

# Shale gas in Europe: A revolution in the making?

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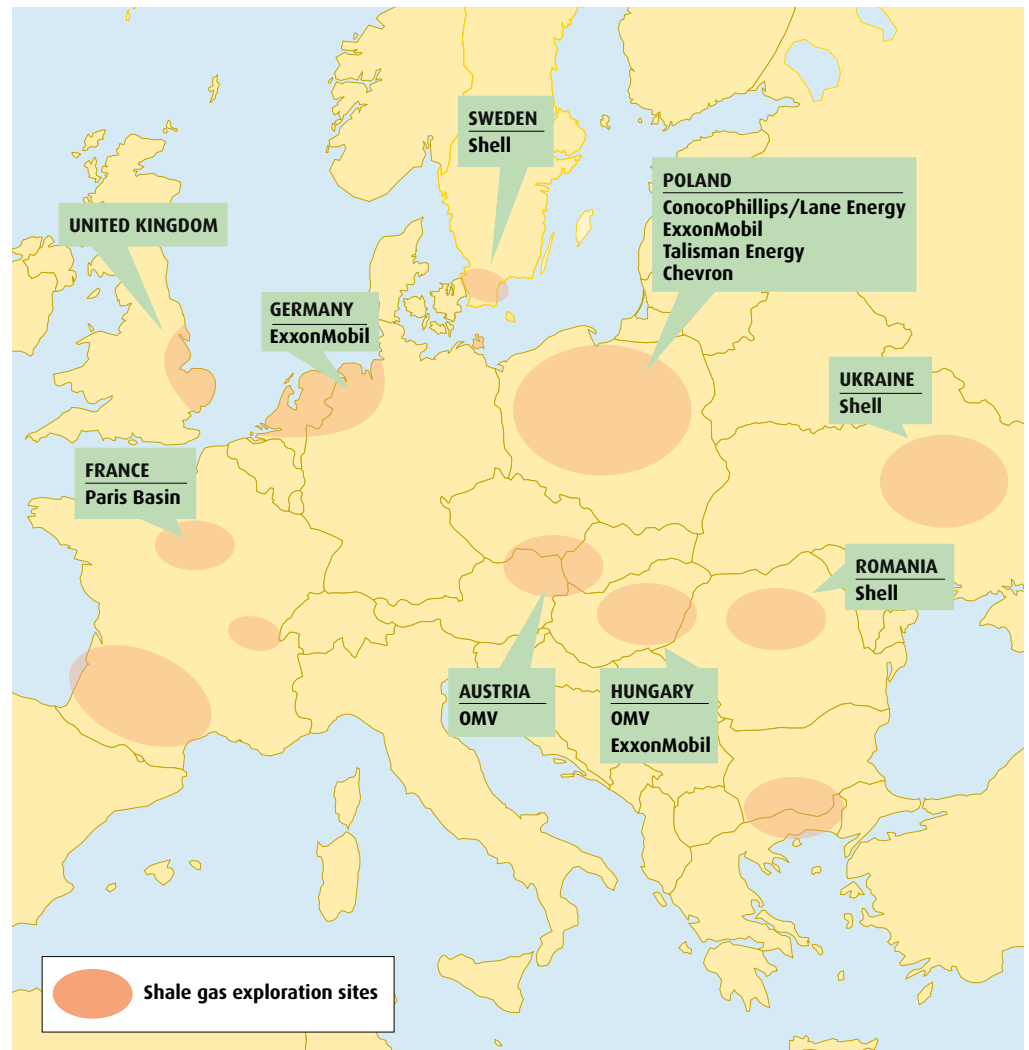
Without question, one of the big gas news stories of the last couple of years has been the so-called “shale gas revolution”. A dramatic rise in US shale gas production has been one of the factors which have boosted US gas production to record levels and led to continuing weak gas prices. Even more dramatic than the increase in production have been the revisions of estimates of US domestic gas resources, which have been sufficiently dramatic for a flock of commentators to talk about shale ushering in a new era of cheap gas, with the potential to revolutionise the US energy scene, boosting energy security and providing a transition to a low-carbon economy. And now the interest in shale is turning in earnest to Europe, precipitating what some observers have called a “land-grab” for potential shale gas acreage. But, despite this optimism, Europe has yet to produce any shale gas and even on the most optimistic projections, shale will not make any impact on European gas production for some years, perhaps a decade. So how excited should we be about the prospects for shale gas production in Europe? In this article we look at the potential and some of the obstacles companies will face in exporting the US shale gas revolution to Europe.

### EVOLUTION OF SHALE GAS PRODUCTION

The idea of producing natural gas from shale deposits is not new. Indeed, the US has been producing shale gas from shale deposits for decades. But shale gas attracted little attention from the majors, being considered a small-scale niche play because of the low productivity of shale gas wells. Also, traditional oil and gas companies have been wedded to the conventional model whereby gas is formed by thermal transformation of an organic-rich source rock, with the gas migrating upwards until it is trapped in a porous reservoir from which it can be recovered by conventional drilling. Gas production from conventional porous reservoirs has high productivity because the gas can migrate through the reservoir to the well bore. Shales are organic-rich sediments which can be source rocks for the production of conventional gas, but have low permeability themselves and, by consequence, low well productivity. Shales were therefore considered poor material for gas production.

But despite this, smaller US companies were producing gas from shale in small quantities. Production in the Antrim Shale in the Northern Michigan Basin began in the 1940s and is the most actively drilled US shale play, having produced more than 2.5 Tcf of gas from over 9,330 wells. Techniques for producing gas from shales have improved over time, with a combination of horizontal drilling and hydraulic fracturing yielding significant increases in well production, albeit with very high decline rates. Horizontal drilling allows a greater length of the shale deposit to be in contact with the well bore, while hydraulic fracturing produces fissures in the reservoir, boosting the migration of gas to the well bore. These enhancements were perfected by smaller companies and by oilfield service companies, leading to a series of incremental improvements which eventually built shale gas production to levels where it has become a significant factor in US gas production. In 2007 US shale gas production had reached 1.2 Tcf, but jumped to 2.0 Tcf in 2008, making up 9.5% of all US gas production.

Estimates of the size of the US gas resource base have also been radically revised in light of the growing importance of shale gas. In June last year the US Potential Gas Committee, which publishes a biennial assessment of US gas resources, reported that US potentially recoverable gas resources were some 1,836 Tcf – the highest estimate in the Committee’s 44 year history. Increases in the assessment of shale gas



resources were the main factor in this increase, with shale gas making up some 33% of the total resource base. And in terms of actual proven reserves the story is similar. US proven gas reserves at the end of 2008 were at their highest ever reported level, with much of the recent increase coming from shale, proven shale reserves having increased by some 50% from 21.7 Tcf in 2007 to 32.8 Tcf in 2008.

The surge in US shale gas has led to a reassessment of the US's long-term gas balance. The immediate impact is on the need for imports, both pipeline gas and LNG. Conventional gas imports from Canada are on a declining trend in any case, but a lot of the LNG which is currently coming on stream or planned is anchored on sales into the US. With demand down in other markets some of this LNG will be forced to go to US terminals, even though the US doesn't need it. Low prices for LNG in the US will also have an impact on marginal prices for LNG in Europe and elsewhere.

### EUROPE LOOKS TO REPEAT US SHALE GAS SUCCESS

So in a way, shale gas is already having an impact on the European market. However many believe that it is set to have a much more direct impact, and that the shale gas boom in the US can be replicated in Europe. The US majors – who largely missed out on the first stages of shale growth in their home patch – certainly seem to think so. ExxonMobil, who recently acquired US shale gas producer XTO, is active in Hungary, in Poland and in Germany, and has teamed up with German upstream company Wintershall. Chevron, ConocoPhillips and Marathon are also hunting for shale gas in Europe, particularly in Poland.

European companies are also positioning themselves to exploit shale gas in Europe. Statoil has done this through an alliance with leading US shale gas producer Chesapeake Energy. The Norwegian company has bought into some of Chesapeake's US shale assets, and is pursuing European opportunities in collaboration with its US partner. In fact Chesapeake seems to be providing leverage to several other companies eager to get into shale, as it has sold down some of its US shale assets to exploit the value – some might say hype – associated with its leading position, and claims it has captured some \$10.8 billion in value from joint ventures where it has allowed Statoil, Total and BP to separately buy into its US shale positions. The other European majors such as Shell, ENI and OMV are all active in developing potential shale gas plays in Europe.

### EUROPEAN RESERVE ESTIMATES

But these moves by US and European companies are only preliminary positioning. On-the-ground activity is only just getting underway and, as the old-time US explorers appreciated, the only real arbiter of oil and gas prospects is "Doctor Drill". In at least one case the drilling results have been negative: disappointing results from drilling in the Mako Trough in Hungary led to the announcement in February that ExxonMobil and MOL were withdrawing from the exploration project, leaving US-based Falcon Oil and Gas looking for new strategic partners.

But these uncertainties have not prevented analysts from speculating on the impact shale gas might have on the European gas industry. The investment bank JP Morgan has, for example, recently published analysis<sup>1</sup> which forecasts European shale gas production growing to nearly 30 Bcm/year by 2015 and to four times that figure by 2020.

How realistic are estimates such as JP Morgan's? Well the simple answer is that it is too early to say. The shale gas map of Europe will take some time to draw reliably – as indeed it did in the US: it is worth noting that maps of US shale plays drawn as late as 2007 did not show the Haynesville and Marcellus shales, now thought to hold some of North America's largest concentrations of producible shale gas<sup>2</sup>. The issue is not uncertainty over the location of shale deposits: European geology is sufficiently well documented for this not to be a problem. The issue is how much gas the shales contain and, crucially, how easy it is to produce that gas. Shale deposits vary greatly in their petrology and geochemistry, and US experience has shown that some shales are far better – i.e. more economic – producers than others.

Given these uncertainties, any estimates of the European shale gas resource base must be speculative. On the whole Europe is likely to be somewhat less prospective than the US, as its geology is more fragmented and lacks sedimentary basins of the sheer scale of those in North America, where some of the shale plays extend over several hundred square miles of territory. Moreover, some of Europe's most promising basins lie offshore, particularly in the North Sea, and offshore production of shale gas has not been tried yet (the likely issue here is not technology but economics). The US National Petroleum Council in 2007 cited a possible European shale gas resource of some 539 Tcf: this would put European shale gas resources below those of the US, but it would still amount to a very significant resource base which would have the potential to radically reshape Europe's gas supply picture (for comparison total European proven gas reserves at the end of 2008 were some 216 Tcf).

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<sup>1</sup> J.P.Morgan, "Shale Gas – a game changer for global gas markets", February 9 2010

<sup>2</sup> See J.B.Curtis, "The contribution of shale gas to future US gas production", AAPG Annual Convention, June 2009

### LOCATION OF SHALE GAS RESERVES

Where might European shale gas reserves lie? The prospective areas lie, unsurprisingly, where companies have announced shale exploration initiatives (see map on page 3):

- At the margins of the North Sea, in the east of the UK and in the Netherlands
- In Poland, particularly in the Baltic Basin in the north of the country where both ConocoPhillips and ExxonMobil have interests
- In several regions in France, particularly the Paris basin but also in Languedoc Roussillon, the Cevennes mountains and the Savoie region near the Swiss border
- In Southern Sweden in the Cambrian Alum Shale – Shell has drilled the first core well and plans to drill two more wells during 2010
- In Hungary and Austria, with OMV planning its first well in the Vienna Basin this year
- In Romania, where Shell is studying prospects
- Outside the narrow confines of the EU in Turkey and particularly the Ukraine

### ECONOMIC AND ENVIRONMENTAL ISSUES

Even if drilling results from these areas are promising, several obstacles lie in the way of efforts to commercialise shale gas in Europe. The most obvious of these is economics. Shale gas wells have lower productivity than conventional wells and, moreover, their production declines very rapidly in the first couple of years. This means drilling a larger number of wells than for conventional gas and, with the requirement for horizontal drilling and hydraulic fracturing, these are relatively expensive wells. Just how expensive shale gas is to produce will technically depend on the shale characteristics. There are also differences of opinion on the true cost of shale gas production, with shale gas promoters claiming costs in the best US plays of \$5/MMBtu and below while sceptics suggest that true costs may be \$7/MMBtu or more. In a European context these figures look good compared with the current price of gas bought on long-term oil price-linked contracts (the average German import price was running around \$8.50/MMBtu in February) but maybe not so good compared with traded gas prices (NBP was around \$5.30/MMBtu in February).

Cost is, however, not the only issue. The environmental impact of shale gas production is becoming an ever more contentious issue in the US. The key concern seems to be the risk of contamination of water supply aquifers by the chemicals used in hydraulic fracturing. Very large quantities of water, potentially millions of gallons of water per well are needed for fracturing operations, and chemicals are added to the water to improve performance. Both the sourcing of such large quantities of water and the risk of migration into water supplies pose environmental issues. And while shale gas promoters say that there are no known incidents of contamination of water supply from hydraulic fracturing, concerns have been sufficiently strong for New York state, for example, to essentially impose a moratorium on shale gas drilling near a watershed that supplies drinking water to New York City (See March issue of Gas Matters – A blip for US shale gas production). Environmental concerns of this sort may well be even greater in more densely-populated Europe, and the playing-out of the environmental issues will be a key factor to watch in assessing the potential of shale gas in Europe.

Even if the geological, environmental and economic hurdles can be overcome, it will take a considerable effort to mobilise the resources needed to make the dream of a European shale gas boom come true. Currently Europe lacks the service industry that would be necessary for a spurt in shale gas activity – there are far fewer land-based drilling rigs available in Europe than in the US, for example. This can be overcome with time but might be a constraint on the rate – and cost – of development.

Shale gas certainly has the potential to make a major impact on European gas supply. Whether it will be a “gamechanger” is rather less certain. What does seem sure, however, is that 2010 will see several European shale gas plays tested for the first time, and by the end of this year we may have a better idea of “Doctor Drill’s” preliminary opinion on the matter.

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**Note:** This article has been edited.

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