In Perspective

May 2012: Episode 3

Energy: the shale revolution

AT A GLANCE

- The US is undergoing an energy sector boom thanks to the commercial exploitation of the country's shale oil and gas reserves.
- Thanks to shale, the US no longer relies on imported gas, and oil imports are also forecast to drop in future.
- Some analysts predict the US could be energy independent within a decade, as well as a key exporter of energy.
- The development of shale energy also helps the US economy by boosting industry competitiveness and supporting private consumption and fixed investment.
- Development of US shale gas reserves is at a more advanced stage than US shale oil.
- Other countries have shale reserves but the US has a considerable lead in the industry.
- The two types of companies that stand to benefit most directly from shale energy are:
  1. those that are involved in some way in the extraction process and/or distribution of shale products; and
  2. those that get a competitive advantage from cheaper energy.

Energy is what drives the modern world. And the modern world is growing. Population increases and continued economic development, particularly in emerging markets, are increasing the demand for limited and finite energy resources.

There are some important structural developments taking place in the energy landscape. The most interesting of these is the rapid growth in the production of gas and oil from shale deposits in North America.

We look at the shale story from a US viewpoint, consider the wider global energy supply perspective and reveal a few of the companies that our investment teams believe will benefit from this theme.

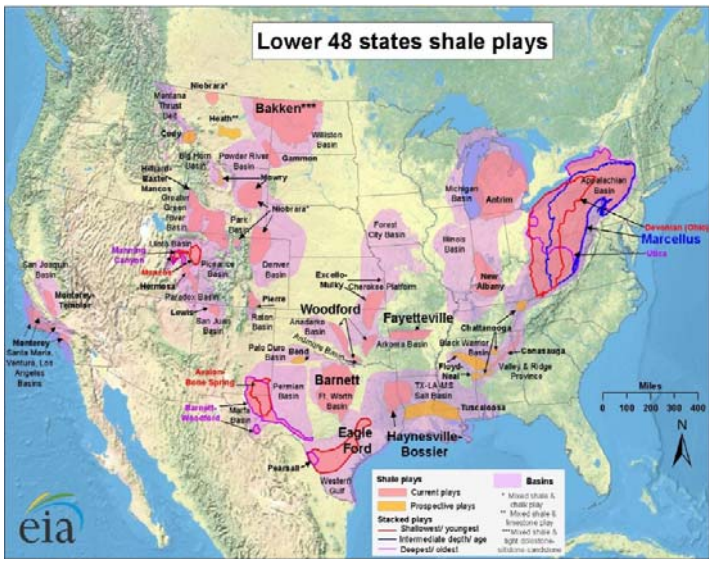
THE SHALE STORY

The presence of large amounts of hydrocarbons, such as oil and natural gas, trapped in layers of sedimentary rock has been known about for many years. The problem however has been finding sufficiently cost effective ways to extract these deposits. So, despite the fact that shale gas was first extracted in 1825, the production of commercially meaningful amounts of natural shale gas did not begin until 2007. This was made possible by the wider application of horizontal drilling and 'hydraulic fracturing' (also called 'fracking'), a technique which involves pumping large amounts of water to create fractures in reservoir rock to allow gas to escape. The same techniques also enable the release of oil from shale, but development on this front has so far been slower than for gas.

The charts below show that there are large amounts of recoverable shale gas reserves in the US and in other parts of the world, particularly in China and Argentina for example. However, the mere presence of reserves is not enough. Over the next few years, the US will be only country with the ideal mix of factors that will make large-scale shale gas production possible.

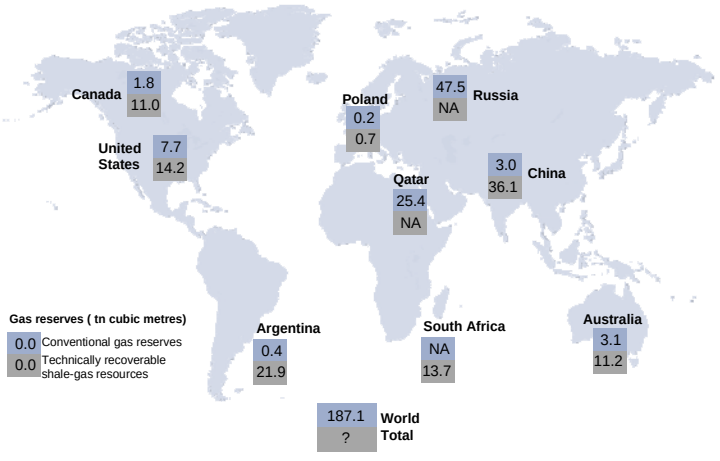
In particular, the US is ideally positioned to leverage its sizeable existing natural gas market, large pipeline infrastructure, technical know-how, ample water resources and favourable tax and regulation regimes. In China, for example, while recoverable reserves are very large, there is a shortage of water and technological and infrastructure deficits. In Europe, policy restrictions are a key stumbling block.

KEY US SHALE GAS REGIONS



Source: EIA as at May 2011

GLOBAL SHALE GAS RESERVES



Source: US Energy Administration (EIA), The Economist

Fidelity WORLDWIDE INVESTMENT

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' …shale resource development will support more than 600,000 jobs by the end of the decade…. the development of natural gas will create jobs and power trucks and factories that are cleaner and cheaper.'

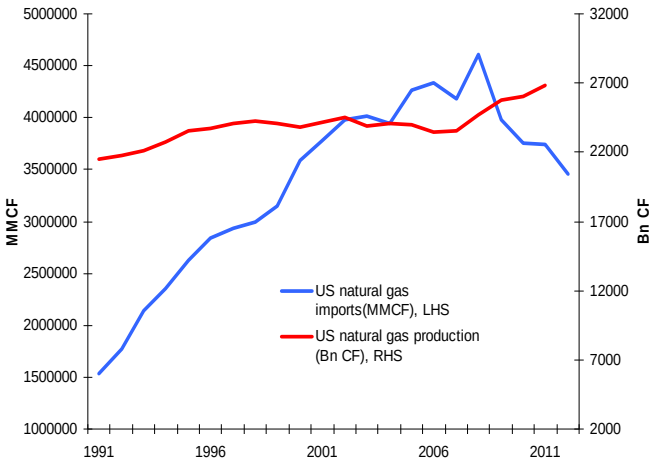
President Barack Obama , 2012
State of the Union address

SHALE GAS IN THE US

Energy statistics illustrate the dramatic impact of shale gas production in the US. For 35 years between 1975 and 2007, US natural gas production largely moved sideways. However, from 2007 onwards, the successful application of hydraulic fracturing enabled total shale gas production to surge by 42% in the four years to 2011. [1]

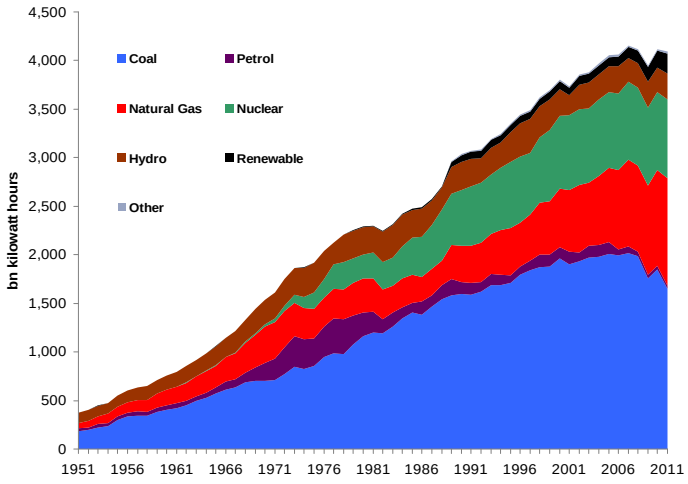
According to Goldman Sachs, shale gas now accounts for 30% of total US gas consumption compared to just 1% in 2000 .[2] The greater availability of gas has helped to push its domestic price lower, leading to a substitution away from other energy sources. For example, in terms of power generation, gas now (2011) accounts for 27% of US electric power production, up from 17% ten years ago. [2] Notably, the increased production and availability of gas has meant less need for imported gas. Indeed, in just four years, the US has gone from being the largest world's importer of gas (in 2007) to being entirely self-sufficient. [1]

US NATURAL GAS PRODUCTION AND IMPORTS



Source: EIA, as at 23.05.2012

US POWER PRODUCTION BY SOURCES OF ENERGY



Source: IEA

ECONOMIC BENEFITS

The shale boom offers a number of significant economic benefits for the broader US economy and casts doubt upon suggestions of a loss of US economic hegemony in the near term:

- ***Rising private consumption*** –The average US household's utility bill is around 2% of its post-tax income, so lower energy bills should boost income that could be spent in other areas. If US transport was adapted to run on natural gas, this would provide additional savings on gasoline costs. According to Goldman Sachs, these two effects alone could provide incremental savings of $1600 per annum for the average US household. [2] This is aside from the benefits to consumption that arise from increased job creation and wages in the US energy industry. In sum, the positive consumption impact from all the effects mentioned could be similar to a sizeable tax or interest rate cut.
- **Rising industry competitiveness** – local access to cheap gas will boost the global competitiveness of industries that are heavily dependent on hydrocarbons as an input, such as petrochemicals, fertilisers, steel, and other energy intensive industries.
- ***Rising investment –*** Extracting hydrocarbons from shale deposits by drilling is an inherently capital-intensive process – this investment benefits US total economic output directly, while the impact on secondary industries also supports investment**.** Higher profitability will provide an incentive for these industries to invest more to build their production capacity also.
- ***Improved external accounts –*** Thanks to rising shale gas production, US natural gas imports have fallen very significantly. The associated reduction in the import bill means downward pressure on the US trade and current account deficits. In turn, other things being equal, lower external account deficits should be supportive for the US dollar. Moreover the positive external account effects will be amplified greatly, if as appears likely, the US moves in the decade to become a net energy exporter. The prospects for this should be supported by the wide favourable price differential between gas prices in

'Shale energy, particularly shale gas, is already materially improving the US energy balance. Given the size of the resource base and the low extraction cost, the positive economic and business impacts are likely to be magnified further through the US economy.'

Edward Ross, Equity Research Analyst, Natural Resources

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the US and other big importing nations such as Japan. Tellingly, there are reports of several US energy services companies (including Sempra and Cheniere energy) converting existing gas importing port facilities into gas exporting facilities for the future.

- ***Lower inflation –*** by lowering direct and indirect energy costs for both individuals and companies, it is reasonable to think that the US shale gas boom could have a more general disinflationary impact.

Collectively, the benefits mean that the shale energy revolution could be an economic *'game-changer'* that provides a significant competitive and economic boost to the US economy in coming years. However there are some important caveats and risk factors that need to be considered.

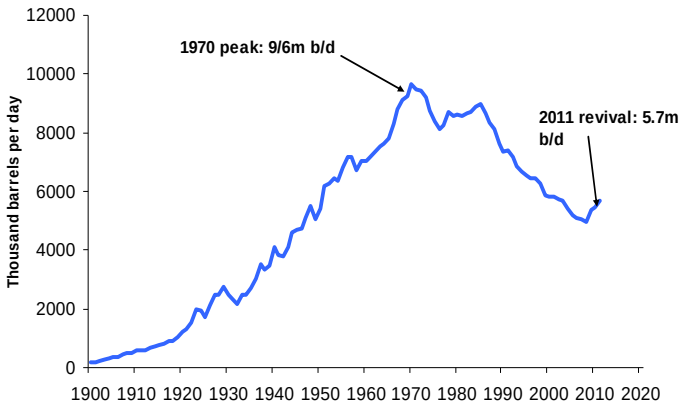
SHALE OIL: THE KEY TO US ENERGY INDEPENDENCE

The same techniques that have led to the US shale gas boom are also being used to extract oil. Indeed, as a result of shale oil production, overall US oil production is now rising again, after many years of decline. Partly as a result of this (the recession was obviously the big factor), US net petroleum imports have declined from over 13m b/d in mid 2007 to less than 8m at the end of 2011 and for the first time in 60 years, the US is now a net exporter of refined products.[3]

The economic advantages stemming from rising oil production in the US are similar to those outlined earlier for gas (higher consumption, more investment, improved net exports and lower inflation). Moreover, in the longer run, the much talked about US ambition of energy independence no longer looks like a pipe dream - for example, BP's long term projections show the gap between US domestic energy production and consumption steadily declining over the next 20 years (see right chart below), with ratio of the former to the latter (a measure of 'energy independence') rising from 77% in 2010 to 94% in 2030. In a recent report, Citigroup went much further, suggesting that the US could achieve a level of energy independence that sees it challenge the Middle East by 2020.[4]

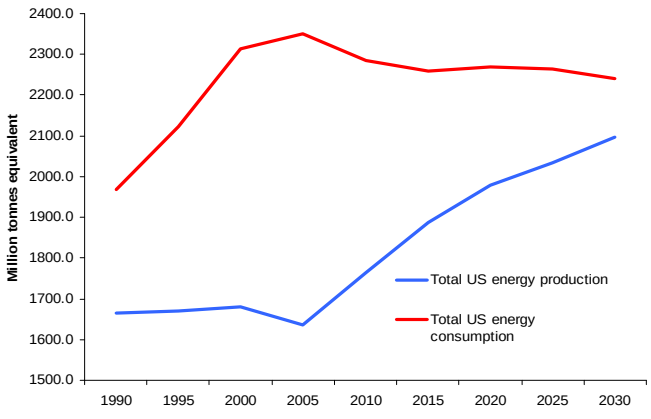
The forecasted long term improvement in US energy independence reflects the combined impact of both rising shale oil and gas production. However, while US shale oil production has been growing very fast (see left chart below), this has been from a relatively low base and the shale oil industry is currently at a much lower stage of development compared to the shale gas industry. This means that positive economic and business effects of shale oil will take a bit longer to be realised.

US OIL PRODUCTION RISING ONCE MORE



Source: EIA, as at March 2012

THE LONG TERM PATH TO US ENERGY INDEPENDENCE



Source: BP energy Outlook 2030 (Jan 2012); Note: *Energy consumption comprises commercially traded fuels, including modern renewables used to generate electricity.

"Energy self sufficiency for the US, while positive for the US economy, has significant geo-political implications for the world at large."

Amit Lodha , Portfolio Manager, Global Equities

GLOBAL ENERGY SUPPLY EFFECTS

Over time, the global shale revolution is likely to have significant impacts that extend well beyond the US, not just in producing countries but also in non-producing countries, and in terms of broader global energy supply balances. In the longer run, the production of oil and gas from shale offers regions with significant reserves (such as China and Argentina) many of the economic benefits outlined earlier for the US. The supply of energy is likely to become localised too, as shale deposits are more diversified geographically than traditional hydrocarbon deposits which have been concentrated in the Middle East; indeed, shale is a material long term threat to Middle Eastern dominance of the global energy market.

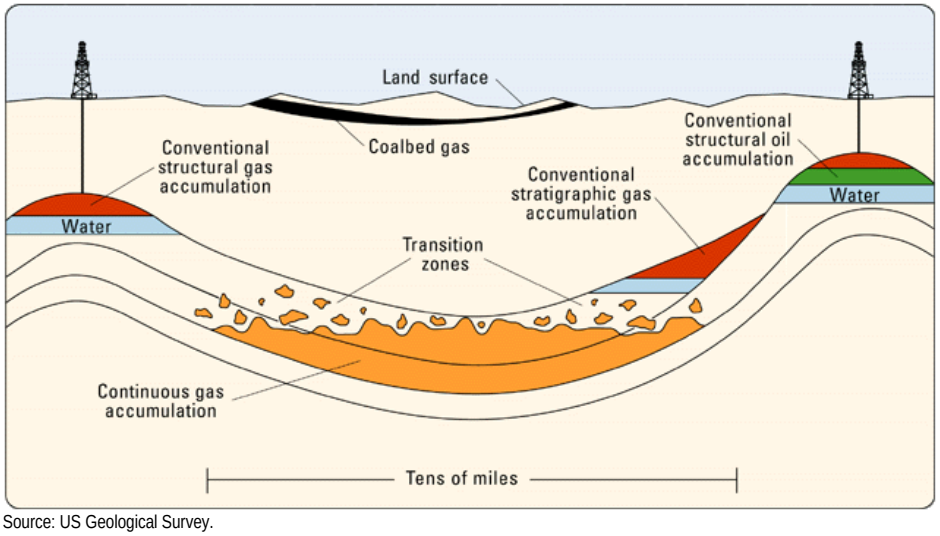
In the short run however, the global effects are more likely to be transmitted via the US since it is far ahead of all other countries in terms of exploiting its shale reserves. One of the most important effects might be reduced demand for other energy sources. Within the US, we have already seen lower demand for coal for electricity production. From a global perspective, greater energy independence and the possibility of significant US energy exports could put downward pressure on global energy prices.

An interesting feature of the global gas markets in particular is the very large variation in gas prices in local markets, with prices in some countries being multiple times higher than current very low US prices. There are many potential explanations for these variations such as the difficulty and large costs of transportation and the preference for large gas-producing countries such as Russia to insist on long-term pricing contracts. However, if US shale gas production continues to rise and it is able to begin exporting significant amounts, then other non-producing countries could also benefit from lower energy costs, with increased flexibility in global gas prices.

THE ENVIRONMENTAL PERSPECTIVE

Perhaps the single biggest constraint and potential stumbling block for the development of the global shale energy industry is the environmental impact. The main concern here is about water pollution, owing to the very large amounts of water used up (around 100,000 barrels for a typical well) and the various chemicals used in the fracturing process. However, according to producers, drilling occurs so deep in the ground (up to 15,000 feet and well below ground water levels) that this should limit the risk of contamination. Regarding the charge of excessive water consumption, Australia's BHP has argued that on a per-unit of energy basis, the amount of water used in shale extraction is actually lower than coal production and corn ethanol production. Two other concerns highlighted by environmental groups are noise pollution and the potential for fracturing to induce seismic activity.

GEOLOGY OF US GAS AND OIL RESERVES



Source: US Geological Survey.

However, all the potential environmental issues also need to be considered in a holistic context of shale-derived gas and oil being relatively clean fuels that produce far fewer carbon emissions than coal for example. Industry susceptibility to environmental concerns also varies considerably across countries. In Europe for example, it is seen a serious limitation, but the trends in the US for example have so been far more encouraging, with expressions of support from the highest levels including the US president who mentioned the potential job creation potential of the shale industry in his 2012 State of the Union address. The US has also laid down a set of best practice guidelines which shale gas proponents argue would overcome much of the environmental objections if followed. For the time being, at least in the US, it seems unlikely that environmental concerns will derail the shale industry, given its ability to boost US energy independence and the numerous economic benefits provided.

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HOW INVESTORS CAN PLAY THE SHALE STORY

To the extent that it supports overall US economic growth, the US shale production boom can be seen as a positive development for US equities generally. More specifically though, there are two types of companies that should benefit more directly from this energy shift - those that are involved in some way in the extraction process and/or distribution of shale products and those that will get a competitive production advantage from cheaper energy input costs.

'Significant supply growth for gas and gas liquids is expected to come from the US in the next few years. This should provide US industrial companies with lower energy costs than international competitors which is positive for both industrial and energy stocks. Companies like National Oilwell Varco, Helmerich & Payne and EOG Resources in the energy sector are key beneficiaries of this trend.'

Aris Vatis, Portfolio Manager, US Equities

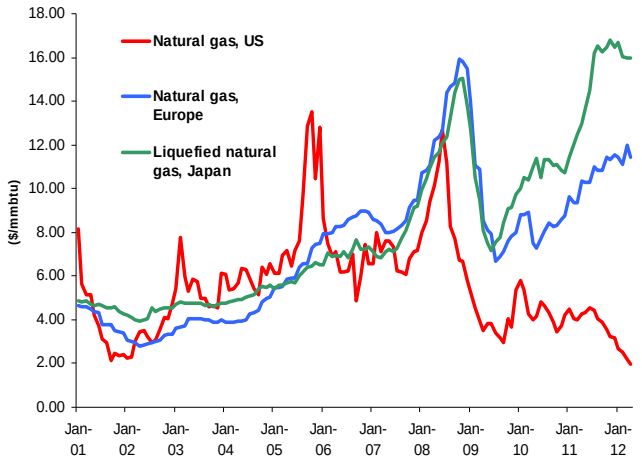
Some of the direct beneficiaries of the shale boom in the US include oil and gas companies such as **EOG Resources** which has operations in the Eagle Ford, Barnett, Marecellus and Bakken shales. Devon Energy is another company with a strong foothold in North American shale reserves. Oil service companies that supply hydraulic fracturing technology and drilling services are also beneficiaries of shale development; these include **Schlumberger, National Oilwell Varco** and **Halliburton.**

In terms of shale oil, a number of US refiners are beginning to see the benefits of lower input costs owing to the use of domestic shale oil rather than the more expensive foreign imported oil. For example, **Valero Energy Corp**, with a reputation as one of the US's lowest cost and most profitable refiners is benefiting from surging oil output from the *Bakken* shale in North Dakota. In fact, its Houston refinery, which once imported all of its crude from West Africa, now uses only U.S. crude. Since Valero pays less for the domestic crude, the savings go to its bottom line.

The US chemicals and manufacturing industries could be among the biggest beneficiaries of lower natural gas prices. Until a few years ago crude oil and natural gas traded in a relatively tight equivalent range but the relationship has broken down due to increased US gas supplies from shale and increased crude oil demand in emerging markets. The widening gas-to-oil ratio (see right chart below) has also widened the spread between naptha (an oil derivative) and ethane (a natural gas derivative). This has greatly benefited US chemical producers who have become more globally competitive by switching to cheaper ethane feedstocks.

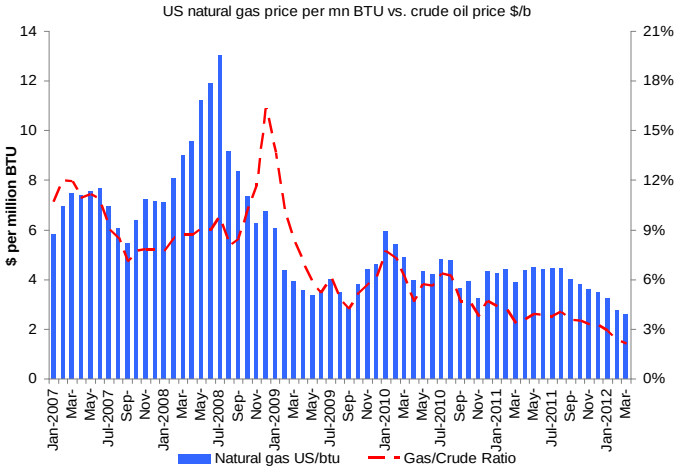
Among the biggest beneficiaries of this is **Dow Chemical**, which after a decade of moving its production facilities out of the US to Asia and elsewhere, is now investing billions of dollars on new domestic production plants in order to take advantage of cheap domestic shale gas supplies. Conversely, the increased competitiveness of US producers is obviously a negative factor for chemical producers in other parts of the world where energy input costs are higher.

GLOBAL NATURAL GAS PRICE VARIATIONS



Source: World Bank 'Pink Sheet', May 2012

GAS-TO-CRUDE RATIO



Source: Goldman Sachs, On the shale Trail, 16.03.12

'Rising shale energy production is a positive for the US. In the long run, this should provide an input cost advantage to certain US industries. In the short run, however, the biggest beneficiaries of the shale story will be companies directly exposed to or involved in the extraction process.'' **Aruna Karunathilake, Portfolio Manager, UK Equities**

The beneficiaries of shale development are not limited to the US. On the extraction side, the UK's **BG** Group is likely to be a major beneficiary of the shale gas boom – over the last few years it has acquired significant US shale assets, including a $1.3 billion investment in a joint venture with Texas-based Exco to develop 120,000 acres covering gas fields in north Louisiana and east Texas. Perhaps more importantly, BG is among a handful of producers that is very well placed to take advantage of the sizeable global natural gas prices differentials (see left chart above) - in the past few months it has struck deals that will allow the export of 5.5m tonnes a year of LNG through terminals in Louisiana in order to exploit high demand in Asia. Of course, underlying this is the expectation that the US will soon become a significant net exporter of the fuel.

Aside from energy companies like BG that are directly involved in shale gas and oil extraction, there are also number companies that contribute in some way to the extraction process. For example, the UK's **Weir Group** is an engineering company that produces the hydraulic pumps used in shale rigs. Also in the UK, speciality chemicals group **Elementis**, makes products that are used in the oil and gas industry as part of the fluids that are used to cool and seal drills in bore holes, including in the shale industry.

CONCLUSION

The US today is seeing a veritable renaissance in its energy sector thanks to the exploitation of abundant shale reserves in the country.

Increasing energy output from shale reserves is already helping the US economy in multiple ways, providing more supportive conditions for private consumption, fixed investment and net exports. If production continues to rise in line with expectations, then the economic benefits for the US will also grow, with significant implications not just for the domestic energy supply balance but also for the global energy landscape. While other countries with large shale reserves such as China can also benefit from shale energy in the longer term, few have the ideal mix of supportive factors existent in the US, including a large domestic energy markets, the requisite installed infrastructure, the advanced technical know-how, ample water resources and favourable regulations.

A research-driven approach is key to getting the most from this investment theme. Returns will flow not only to the companies with the best portfolio of shale assets, but to those with the best technical skills and component products. Stock-specific analysis will be critical in identifying the winners and losers in what seems set to be a rapidly-changing energy landscape.

Notes

[1] Longview Economics, Commodities Monthly No.32, April 2012.

[2] On the shale trail', Goldman Sachs Equity Research, Fortnightly Thoughts, March 2012.

[3] 'Resurging North American Oil Production and the Death of the Peak Oil hypothesis.' Citigroup Global Markets, February 2012.

[4] 'Energy 2020 – North America, the New Middle East.', Citigroup Global Markets, March 2012.