The shale gas 'revolution':

Challenges and implications for the EU

by Iana Dreyer and Gerald Stang

The recent boom in 'unconventional' oil and gas in the United States has raised many questions regarding the impact it will have on global energy markets, the security of energy supplies, the fight against climate change and even the global balance of power. An intense debate has emerged on the need for Europe to develop its own resources, and the risks and benefits of unconventional hydrocarbon production.

The global context

The last decade has seen oil prices rise to record levels, peaking in 2008 at nearly 140 US$ per barrel, then subsequently stabilising near 100 US$. Although more oil and gas reserves are found than consumed every year, high prices triggered by rising demand in Asia have evoked Malthusian fears of scarcity. Eyebrows were raised over the market power and potential geopolitical clout that leading hydrocarbon exporters were exerting on their democratic customers in the West. The rising cost of energy has also been a major contributing factor behind the gaping trade deficits of the US and some European countries.

Energy dependency fears are more acute over gas than over oil. Oil is transportable on tankers and its market is more flexible. Gas, however, is traditionally only transportable through fixed pipelines. This physical limitation has made gas markets regional, less flexible in adapting to supply disruptions, and easy to control by governments and monopolistic firms. Natural gas has thus remained largely separated into regional gas markets in North America, Europe and East Asia.

Efforts to limit the impact of climate change by cutting CO2 emissions have reduced the attractiveness of using coal. This issue of emission reduction remains as pressing as ever now that the 'nuclear renaissance' expected in the early 2000s has come to a halt after the Fukushima-Daiichi nuclear accident in Japan in March 2011.

Talking about a revolution

Unconventional sources of oil (tar sands, tight oil, deep water) and natural gas (tight gas, coal bed methane) have traditionally been considered too costly to produce. Among the most promising of these is 'shale gas', a natural gas contained within commonly occurring shale rock, which has low permeability and thus does not allow gas to flow easily.

High prices have encouraged investment in new technologies and exploration. The production of unconventional gas and oil has become more economically viable due to improvements in the

drilling of horizontal wells and hydraulic fracturing, or 'fracking', a process which involves the injection of sand, chemicals and water into shale rock to release trapped hydrocarbons.

The shale gas boom took off in 2007 in the US, the world's top gas producer, along with Russia. By 2010, shale gas already made up 23% of US gas production. The share of imports in US natural gas consumption dropped from 16.5% in 2007 to 11% in 2010, almost all of this from Canada, which has experienced its own shale gas boom. The US energy mix has changed, accelerating the long-term trend that has seen gas and renewable energy replacing the use of oil and coal. The share of natural gas in total primary energy consumption reached 26% in 2011, rising from 23% in 2007. In 2012, the US achieved its lowest level of CO2 emissions in 20 years.

'The unconventional gas boom should be viewed in conjunction with the development of international trade in liquefied natural gas (LNG).'

The environmental impact of shale gas is controversial. If improperly handled, chemicals from hydraulic fracturing can leak into underground water reservoirs. There are also small risks of chemical spills during extraction and seismic disturbances in drilling areas. While burning gas for electricity production releases half as much CO2 as burning coal, uncertainty around the environmental advantages of shale gas remains due to the worry that cheap gas will simply replace renewables as much as it displaces coal. There is also worry over the leakage of methane (a greenhouse gas 20 times more damaging than CO2) during the production process, though methane leakage from shale gas production is estimated to be comparable to that of conventional gas production. Despite these concerns, energy experts tend to see gas as a useful 'transition' fuel on the way to a low carbon economy if it is used as a substitute for coal, as is occurring in US power plants.


THOMAS NILSEN/BARENTSOBSERVER

Tanker for liquefied natural gas (LNG) outside Hammerfest in northern Norway

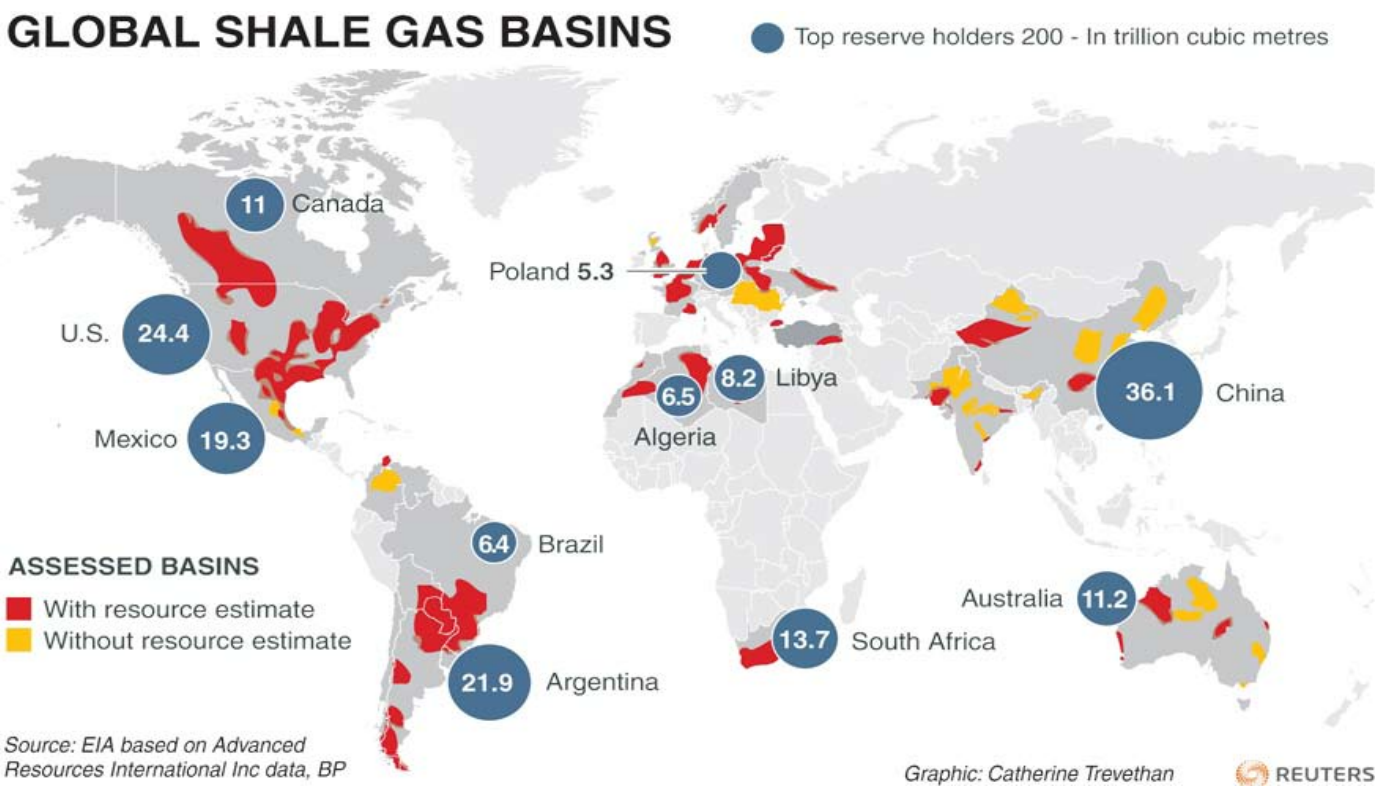
The benefits of the US shale gas boom – replacing coal, lesser reliance on imports, low energy prices for industry – have raised interest in replicating the experience elsewhere. According to 2011 US estimates, the advent of shale gas has increased the total global reserves of technically recoverable natural gas by 40%. Large estimated reserves are thought to be in China (36.1 trillion cubic metres - tcm), the US (24.4 tcm), South America, and Africa. No shale gas reserve estimates exist for leading gas exporters in Russia, Iran and the Persian Gulf, perhaps because their vast conventional gas reserves render the point moot. In Europe, the largest estimated gas reserves are in Poland (5.3 tcm), France (5.1 tcm), Norway (2.4 tcm), Ukraine (1.2 tcm) and Sweden (1.2 tcm). Of these countries, only Norway and Ukraine also have significant conventional gas reserves, and only Norway has significant existing production infrastructure.

China – now the world's biggest CO2 emitter, heavily reliant on energy imports and located in the region of the world where gas is most expensive – has, unsurprisingly, seized on the idea of producing its own shale gas. China wants to raise the share of natural gas in its energy consumption from 4% today to 8% in 2016. China is facing geological, infrastructure and water supply hurdles, however, that will likely delay large-scale shale gas production.

Shale gas meets LNG

The unconventional gas boom should not be viewed in isolation, but in conjunction with the development of international trade in liquefied natural gas (LNG). Along with the liberalisation of some domestic gas markets, it is revolutionising the way gas prices are fixed, namely through 'spot' prices on short-term capacity markets. This reduces the attractiveness of the traditional model of pricing through oil-indexed long-term contracts between suppliers and consumers.

LNG is obtained by cooling natural gas to –162 °C. Although expensive to produce, LNG can be transported by special ships (cryogenic sea carriers) rather than pipelines. The last decade has seen a boom in the LNG trade, which now accounts for a tenth of all gas produced.



Before the shale gas boom, the US was building LNG gas terminals to import gas. Now the five US LNG terminals lie idle as plans are made to turn some of them into platforms that can allow the US to export gas for the first time. The most likely export market will be Asia (particularly China, Japan and Korea), where gas imports increased almost 500% between 2000 and 2011 and where demand is expected to rise another 17% by 2017. Asian demand has also triggered investments into LNG capacities in Australia, which could overtake Qatar as the leading global exporter by 2020.

Costs and benefits for the EU

Europe reacted slowly to the US shale gas boom. Initial reactions in most European countries have been sceptical due to environmental concerns. Moreover, the EU imposes strict CO2 emission targets (20% fewer carbon emissions in 2020 than in 1990) and is not enthusiastic about new fossil fuels. France, Bulgaria and the Czech Republic have banned fracking. Germany is not issuing production permits, although debate and research continue. The United Kingdom, a declining conventional gas producer, has authorised fracking, albeit with strong regulations. In late 2012, the EU Parliament, whilst not calling for a ban on fracking, did call for a robust regulatory framework.

Countries react differently according to their energy concerns. Poland, whose energy mix is dominated by domestic coal and gas imports from Russia, has shown a keen interest. Neighbouring Ukraine is anxious to develop its own reserves and avoid further gas battles with Russia. Initial drilling results for both countries, however, have led to concern about the economic viability of their shale gas reserves.

A host of conditions on the continent make shale gas development more costly than in the US. In addition to differences in geology, many European countries lack the oil and gas service sector, production infrastructure, relatively easy access to land and a permissive regulatory environment that have eased shale gas development in North America.

Energy-intensive industries in Europe are ringing alarm bells about the high and rising cost of energy. Cheap gas is industrially important for chemical companies that use it as a feedstock, as well as for the downward price pressure on power. A 2012 report by PricewaterhouseCoopers estimated that the US has benefited from more than 90 billion US$ in additional investments because of the low gas prices of the shale boom.

However, despite falling domestic gas production and limited shale gas activity, gas prices are likely to slowly decrease in Europe. In addition to spare LNG that has flowed to the continent from Qatar and other gas exporters, Europe's gas markets - partly liberalised in the 1990s - have allowed the development of spot markets in the north-western corner of the continent where prices are lower than

the EU average. Energy majors have tapped resources in the region to meet special requirements that go beyond those covered by long-term contracts with Russia, Algeria, or Norway. Since 2010, some of those contracts have been renegotiated, allowing for price reductions or partial linking to spot market prices.

Looking ahead - and around

More gas supplies originating from a greater number of countries, along with greater market interconnectedness thanks to LNG, indicate that global gas prices will tend toward convergence: higher for the US, lower for Asia and the EU. Prices will increasingly be delinked from oil.

Traditional gas exporters working with traditional constraints – pipelines, long-term contracts – already feel the pinch of competition. This could tilt the balance of power between producers and consumers in favour of the latter, limiting the concentration of market power in the hands of only a few producers. As a result, gas will matter less in geopolitics and its trade be more dictated by market considerations.

The geopolitics of shale

Despite investments in nuclear, renewable and fossil fuel energy, China will not achieve energy self-sufficiency. China will continue to pursue diversity and security in its energy supplies. For gas, this includes pipelines from Myanmar and Central Asia and new LNG import terminals. For oil, this includes long-term contracts with Middle East suppliers (particularly Saudi Arabia and Iran) and the pursuit of other partners, especially in Africa.

Russia's vast, cheap conventional gas reserves and extensive pipeline network mean that the direct impact of shale gas development on its exports will likely be limited. The increasing interconnectedness and flexibility of global gas markets, however, may slowly force Russia to reassess the political content of its energy relationships.

In the US, self-sufficiency in natural gas is expected to be matched by self-sufficiency in oil by 2030. This condition of energy security will test the depth and breadth of US engagement with much of the world, including the Middle East and Europe. A self-sufficient US would have less incentive to worry about Middle East oil supplies (though most of their allies will), particularly as supply diversity continues to expand to new corners of the globe. American political, military and trade relationships around the world, however, are unlikely to be reconfigured overnight, and depend on other long-term trends.

The prospect of the US becoming a gas exporter by the end of this decade will probably not impact the trend of rising import dependence in the EU. The EU relies on imports for 62% of its gas (along with 84% of its oil and 45% of its coal, all trending upward). Even if the EU does not import directly from the US – an unlikely scenario – the prospect of more diversified and less costly gas imports will give it greater leeway when dealing with traditional gas suppliers like Russia, on whom the EU will continue to rely. This could raise political support for more market integration and making spot markets the norm. Globally, gas is likely to continue gaining market share against coal and oil. However, the vision of a transition to a carbon-free economy will not materialise in the coming decades.

The EU is keen to limit carbon emissions but will find it increasingly difficult to pay for the rising costs of renewables while reducing its exposure to nuclear power. Gas is likely to be the EU's fall-back energy source if it does not want to continue the 2010-2011 trend of making coal a bigger share of its energy mix. This issue, along with rising import dependency, could lead to reduced opposition to domestic shale gas development if means are found to engage local communities and design regulation that responds to environmental concerns.

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