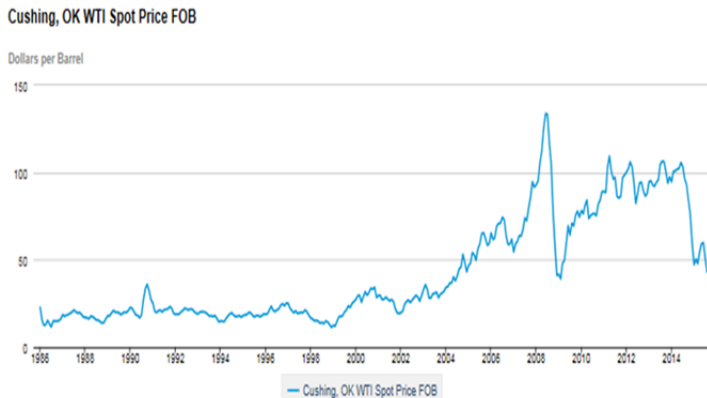


## Crude Oil Markets: 2016 and Beyond

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### 1. Oil Prices Are Volatile & Difficult to Forecast



Crude oil prices have been more volatile this year than at any time since the financial crisis of 2008. Volatility is a major concern for active portfolio managers as it reflects on the stability of the markets. Periods of high volatility tend to be associated with periods of high systemic risk to the system, with unforeseen and unpredictable events. The U.S. Commodity Futures Trading Commission last month revealed that there have been 35 “flash crashes” in American oil markets alone so far in 2015 – making price forecasting all that more difficult.

#### A Ticket to Fortune?

##### Marginal & High Cost Unconventional (Shale) Reserve Field Economics

CASE 1: 5 year field life with oil price and production constant

	2015	2016	2017	2018	2019	2020	2021		
Revenues	\$50	\$50	\$50	\$50	\$50	\$50	\$0		
Expenses	\$49	\$49	\$49	\$49	\$49	\$49	(\$10)	(well is depleted)	
cash flow	\$1	\$1	\$1	\$1	\$1	\$1	(\$10)	(plugging cost)	
Sum of cash flow:	(\$4)		(undiscounted)						

CASE 2: 5 year field life with oil price increasing and production constant

	2015	2016	2017	2018	2019	2020	2021		
Revenues	\$50	\$55	\$60	\$65	\$70	\$75	\$0		
Expenses	\$49	\$49	\$49	\$49	\$49	\$49	(\$10)	(well is depleted)	
cash flow	\$1	\$6	\$11	\$16	\$21	\$26	(\$10)	(plugging cost)	
Sum of cash flow:	\$71		(undiscounted)						

Oil price forecasts are incredibly important since the ultimate valuation of oil and gas properties are a function of cash flow. Capital expenditure decisions are made based on financial models and pricing assumptions. Many older fields, and new ‘unconventional’ shale reserves, are more costly to develop – so pricing assumptions are critical.

Note, however, that an increasing oil price can be ‘*a ticket to a fortune*’ for oil and gas operators and shareholders (Case 2).

### 2. Energy Use Correlates With Economic Growth

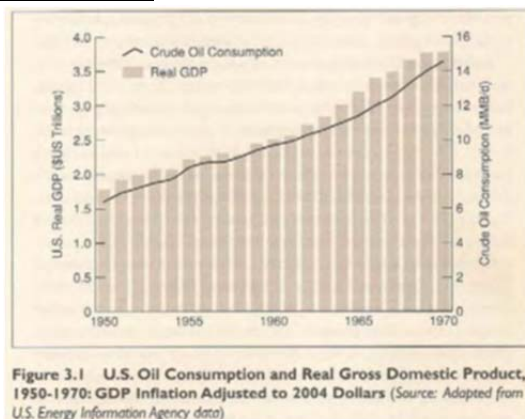
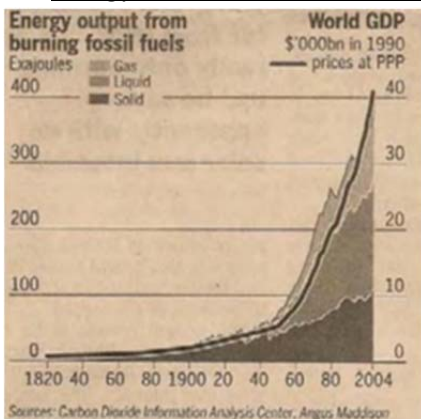
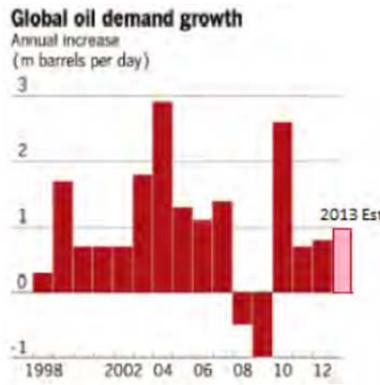
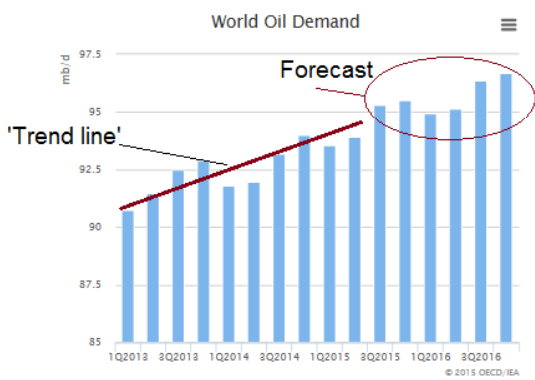


Figure 3.1 U.S. Oil Consumption and Real Gross Domestic Product, 1950-1970: GDP Inflation Adjusted to 2004 Dollars (Source: Adapted from U.S. Energy Information Agency data)

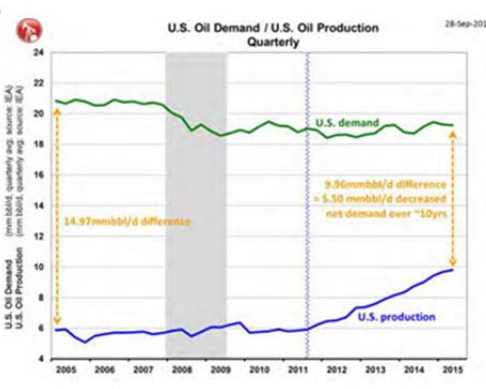
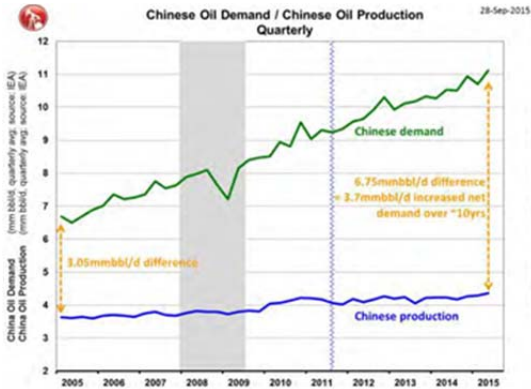
Longer term there is an incredibly close correlation between economic growth and energy use. If the global economy is going to grow we will consume more energy. While alternative fuels will add to supplies over the next several decades conventional fuels will provide most of the incremental energy supplies we need.

### 3. Global Demand Growth is Relentless



Over the last four decades we have had only two years that global oil demand has decreased – during the Great Recession. Ninety-five percent of the time demand increases year over year to record consumption levels. On average global demand growth is roughly 1 million barrels per day per year – or roughly 1.2% compounded.

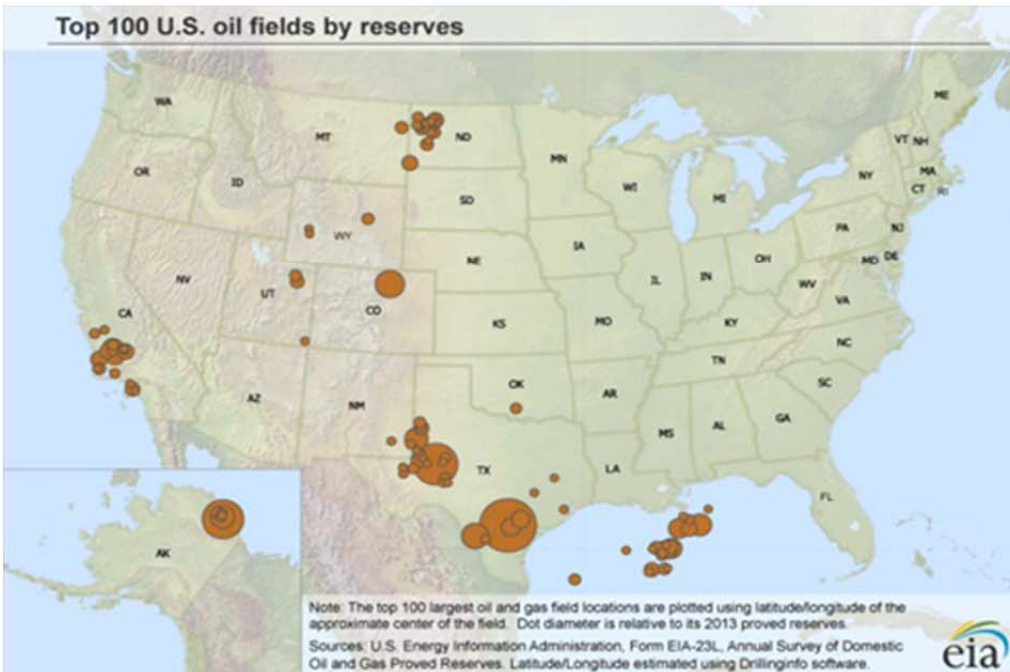
### 4. Developing Economies Account For Much of the Demand Growth



Demand from developing economies, especially China, has increased much faster than in the developed economies. This trend should continue as developed economies have experienced a period of relatively slow economic growth compared to historic norms.

### 5. 'Tight' Unconventional Shale Reserves Have Revolutionized the Oil Market

Production from shale reserves has exploded since 2008 – and now accounts for roughly 50% of U.S. oil production. The Eagle Ford field in South Texas is now the largest oil field by proven reserves in the U.S. – and it was not even in the top 100 fields five years earlier! Note that four of the top 10 fields are in Texas



U.S. tight oil production  
million barrels of oil per day

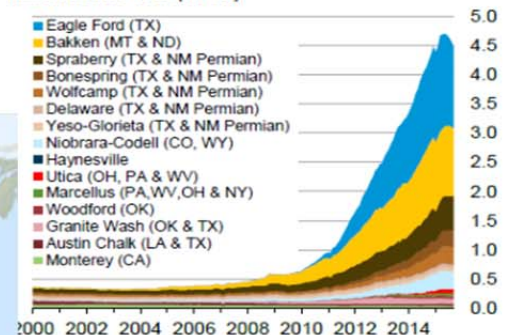


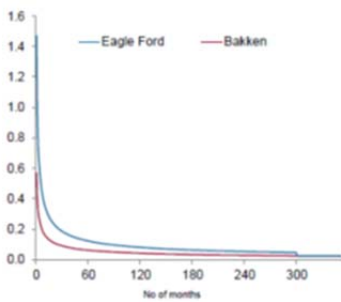
Table 1. Top 100 U.S. oil fields as of December 31, 2013

thousands of barrels of 42 U.S. gallons

2013 Rank	Field Name	Location
★ 1	EAGLEVILLE (EAGLE FORD SHALE)	TX
★ 2	SPRABERRY TREND AREA	TX
3	PRUDHOE BAY	AK
4	WATTENBERG	CO
★ 5	BRISCOE RANCH (EAGLE FORD SHALE)	TX
6	KUPARUK RIVER	AK
7	MISSISSIPPI CANYON BLK 778 (THUNDER HORSE)	Fed Gulf
★ 8	WASSON	TX
9	BELRIDGE SOUTH	CA
10	GREEN CANYON BLK 699 (ATLANTIS)	Fed Gulf

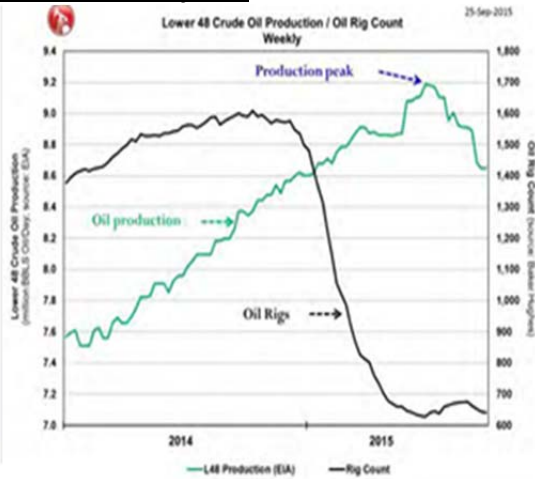
## 6. Unconventional Well Production Declines Very Fast

Type curve in shale basins  
mb/d

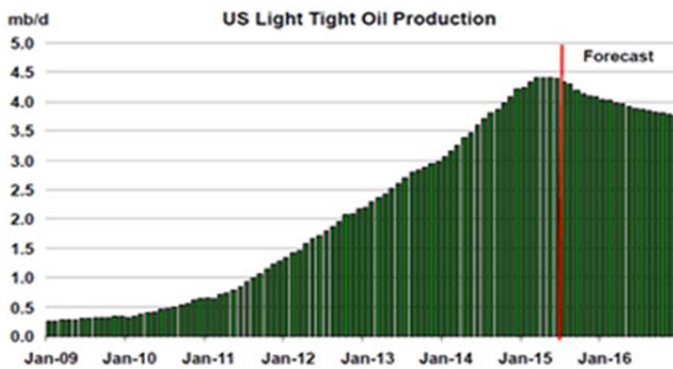


Decline rates at liquid plays are extremely steep, and can range between 50-70% after the first year

Source: American oil and gas reporter, Energy Aspects analysis



The 'decline rate' for wells drilled into unconventional shale formations is very steep compared to conventional wells. As such once drilling slows production will fall off quickly even with the constant advances in efficiency and technology. The U.S. drilling rig count is down 60% from year earlier levels (Nov. 15<sup>th</sup>) and the Canadian rig count decreased a similar amount. U.S. oil production has begun to 'roll over' to the downside.

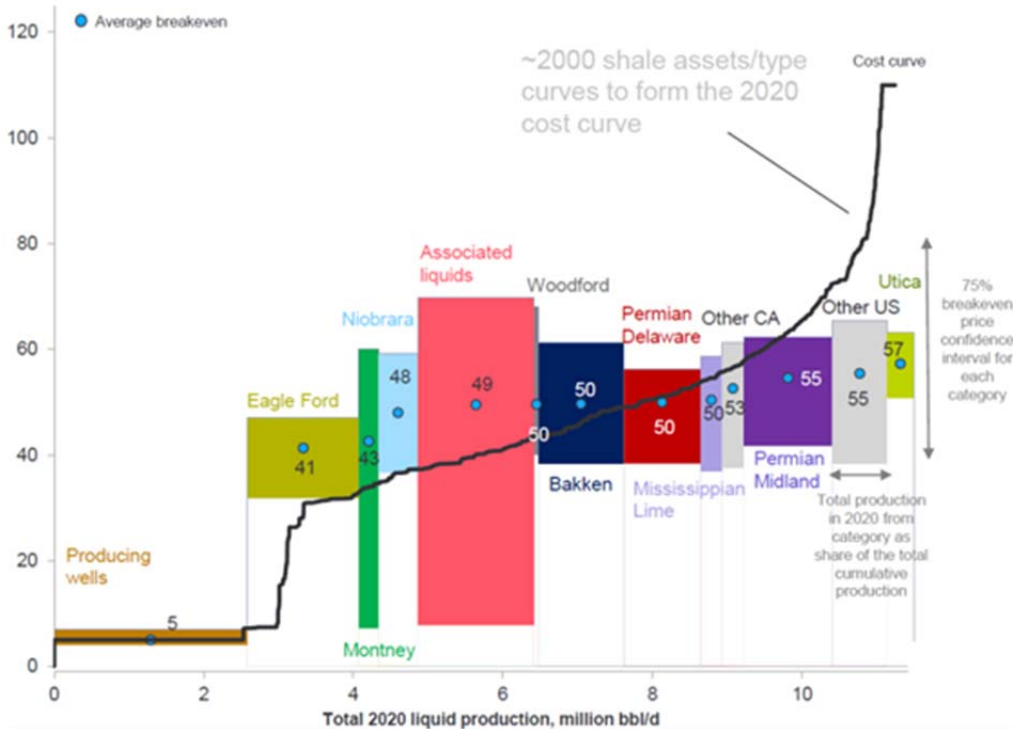


The average shale formation in the U.S. roughly requires crude oil at \$65 a barrel or better to justify the economics of development. At \$45 a barrel the resources won't be developed and the decline curves will quickly shrink production.

The U.S. is the incremental global producer, so the falling supply and rising demand should in the near future but a floor under crude oil prices. Data from Morgan Stanley

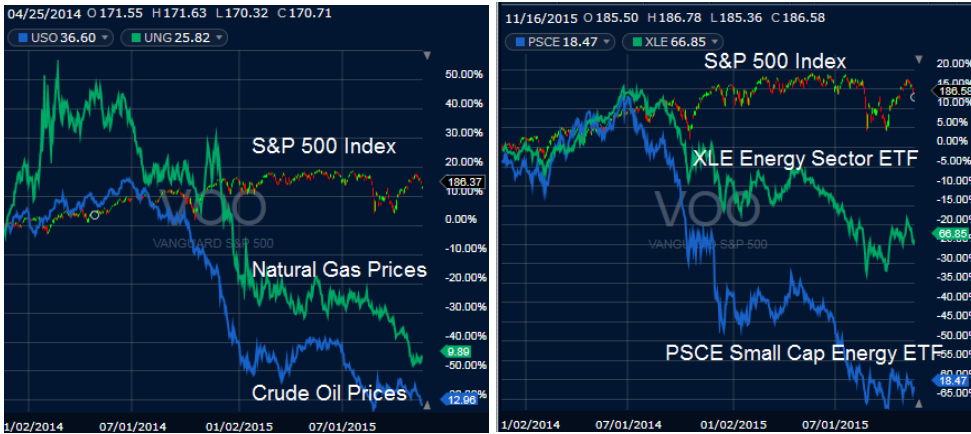
## 7. Unconventional Wells Are High-Cost Reserves

NA shale liquid supply cost curve  
WTI USD/bbl



With production from conventional oil reserves declining at roughly 5% per year and unconventional shale reserves declining at a multiple of that rate new capital will not be employed unless investors expect a return on their investment. Note that according to some estimates unconventional shale wells need an average of \$65 per barrel to break even – so until oil prices approach that level expect drilling activity to remain muted in most basins. Note also that once the sunk cost of drilling as well have been expended that the cost of operating a producing well is very low – so regardless of how low oil prices may fall few wells will be shut in for economic reasons.

## 8. Investors Figured Out How Lower Commodity Prices Impact Valuations



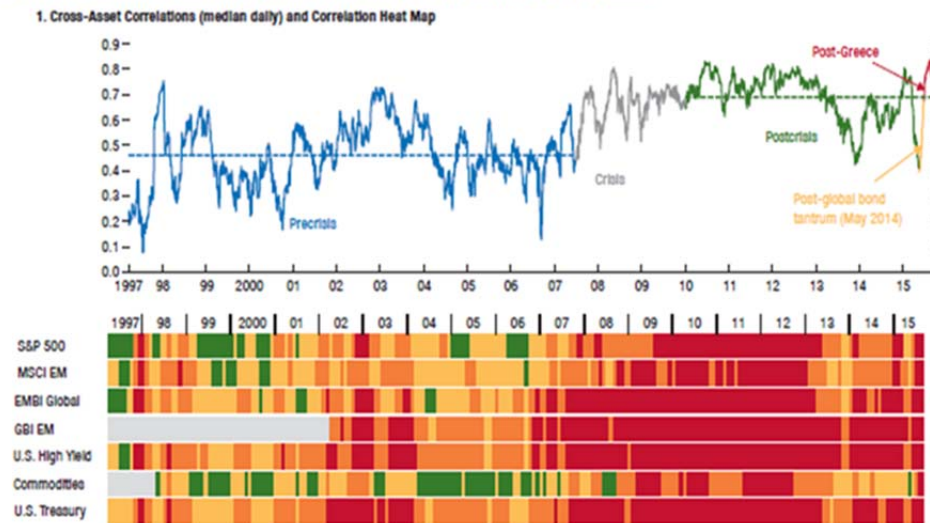
Both crude oil and natural gas prices have declined substantially over the last two years – and with them the valuation of many energy related stocks.

Energy sector investors have had a very difficult time tracking the S&P 500 index – considered a benchmark for many portfolios – regardless of the skill of the active manager.

## 9. Markets Are Increasingly Correlated – Making Active Portfolio Management Less Productive

Figure 1.17. Potential Amplifiers of Market Stress

Asset correlations have increased in the postcrisis era, reflecting a rise across most major asset classes.



Sources: Bank of America Merrill Lynch; Bloomberg, L.P.; and IMF staff estimates.

Note: The correlation index summarizes the median daily cross-asset correlations of Sharpe ratios across all of the following asset classes: U.S. Standard & Poor's 500, MSCI Emerging Markets, U.S. Treasuries, EMBI Global Bond Index, GBI Emerging Markets Bond Index (local currency), U.S. High Yield, and Commodities. The heat map displays the underlying median correlation for each of the seven asset classes against the remaining six asset classes. The correlation of U.S. Treasuries, being a "risk-free" asset, is expressed in absolute terms, as it is typically negative vis-à-vis risk. Correlation key: green 0.00–0.30; yellow 0.31–0.50; orange 0.51–0.65; and red 0.66–1.00.

The IMF chart at left indicates something rather bizarre is happening in the markets. Between 1997 and 2007 the level of correlation between the major asset classes was around 45 per cent - roughly in line with historic norms. Markets occasionally swung in tandem with each other (say, during the crisis of 1998), but generally did not. During the crisis of 2008-09, correlation jumped to 80 per cent. No surprise there: history shows that a crash is usually accompanied by high correlations as investors panic — and sell. What is fascinating is the experience of the past five years. Since 2010, the sense of market crisis has ebbed and many asset prices have soared. But correlation has not fallen, as in the past; instead, it has averaged about 70 per cent, almost twice the pre-crisis level.

## 10. SMU Spindletop Student Managed Fund Portfolio

MUSTANG SPINDLETOP INVESTMENT FUND				Spindletop Portfolio								
Vertical	Ticker	Day % Change	Day \$ Change	Total % Gain/Loss	Total \$ Gain/Loss	Purchase Price	Current Price	# of Shares	Market Value	Cost Basis	Distributions	
Upstream	FANG	1.80%	\$122.00	18.74%	\$1,230.00	\$85.64	\$77.94	100	\$7,794.00	\$8,564.00		
	PE	2.19%	\$138.00	3.61%	\$221.00	\$18.00	\$18.85	340	\$8,341.00	\$8,120.00		
Midstream	EPD	2.38%	\$122.00	-4.48%	-\$248.00	\$27.68	\$28.44	200	\$5,288.00	\$5,538.00	\$78.00	
	VLO	0.32%	\$15.40	2.38%	\$112.70	\$87.57	\$89.18	70	\$4,842.80	\$4,729.90	\$28.00	
Downstream	PSX	0.78%	\$47.80	7.30%	\$427.70	\$83.65	\$89.78	70	\$8,283.20	\$5,855.50		
	OFS	-0.78%	-\$15.50	-0.31%	-\$6.20	\$6.41	\$8.39	310	\$1,980.90	\$1,887.10		
Power	AEP	0.74%	\$32.80	-0.63%	-\$28.00	\$55.82	\$55.47	80	\$4,437.80	\$4,485.80	\$42.40	
Day Gain/Loss:		\$460.30						Totals:		\$36,967.30	\$35,258.10	

Conclusion: The general takeaways from all the data can be summarized as follows:

- Global demand for crude oil is increasing relentlessly, roughly 1% per year compounded
- Energy use correlates closely with economic growth
- Developing economies are growing much faster than developed economies - developing countries are much less energy efficient
- Supplies of crude oil are highly dependent on capital expenditures. A reduction in capital spent for development will lead to a decline in output and capacity. In the case of unconventional shale resources this decline will occur very quickly
- Improvements in drilling and development technology and efficiency are continuous – but have failed to keep up with the decline in commodity prices
- Energy development is very capital intensive and is heavily reliant on the capital markets to supply the needed funds to drill and develop
- Volatility, and ‘flash crashes’, have made economic modelling much more difficult. The number of ‘paper barrels’ traded on electronic high frequency trading platforms continues to increase, destabilizing short term market signals
- The current slide in North American drilling rig counts may have a larger impact on production than expected, with crude oil prices possibly spiking upward to reflect the short term shortage in supply. The impact on field and company valuation will be magnified by such price increases – and may be ‘a ticket to a fortune’.
- Longer term proved reserves of conventional and unconventional reserves should be available to meet market demands and they should be developed as economics justify.
- ***With relentless global demand growth, and falling incremental supplies, the price of oil should firm and stabilize at levels substantially higher than the current \$41 per barrel (WTI). Many shale basins become attractive at \$65 a barrel or higher which should provide a long term price floor***

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