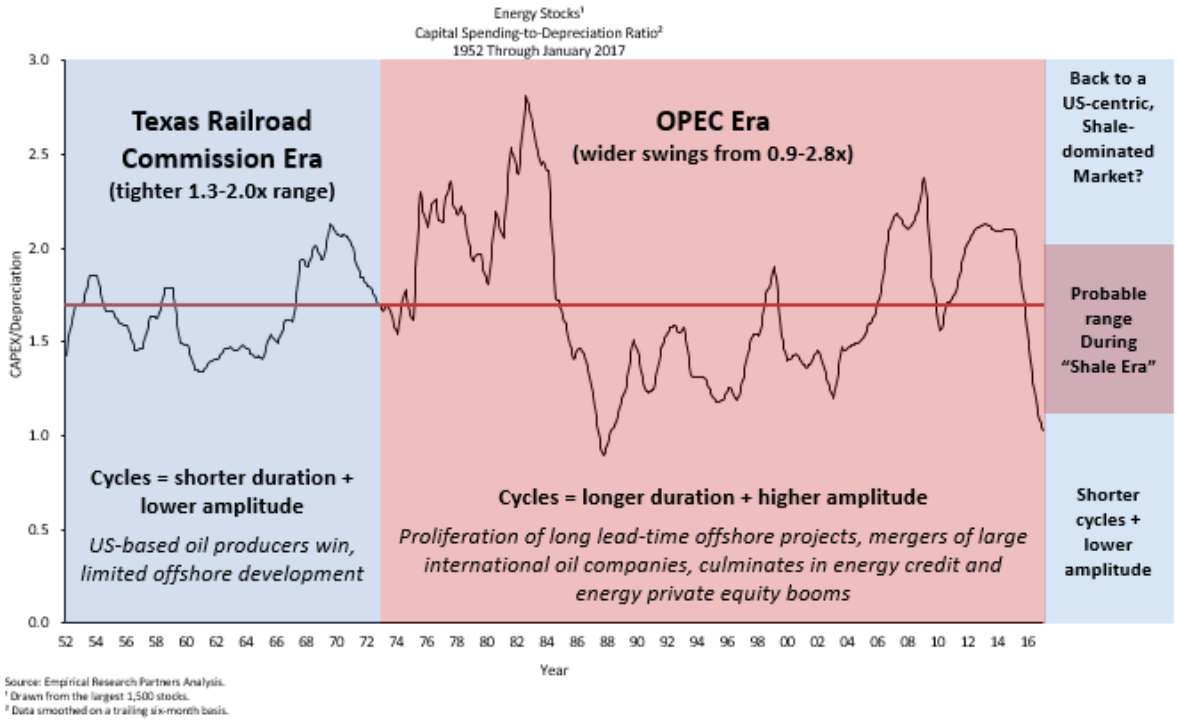
Source: Bloomberg

In contrast, in the OPEC era, the method by which supply was altered to match changes in demand came in the form of an oligopolistic entity deciding to cut or increase production. However, supply's cost or speed to market was not considered. In fact, many of the OPEC producers were relatively low cost, which meant that OPEC cuts actually benefited higher-cost producers. As such, at times when OPEC cut, higher-cost producers continued to produce, exacerbating market oversupply. Market dislocations extended and cycles moved further from their natural equilibriums. Cycles of long duration and high amplitude became the norm.

US SHALE IMPACT ON ENERGY CYCLES AND THE LESSONS FROM HISTORICAL CYCLES

As outlined above, the profound impact of US shale production made us reconsider our expectations of energy cycles going forward. In many cases, investors' view of energy cycles relates to the OPEC era post-1973 when changes in demand were offset by production increases or decreases by lower-cost, long-cycle production. However, a period of short-cycle oil production existed prior to 1973. Before OPEC took control of global oil markets, the Texas Railroad Commission effectively managed global oil markets. As the regulatory body for the largest oil-producing state in one of the largest oil-producing countries, the Texas Railroad Commission had a unique ability to quickly affect global oil markets. In practice, on a monthly basis, the Texas Railroad Commission mandated how much Texas producers could produce, thereby maintaining a supply/demand balance close to equilibrium. Global oil markets remained close to supply/demand balance, and the shape of energy cycles reflected that reality. Cycles were short in duration (3-7 years), and the amplitude was relatively low. In contrast, cycles during the OPEC era were much more dramatic, with multi-decade long cycles and high peaks and low troughs **(Exhibit 5)**.

Exhibit 5 – Energy Industry CAPEX/Depreciation



Source: Empirical Research Partners, Recurrent Investment Advisors

INVESTMENT IMPLICATIONS

The question remains: in what shape of cycle are we in today? Why? What does that mean from an investment perspective?

The simple answer to these questions is that the natural attributes of shale production – higher cost, quick to turn on and off, etc. – dramatically change the economic structure of the global oil market to resemble deregulated electricity markets. Using market price signals, the high-cost shale barrels turn on and off quickly, creating oil market cycles which are shorter in duration and lower in amplitude than the cycles of the recent past. From a purely global oil market perspective, today's cycles are more similar to those of the Texas Railroad Commission era than to those of the OPEC era.

From an investment perspective, there are a few relevant ramifications. First and foremost, to invest successfully, liquidity and valuation discipline are essential. With short cycles, investors must adhere to valuation discipline to identify buying and selling opportunities, in many cases before proof of a change in company/industry dynamics has occurred. Also, the requisite liquidity to efficiently enter and exit will enable investors to build positions at cyclical bottoms and reduce positions at cyclical highs. Investment returns of traditional 10- and 20-year projects may rest primarily on the entry/exit points of the investment. Instead, investing in public equities offers the ability to benefit from the short cycles caused by US shale as opposed to more illiquid investments which are more suited to secular trends more prevalent in the OPEC era.