# Shale Gas Production in Poland

**Igor S. Zonn and Aleksander V. Semenov**

**Abstract** One of the first countries in Europe that focused attention on the shale gas production is Poland that, according to preliminary estimates, possesses considerable shale gas reserves. The interest to assessing the shale gas reserves in this country has grown after commercial production of this hydrocarbon in the USA. The interest of Poland to development of shale plays was still greater if to take into consideration that this country was seeking to alleviate its dependence on the Russian gas.

**Keywords** Poland, Production, Reserves, Shale gas, Technologies

## Contents



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## 1 Introduction

Poland was one of the first in Europe that has taken practical efforts to prospecting the shale plays and started developing plans of their production. The Polish authorities were forced to do this in view of the dropping level of production in the country as surveys of new fields were stopped.

In 2008–2009 Poland launched implementation of the program of investments into prospecting of its large tight gas fields. The Polish "shale revolution" supported by the US corporations was expected to increase the gas output from 5 to 10 bcm and even more [1].

The shale gas production was defined by the Polish authorities as the priority direction of the energy policy. Poland believed that the shale gas reserves in the country might be much greater than in the USA as the geological conditions here were much better compared to the US plays. This fact permitted to assume that the shale gas extraction in Poland could allow for alleviating the dependence on the Russian gas.

## 2 Preparation for the "Shale Revolution"

The main shale gas reserves in Poland are concentrated in three basins: Baltic with the technically recoverable resources of 3.65 tcm; Lublin, 1.25 tcm; and Podlesie, 0.4 tcm. According to EIA, the Polish "shale belt" extending across the eastern part of the country from the Baltic coast to the Ukrainian border contains around 5.3 tcm of gas [2]. However, the data of EIA experts were based on rather shallow theoretical analysis of the geological situation in different world regions, but not on the results of prospecting drilling.

According to EIA forecasts, Poland accounts for not more than a third of all shale gas reserves in Europe (17.5 tcm). Other experts assert that the shale gas reserves in Poland are as large as 12 tcm. The State Geological Institute of Poland published data stating that Ukraine possesses 5 tcm of shale gas reserves [3]. The assessments of the consulting company Wood McKenzie say that the reserves of shale gas in the northern and central regions of Poland do not exceed 1.4 tcm. Taking into consideration the annual level of gas consumption at 13–14 bcm, it was assumed that in case of shale gas development, the country will have its own gas sufficient to meet its needs for 380 years.

In 2012 the experts of the Polish Geological Institute assessed the shale gas reserves in the country at 346–768 bcm, which is much lower than the published estimates of Western analysts. They also noted that the prospecting works are progressing very slowly; still worse is the situation with construction of horizontal wells.

## 3 Shale Gas Reserves

Poland planned to initiate shale gas production with the help of the US companies. And the major energy corporations started purchasing land sites in Poland that became the European leader in shale gas development.

In 2009–2010 such companies as ExxonMobil, ConocoPhillips, Marathon Oil, Talisman Energy, Shell, Total, Lotos, Aurelian Oil, and Chevron purchased licenses in Poland for prospecting works on an area over 400,000 ha. Polish Oil & Gas Company (PGNiG) is also intending to join these works.

In April 2010 there was information that considerable shale gas reserves were discovered in Poland, and ConocoPhillips was planning to initiate their development. The Gdansk area on the Baltic Sea coast was meant here. It was asserted that at a depth of 2–3 km, there were found shales up to 200 m thick. Company ConocoPhillips intended to use its own equipment for shale gas extraction. Other US companies, such as US ExxonMobil and Marathon Oil as well as Canadian Talisman Energy, were intending to launch similar projects.

In 2011 British San Leon Energy during drilling of a horizontal well nearby Leben in the Pomorskie Voivodeship came across the shale gas play at a depth of 4 km. The obtained results permitted this company to announce the discovery of the shale gas reserves in the northwest of Poland. Oisin Fanning, Executive Chairman of San Leon Energy, who together with the Canadian company Talisman Energy purchased the right to development of three Polish shale plays, said that after implementation of this program, Poland would become a large gas producer [4].

The US Chevron that in July 2011 signed the service contract with the company Halliburton declared its intention to initiate prospecting drilling, especially as Poland granted the unprecedented tax privileges to Chevron.

By early 2012 the Polish Ministry of Environment issued about 90 licenses to geological prospecting and extraction of shale gas (Fig. 1).

The Polish government being in a hurry to take the leading positions in shale gas production has provided privileges to foreign companies. A company should pay 100,000 US dollars for concession and without any tenders it can obtain a permit to shale gas production. As a result of such privileges, many small companies without sufficient finance and experience in shale gas recovery came to the country.

## 4 Shale Gas Production

In 2011–2012 the shale projects were energetically supported by the Polish government that figured out to initiate commercial-scale production of shale gas already in 2014. The specialists of Chevron believed that the trial extraction of shale gas could start in Poland not earlier than in 2013. But many observers being very cautious in their assessments thought that the commercial-scale production of shale gas would start in 10 years at the best [5].


**Fig. 1** Shale gas basins in Poland (https://www.stratfor.com/sites/default/files/styles/stratfor_full/public/main/images/Poland_920_1_0_0.jpg?itok=nmJCg55F)

But still some Polish experts believed that already by 2020, the shale gas output in the country could reach 20 bcm per year. This would not only cover the domestic needs and would permit to stop gas import accounting for 70% of the Poland requirements, but would turn Poland into gas exporter. In Warsaw such assessments were considered understated, and it was expected that by 2015 the country would produce up to 30–35 bcm of gas.

The Polish PGNiG did not share such optimism of the government. The specialists of the company believed that one could speak about any serious commercial volumes not earlier than in 10–15 years. Many experts agreed that the more accurate estimates of the shale gas reserves could be obtained only in 3–5 years and the shale gas production could have its effect on the gas balance of the country not earlier than in 9–10 years. Until that time the main source of natural gas would be Russia.

But regardless of the cautious forecasts, Poland already by 2015 was planning to get rid of dependence on the Russian gas and not only satisfy completely the domestic needs but become a gas exporter. By the commercial-scale recovery of shale gas, the Polish authorities intended to attain complete "gas independence" within two decades [6]. Accordingly, the company possessing 15 concessions for shale gas extraction in Poland figured to start experimental exploitation of Lubocino play in 2012. This permitted the Polish authorities to make forecasts according to which the shale gas production in Poland could result in Russian Gazprom loosing annually 10 bcm of gas export. The losses of Gazprom were assessed at 3–3.5 billion US dollars. Keeping in mind the plans to initiate shale gas production in Ukraine, Lithuania, and Belarus, the Russian company could lose a

considerable portion of the gas market and, consequently, a sizable part of its export revenues.

## 5 First Results

Energetic activities of foreign companies on shale gas production development in Poland have brought first results. However, they were not so encouraging as Poland expected.

By mid-2011 there were drilled five exploratory wells. According to Petrolinvest estimates, the companies having licenses to exploration were paid around $3 billion only for trial drilling (Fig. 2).

In September 2011 the company Aurelian Oil published the first results of well drilling. They were not as bright as it was expected. The gas output was much lower than it was forecasted, while the water consumption was much greater. Two months later, in November, the company stressed that 300 wells should be drilled to make accurate forecasts. And it was also said that 20,000–30,000 wells should be drilled to exploit the full gas volume to be extracted in the Polish territory [7]. All this required the construction of the appropriate infrastructure (supply pipelines, power generation facilities, chemical plants) which would demand investing many billion dollars.

**Fig. 2** Shale gas rig in Lebien, in northern Poland, where Lane Energy Poland company does test drilling (http://www.mlive.com/business/mid-michigan/index.ssf/2011/06/is_growing_shale_gas_revolutio.html)

In late 2011 British company 3Legs Resources that had been already operating in Poland drilled its first well. The company extracted shale gas, but it was not ready to say whether the Leben well in the Pomorskie Voivodeship would be cost effective [8].

The drilling results of ExxonMobil followed the discouraging results obtained by 3Legs Resources and BNK Petroleum in 2011 in Poland that for 2 years of drilling in the northwest of Poland managed to recover only small volumes of gas.

In early February 2012, it was announced that ExxonMobil drilled two experimental wells in Poland; however, they were not cost effective as the amount of the recovered gas was not sufficient to offset the cost of production. In mid-2012 ExxonMobil stopped prospecting works and refused to extract shale gas in Poland. The main reason here was insufficient volumes of shale gas for their sale which made further development of this play unprofitable.

Thus, by mid-2012 companies ExxonMobil, Marathon Oil, and Talisman withdrew from some shale projects and decided not to continue shale gas production in Poland having considered the wells not cost effective. These failures proved that the shale gas production in Poland could face difficulties, leading to gas cost growth and postponement of commercial-scale production.

Companies Chevron and ConocoPhillips started drilling test wells in Poland in order to confirm the conclusions of geologists on availability in this country of shale gas reserves. It was expected that at a depth of 3–4 km, the not easily accessible shales contained sufficient gas resources to satisfy the needs of Poland for many years ahead. Accordingly, the deeper drilling required greater investments. According to rough estimates, the cost of drilling of one well on the Baltic coast of Poland may be as high as five million US dollars, and the cost of one well in the south of the country will be ten million US dollars. Thus, the shale gas cost may reach 300–350 US dollars per 1 cubic meter.

In mid-2013 the US company ConocoPhillips managed to achieve stable shale gas recovery although its volumes have not reached the commercial scale. To keep up interest of foreign companies to shale gas production, the Polish authorities in 2014 considered different options of providing tax privileges. However, the creation of attractive conditions for foreign companies busy in shale gas prospecting has not been effective.

In January 2015 the US Chevron refused from shale gas production in Poland due to its low competitiveness. Among the reasons of abandoning by foreign oil and gas companies of shale gas prospecting in Poland, there were low cost effectiveness, technical difficulties, and too confused environmental legislation [9].

## 6 Conclusions

In 2013–2015 Poland failed to make a breakthrough in shale gas production although this was the critical issue for ensuring energy security of this country. Poland, like many other European countries, encountered high cost of shale

hydrocarbon extraction due to complicated geographical conditions in its territory; as a result, the cost of shale projects in Europe is much higher than in the USA, which does not permit to expect in the next decade the appearance of additional shale gas volumes.

The implementation of the shale gas projects in Poland faces many problems, the key ones being the high cost of geological prospecting and production works in the initial phase of shale play development, inadequate knowledge about shale plays, and also lack of technologies. In the USA the average cost of one well is around US $ four million. In Poland the shale gas production may be possible provided the newest US equipment is applied. In addition, it is necessary to create the pipeline infrastructure to connect the shale gas plays with the pipeline system. According to estimates of Polish experts, for attainment of the shale gas production level of about 6 bcm per annum by 2025, it will be required to invest US$ 11 billion and further on to spend up to US$ 1.5 billion for increasing the gas production by 2035. As of today, the Polish government and the Polish companies are unable to appropriate such finance [3].

The interest to the shale gas production in Poland is dropping as there are no encouraging results of prospecting drilling. Nearly 70 wells were drilled and hydraulic fracturing was made in ten of them. Around one billion US dollars were invested in total. However, these wells were unfit for commercial exploitation. Some 3 billion US dollars more are required for drilling at minimum 200 more wells [10].

More conservative forecasts were made in Poland claiming to be the leader in the shale gas production in Europe. The attainment of the commercial level of gas extraction in the amount of 3–5 bcm per year is possible by 2024, which will require no less than US$ 10 billion of investments.

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