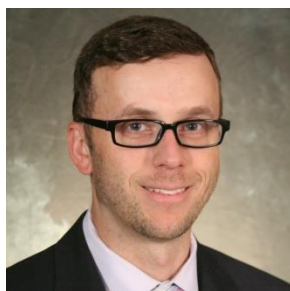




Brian Barnhurst, CFA
Principal,
High Yield Credit Analyst



David Winans
Principal,
Investment Grade Corporate
Bond Analyst

Adjusting to a World of Surplus Crude

From Peak Oil to Crude Abundance in Just Over a Decade

The arrival and subsequent exploitation of U.S. shale has disrupted oil market equilibrium. A newfound dynamic of abundant global oil supply, coupled with the short-cycle production characteristics and sustained productivity improvements of U.S. shale output, underscore an in-process recalibration of the global crude cost curve and our expectation that a sustained move above the \$70 / barrel threshold is likely to be quickly countered by upticks in U.S. shale production.

Ultimately, a persistently low oil price environment breeds underinvestment in higher-cost projects and informs our longer-term expectation for a more sustained increase in oil prices.

While projections of future oil prices may garner attention given the recent price volatility, a repeatable investment framework is not based on time-specific price calls. Rather, opportunities to consistently generate alpha within the energy sector are driven by allocating capital to the most attractive assets as identified by an established credit selection process. A dynamic assessment of field-level drilling economics and cash-flow sensitivities to various commodity price scenarios is central to our investment approach.

The world has plenty of crude oil, a newfound dynamic in global oil markets and a clear distinction from the peak oil scenarios proselytized a little more than a decade ago. Our forward investment framework is constructed around a medium-term expectation for an adequately supplied global market, in which moderate demand growth and upward oil price movements are quickly countered by upticks in U.S. shale production, the by-product of which is lower prices relative to recent years, but also the potential for considerable price oscillation.

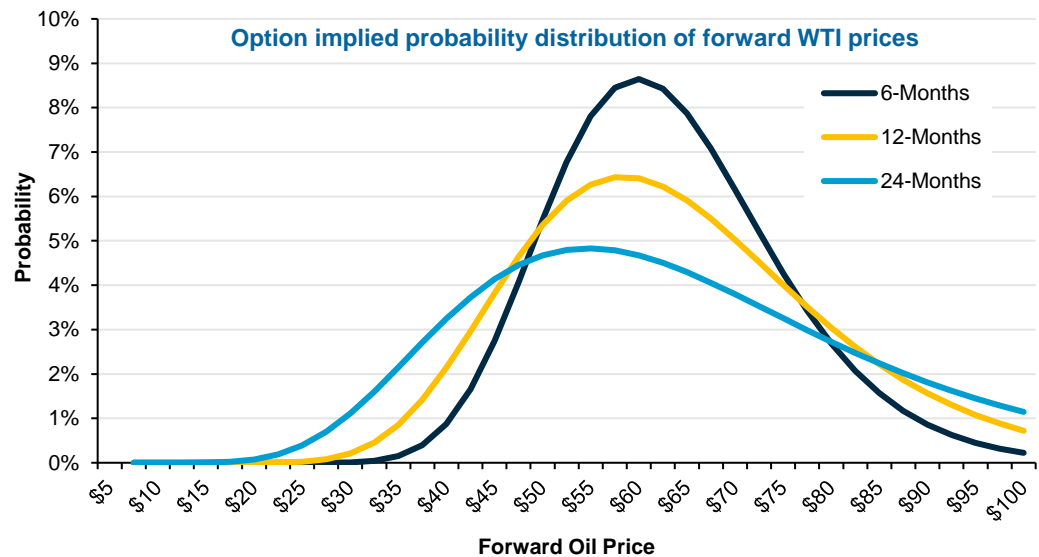
Beginning with global oil abundance as a constant (and not simply in reference to the current oversupply dynamic), the key fundamental crude oil pricing considerations become two-fold; demand, as sustained growth in global oil consumption at some moderate level (1-2%, for example) should be sufficient to move the crude oil price curve to the marginal cost of global production, which we

For professional and institutional investor use only—not for use with the public.
Your capital is at risk and the value of investments can go down as well as up.



currently observe in the high \$60s / low \$70s per barrel, and a recalibration of the global crude cost curve itself, with a particular focus on the increasingly efficient production characteristics of short-cycle U.S. shales. Taken together, the advancement of U.S. shale brings capitalist discipline to a global oil market that has long been dominated by the coordinated policies of the Organization of the Petroleum Exporting Countries (OPEC).

**CONSIDERABLE
UNCERTAINTY IN
THE FORWARD
PRICE CURVE**

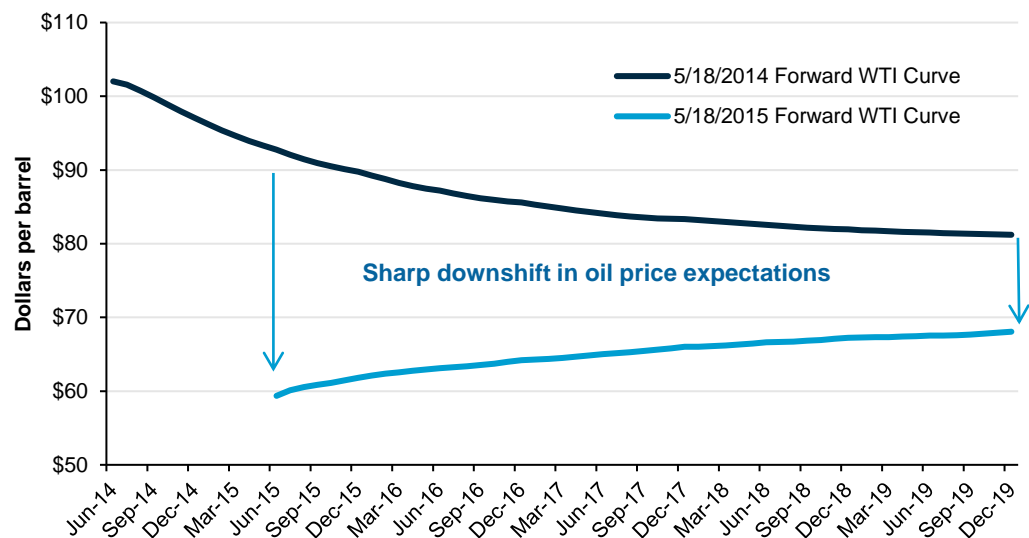


Source: Bloomberg and Prudential Fixed Income as of May 2015

Although shale production may cap prices in periods of moderate supply shortages over the medium term, the potentially volatile dance between prices and short-cycle shale supply has an endgame. Sustained periods of low prices breed underinvestment in future projects and reduced investment in current projects, likely giving way to a meaningful imbalance at some point in the future. Whether this occurs in 2016, 2017, or beyond, is challenging to pinpoint, but world prices will almost certainly need to move higher for a period of time sufficient to attract investment in new projects. That notion, too, carries caveats as we consider sustained growth in global demand as an absolute prerequisite for higher oil prices.

The adjustment in the crude oil market and its consequent effect on asset valuations underscores the importance of asset quality and the value of scale—both from production cost/efficiency and capital access perspectives. It is our assessment that a strong case for industry consolidation exists over the next few years. We expect good assets will find good balance sheets, either the hard way (balance sheet restructuring) or the easy way (consolidation). Further, the amount of capital attracted to the energy space should not be underestimated; the asset-rich nature of the companies continues to attract capital from traditional and non-traditional sources alike. After all, crude reserves don't self-deplete, they don't have a half-life, and they don't disappear—and with a three-to-five year time horizon, many investors will likely prescribe to the out-year option on higher crude prices and deploy capital in the sector.

CHANGES IN THE FORWARD OIL PRICE CURVE: 2014-2015



Source: New York Mercantile Exchange and Bloomberg as of May 2015

U.S. Shales: The First Responder

The advent of U.S. shale production is important for two specific reasons. First, output from U.S. shales has grown phenomenally, from effectively zero five years ago to nearly 5% of global oil production currently. The considerable supply wave has had profound impacts on global crude markets, manifesting itself most obviously in the price collapse during the Fall of 2014. But a critical second consideration is that U.S. shale production is “short-cycle” output that can be activated relatively quickly (a new well may require less than 60 days to bring online), particularly as compared to many of the multi-year development projects employed by much of the legacy oil-producing world.

The shorter-cycle nature of U.S. shale is particularly meaningful when attempting to forecast the behavior of oil prices in the future, as theoretically any sizeable move higher in spot oil prices or in the forward price curve may be quickly met by an uptick in capital deployment to shale and an associated uptick in production. For this reason, U.S. shale producers are likely to act as first responders to any global supply/demand imbalance, thereby dampening upward price movement, particularly in the short-run and in instances of small global supply shortages.

While U.S. producers may fulfill the role of first responder, we see practical limitations on the ability of shale to meet anything more than a moderate supply shortage, as any persistent shortage beyond some material threshold is likely to require considerable investment and adequate time to manifest. Ultimately, a persistently low oil price environment breeds underinvestment in higher-cost projects (deep water, Canadian oil sands, and the Arctic) and underscores our longer-term expectation for a more sustained increase in oil prices.

Oil Collapse: How It Happened...And How It May Play Out

In August 2014, after approximately three years of relative stability, crude oil markets began to selloff in recognition of unrelenting U.S. domestic oil production growth—previously camouflaged by a wave of unplanned production outages throughout the Middle East—lowered expectations for global worldwide demand, and a perception of lower geopolitical risk. The selloff accelerated as core OPEC's abandonment of its historical market-balancing role as *the* swing producer gained traction, ultimately culminating in its “no-cut” production decision rendered on Thanksgiving 2014. While the industry has been quick to adjust capital spending in response to the oil price selloff, high storage inventories and backlogs of uncompleted wells are likely to keep pressure on prices in the near term. Storage overhang aside, we believe the oil price mechanism is working, and the sharp decline in drilling rig counts and sizeable capital curtailment will likely prove successful in “bending the production curve,” balancing crude output with demand, and driving prices toward the marginal cost of global production in late 2015 or 2016.

Herein lies the trickier proposition, as the global cost curve has been disrupted by the deflationary influence of shale plays and remains very much in transition, with

continued gains in shale drilling productivity and efficiency equating to secular reductions in drilling costs and better well economics. In short, the global crude oil cost curve is moving lower. In our view, the marginal cost of global production going forward will be dictated by the most economic shale assets, which we currently observe to be somewhere in the high \$60s / low \$70s, although rapidly declining drilling and well servicing costs render this calculation imperfect.

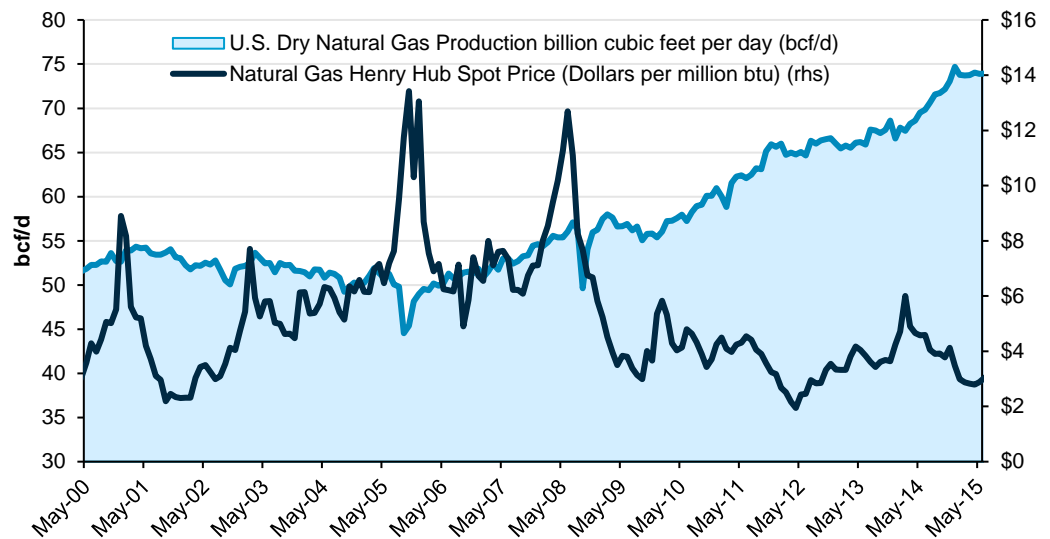
Once the oil market returns to balance, however, the forward price picture becomes murkier, as incremental drilling and production from short-cycle shales are likely to limit sustained price movements higher in the shorter-run. But there are limitations on the market's ability to efficiently transfer large amounts of share to shale from higher-cost production mediums, underscoring our view that oil prices must eventually move higher. Wildcards to achieving market balance include incremental supply from Iran in the event of sanction relief and/or a shift in global demand, both of which could extend the timeframe necessary to achieve oil market equilibrium.

The United States is currently the largest producer of hydrocarbons in the world—even larger than Saudi Arabia and Russia—as measured by combined oil and gas output.

The Shale Gale: Multi-Year North American Supply Growth Saturates Global Markets

The technologies that facilitated the U.S. shale oil transformation (hydraulic fracturing, horizontal drilling, and advanced micro-seismic modeling) were previously applied to natural gas drilling. Successful experimentation facilitated by high natural gas prices in the mid 2000s (natural gas prices averaged \$8.00/mcf¹ between 2004 and 2008) led to the economic extraction of previously unrecoverable resource, predominantly in Texas, Louisiana, western Pennsylvania, and the U.S. Rocky Mountains. The widespread application of this technology and the efficacy of hydraulic fracturing in the 2004-2010 timeframe produced a surge in U.S. gas output and the resultant collapse of regional gas prices into the \$2-4/mcf range, from which the market has not yet recovered.

SURGING NORTH AMERICAN GAS PRODUCTION DEPRESSES PRICES

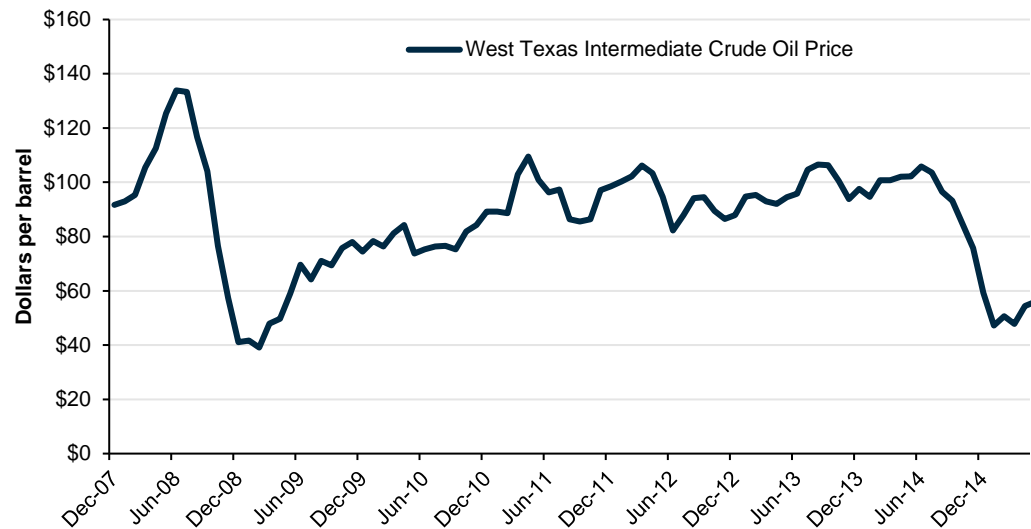


Source: U.S. Energy Information Administration as of May 2015

The deflationary influence of new extraction technologies in the U.S. gas market is analogous to the recent decline in global crude prices, seen in the following chart, with certain caveats. Notably, drilling economics have benefited from high oil prices and the production of associated liquids (the presence of ethanes, propanes, and natural gasolines may greatly enhance the value of production relative to a “dry” natural gas well). In addition, the development of the Appalachia region, a world class gas basin with tremendous economics and scale, and broad-based advancements to shale technology itself also contributed to improved drilling economics. Finally, it should be noted that U.S. gas is priced in a regional market, largely agnostic to the supply and demand fundamentals in the rest of the world.

¹ mcf equals 1,000 cubic feet

A VOLATILE SPAN FOR OIL PRICES

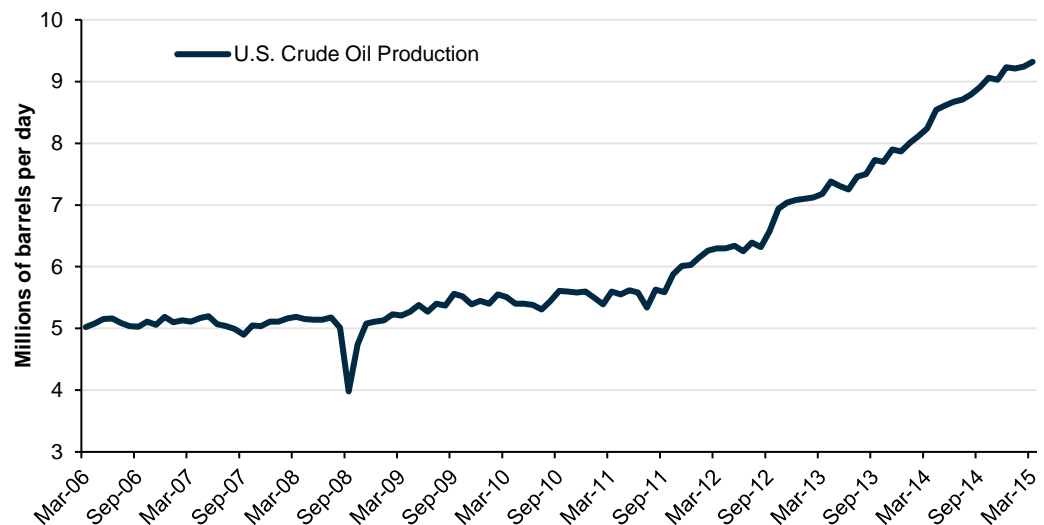


Source: U.S. Energy Information Administration as of May 2015

America...The Oil Producer?

As global commodity demand and oil prices recovered following the Great Recession in 2008/2009, shale-focused oil and gas producers responded in kind. Oil production in the United States grew from roughly 5.3 million barrels per day (bbl/d) in 2009 to approximately 9.4 million bbl/d by the end of 2014. U.S. oil output is now at the highest level since the early 1980s, and the United States is currently the largest producer of hydrocarbons in the world—even larger than Saudi Arabia and Russia—as measured by combined oil and gas output.

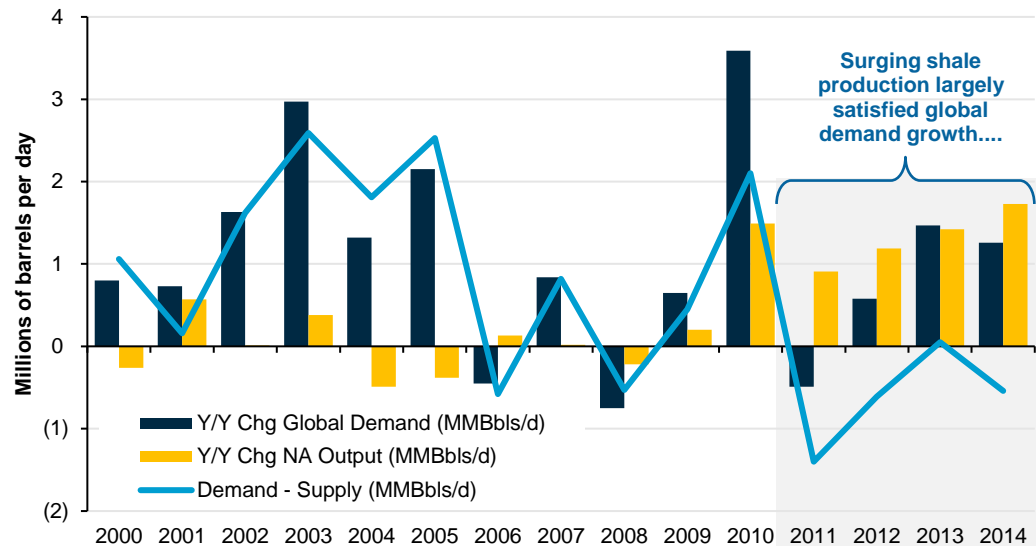
EXPLOITATION OF SHALE JUMPSTARTS U.S. OIL PRODUCTION



Source: U.S. Energy Information Administration as of May 2015

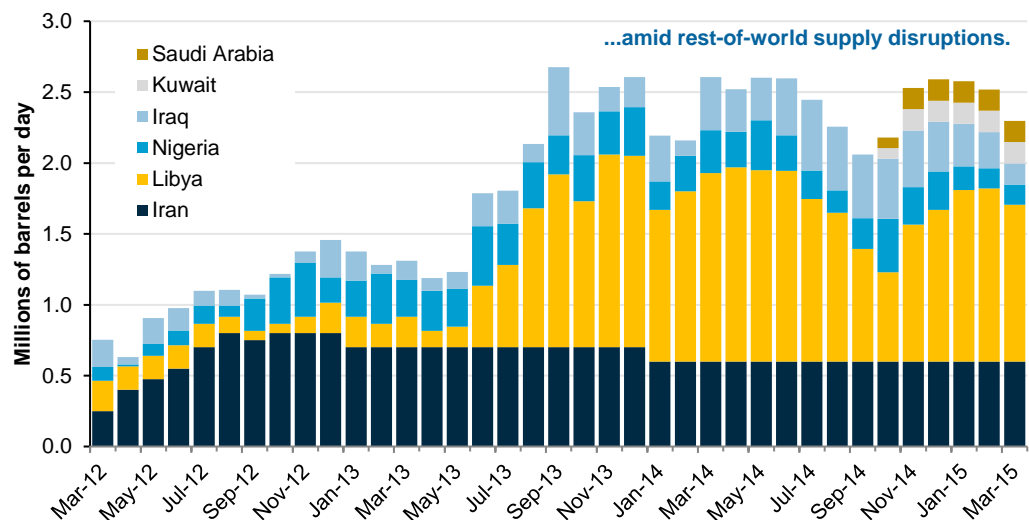
Concurrent with the growth in North American (NA) shale production was considerable unplanned production outages in large OPEC countries, particularly Iran, Iraq, and Libya. Unplanned supply outages jumped in 2011 following conflict in Libya, eventually peaking between 2.0 to 2.5 million barrels per day for much of 2013 and early 2014 (illustrated in the following charts), which masked the multi-year surge in NA oil output and allowed global crude prices to remain in a rangebound, albeit elevated, level. The lengthy period of elevated prices facilitated the discovery, development, and refinement of U.S. drilling and fracturing technology, which may have otherwise not occurred.

THE GLOBAL CRUDE SUPPLY/DEMAND BALANCE



Source: BP Statistical Review and Bloomberg as of December 2014

UNPLANNED OPEC PRODUCTION OUTAGES MASKED NA PRODUCTION GROWTH



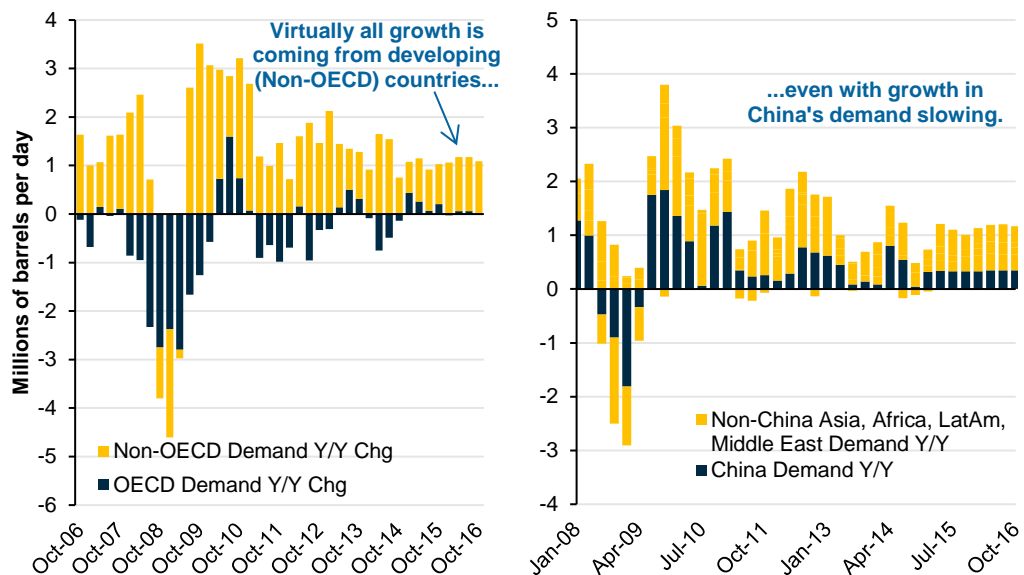
Source: Energy Information Administration Short-Term Energy Outlook, April 2015

As an aside, an interesting consideration is how high oil prices may have been in the absence of NA shale oil (very high, we think). As usual, it takes a confluence of factors to burst a bubble. The return of certain OPEC production in mid-2014 (primarily Libya), coupled with weaker-than-anticipated global demand signals, a strengthening U.S. dollar, some seasonal weakness for crude demand, and a historic decision by Saudi Arabia to “pump away” conspired to unmask the relentless growth of NA crude oil supply and the resultant global oversupply of crude oil in the Fall of 2014.

Demand a Factor, Too

Not to be overlooked is the role of demand in the current oversupply situation. While the growth in shale output grabs most of the headline attention and weaker demand was not *the* triggering factor to the 2014 price collapse, weakening oil demand over the past several years has certainly been a contributing factor. Several years of flattish demand in developed markets, European economic stagnation (cyclical), and continued gains in transportation fuel efficiency (secular), has magnified the importance of Asia to global crude demand calculations. A slower rate of growth in crude demand from important oil consumers, most prominently China, established a multi-year headwind for crude oil markets. While an uptick in demand is not likely to solve the global crude imbalance, it could certainly be exacerbated by another structural downshift in demand.

**TEPID GROWTH IN
GLOBAL, CHINESE
DEMAND***

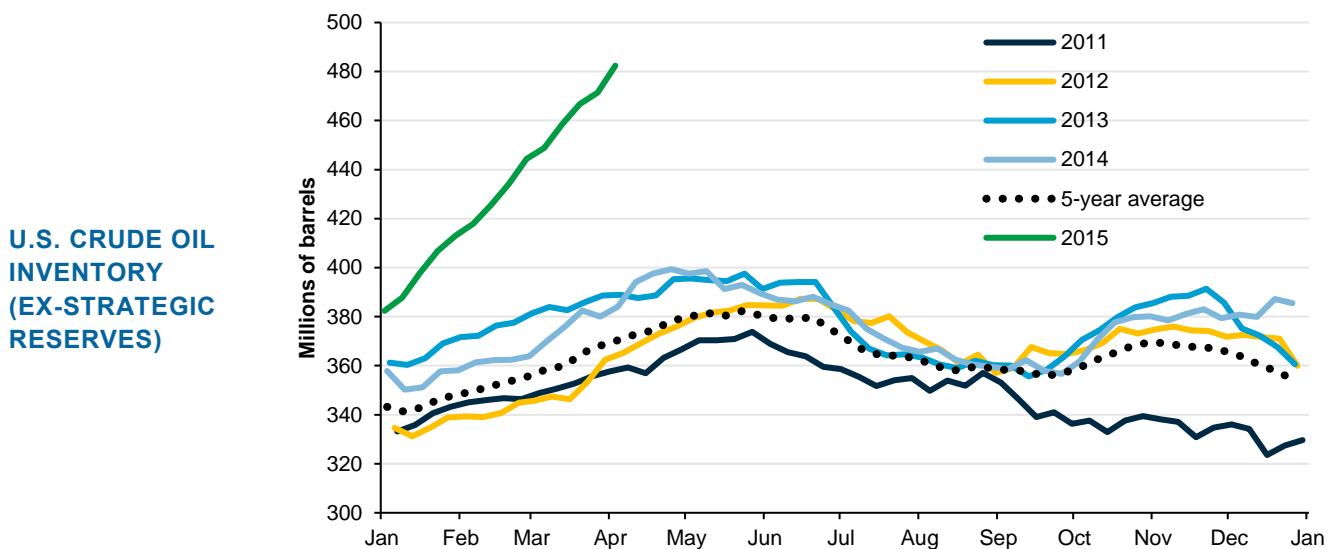


Source: U.S. Energy Information Administration as of May 2015. *OECD, non-OECD demand through October 2016 are estimates. For informational purposes only. There is no guarantee that these estimates will be achieved

Too Much of a (Formerly) Good Thing? Store It

Practically, production response lags changes in the drilling rig count. So while the U.S. rig count is down by nearly half from Fall 2014 levels, headline U.S. production numbers remain above prior-year levels and crude oil-in storage has surged to historically high levels. U.S. crude inventories (ex-Strategic Petroleum Reserve) are more than 30% above the five-year average and inventories at the Cushing, OK, delivery point for West Texas Intermediate Crude (WTI) are roughly 65% above the five-year average. Gulf Coast and Midwest storage levels are also well above normal levels. Storage builds are further encouraged by the steep “contango” shape of the crude oil forward price curve (upward sloping).

If bloated storage levels were to reach effective capacity (Fall 2015 refinery turnarounds represent a potential flashpoint), or bloated crude storage shifts to bloated refined product levels, downward pressure on the spot price for WTI oil could be very severe (perhaps forcing oil prices briefly toward cash operating costs for more expensive NA projects). In addition, there is a deep and growing inventory of drilled, but not yet completed, wells that could be quickly activated in a more favorable price environment and may further delay the production response needed to balance oil markets.



Source: U.S. Energy Information Administration as of April 2015

OPEC, Where Art Thou?

Historically, OPEC (effectively the Saudis) has acted as the global crude balancer, rationalizing its own output to preserve market equilibrium. To date, OPEC / Saudi have been unwilling to taper supply in response to weaker fundamentals, instead choosing to sustain output in support of market share. Many have postulated on the rationale for OPEC inaction, with reasons ranging from various political motivations (to intensify isolation of Iran and Russia, for example) to a “War on Shale.” At this juncture, we see two conditions precedent before any OPEC supply curtailment is considered, if ever; 1) OPEC cooperation (thus far elusive); and 2) clear line-of-sight to economic payback.

With the high likelihood that OPEC supply rationalization simply cedes higher-valued market share to U.S. shale producers, we see voluntary OPEC output cuts as unlikely in the short-run and probably the medium-term. Notably, secular cost reductions in global oil field services, coupled with the deflationary impact of ever-improving shale oil extraction techniques creates a serious dilemma for the producer set whose production costs are fiscally-anchored and not easily adjusted (i.e. Saudi Arabia and Russia). An additional consideration is the implication of OPEC fracture itself; without a cohesive conglomerate capable of influencing global oil prices, it appears to us that countries are now incited to act in their own self interest. For many, the clear implication would be to pump as much as possible, an obvious headwind to future OPEC cooperation and for future global crude balances.

Back to the Future: Lower Highs and Lower Lows?

Specific to U.S. shale, although it gets all the attention as it requires the shortest lead time capital and has contributed nearly all of the non-OPEC supply growth since 2010, shale is not the most expensive barrel in the industry. This in and of itself creates an interesting question regarding future crude production; would a super-major prefer a multi-billion dollar, long-lead time project in a foreign jurisdiction, or a shorter-cycle U.S.-domiciled shale asset with the ability to quickly adjust capital allocation to the oil price environment? As an aside, if one assumes that the world needs the 4.5 to 5.0 million barrels per day of U.S. shale oil currently flowing, one may conclude that ultimate settling price for oil must be a level that accommodates the economics of the highest quality shale assets.

There are many projects in the world (Canadian oil sands, the Arctic, portions of the North Sea, and certain deepwater offshore drilling projects) that have higher cost structures than many U.S. shale operators. The “fiscal break evens” of many petroleum producing nation-states are much higher than many shale producers. However, shale is unique in that the wells represent a very short-cycle type of production that delivers high initial productivity, but very high decline rates (sometimes 80% in the first year). U.S. shale producers now have a “just-in-time” business model relative to the long-lead time projects that for decades have dominated the portfolios of international oil companies. Most long-lead time, multi-billion dollar development projects appear increasingly disadvantaged relative to shale, which can react more quickly to the commodity price environment. Of course, lower prices are likely to shake-out marginal operators and marginal acreage, underscoring our expectation for greater industry capital efficiency going forward (a fairly low bar, as it stands).

A forward view on global crude oil prices must recognize the advent of U.S. shale output and account for the massive cost deflation and technological innovation underpinning its rapidly evolving drilling economics and, to a lesser extent, other producing mediums, including offshore wells. Experience in the natural gas market may prove illustrative. Post-2008, nearly any upward movement in U.S. gas prices beyond the mid \$3/mcf level has been met with a rapid supply response, as producers add rigs and lock-in forward production economics in the futures market. We believe a similar dynamic could take hold in the oil markets, with producers quickly adding rigs as prices become economic. With cost structures being driven lower by decreased materials, fuel, labor, and equipment costs, we expect many operators may now achieve fairly attractive returns in the \$60-75/bbl range, and a price move in long-dated futures above this level would result in drilling rigs being quickly added with the economics “locked in” by hedges. Thus, barring a geopolitical event (not an insignificant risk), we do not view a return to \$90-100/bbl oil as likely anytime soon.

Conclusion

The arrival and subsequent exploitation of U.S. shale has disrupted oil market equilibrium, ushering in a period of global oil abundance. Further, the unique production characteristics of shale, most notably the shorter-cycle nature of shale output and continued improvement in drilling productivity, have profound implications for global oil markets. These factors are contributing to a downshift in the global oil supply cost curve, particularly in the short-run.

Bloated crude oil storage and a deep and growing inventory of drilled, but uncompleted wells present near-term headwinds to rising crude oil prices, although a persistently low oil-price environment breeds underinvestment in higher-cost projects and underscores our longer-term expectation for a more sustained increase in oil prices.

From an investment perspective, we believe navigating these changes requires an established, consistent process of allocating capital to borrowers with the most attractive asset mix. No substitute exists for rigorous, field-level evaluation of drilling economics, encompassing well behavior over multiple time-periods, repeatability of well performance, field and corporate cost structures, and capital requirements and associated capital accessibility. Combined, a dynamic assessment of cash-flow sensitivities to various commodity price scenarios is an absolute prerequisite to an informed investment process capable of consistently generating alpha across market conditions.

As the newfound dynamics of oil supply become more apparent, so too will the value of scale within the energy sector. Not only will high-quality assets ultimately find strong balance sheets, but investors will also likely place heightened emphasis on these assets when deploying capital to a sector adjusting to the surplus of crude oil.

NOTICE

Source(s) of data (unless otherwise noted): Prudential Fixed Income as of May 2015.

PGIM Fixed Income operates primarily through PGIM, Inc., a registered investment adviser under the U.S. Investment Advisers Act of 1940, as amended, and a Prudential Financial, Inc. ("PFI") company. PGIM Fixed Income is headquartered in Newark, New Jersey and also includes the following businesses globally: (i) the public fixed income unit within PGIM Limited, located in London; (ii) PGIM Japan Co., Ltd. ("PGIM Japan"), located in Tokyo; and (iii) the public fixed income unit within PGIM (Singapore) Pte. Ltd., located in Singapore. Prudential Financial, Inc. of the United States is not affiliated with Prudential plc, which is headquartered in the United Kingdom. Prudential, PGIM, their respective logos, and the Rock symbol are service marks of PFI and its related entities, registered in many jurisdictions worldwide.

These materials are for informational or educational purposes only. The information is not intended as investment advice and is not a recommendation about managing or investing assets. In providing these materials, PGIM is not acting as your fiduciary as defined by the Department of Labor. These materials represent the views, opinions and recommendations of the author(s) regarding the economic conditions, asset classes, securities, issuers or financial instruments referenced herein. Distribution of this information to any person other than the person to whom it was originally delivered and to such person's advisers is unauthorized, and any reproduction of these materials, in whole or in part, or the divulgence of any of the contents hereof, without prior consent of PGIM Fixed Income is prohibited. Certain information contained herein has been obtained from sources that PGIM Fixed Income believes to be reliable as of the date presented; however, PGIM Fixed Income cannot guarantee the accuracy of such information, assure its completeness, or warrant such information will not be changed. The information contained herein is current as of the date of issuance (or such earlier date as referenced herein) and is subject to change without notice. PGIM Fixed Income has no obligation to update any or all of such information; nor do we make any express or implied warranties or representations as to the completeness or accuracy or accept responsibility for errors. **Your capital is at risk and the value of investments can go down as well as up. These materials are not intended as an offer or solicitation with respect to the purchase or sale of any security or other financial instrument or any investment management services and should not be used as the basis for any investment decision. No risk management technique can guarantee the mitigation or elimination of risk in any market environment. Past performance is not a guarantee or a reliable indicator of future results and an investment could lose value. No liability whatsoever is accepted for any loss (whether direct, indirect, or consequential) that may arise from any use of the information contained in or derived from this report. PGIM Fixed Income and its affiliates may make investment decisions that are inconsistent with the recommendations or views expressed herein, including for proprietary accounts of PGIM Fixed Income or its affiliates.**

The opinions and recommendations herein do not take into account individual client circumstances, objectives, or needs and are not intended as recommendations of particular securities, financial instruments or strategies to particular clients or prospects. No determination has been made regarding the suitability of any securities, financial instruments or strategies for particular clients or prospects. For any securities or financial instruments mentioned herein, the recipient(s) of this report must make its own independent decisions.

Conflicts of Interest: PGIM Fixed Income and its affiliates may have investment advisory or other business relationships with the issuers of securities referenced herein. PGIM Fixed Income and its affiliates, officers, directors and employees may from time to time have long or short positions in and buy or sell securities or financial instruments referenced herein. PGIM Fixed Income and its affiliates may develop and publish research that is independent of, and different than, the recommendations contained herein. PGIM Fixed Income's personnel other than the author(s), such as sales, marketing and trading personnel, may provide oral or written market commentary or ideas to PGIM Fixed Income's clients or prospects or proprietary investment ideas that differ from the views expressed herein. Additional information regarding actual and potential conflicts of interest is available in Part 2A of PGIM Fixed Income's Form ADV.

In the United Kingdom and various European Economic Area ('EEA') jurisdictions, information is issued by PGIM Limited with registered office: Grand Buildings, 1-3 Strand, Trafalgar Square, London, WC2N 5HR. PGIM Limited is authorised and regulated by the Financial Conduct Authority of the United Kingdom (registration number 193418) and duly passported in various jurisdictions in the EEA. These materials are issued by PGIM Limited to persons who are professional clients or eligible counterparties for the purposes of the Financial Conduct Authority's Conduct of Business Sourcebook. In certain countries in Asia, information is presented by PGIM Singapore, a Singapore investment manager registered with and licensed by the Monetary Authority of Singapore. In Japan, information is presented by PGIM Japan, registered investment adviser with the Japanese Financial Services Agency. In South Korea, information is presented by PGIM, Inc., which is licensed to provide discretionary investment management services directly to South Korean investors. In Hong Kong, information is presented by representatives of PGIM (Hong Kong) Limited, a regulated entity with the Securities and Futures Commission in Hong Kong to professional investors as defined in Part 1 of Schedule 1 of the Securities and Futures Ordinance.

© 2017 PFI and its related entities.