

# US Shale Boom: A Case of (Temporary) Indigestion

BlackRock Investment Institute  
**June 2012**

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## So What Do I Do With My Money?™

### Oil and Gas Companies

Our main investment themes are:

- ▶ Energy infrastructure—pipeline operators and companies benefiting from building out the US energy infrastructure.
- ▶ Oil services—especially those with international operations and deep-water expertise.
- ▶ Exploration—particularly in US shale areas, East and West Africa and the Gulf of Mexico.

### Other Companies

Other (long-term) themes include:

- ▶ Rail and barge operators transporting shale oil and gas to market.
- ▶ US-based chemicals makers and manufacturers with a natural cost advantage over EU-based competitors.
- ▶ Trucking companies and engine makers profiting from a long-awaited shift to liquid natural gas.

### Oil and Gas Prices

Today's Brent oil price of around US\$100/barrel appears well-supported given ongoing supply disruptions and political risk in the Middle East. US gas prices should rebound in the medium term, but we favor oil over gas for now.

### Alternative Energy

Developers and operators of wind and solar farms look attractive, whereas most manufacturers of solar panels and wind turbines do not. The latter group is squeezed by intense competition. Investors would do well to closely watch emerging technologies such as nuclear fusion.

### Coal

Prices of coal and coal producers have taken a beating. We understand the reasoning (coal's long-term decline as an energy source), but believe investor sentiment is so overwhelmingly negative that it may set up coal for a reversal. We prefer metallurgical coke over other coal.

*For detailed investment opportunities, please see pages 11-12.*

# First Words and Summary

A glut of cheap US gas from shale rock has taken the world by surprise, and caused even seasoned energy analysts to completely redo their forecasts. The global ramifications are huge. If—and this is a big if—the newfound energy can find its way to market, the US could become an energy exporter by 2030.

This publication discusses the boom's impact on energy prices, producers and services. The picture is not simple and things rarely happen in a straight line. This is true for energy as much as anything else. Our main conclusions are:

- ▶ US oil production is growing thanks to the boom in shale oil—reversing a decline since the early 1970s. Getting the oil to market, however, is a huge challenge. Keeping close tabs on this conundrum can help investors identify opportunities in energy infrastructure. It also gives insights into future price differences between global and US oil prices.
- ▶ Shale reserves abound around the world, with vast deposits in countries such as China, Argentina and Poland. But the scale and speed of the US boom is unique, and cannot be easily replicated elsewhere. Reasons include well-documented and cooperating geology, an experienced and competitive exploration industry, and well-established ownership and property rights.
- ▶ Most energy analysts project a global energy supply gap caused by depletion of traditional oil fields and steady demand. US shale exploration is unlikely to close this gap, we believe.

## BlackRock's Energy Forum

Two dozen leading BlackRock portfolio managers and external experts recently discussed the impact of the US shale oil and gas boom at an event organized by the BlackRock Investment Institute. The boom is transformative and raises the specter of US energy self-sufficiency.

The problem—and opportunity—is getting the energy to market. One veteran energy executive captured this well when he related at the forum how he felt after discovering shale gas in the early 2000s: “The first thing was elation. Five seconds later came: ‘Where is all this gas going to go?’”

In fact, traditional OPEC members are likely to expand their share of world capacity, according to research firm Wood Mackenzie. One big caveat is many energy supply projections assume robust global growth of around 3%—a pretty hefty rate in today's climate, we think.

- ▶ The US is awash in gas, helping knock down US prices to record lows—and below many producers' costs of production. US gas reserves are generally estimated to be ample enough to last a century. Improved drilling techniques could significantly extend this time frame, we think. This raises the prospect of US energy self-sufficiency and may be a boon for energy-intensive industries such as chemicals and heavy manufacturing.
- ▶ The great US gas glut is here to stay. Gas prices in Asia are about seven times higher than in the US, but there is no easy arbitrage yet. Exports require huge investment in liquefying gas and transporting it to market. Companies are slashing capital spending and pulling gas rigs, but we do not yet see a real hit to production and a quick rebound in prices.
- ▶ Deal activity and other indicators (including a 1,000% rise in the price of Indian guar beans used in the process of extracting shale oil and gas) show the boom's intensity. We expect more takeovers in the fragmented industry as many producers are hungry for cash and some risk violating their debt covenants. Private equity funds would be likely buyers because they can afford to take the long view on gas prices.
- ▶ Gas and alternative energy such as wind and solar power will likely replace coal and—to a lesser extent—nuclear energy as top sources of electricity generation in the developed world over the next two decades. We do not believe cheap gas spells the end of alternative energy. Alternatives are starting to compete on price—even without tax incentives in some markets. Some wind farm operators have locked into long-term supply contracts with utilities, still a rarity for gas producers.
- ▶ Politics and public opinion matter. The process of fracturing rock to extract oil and gas from shale has come under fire by environmentalists. They worry about chemical spills, a depleting water supply and the risk of causing (minor) earthquakes. They are pitted against shale industry proponents highlighting job growth and energy security.

# American Exceptionalism



Source: Wood Mackenzie.

US oil production has spiraled upward by 1 million barrels a day (b/d) in the space of just two years. The boom has been driven by improved techniques to extract oil and gas from shale rock formations across the continent. See the map above.

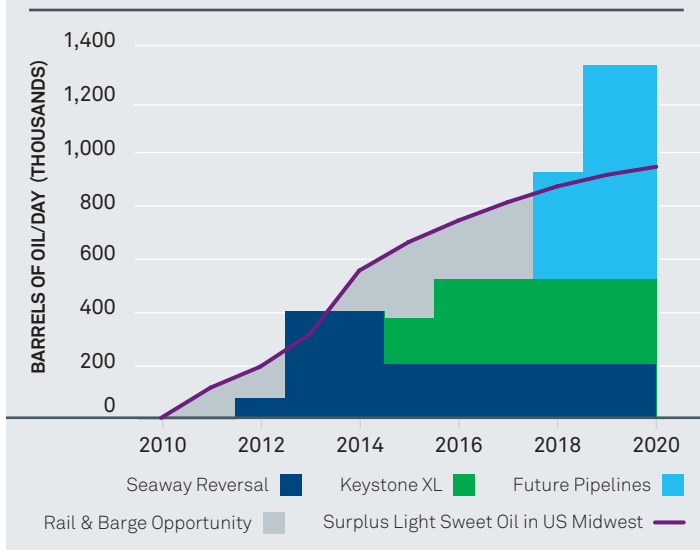
Canadian oil sands, another unconventional (but more expensive) source of energy, are already producing 2 million barrels of oil

equivalent a day (boe/d), and could double production by 2030, according to Wood Mackenzie.

Getting these new sources of supply to market is a big challenge. US pipelines are either at full capacity, going the wrong way or are just not there. Shipping oil by train tells a similar story: Waiting times for cargo space are now as long as 18 months.

## Pipe Dreams?

Projected Impact of Pipelines on US Sweet Oil Flows, 2010–2020



Source: Wood Mackenzie.

Notes: Future pipelines are forecast capacity that is not yet in the project stage. The Keystone XL pipeline is not approved yet.

As a result, oil is piling up in storage tanks in Cushing, Oklahoma, which functions as the pricing point for benchmark US West Texas Intermediate (WTI) oil.

This has depressed WTI prices and established Brent North Sea oil as the international gauge of world oil prices. The flow reversal of a pipeline connecting Cushing to the US Gulf Coast this year should help to reduce the price differential between Brent and WTI, we believe.

Ramped-up oil production, however, will likely cause Cushing to become a bottleneck again in 2013, according to Wood Mackenzie. This could once again crack the Brent-WTI spread wide open. Railway operators and barge shippers could see their businesses boom as companies scramble to get their oil to market. See the chart on the left.

How about exploiting shale formations elsewhere in the world? China, Argentina, Mexico, France and Poland, among others, have large reserves. See the table below. The potential may be there in the long run, but we believe the US shale boom is unique in its size and speed.

The US has well-researched and easily accessible shale rock stuffed with gas and oil, a network of pipelines and plentiful water in most deposits. The US market also boasts a low-cost, expert field of drillers and related service companies, and has clear and long-established rules for using land for exploration. No other country has all these elements in place. Bottom line: The US shale experience cannot be easily replicated elsewhere.

## A Gassy World

Technically Recoverable Natural Gas Resources

	Total in trillion cubic meters (tcm)		Unconventional (tcm)		
	Conventional	Unconventional	Tight Gas	Shale Gas	Coalbed Methane
E. Europe/Eurasia	131	43	10	12	20
Middle East	125	12	8	4	–
Asia/Pacific	35	93	20	57	16
OECD Americas	45	77	12	56	9
Africa	37	37	7	30	–
Latin America	23	48	15	33	–
OECD Europe	24	21	3	16	2
<b>World</b>	<b>421</b>	<b>331</b>	<b>76</b>	<b>208</b>	<b>47</b>

Source: International Energy Agency World Energy Outlook 2012.

Note: Forecasts as of May 2012.

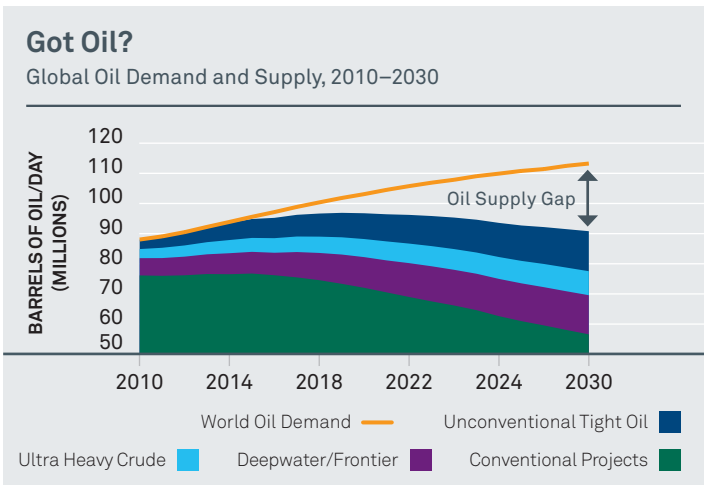
# Painting the Oil Landscape

Despite the well-documented frenzy, US shale oil is not affecting world markets. In fact, the Organization of the Petroleum Exporting Countries (OPEC) is expected to increase its share of global supply to 45% by 2030, from around 43% now, according to Wood Mackenzie. Saudi Arabia is adding capacity, and Iraq has the potential to crank up production significantly.

Meeting oil demand growth is expected to be a challenge. Wood Mackenzie, for one, forecasts a supply gap of 20 million b/d by 2030 that will need to be bridged by yet-to-be-discovered resources. See the chart on the right. Keep in mind this model is heavily dependent on a rosy scenario of global economic growth of 3.2% to drive demand.

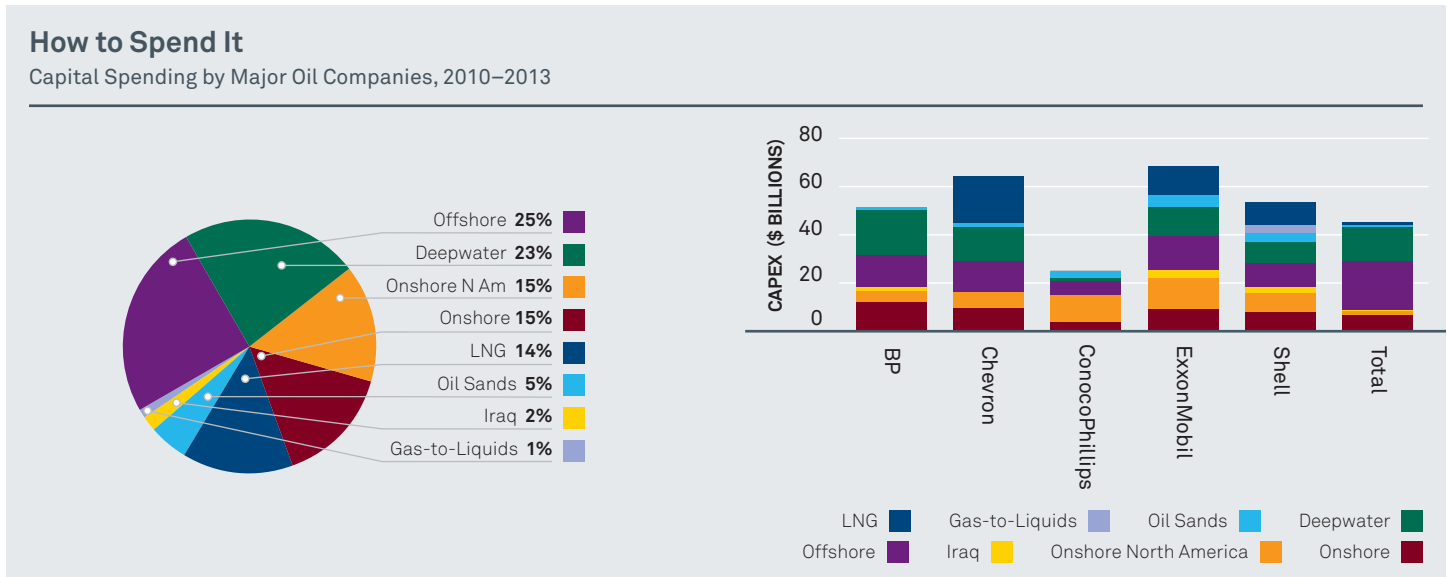
What could upset this upbeat outlook for prices? The biggest spoiler would be a long-term downdraft in global growth, we think. This would spell the end of the commodity cycle that drove prices to record highs in the last decade. Higher prices can also weaken demand and boost energy efficiencies.

On the other hand, supply disruptions jack up prices. And disruptions happen all the time. This epitomizes what Wood Mackenzie calls the oil industry's Formula One problem: Not a single racer predicts his or her car will break down at the start of the race, yet only half make the finish line.



Source: Wood Mackenzie  
Notes: Data as of November 2011. The forecast assumes global annual GDP growth of 3.2% for the period 2015 to 2030 (2.5% for North America, 1.8% for Europe and 4.5% for Asia Pacific). Conventional projects include expected future reserves growth. Unconventionals/tight oil projects include biofuels, gas-to-liquids (GTL), coal-to-liquids (CTL) and shale oil.

Underlying the forecasts for a supply gap are the rapid depletion of conventional fields onshore and in shallow waters. New technologies have opened up deep-water deposits, oil sands and shale oil—which should help close the gap. This change is reflected in how big oil firms spread their bets, with half of capital expenditures going to offshore projects. See the charts below.



Source: Wood Mackenzie.  
Notes: Projects with net capital spending of \$100 million or more in the period 2010 to 2013.

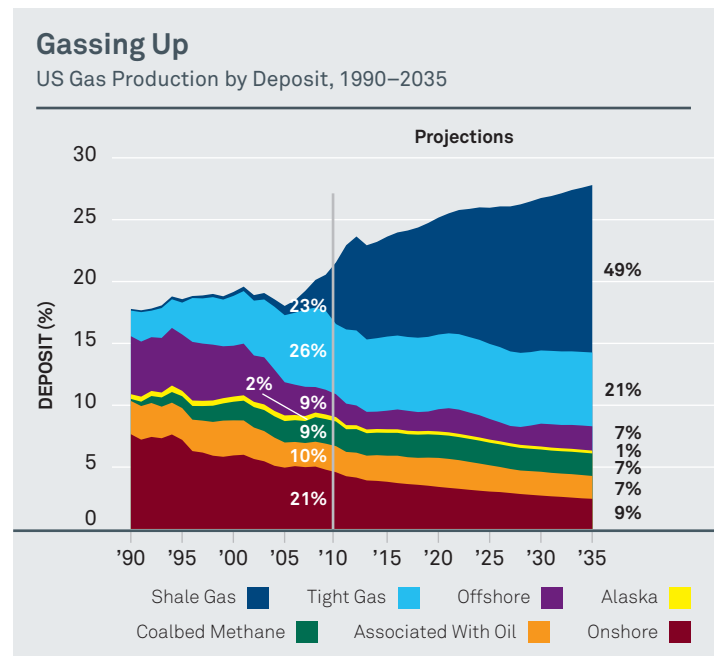
# The Great US Gas Glut

The US is currently drowning in gas. In all, the US has 2,600 trillion cubic feet (tcf) of unproven gas reserves, enough to last a century at current production, according to the US Energy Information Administration (EIA). About a quarter of this number lies in unproved shale reserves.

We actually believe shale reserves hold a much greater amount of gas that could be extracted with improving technologies. These reserves could double the EIA estimates, we think, providing an even longer-lasting supply.

Operators currently extract just 35% of the potential gas available, we estimate. Longer horizontal wells and improved fracturing techniques could result in a 70% extraction rate, we believe. There is just a lot of gas out there—and the technology for extracting it is only in the grade-school stage.

The shale bonanza has led to record US gas production, an estimated 23 tcf in 2011, according to the EIA. Shale gas could make up half of US gas production by 2035, about double current levels, according to EIA projections. See the chart on the right.

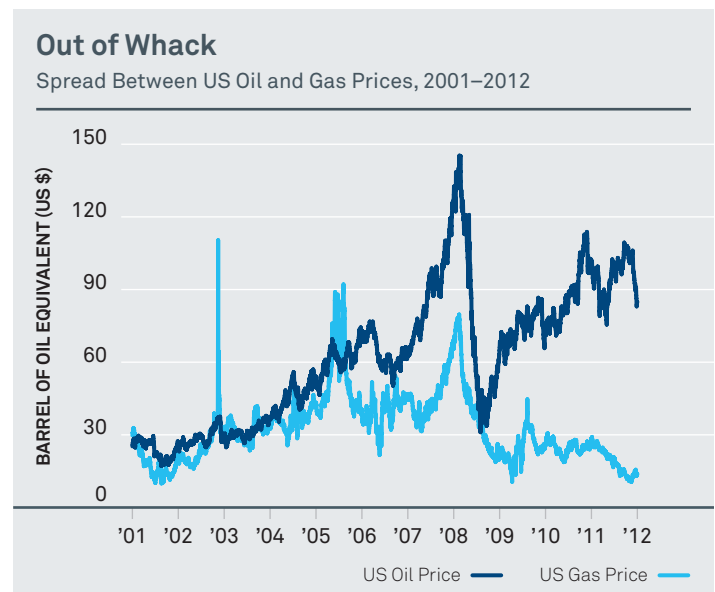


# When the (Gas) Price Is Not Right

Already trending down, US gas prices imploded this winter when demand dropped due to unusually warm weather. Prices have recovered but are still near record lows, recently trading at \$2.40 per million British thermal units (MMBtu). Exploration companies are pulling rigs, slashing capital spending and cutting production.

The gas slide has led to a record price differential between gas and oil (a barrel of oil contains the energy equivalent of 5.8 MMBtu of natural gas). Oil is now about seven times more expensive than gas on an energy equivalent basis, whereas the pair was trading at roughly the same levels before 2005. We believe this spread will tighten in time. See the chart on the right. Utilities, burned by spikes in gas prices before, mostly remain on the sidelines for now.

Arbitraging this pricing differential is not possible yet because oil and gas are serving different markets. Oil is mainly used as a transport fuel, whereas gas' primary use is for heating and power generation.





Try feeding a gasoline engine with natural gas—you will not get very far. That said, US power generators are switching to gas from coal, particularly in the Southeast, Texas, Mid-Atlantic and Northeast, according to the EIA. It also means exploration companies will target their capital spending to extract oil, not gas.

Gas prices are now so low that incremental investment would be loss making for most producers. On average, companies spend about \$2 per MMBtu to find and develop gas fields and an additional \$1.50 per MMBtu or so to operate the wells for a total of \$3.50 per MMBtu, according to shale exploration company EQT. Not a great business at current gas prices.

At the same time, ultra-low US gas prices raise the specter for a rebound. Are current prices the equivalent of \$9-per-barrel oil in the late 1990s? If so, gas is the buy of the decade. Pundits have predicted a turnaround for years, saying producers would close down at below-cost levels. But production and investments kept rising, and costs came down.

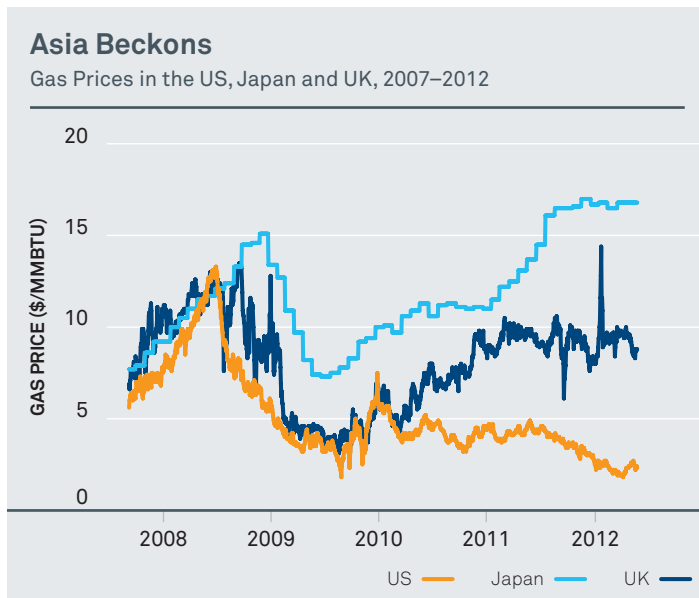
This situation is changing. The number of US gas rigs stood at 588, or 30% of the total rig count, in early June, according to oil services company Baker Hughes. This compares with a recent peak of 936, or 46% of the total, in October 2011.

Weather is another factor. There is always a scorching hot summer or sub-zero winter around the corner. North America's unseasonably warm winter this year took markets by surprise. It is relatively easy to predict long-term weather patterns, but it is very tough to pinpoint how these will play out in a given season.

In the medium term, US gas prices will likely find a new equilibrium between the current \$3.50 per MMBtu cost price and \$6 per MMBtu. At \$6 per MMBtu, we estimate most producers would be willing to hedge their production and commit to long-term supply contracts with utilities (which currently are unusual in this industry).

## Gas Exports: Easier Said Than Done

How about exports? Gas prices in Asia's markets are around \$16 per MMBtu, roughly seven times US prices. See the chart below.



Source: Bloomberg.  
Note: Data through June 7, 2012.

This natural arbitrage trade is easier said than done. Gas needs to be liquefied before it can be transported. This process requires a huge investment to chill the gas into liquid natural gas (LNG) and to build harbor facilities to accommodate LNG tankers.

One company, Cheniere Energy, recently received regulatory permission to convert an importing LNG plant into the first US LNG export plant in 50 years. The \$10 billion project is slated to start exporting gas as early as 2015.

Cheniere has its fans, but others are skeptical. It costs about \$6 to \$8 per MMBtu to liquefy gas and transport it to Asia. This would still leave a healthy profit margin at current prices, but Wood MacKenzie expects prices in Asia to fall. First, prices are artificially high because Japan shut down its nuclear reactors in the wake of the 2011 Fukushima disaster. Second, international prices should fall once Australia's giant gas fields and LNG export plants come online.

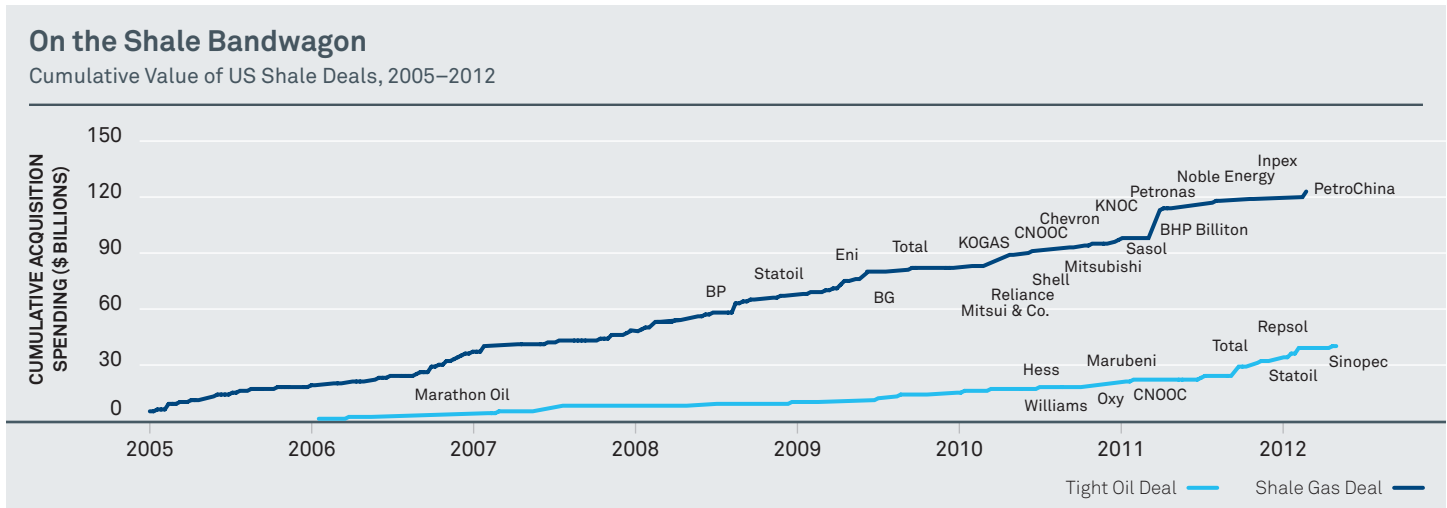
In any case, Cheniere's plant alone is unlikely to boost US gas prices. The plant initially will have capacity to process 1.2 billion cubic feet of pipeline gas a day, the company says. This means the plant's initial annual capacity equals about 2% of US supply.



# Signs of a Boom: M&A and Guar

Shale is still very much in its honeymoon phase. The question is whether the exploration costs will pay off given the currently low gas prices—the equivalent of the honeymoon's bills coming due just when the couple's income is falling.

A range of investors who jumped on the shale bandwagon in recent years, from Japanese trading houses and Chinese state oil companies to homegrown minnows, is eager to find out. See the chart below.



Sources: Wood Mackenzie.

Notes: Acquisitions by new players are highlighted. Data as of January 2012.

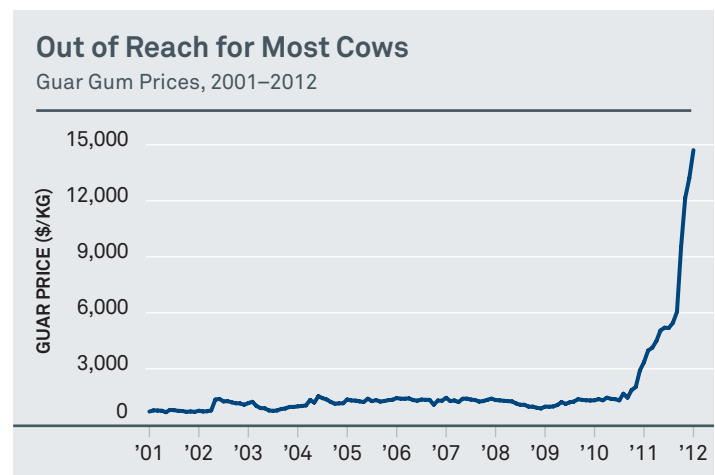
More takeover activity will likely occur in the shale sector, albeit driven by different factors. There are 200 publicly traded gas producers with a market value of less than \$4 billion. Low gas prices are vexing small producers, with many struggling to access credit and some close to breaching debt covenants. Even top producers such as Chesapeake are selling assets to pay for capital expenditures.

Most large energy companies are currently sidelined for fear of an investor backlash against buying into a sector where many producers are losing money. Private equity funds, which have longer time horizons and fewer stakeholders, are more likely buyers at this point, we believe.

The volume of shale deals is one indication of how hot the sector has become. Labor shortages in shale exploration areas is another one. McDonald's, for example, has been offering signing bonuses in North Dakota.

A lesser-known indicator is the skyrocketing price of guar, a bean grown mostly in northwest India. Traditionally used as cattle feed (*guar* means “cow food” in Hindi), guar gum powder is used to thicken ice cream, but also to gel sand and water to keep open

rock fractures. It is the latter use that triggered a 10-fold price jump in two years. See the chart below. Watch this space to see if the shale boom is accelerating or fizzling out—until somebody finally comes up with a synthetic alternative.

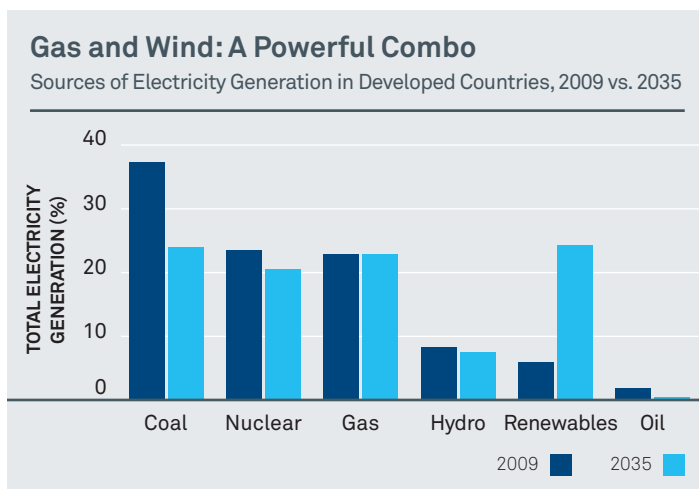


Source: Thomson Reuters Datastream.

Notes: Pricing information for 200 mesh 3500 centipoise (CPS) technical grade guar gum powder. Data through April 2012.

## Alternative Impact

Gas is likely to replace coal as an energy source at many utilities, both because its price has come down and because of environmental regulations such as carbon taxes. Coal is dead, to sum up the current market consensus. This actually can be a warning sign and a reason to believe in coal's staying power. Markets typically surprise, especially when investor sentiment is overwhelmingly positive or negative. Plus, coal is easily exportable and valuations of coal producers are low.



Source: International Energy Agency World Energy Outlook 2011.  
Notes: North America and EU electricity generation by fuel.

We do expect coal will gradually slip from its perch as the biggest source of electricity generation in the developed world. The International Energy Agency (IEA) projects coal's share to decline to 24% by 2035, down from 37% in 2009. See the chart on the left.

We believe, however, gas will make up a larger share of the developed world's electricity generation by 2035 than the stagnant 23% predicted by the IEA. For one, gas has become much more competitive with coal at current prices. Plus, we expect nuclear electricity generation to take a bigger hit as older plants close. It will take time, political willpower and a lot of money to build new nuclear plants, we think.

How about renewables? Doomsayers have predicted the gas glut will end the alternative energy boom. We do not agree. Onshore wind has become cost competitive in some US markets, even if you take away tax credits. New technologies are improving the distribution of excess wind energy. Plus, US utilities typically lock into long-term contracts at fixed prices. This has not been the case with natural gas.

That said, wind and other renewables will never be the only energy sources, and need to be used in conjunction with other more traditional sources.

## Polls and Policy

Fracking has fervent opponents. They worry about chemical spills, water usage and the risk of setting off earthquakes. The 2010 documentary *Gasland* showed residents of a Pennsylvania community lighting their tap water on fire. France for now has banned shale exploitation.

Environmental concerns could turn public opinion against fracking and end the boom. Public opinion on shale exploration differs by region, with people in economically depressed states such as Ohio supporting it. Opinions are split evenly in more robust and economically diverse states such as New York, polls show.

The US debate about energy—both shale, offshore exploration and pipelines—has become highly politicized. It has descended into a jobs (and energy security) vs. environment debate. It suffices to say public opinion and politics will play a big role in further development of shale.

Spills and other disasters would be big negatives for the industry. Positives include the roll-out of engine maker Cummins' 12-liter natural gas engine for long-distance trucks. This could trigger a quiet revolution of LNG stations popping up across the US, leading to wider adoption across the car industry.

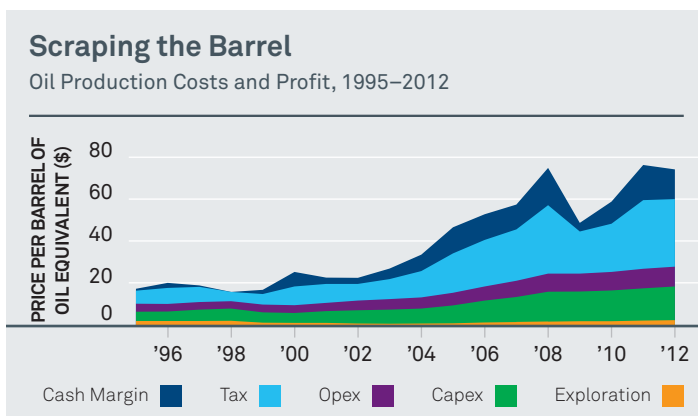
# Investment Opportunities

## Companies: Services, Transport and Exploration

Our main global oil and gas investment themes evolve around infrastructure, services and exploration. Broadly speaking, we prefer oil over gas for now. UK engineering group Weir recently illustrated this point: It blamed the impact of energy firms emphasizing oil over gas for a 26% plunge in orders in its oil and gas division in the first quarter.

- ▶ **Infrastructure:** We favor companies that facilitate the transport of energy, such as pipeline operators and those that benefit from investment in building out the US energy infrastructure.
- ▶ **Services:** We like oil service companies specializing in deep-water exploration—the area where major oil firms are directing a quarter of their investments. We also like service companies with international operations as beneficiaries of growth in emerging markets.
- ▶ **Exploration:** We are focused on exploration companies that could benefit from a rebound in gas prices, US shale growth, the resumption of Gulf of Mexico drilling, and East and West Africa exploration.

Even with increased spending on technology, equipment and experienced staff to extract oil from tough places, profit margins at most oil companies look healthy. Looming on the horizon are cost inflation from rig rental rates for deep-sea drilling, and increased taxes by governments eager to close budget gaps. See the chart below.



Source: Wood Mackenzie.

Note: Opex = operational expenses of running an oil and gas field. Based on BP, Chevron, ConocoPhillips, Eni, ExxonMobil, Shell, Statoil and Total.

Other investment themes include takeovers of US shale players; refiners that can take advantage of price differentials between heavy and light oil and WTI and Brent; and selected explorers focused on non-US shale and new North Sea fields.

## Oil and Gas Prices

Today's Brent oil price of around \$100 a barrel appears well supported given ongoing supply challenges and political risk in the Middle East. Energy stocks, however, have been trading as if oil sells for \$80 a barrel.

US natural gas prices should rebound in the medium term, but it is tough to see a catalyst for a big reversal in 2012. As a result, we favor oil over gas and oil explorers over gas producers.

## Alternatives: Developers, Producers and Start-Ups

We are bullish on developers and owners of wind parks and other alternative energy projects. We are not alone in this. Billionaire investor Warren Buffett has made a series of investments in solar farms. Traditional sources of finance such as European banks have pulled out of project financing to free up capital, paving the road for new entrants. One risk is less financing resulting in fewer projects—and fewer investment opportunities.

We are cautious on alternative energy manufacturers such as solar panel and wind turbine makers. Intense competition from Chinese manufacturers has driven down prices in many markets below production costs. This is a boon for the use of alternative energy, but also has caused a sea of red ink among manufacturers.

We are closely following start-ups experimenting with new technologies such as low-energy nuclear reaction and fusion. If successful, these efforts could completely change the current status quo and hurt traditional energy producers. It is worth watching this space. People tend to overestimate what can be done in a year, but underestimate what can happen in a decade.

This is a race for long-distance runners, not sprinters. It took sun and wind power more than three decades to become competitive. Corporations follow developments in new technologies closely, but will treat them as side bets until they reach economic scale. Investors would do well to take the same approach, we believe.

## Coal, Utilities and Macroeconomic Fallout

Wild cards are US coal producers and utilities. Share prices of the first group have plummeted due to concerns about coal's long-term decline as an energy source and a build-up in US inventories after the warm winter. At the same time, coal can easily be exported to world markets. Within the sector, we focus on producers of metallurgical coke, used in smelting iron and blast furnaces.

US utilities, long a favorite of investors focused on steady earnings and high dividends, are likely to become more volatile as energy prices fluctuate.

Guar prices look rich. We are happy for the Indian farmers growing the beans, but suggest investors tempted to buy at these levels tread carefully. Whoever develops a synthetic alternative to guar gum deserves a thorough look.

More thinking is needed on the macroeconomic implications of the US shale boom on other asset classes. How likely is a revival of US manufacturing on the back of cheap gas, and who would

profit the most? What would the US transformation into an energy exporter do to the US dollar? How would self-sufficiency affect agricultural commodities and producers? Will scarce water around the world finally become an investible and prospering asset class? To be continued...

### BlackRock Investment Institute

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