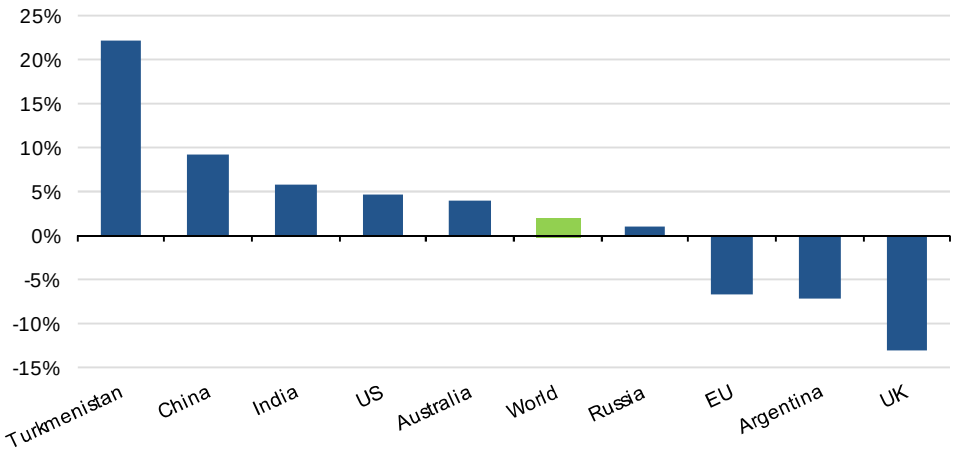
The Economic Impact on UK Energy Policy of Shale Gas and Oil

The option to develop shale in the UK comes at a time of falling hydrocarbon production, increasing imports and reduced oil & gas tax revenues for HM Treasury

2002-2012 CAGR of gas proven reserves in selected countries

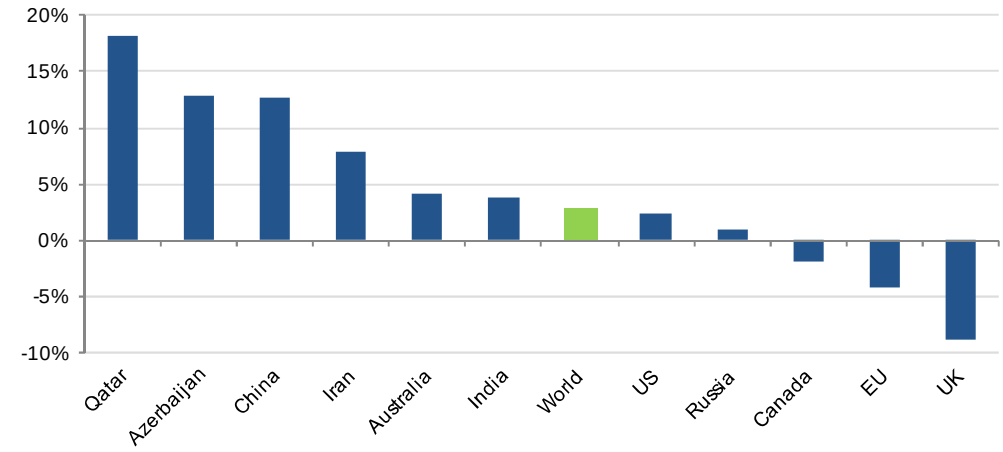


Source: BP Statistical Review

US growth, more than twice the world average, comes from the unconventional gas resources that have now been deemed recoverable thanks to innovative technologies. This high growth has allowed the US to overtake Saudi Arabia as the fifth-largest reserves holder in the world. Turkmenistan's huge growth comes from an area in the country that wasn't explored much under the Soviet regime and that is estimated to hold the world's second-biggest gas reservoir. Albeit from a very low level, China's high gas reserves growth is laying a solid foundation for the further expansion of its domestic production. Australia's growth is recent (2008) and comes from the huge capex private companies are dedicating to new LNG projects. The EU (and particularly the UK with -13.1% compound annual growth rate (CAGR) saw its gas proven reserves reduce over 2002-2012 as it was producing more gas than it was finding reserves. The world record for the largest decline in gas proven reserves is held by the UK, beating even Argentina, where the government decided in 2012 to nationalise the local oil company (YPF).

For the top-four reserve holders (Iran, Russia, Qatar and Turkmenistan), the reserves-to-production ratio (R/P) is over 55 years. Then comes the US where the R/P is 'only' 12 years. This is because, in the US, private companies are geared towards monetising resources rapidly; hence, there is less time between booking and production than anywhere else. This doesn't mean that in 13 years the US won't have any more gas reserves because by then some resources should have been booked into reserves thanks to companies' capex programmes. For the EU, the R/P is 12 years but, if the EU continues to fail to replace its gas production, this could mean that in 13 years' time, EU domestic production could be insignificant.

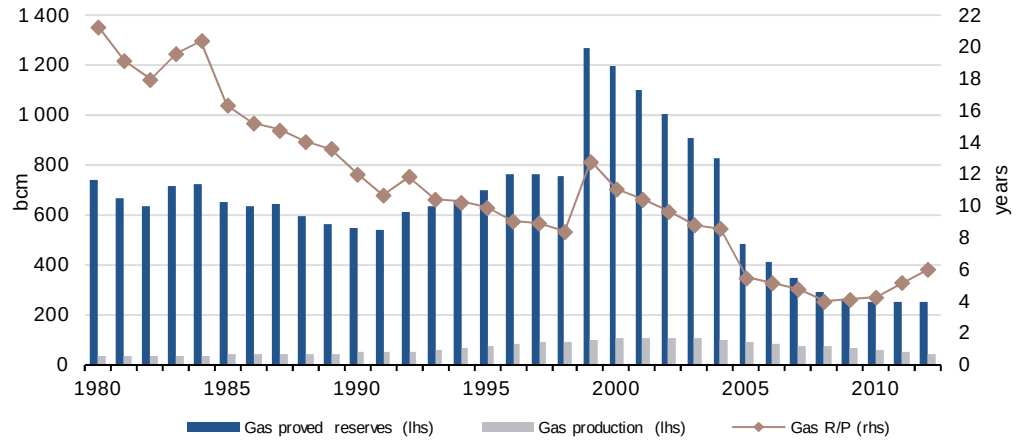
2001-2011 CAGR of gas production in selected countries



Source: BP Statistical Review

For the UK, the R/P gas ratio is just six years. This ratio has been growing in the last five years thanks solely to the fast decline in gas production as the proven reserves have gone down steadily.

UK gas proven reserves (R) & gas production (P)



Source: BP Statistical Review

Between 2002 and 2012, the CAGR for UK gas production was -8.9% with record drops witnessed in 2011 (-20.3%) and 2012 (-14.1%). With a further fall of 15.4% in Q1 13 vs Q1 12, we expect UK gas production to continue to decline in the years to come, even if new conventional fields are anticipated to come onstream thanks to record offshore capex spending

North America to become the third-largest LNG exporter thanks to shale gas

Between 2005 and 2012, US gas production increased by 30% thanks to shale gas, which today represents more than 40% of total domestic production. To access new markets to balance this supply (and to benefit from low US gas prices), many companies want to build liquefaction facilities to export Liquefied Natural Gas (LNG). However, a wide range of authorisations are needed before a liquefaction facility can be built in the US, including:

- An important one granted by the US Department of Energy (DoE) to allow exports, as all nation states have permanent sovereignty over their natural resources. The US DoE can grant authorisation either to countries with which the US has a free trade agreement (FTA countries are Australia, Bahrain, Canada, Chile, Colombia, Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras,

Israel, Jordan, Mexico, Morocco, Nicaragua, Oman, Panama, Peru, Singapore and South Korea) or to all countries with which trade is not prohibited by US law.

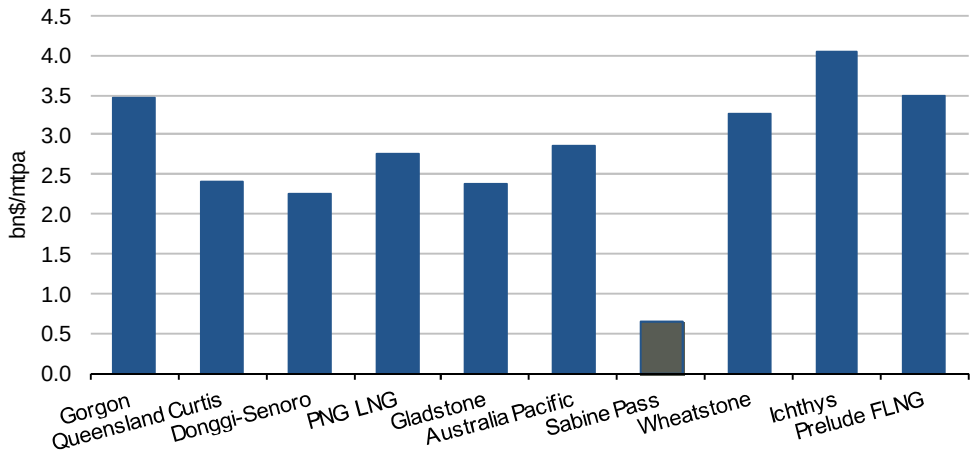
- One granted by the US Federal Energy Regulatory Commission (FERC) to site, construct and operate facilities for the liquefaction and export of domestically-produced natural gas. This process takes more than a year and costs tens of millions of dollars.

Cheniere was the first company, in May 2011, to be granted all export authorisations. It has managed to sell 16 million tons per annum (mtpa) (equivalent to 22 billion cubic metres per year (bcm/y)) of LNG under a US spot-linked (Henry Hub) formula (LNG delivered Free On Board: 115% HH + fixed fee). The 115% HH covers the gas sourcing (100% at the hub), the cost of fuel gas needed for the process (10%) and additional costs of transportation to the liquefaction terminal (5%). The fixed fee is for the remuneration of the liquefaction plant, which will therefore operate as a tolling plant. As Cheniere took a Final Investment Decision in July 2012 on Sabine Pass Phase 1 (and in May 2013 on Sabine Pass Phase 2), LNG should be in production in the US as early as 2016e.

Since our written submission, the US DoE authorised Dominiom to export US LNG to non-FTA countries from its Cove Point terminal at a rate of 5 mtpa.

In August 2013, the US DoE authorised Lake Charles to export US LNG to non-FTA countries from its terminal in Louisiana at a rate of 15 mtpa (20 bcm/y). The US DoE granted a further authorisation, in May 2013, to Freeport in Texas at a rate of 9 mtpa (12 bcm/y). Lake Charles and Freeport are still waiting for the FERC authorisation. Several other projects with a total capacity of around 200 mtpa (270 bcm/y) have filed applications seeking export authorisation. So our estimate of 50 mtpa (67 bcm/y) in exports in 2020e from North America (US and Canada) is now very likely to materialise.

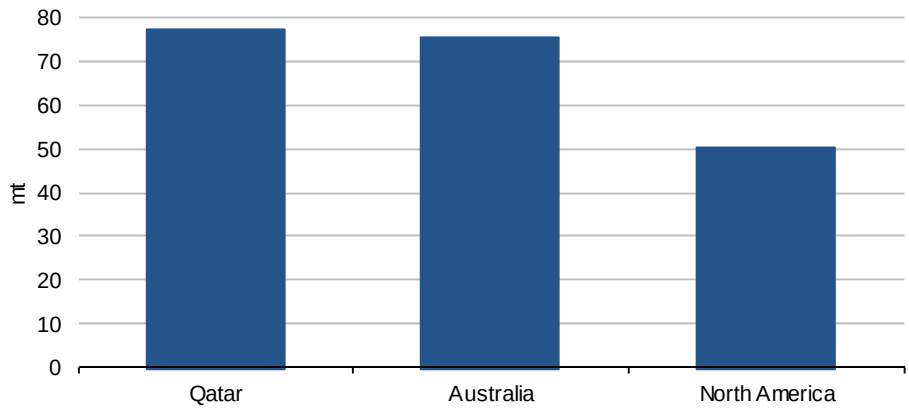
Disclosed capex of sanctioned LNG projects



Source: SG Cross Asset Research, companies data

Thanks to unconventional gas, Australia is set to become the next growth area for LNG from 2015e. Its current 24 mtpa (33 bcm/y) capacity is set to grow, as 53 mtpa (71 bcm/y) capacity is already under construction. But Ichthys could be the last greenfield LNG project sanctioned in Australia because, with rampant cost inflation and faced with an increasingly price-sensitive customer base, these large-scale, expensive projects simply look cumbersome and out-dated in the context of intensifying global competition. As a result, Australian projects are being priced out of the market by US ones that are much cheaper as: 1/ the upstream, transportation and LNG infrastructure (jetty, tanks) are already there; and 2/ the cost of labour is lower than in Australia.

2020e LNG production: three largest producers



Source: T.Bros, *After the US shale gas revolution*

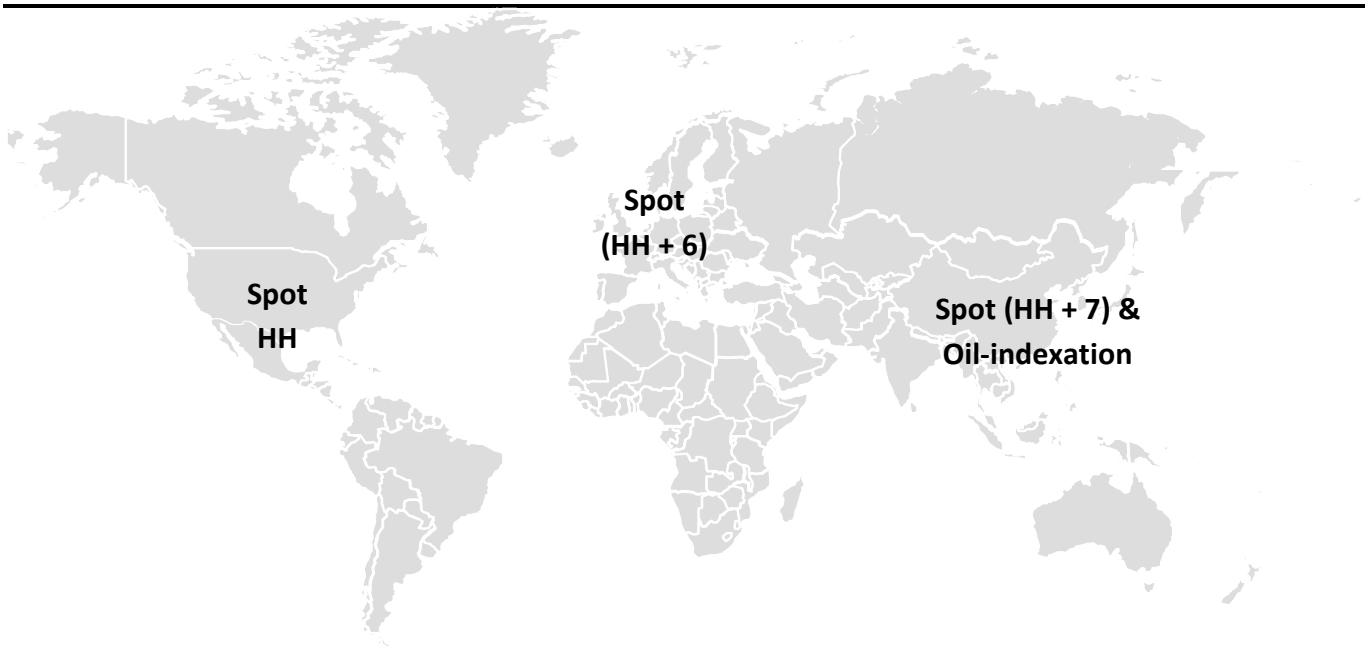
Markets could be linked via the cost of LNG arbitrage

By directly sourcing US LNG priced under an HH formula, Asian customers are cutting out the middle man, the LNG aggregator. And, if the US becomes a major LNG producer as we believe, then this change in business model could start to reduce oil indexation in Asia, as we are seeing in Europe.

If we assume no other country can replicate, before 2020e, the US's success, the US could remain the cheapest gas market at least for the rest of the decade; other markets will be linked via the cost of arbitrage (liquefaction, transport and regasification). For a unified global gas market to be achieved, all countries will need to follow the US path by producing their own domestic shale gas, something that looks improbable before 2020e.

In 2012, the difference between US and European gas saw Europe paying $130bn (or 0.8% of GDP) more for its gas than it would have if it had paid US prices. This spread is there to stay for this decade as Europe will not be able to produce shale in any significant quantities before 2020e. The low level of European shale production should therefore have only a limited impact on European prices (be it wholesale or at the residential level).

Overview of gas prices in 2020e (with estimated spreads in $/MBtu)



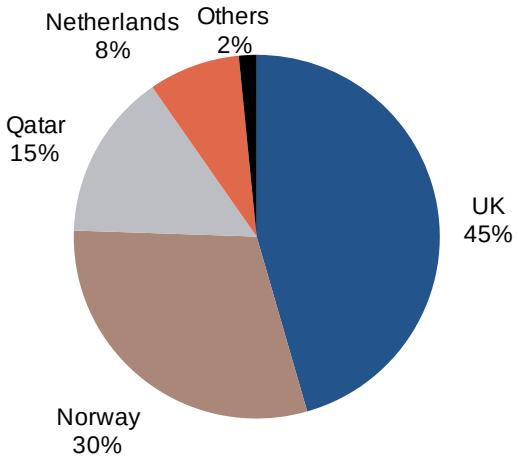
Source: T. Bros, *After the US shale gas revolution*

UK: a leader for shale gas in Europe

Like any human activity, shale needs a 'social licence' to operate and the industry should be aware that its least successful player, in the eyes of the general public, defines the industry as a whole. The way the industry operates in the first countries to allow fracking will have a major impact on further shale oil & gas production throughout Europe. A tightly regulated production process, with a systematic programme for the disclosure of chemicals used in unconventional gas production, could help the industry to expand in Europe. The International Association of Oil and Gas Producers launched in June 2013 www.ngsfacts.org to provide information concerning hydraulic fracturing of natural gas from shale wells and other issues, including voluntary disclosure of chemical additives on a well-by-well basis in the European Economic Area. This site includes wells which have been hydraulically fractured since January 2011 by participating operators (six wells in Poland so far). This is in line with the wider US www.fracfocus.org initiative. A comprehensive disclosure programme allows citizens and communities to consider the technology. Only this can lead to informed discussion about environmental protection and risk management, and the potential benefits of shale development in Europe. Any environmental issue would have a dramatic effect on shale production throughout Europe. Thanks to its long history of conventional exploration and production, the UK has well-established rules on the environmental issues that could help local acceptance.

Tighter environmental standards will mean that this business will not be as profitable as conventional gas production in major resource-holder countries, but the risks (financial, security, etc.) are much lower in Europe than in other gas-producing countries. The UK industry is a pragmatic price taker, which means that it will proceed with shale gas production only if it perceives it could be profitable. The above map shows that if the full cost to produce 'green' shale gas in the UK is less than HH+6 $/MBtu then it should go ahead as it will be profitable for private companies to extract it. As in hydrocarbon production, taxes are very high, therefore the tax regime will have an impact on the level of investment (and hence the production). It is too early to estimate the amount of UK shale production but it is possible that the UK will produce some as soon as 2020e.

Split of 2012 UK gas supply

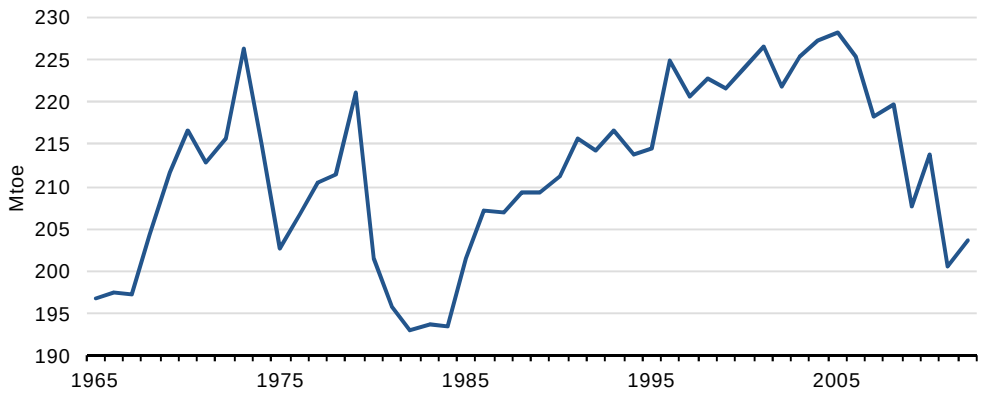


Source: BP Statistical Review

Until the shale gas revolution, net importers were fated to become more and more energy dependent. The shale gas revolution changed this dependency paradigm forever and is offering an alternative. The US has chosen to reduce its dependency on foreign oil & gas. China will try to use it to mitigate its growing gas dependency. The UK (like Poland) could use it to mitigate its growing dependency on importation of gas, leading it to displace Qatari LNG, whereas Poland could displace Russian pipe gas, which is viewed by the Poles as not fully reliable. In the UK, shale gas could lead to a useful diversification of supply which would boost energy security and have a positive impact on jobs and the trade imbalance.

If this is done successfully in the UK, other European states that actually ban this technology could follow with production after 2020e (to curb their own deficits). With shale gas development in its early stages in Europe, the resource is unlikely to play more than a marginal role in helping to meet Europe's energy requirements in the next decade. European shale gas production could also be the only answer to the ill-functioning EU gas market in which four foreign national oil companies (Gazprom from Russia, Statoil from Norway, QP from Qatar and Sonatrach from Algeria) control c.50% of supply, allowing the wholesale price to be way above the marginal cost of production. And when market participants view material shale gas production in Europe as possible (meaning around 25 bcm or 10% of domestic supply or 5% of demand), the price curve could move down to reflect this new world.

UK primary energy consumption



Source: BP Statistical Review

UK primary energy consumption peaked in 2005. Since then, consumption has declined by 1.6% pa. Such a peak in primary energy consumption is also visible for EU-27 (2006), the US (2007), Japan (2006) and the OECD countries as a whole (2007) as well as for Russia (1989). Poor economic growth, high fuel prices and greater energy efficiency should continue to cap UK primary energy consumption. This tends to show that, like other OECD countries, the UK has entered a new world where energy efficiency has kicked in. The question now is no longer how much consumption of each energy fuel is going to grow, but which one is not going to decline for the foreseeable future. In this context, the inter-fuels competition that currently favours renewable (on the policy side) will exacerbate the decline of other types of fuel. So this 'new' gas will displace imported gas first and could be used in power generation but also in transport (either via LNG, CNG or electric vehicles powered by gas-fired power stations). It could also lower wholesale gas prices thanks to increased competition. UK/European shale oil if produced could, after 2025e, mitigate a growing dependency on the less reliable Middle East.

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