

Shale Gas in Europe: Reserves, Production, and Perspectives

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Abstract The history of the commercial shale gas production in Europe is not long. But still the issue of shale gas production is in the focus of attention in many European countries. On the one hand, this is connected with the tougher competition among the countries exporting natural gas and, on the other hand, with the endeavors of many gas-importing countries to diversify the sources of hydrocarbons and at the same time to purchase them at a lower price.

Keywords Europe, Production, Reserves, Shale gas

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1 Introduction

The phenomenon of the so-called shale revolution advertised widely by the US companies was not overlooked in energy-dependent Europe. Moreover, the US experience and successes in the shale gas production stirred great interest in many European countries that started developing plans for extraction of their own reserves of shale oil and gas. Primarily, the European countries saw the opportunity to diminish their dependence on gas supplies via pipelines, first of all, from Russia.

In 2009 EU launched the project “Gas Shales in Europe” to be implemented within 3 years. It envisages large-scale surveys of shale plays in Europe. This project is sponsored by a group of companies, including Statoil, ExxonMobil, Gas de France, Wintershall, Vermillion, Marathon Oil, Total, Repsol, Schlumberger, and Bayerngas. In November 2012 the European Parliament by majority votes gave permission to the EU countries to produce shale gas and did not support the proposal of imposing moratorium on the fracking technology application. In December 2012 the decision on renewal of the shale gas production was passed in Great Britain, and in January 2013 Chevron applied for permission for shale development in Lithuania.

At the same time, the policy of the European countries in shale gas prospecting and production lacks some single approach. The countries pursue their own interests and rely on their own assessments of possibilities of shale play development. Perhaps, for this reason by 2013 no unified strategy in respect of this technology of gas production in united Europe had still existed [1].

The European countries like many other countries that showed interest in shale gas plays faced the lack of reliable and accurate data on the reserves of this hydrocarbon. This gave rise to many speculations concerning the shale gas reserves and appearance of some fantastic projections about future volumes of shale gas production. As a result, Europe has no accurate data about the shale gas reserves, but only some rough estimates varying widely.

2 Shale Gas Reserves

In 2009 the “shale boom” reached Europe. The interest to this hydrocarbon was supported by availability of enormous resources of gas-containing shales and also the endeavor to diversity the sources of gas supply to the European market. Herewith, the European countries have no accurate assessments of the shale gas reserves. The multiple estimates of the shale gas reserves were usually provided by the representatives of foreign, primarily US, companies and international organizations. Thus, according to International Energy Agency (IEA), Europe may have up to 16 tcm of shale gas, while according to the US statistics agency at the US Department of Energy [2], this figure may be as high as 18.1 tcm. At the same time, by estimates of the US Energy Information Administration, the technically



Fig. 1 Shale gas opportunities in Europe (<http://www.netlabgmbh.de/ShaleGas%20Europe.jpg>)

recoverable resources of shale gas make 5.3 tcm. Based on such data, there were made assumptions about the opening opportunities for Europe to change drastically its gas market structure having reduced significantly the dependence on hydrocarbon supply from Russia, Near East, and North Africa. Thus, in the recent years, the gas consumption in the European countries made around 550 bcm. After respective estimates, it was concluded that the shale gas reserves were sufficient to meet the needs of Europe for 30–35 years.

Regardless of the lack of geological survey data and insufficiency of information, it is assumed that such countries as Poland, Germany, the Netherlands, Hungary, Sweden, Great Britain, and France may have up to 15 tcm of shale gas that in the future may be developed in industrial scales (Fig. 1).

According to projections, the largest shale gas plays are found in Poland and Northern Germany. For example, the shale gas reserves in Germany are estimated at 2.2 tcm, in Poland – 5.2 tcm or 29% of the cumulative reserves in Europe, and in France – 5 tcm. These data need further verification which requires drilling of many wells. And only a small fraction of these resources may prove cost-effective in the future for industrial-scale production.

3 Shale Gas Production

The recent years have been marked by close attention of US companies to European countries that are considered as one of the potentially profitable regions for shale gas production. In April 2010 the US Department of State launched the Global

Shale Gas Initiative called to assist the world countries in finding and developing the unconventional gas sources applying safe and cost-effective techniques. At the same time, this program supports the economic and commercial interests of the USA.

It is highly probable that in some parts of Europe the shale plays may be less convenient for development than in the USA. As a result, it will be very difficult for Europe to repeat the success of the USA because the West European shale plays are smaller, contain less gas, and occur deeper. At the same time, they have a high clay content which impedes the application of the fracking technology. Thus, in Poland the shales occur at a depth of 3–4.5 km, which exceeds much the depth of shale gas occurrence in the USA. Accordingly, already today it can be said that the shale gas production in Europe will be more costly than in the USA.

Europe only starts the trial drilling and it is too early so far to speak about industrial-scale production. In 2010 Europe launched nine projects of shale gas prospecting, of which five projects are implemented in Poland. The cost of drilling of one prospecting well there was US\$ 20 million. In general, the cost of the shale gas production in Europe will be several times higher. It is still difficult to forecast the role of shale gas in Europe as there are no operating wells so far. Only after drilling wells it will be possible to assess the conditions of geological structures and their perspectives in terms of commercial feasibility.

4 Difficulties in the Shale Gas Production

There are some peculiarities interfering with the development of unconventional gas sources in Europe. First of all, these are issues connected with the geological structure of the plays. There are no two shale gas plays in the world with identical characteristics; likewise, there are no two identical shale formations. Each of them has its unique features. They may occur at different depths, differ by the volume and other parameters. The shale gas prospecting and production are the process that requires much time and costly technologies. Therefore, the production technology in each play shall be modified with regard to its particular features. This may lead to the increase of the play development time and related costs.

There are also other problems faced by the companies intending to extract shale gas in Europe, such as high population density in European countries that makes rather problematic the access to shale plays which development may result in groundwater pollution.

The shale gas production in Europe may be a much more complicated venture than in the USA due to likely negative environmental consequences and some other difficulties. First of all, the relationships with the population and controlling authorities will not be easy. The main shale gas plays in the USA locate in the sparsely populated areas where oil and gas have been produced for many decades. According to the US laws, the owner of a land site where mineral deposits are found may expect high revenues from rent. In Europe the shale gas will be extracted

nearby the densely populated areas. Moreover, in Europe the pay for the mineral deposit production is directed to the state. In this context, the companies engaged in shale gas production may face the opposition of the population and legal suits against drilling of wells.

All these factors lead to a conclusion that one should not expect the repetition of the US “shale revolution” in Europe. In Europe there are legislative restrictions preventing the companies from launching the shale gas production in the scales observed in the USA.

Development of the shale gas production may require serious alterations in taxation of this industry in the countries planning to conduct surveys of these resources. Regarding the potential of the shale gas plays, the new players, including Poland and Ukraine, may appear in the oil and gas industry.

Therefore, the low level of geological exploration, the lack of free access to shale plays due to high population density, difficulties with obtaining licenses to development works, the absence of a legal and tax base, hazards of breaking the integrity of underground structures, and the lack of the US technologies in the European companies, all these factors are obstacles for the shale gas production in the European countries.

5 Prospects of the Shale Gas Production

The flow of news from the USA stirred discussions in Europe regarding the prospects of the shale gas production. One of the key issues being in the focus of attention in Europe is whether the shale gas will substitute in the future the natural gas supplied by pipelines.

Even if the shale gas reserves in Europe are confirmed, it is quite unlikely to expect rapid growth of its production. The main skepticism in respect of forecasts of the shale gas production in Europe takes its origin in many problems around this venture, primarily, the fact that the shale gas reserves require careful studies. All data about the shale plays present only rough and unconfirmed estimates. In addition, the population density in Europe is much higher than in the USA. This will cause the conflict of interests between the oil and gas companies, on the one side, and the public that in its majority pushes back against the shale gas production, on the other. Considerable investments are required for creation of infrastructure and development of shale plays. Thus, the EU countries have a small quantity of gas wells. Moreover, the European countries do not have the appropriate equipment and the personnel to organize gas production in such scales. Meanwhile, the shale gas production requires drilling of a great number of wells, and the wells should be drilled permanently as, unlike the natural gas deposits, the well yields in shales decline by 70–90% by the end of the first year of operation. Consequently, in Europe the drilling rates should be increased multiply which needs time and additional costs.

And, at last, we should not neglect the wide public movement against the shale gas production. The ecologists in the European countries organize protest meetings demanding not to launch the shale gas production. This is connected with drilling works and environment pollution which get under the European bans.

If we take into consideration the current realities of geological surveys and existing difficulties connected with the shale gas production, it can be said that the role of shale gas in ensuring the energy security of Europe will be much more modest than declared by some politicians and experts. Shale gas may be very useful for Europe, however, quite unlikely that the European gas market will witness any shale revolution and will be able to abandon completely its dependence on the Russian energy sources. In this regard it is difficult to assume that shale gas will become the panacea for energy independence of Europe, rather the shale gas may be considered, more precisely the whole problem, as a tool with which Europe will assert its geopolitical and economic interests in relations with Russia.

Regardless of rather obscure prospects, a powerful PR-campaign in support of the shale gas production was unrolled in Europe. This boom around the shale gas is created artificially and is supported by major energy companies. The European countries are pressed strongly by the US administration that is targeted to promote the interests of the US companies engaged in the shale gas production. The idea that the natural gas extraction from unconventional fields will lessen the EU dependence on exporting countries is pushed energetically. The shale gas production will lead to serious geopolitical changes on the continent. The growth of the shale gas extraction as well as supply of liquefied gas from Qatar at dumping prices will cut significantly the gas supply by Gazprom; thus, the European countries are expecting to reduce their dependence on gas supply from Russia.

Based on rather approximate estimates of reserves, the projections concerning the shale gas production in Europe are also only rough (Fig. 2). Accordingly, the extraction of shale gas in Europe cannot start earlier than in 2025. So, the role of shale gas in EU may be quite minor. The estimates of shale gas production vary from 10 to 30 bcm, and then only in perspective. These are small figures and they are unable to influence seriously the situation in the European gas market. And especially since the main limiting factors here are the strict European laws and safety requirements. The most optimistic forecasts do not go over 40 bcm per year by 2030 or 5–7% of the volume of planned natural gas consumption in Europe.

In fact, the technologies of the shale gas extraction are rather traditional and their specific feature is in their adaptation to the conditions of particular plays. It is not a fact that the US technologies of shale gas production may be applicable in other countries, both for financial and operational-technological considerations.

The large-scale development of shale gas plays in the EU countries is rather doubtful, at least, in the midterm perspective. The production costs are high and may be equal to US\$ 100–200 per 1,000 cu. m in well mouth. According to other estimates, the shale gas production in Europe will be more costly than in the USA and may reach US\$ 350 per 1,000 cu. m.

Some legal, tax, and environmental constraints should be also added here. The poor geological survey of reserves, high production costs, and the lack of own

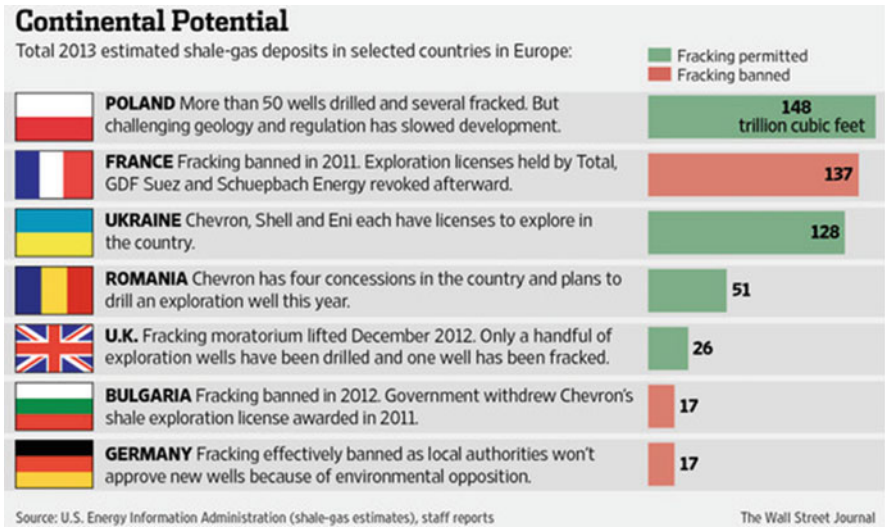


Fig. 2 Shale gas deposits in selected countries in Europe (https://si.wsj.net/public/resources/images/WO-AR812A_EUSHA_G_20140326183913.jpg)

extraction technologies [3] will make the shale gas production in Europe much more difficult. Consequently, in the near future, the shale gas in Europe will be treated as backup and not the main source of gas supply.

The European environment protection laws which are much tougher than in the USA will play their role here. In the USA the effect of the fracking technologies requiring great amounts of water and chemical agents on the ground waters is being studied. This issue remains acute and from time to time it is raised by ecologists. Obviously, in Europe, the protests of the “green” and initiative groups will be more energetic than in the USA.

6 The US Role in the Shale Gas Production in Europe

There has been no any certainty so far about the prospects of the shale gas production in Europe although the major oil and gas companies have invested cumulatively about dozens of billion dollars into purchase and initial development of shale plays seeking to “stake out” a place in the market and to obtain licenses for prospecting and development of the most promising plays. These companies assume that the production technologies will be improved and it will be possible to speak about a considerable progress in choosing the natural gas production techniques. In Europe about 40 companies undertake surveys of the shale gas plays. The US companies ConocoPhillips and ExxonMobil as well as the British-

Dutch Shell purchased licenses to the shale gas extraction in Poland, Sweden, and Germany.

The Washington's strategy for energy diversification of EU was targeted to reduce the dependence of the European states on the Russian hydrocarbon supply by creating alternative routes for natural gas transit from the Caspian and Central Asian Region. However, after the beginning of the "shale revolution," the major US oil-producing transnational corporations have shown interest to development of shale plays directly in Europe, thus seeking to diminish the hydrocarbon supply from Russia.

So far the Old World has been discussing the prospects of the shale gas production that will radically change the perspectives of the energy market development in the USA. But the effect of the "shale revolution" on the European energy market may be described more likely as an evolutionary process. Only a small fraction of these resources may be cost-effective in the future for commercial scale production. More than 50% of all assessed reserves of shale gas in Europe making around 10% of the world reserves are found in two countries – Poland and France – which are followed by Germany that also possesses the considerable shale gas reserves.

The most active advocates of the shale gas idea are the US-oriented countries. The peak of the shale gas production is reached very quickly, but its decline goes on at an equally rapid pace.

The plans for meeting the growing needs of the EU energy markets include construction of gas pipelines in the eastern direction, development of the infrastructure for take-in and use of LNG, and introduction of energy-effective technologies. According to the IEA forecasts, by 2035 the demand for gas in Europe will show a 20% growth which may enhance dependence of the European countries on gas import.

7 Conclusions

Based on the foregoing, it can be said that in the near 1–2 decades, it is quite unlikely that shale gas with its rather modest share in the energy balance will influence significantly the European gas market. Much time should pass until we see the tangible effect of the "shale revolution" on the market. So, Europe goes on to stake on the natural gas supplied by pipelines.

But this does not mean that the technologies of shale gas production and likely ways to mitigate negative environmental consequences should not be investigated. These issues should be permanently in the focus of attention of the leading oil and gas companies. Quite another thing is that the issues related to the shale gas production and its perspectives should not be carried over to the political sphere. It is obvious that in the long-term perspective the Russian gas will dominate in the energy balance of the European countries. In 15–20 years, when new technologies may appear, the share of the natural gas in the market may be reduced, but its

complete substitution with shale gas is highly doubtful. Besides, the increase of LNG supply expected in the nearest decades as well as construction in Europe of additional terminals for LNG import may also subdue the interest of the European countries to development of shale gas plays.

The difficulties with the shale gas production in the absence of the accurate information about its reserves as well as environmental risks may also force to postpone the shale gas production in Europe for the uncertain time period. Therefore, it can be said that even in case of increase of the shale gas production, the drop of hydrocarbon prices in Europe will be not as rapid as in the USA. Accordingly, long waiting for the progress in the shale gas production creates prerequisites for ongoing high interest to further development of the pipeline transport in Europe and for maintaining interest to delivery of liquefied natural gas.

In general, the effect of shale gas on the energy markets in different countries will vary greatly governed by such factors as the national energy strategy of a particular country, the degree of its dependence on energy import, the projections of gas demand growth, the cost of alternative rivalry supplies of hydrocarbons, and the attitude to them of the public. But these factors may become decisive for small and medium independent companies oriented to development of the shaping shale gas sector in Europe. Finally, the pace and feasibility of shale gas play development in Europe will be controlled by numerous considerations, including environmental and social, the hydrocarbon prices, demand in gas and also taxation and regulation regimes.

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