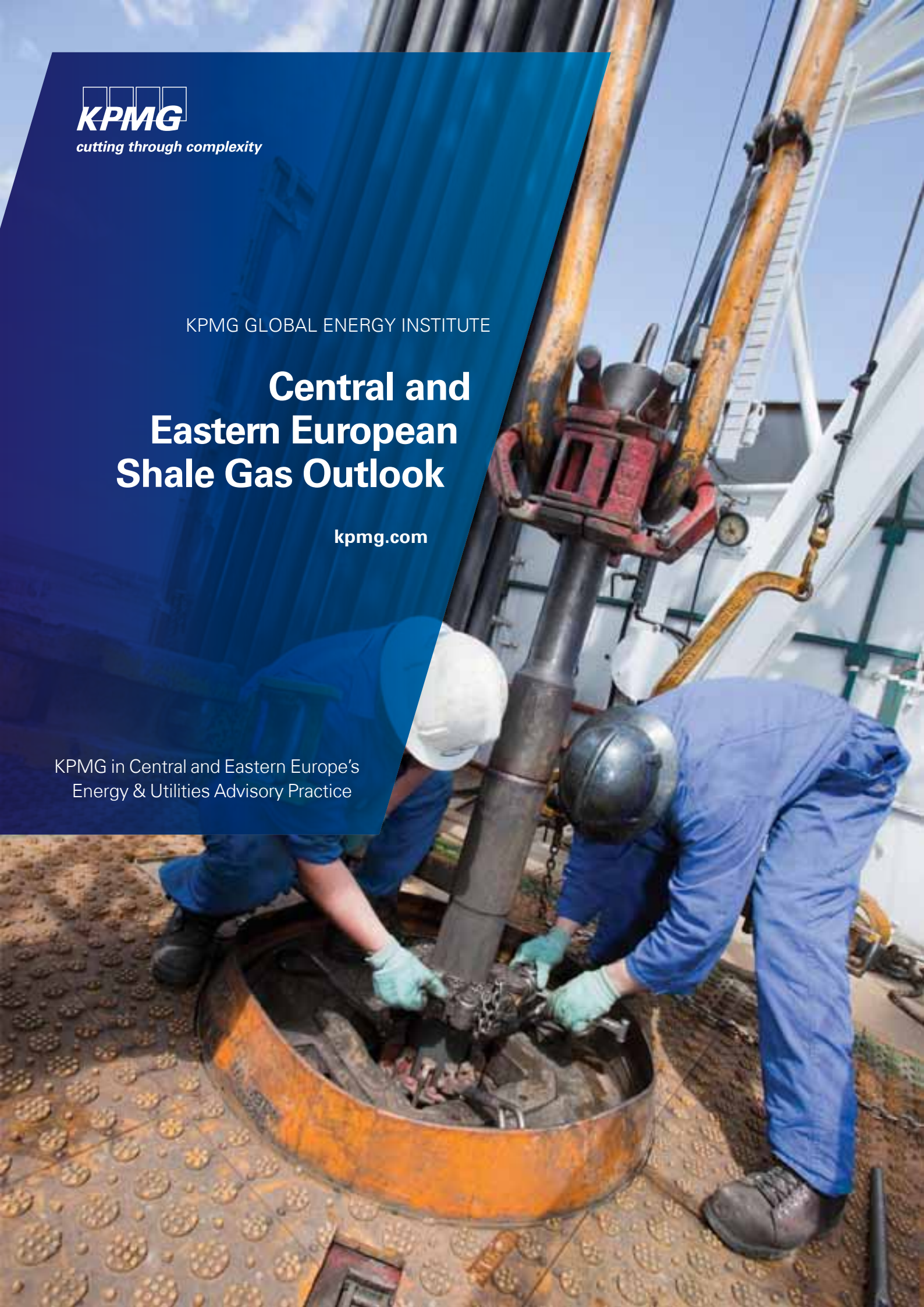


KPMG
cutting through complexity

KPMG GLOBAL ENERGY INSTITUTE

Central and Eastern European Shale Gas Outlook

kpmg.com

KPMG in Central and Eastern Europe's
Energy & Utilities Advisory Practice

Dear Reader,

It is our pleasure to introduce the Central and Eastern European Shale Gas Outlook, which has been prepared by the KPMG in Central and Eastern Europe's Energy & Utilities Advisory Practice, located in Budapest, Hungary.

Based on the success of our previous publications covering electricity, natural gas, renewable and nuclear energy, as well as the district heating sector, we have assembled this report with the ultimate aim of highlighting the most important opportunities in the region's shale gas industry.

On the following pages, it is our aim to turn market data into meaningful analysis, thus offering insight on available opportunities for business organizations and institutions interested in shale gas development in the Central and Eastern European region.

We trust that our report will prove useful to you, and we wish you all the best on your exciting journey through and, hopefully, participation in, the development of the CEE shale gas sector, whether you are an investor, supplier or any other stakeholder on the market.

Sincerely,

Péter Kiss
Partner, Global Head of
Power & Utilities
Head of Energy Sector,
KPMG in Central and Eastern Europe

Steve Butler
Director,
KPMG in Hungary

Table of contents

Note: Unless otherwise indicated, all currency in this publication refers to US dollars ($).

Executive summary

Technological developments in the United States have increased the economic viability of shale gas production, which have in turn revolutionized the import-dependent US natural gas market. Indeed, according to the 2012 forecast of the US Energy Information Agency (EIA), the development of shale gas could potentially lead the US to become a net exporter of LNG by 2016, and a net pipeline exporter by 2025.

Like the US until recently, most Central and Eastern European countries are also highly dependent on the importation of natural gas, while in addition, they rely heavily upon a single, large supplier – namely, Russia. Together with concerns over the reliability of transit routes and the relative volatility of gas prices in the past, these factors have made energy security a top priority for the countries of Central and Eastern Europe. As a result, the development of unconventional energy resources, such as shale gas, has increasingly been viewed as a potential solution for the region, despite the fact that shale gas from the region is unlikely to be produced at the low costs realized in North America. And although CEE shale gas production will not reach the same volumes as those of North America, it is expected to be a competitively-priced source of energy, as compared to that of imported Russian conventional gas.

In collaboration with experienced North American companies that have the necessary technology, know-how, and capital, CEE countries have begun to look for ways to access their shale gas resources, while at the same time sharing the costs and risks of exploration.

With strong governmental and public support for shale gas development, and significant proven shale gas reserves, Poland is considered to be the most favorable market in the CEE region for shale gas production, which – as in Romania and Lithuania – will essentially be driven by the economics of development. Other countries, such as Ukraine, have also demonstrated their support for the development of unconventional gas, although their current regulatory and legal environments continue to have elevated risk in the eyes of potential investors. Most of the remaining countries in the region have yet to explore for any potentially extractable resources, while in some cases, limited domestic experience with upstream oil and gas production means that such countries may need to rely more heavily on the technology and expertise of foreign investors. There is also a need for further investment in existing gas transmission infrastructure in the region, although there are a number of projects that are underway, or in the planning phase.

As a result, the CEE region provides several opportunities for investors. To be able to produce and sell shale gas resources, investments will be required in several industry segments, including gas field services, water treatment services, and pipeline infrastructure, each with its own variety of opportunities and country-specific considerations. And while many countries would like to ensure that their national energy companies play a meaningful role in the development of their own energy resources, the private sector will have an important role to play in the financing of shale gas exploration and production in Central and Eastern Europe.

As this report notes, there are a number of environmental (and often social) factors related to the recovery of shale gas that need to be monitored, while local topographical particularities in Europe will also need to be considered, should the development of shale gas resources proceed in earnest within the CEE region. While the public's concern over shale gas exploration and development has – with the exception of Bulgaria – been limited thus far, addressing potential environmental and safety issues will be essential for the industry's development.

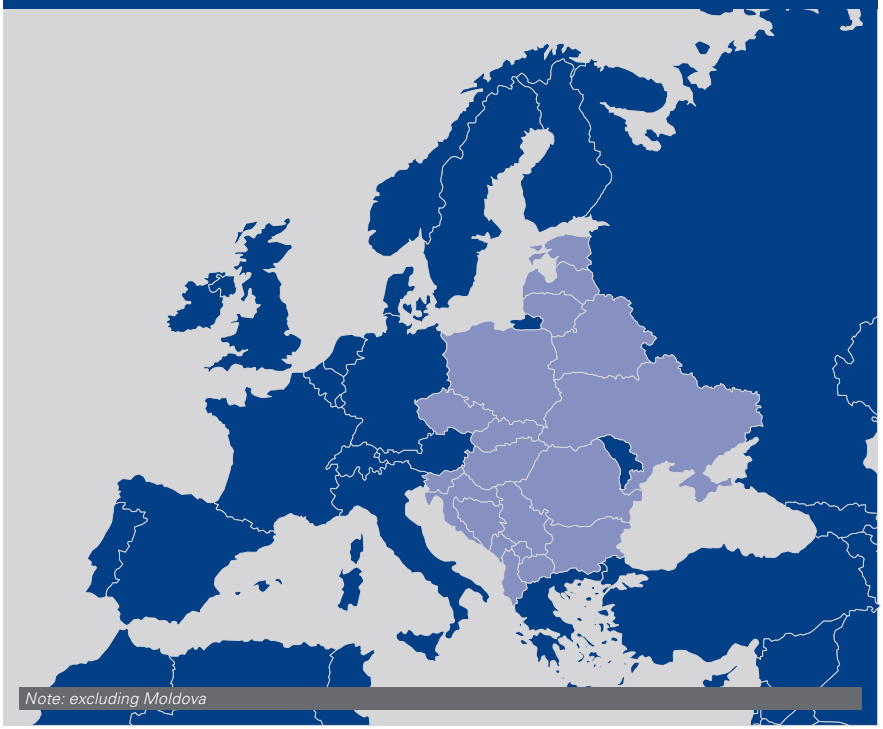
In order to attract further investment, it will also be necessary for countries in the CEE region to develop their regulatory frameworks with regard to shale gas exploration and production, and to better define and clarify their tax regimes. At the same time, regional energy companies will need to undertake careful financial and technical planning, in order to pursue their national shale gas resources effectively and responsibly.

1. Defining CEE energy markets

For the purposes of this study, the Central and Eastern European region is defined as the 18 countries – Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Kosovo, Latvia, Lithuania, Macedonia,[1] Montenegro, Poland, Romania, Serbia, Slovakia, Slovenia, Ukraine – surrounded by the EU-15 (neighboring Germany, Austria, Italy and Greece, and the water boundary between Estonia and Finland) as well as Russia, Belarus, and Moldova.

Ten out of 18 of the above-listed CEE countries are EU members, with Croatia's accession date set for July 1, 2013. Macedonia, Montenegro, and Serbia are currently candidate countries.[2]

Figure 1: CEE countries



Note: excluding Moldova

This study aims to collect and organize data, identify major trends, and describe the similarities and differences between the countries in the CEE region, with regard to their progress with shale gas exploration and extraction.

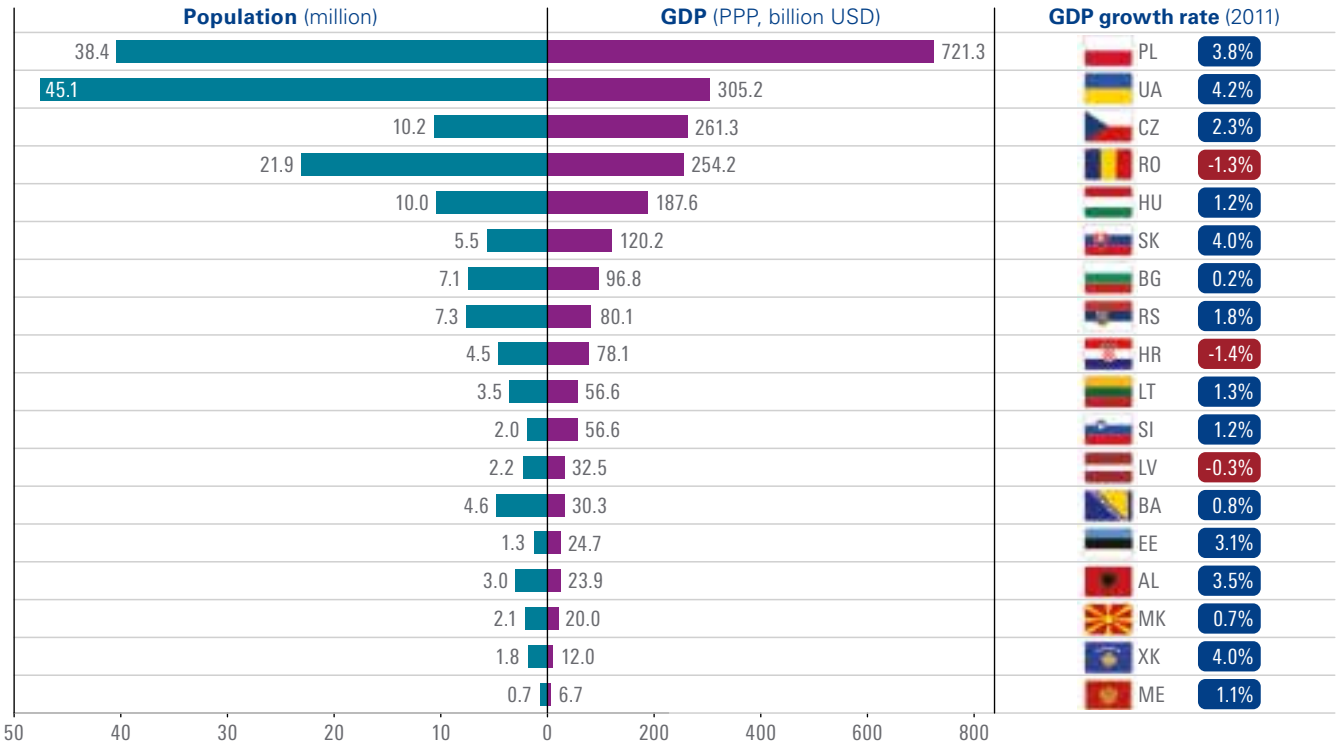
1 *Note: The country is often referred to as Former Yugoslav Republic of Macedonia; in the current report we refer to it as Macedonia*

2 *Source: European Commission, European Commission Enlargement Newsletter, February 2012*

Many of the CEE countries have shown remarkable economic development during the last decade. This development is expected to continue, as economic growth has slowly begun to recover after the global financial crisis: as a result, the economies of the region have resumed their progress toward achieving parity with those of the EU-15 countries.

With regard to the CEE energy sector, most international energy firms have taken steps to strengthen their balance sheets in recent years, which has in turn led to reduced investment activity by their regional subsidiaries, and thereby left a significant funding gap in the region's energy sector. This has partly been filled by foreign investors from North America, China, and the Middle East, which increasingly see the opportunity for strong regional growth. Investor interest has therefore returned to the CEE region, with energy exploration and production leading the way.

Figure 2: Population and GDP of CEE countries



Source: CIA World Factbook 2011

2. Importance of shale gas in CEE

A number of factors in the CEE region are driving the development of shale gas. Among these are region-specific concerns, particularly with regard to energy security, and a desire to reduce dependency on foreign sources of primary fuels. However, there are also a number of inhibitors preventing shale gas from gaining traction in various countries, including issues related to land access, higher production costs than in the North American market, as well as heightened environmental concerns, which have resulted in a moratorium on shale gas exploration in two European countries – Bulgaria and France. These drivers and inhibitors have implications for the future of shale gas development in the CEE region, as well as the energy security of those countries.

2.1. Key drivers

Energy security

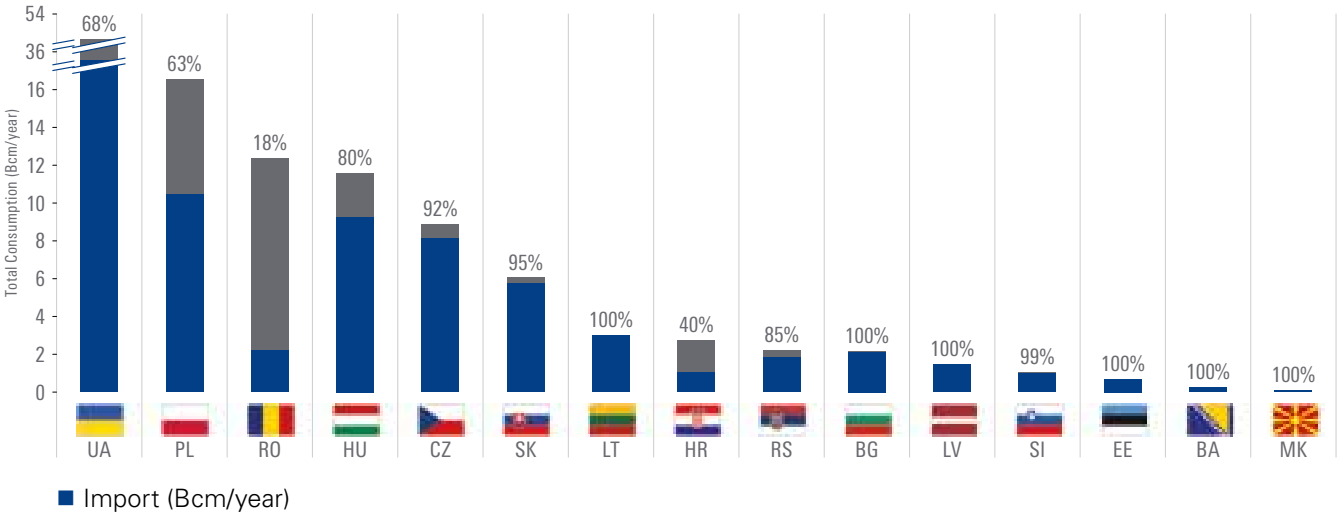
CEE countries are heavily dependent on natural gas imports, making them vulnerable to supply and geopolitical risks. On average, 69% of regional natural gas consumption was covered by imports in 2010,[3] of which more than 90% of these imports were supplied by Russia.[4] Furthermore, most of this supply has been contracted under long-term energy agreements. Since the unfortunate 2006 and 2009 Russia-Ukraine gas crises, and the Russia-Belarus disruption in 2010, most CEE countries have been looking for ways to reduce their dependency on foreign imports. Beyond the region, EU member states have formed an energy policy for Europe, in which one of the key goals is the strengthening of Europe-wide energy security by, among other means, constructing more pipelines to diversify resource routes.

Generally, CEE countries import most of the natural gas that they consume, which is in many cases complemented by domestic gas production capabilities.

3 *Source: International Energy Statistics, Natural Gas Overview 2010, December 2011*

4 *Source: BP, Statistical Review of World Energy, June 2011*

Figure 3: Total import and domestic consumption of natural gas, 2010



Note: percentage values represent import/consumption ratio based on 2010 figures
Source: US Energy Information Administration, 2011

Dwindling conventional gas reserves

Of the 18 CEE countries, only a handful have substantial conventional natural gas reserves (equivalent to approximately 3 percent of Russian reserves in 2010). The amount of proven natural gas in these countries was 1.4 Bcm as of 2010.[5]

Based upon 2010 annual production rates for Hungary and Poland, these countries will be most affected by dwindling conventional gas reserves: Hungary's conventional reserves are estimated to run out by 2013, and Poland's by 2037.[6] Comparatively, the conventional reserves of Russia, the region's main gas supplier, are estimated to last for another 75 years.[7]

Based on 2010 annual consumption rates, and taking into account the estimated amount of shale gas available in the CEE (an estimated 4.13 Tcm), shale gas is estimated to have the potential to cover CEE's natural gas demand for decades.[8]

Growing demand for natural gas

According to the latest forecasts prepared by Datamonitor, demand for natural gas in CEE between 2010 and 2015 is expected to increase by a CAGR of 3.6%.[9]

As seen in Figure 4, this trend is expected to continue for most EU countries in CEE at a CAGR of 1.6% between 2011 and 2030, with the fastest growth among these countries being in 2011-2015 with a CAGR of 3.2%. In each 5-year period thereafter, growth rates are expected to increase at a slower pace, stabilizing at 1% in 2025-2030.

5 *Source: US Energy Information Administration, December 2011*

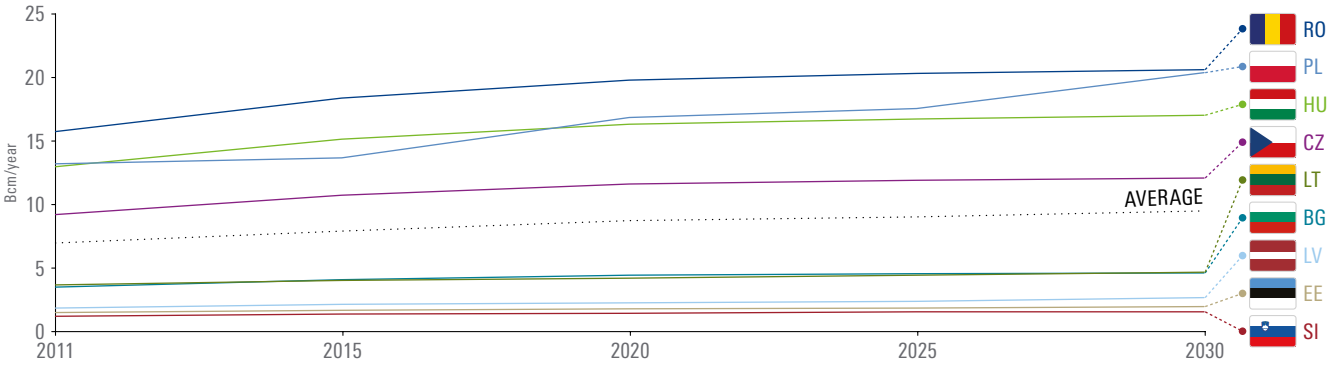
6 *Source: KPMG estimate based on information by US Energy Information Administration, December 2011*

7 *Source: KPMG estimate based on information by US Energy Information Administration, December 2011*

8 *Source: KPMG estimate based on the estimate of the US Energy Information Administration (World Shale Gas Resources, April 2011) and adjusted for recent maximum estimations on extractable shale gas resources, 768 Bcm, released by Polish Geological Institute (Assessment of shale gas and shale oil resources of the lower paleozic Baltic-Podlasie-Lublin Basin in Poland, March 2012).*

9 *Source: KPMG analysis based on information by Datamonitor (Oil and Gas Supply, March 2010 and Gas and Power Fundamentals Outlook: Europe, April 2010)*

Figure 4: Forecasted natural gas demand in CEE EU



Source: Datamonitor, 2010

Increasing natural gas prices

Almost every country with an existing gas market in the CEE region is dependent on imported Russian gas, which is based on long-term oil-indexed 'take-or-pay' contracts. In line with the price of oil during the past ten years, Russian import prices[10] have fluctuated significantly, increasing from $110 in January 2000, to $577 in October 2008, before falling to $222 in August 2009.[11] Since August 2009, Russian import prices have begun to increase once again,[12] by an average of 2.3% per month.[13] While long-term 'take-or-pay' contracts are expected to remain the standard between Russia and CEE countries, the weight of oil-indexation is expected to slowly be replaced by spot-indexed prices over the long-run. This is due to the increasing differential between Russian oil-indexed and European natural gas spot prices, and the improved negotiating positions of some large European utilities.

With the expanding role of liberalized gas trading in Europe, the development of cross-border interconnections and transport capacities, and the growing supply of potentially cheaper LNG and unconventional gas, the share of spot market imports is expected to slowly increase. However, due to the projected growth in demand for natural gas, spot prices themselves are also expected to increase over time.

Financing issues

The high initial exploration and subsequent development costs of shale reserves are daunting. State-owned E&P companies in the CEE region – especially those with high levels of debt – are unable to fulfill their drilling commitments, and are entering into joint ventures with larger, cash-rich companies that are ready to share some of the drilling costs. The need for capital is often the most important driver of joint ventures in the CEE shale gas segment, though knowledge transfer is a keen motivator behind such partnerships as well.

10 *Note: Russian natural gas border price in Germany, USD per thousand cubic meters of gas*

11 *Source: IMF, IMF primary commodity prices, March 2012*

12 *Note: between August 2009 and February 2012*

13 *Source: IMF, IMF primary commodity prices, March 2012*

Interest in new drilling technology, infrastructure, and ready resources

Until recently, it was primarily North American companies that had developed expertise in horizontal drilling and hydraulic fracturing – a critical technology in shale gas production – thereby positioning such companies as the leaders in shale gas development.

Joint ventures are a standard way for state-owned oil and gas companies in CEE to gain access to technology and expertise from their international counterparts, and to share the high costs and risks of shale gas exploration and development. ExxonMobil, ConocoPhillips, Royal Dutch Shell, Chevron, and Halliburton are among the major companies that have entered into various types of collaboration in the CEE region (i.e. Poland, Bulgaria).[14] On the other hand, European (i.e. Statoil) and Asian companies have also bought themselves into North American shale formations, in part to acquire and transfer technology, which may in turn be applied to their activities abroad – including those in the CEE region.

Intergovernmental cooperation

To help countries identify and develop their unconventional gas resources, the US Department of State set up the Global Shale Gas Initiative (GSGI) in April 2010.[15] The ultimate goals of the GSGI are to help countries achieve greater energy security, to meet environmental objectives, and to further US economic and commercial interests.[16] The first country in the CEE region to participate in the GSGI was Poland,[17] which received support for hosting conferences concerning Polish shale gas, as well as educational trips for Polish regulators and geologists to the US to learn about American companies' experience in assessing recoverable shale gas resources.[18, 19]

2.2. Key inhibitors

Environmental concerns

The recovery of shale gas uses hydraulic fracturing, which requires millions of gallons of water and presents a challenge in water-deficient areas, or in regions where the price of water resources is relatively high. Moreover, water contamination resulting from the improper disposal of fluids is a concern, especially with regard to fears that chemicals used in hydraulic fracturing may migrate into drinking water sources, posing a threat to human health and the environment.

CEE countries have generally taken a conservative approach to these concerns by requiring companies to examine the environmental impact of hydraulic fracturing before permitting shale gas exploitation.

14 *KPMG analysis based on information from Natural Gas Europe, Mergermarket, Infrastructure Journal*

15 *Source: U.S. Department of State, Global Shale Gas Initiative, April 2012*

16 *Source: U.S. Department of State, Global Shale Gas Initiative, April 2012*

17 *Source: U.S. Department of State, Global Shale Gas Initiative, April 2012*

18 *Source: U.S. Ambassador Lee Feinstein, Shale Gas: Managing Europe's Emerging Resource, May 18, 2011*

19 *Source: U.S. Diplomatic Mission to Warsaw, Poland, Shale gas conference opens in Warsaw, May 19, 2011*

Market access

Following the Second and Third Energy Packages of the European Union, EU countries, as well as members of the Energy Community,[20] have committed themselves to liberalizing their natural gas markets. While most EU countries in the CEE region are well on their way towards the liberalization of their natural gas markets, Energy Community members have made varied progress towards full liberalization: in some countries, this progress is non-existent (Montenegro, Kosovo), in others it is in its beginnings (Albania, Macedonia, Bosnia and Herzegovina), while others have made intermediate development in this regard (Croatia, Serbia).[21] Each country's progress with the liberalization of its domestic gas market affects the ability of suppliers to sell gas from alternative sources to other market participants.

Another issue regarding market access is the long-term 'take-or-pay' contracts between Gazprom and incumbent wholesalers of Russian natural gas. Under a 'take-or-pay' contract, the producer guarantees to supply a set amount of gas to the purchaser in return for payment guarantees from the purchaser, regardless of whether the buyer takes delivery of the gas.[22] Since incumbent wholesalers of Russian gas are obliged to pay for their contracted volumes, the substitution of Russian gas with potentially cheaper shale gas would be both uneconomical and illogical. Moreover, the maturity of long-term contracts in the CEE region can extend for up to 25 years, essentially locking countries into an extended period of commitment, without much room for re-evaluation of their supply options during that time.

Finally, the maturity of contracts between incumbent wholesalers, utility companies, and power generators varies by country and, in some markets, could potentially restrict the distribution of shale gas. While these contracts are similar to the conditions of the long-term 'take-or-pay' contracts used by incumbent wholesalers to purchase gas from Russia, utility companies and power generators may also be restricted from buying gas from alternative sources. On the other hand, in mature, liberalized markets, the average contract duration between large end-customers and incumbent wholesalers typically ranges from 1 to 3 years, thereby making it possible to buy from alternative sources over the medium term.[23]

Country risks

Taking into account various risk factors, the investment environment in most CEE countries is significantly riskier than in Western Europe or North America. According to the credit ratings of the three major rating agencies,[24] the OECD's country risk classifications,[25] and The World Bank Group's 'Ease of Doing Business 2012 Rank',[26] EU member-countries in the CEE region have the lowest country risk and the best investment environment. Among non-EU members, Macedonia has the highest ranking and the best investment environment, based on construction permits, taxation, cross-border trading, and other considerations. By contrast, Ukraine has been characterized as having a riskier legal environment, which predicates relatively higher investment risks.

---

20 *Note: Member countries include Albania, Bosnia and Herzegovina, Croatia, Kosovo, Macedonia, Montenegro, Serbia, and Ukraine and have committed to aligning their energy policies with that of the EU.*

21 *Source: Regulation of gas transmission flows in the Energy Community, Energy Community Regulatory Board, February 2011*

22 *Source: Carnegie Endowment, Natural gas pricing and its future, 2010*

23 *Source: Carnegie Endowment, Natural gas pricing and its future, 2010*

24 *Source: Standard & Poor's (April 10, 2012), Moody's (April 10, 2012), Fitch Ratings (April 10, 2012)*

25 *Note: Country Risk Classifications of the Participants to the Arrangement on Officially Supported Export Credits, valid as of March 30, 2012, OECD*

26 *Source: The World Bank, Ease of Doing Business 2012, 2012*

Table 1: Risk ratings across CEE

	Country	Risk rating Moody's	S&P	Fitch	OECD	World Bank
	EE	A1	AA-	A+	0	24
	SI	A2	A+	A	0	37
	SK	A2	A	A+	0	48
	CZ	A1	AA	AA-	0	64
	PL	A2	A	A	0	62
	HU	Ba1	BB+	BBB-	0	51
	LT	Baa1	BBB	BBB+	4	27
	BG	Baa2	BBB	BBB	4	59
	LV	Baa3	BB+	BBB	5	21
	RO	Baa3	BB+	BBB	4	72
	MK		BB	BB+	5	22
	HR	Baa3	BBB-	BBB	5	80
	ME		BB		6	56
	RS		BB	BB-	6	92
	AL	B1	B+		6	82
	XK				7	117
	BA	B2	B		7	125
	UA	B2	B+	B	7	152

Source: Website of Moody's, Standard & Poor's and Fitch, accessed April 10, 2012
OECD, Country risk classifications of the participants to the arrangement on officially supported export credits, March 30, 2012
The World Bank, Doing Business 2012, 2012

High production costs

Drilling costs are mostly dependent on physical factors such as vertical depth, lateral length, and reservoir pressure, as well as commercial factors such as the availability of services and raw materials. Some estimates price the development of a shale gas formation, often called a 'play', in the United States to be typically between $3.0 million and $9.0 million.[27] According to Schlumberger, the world's largest oil field services provider, shale gas development in Poland can cost, on average, almost three times more than in the United States. The cost of drilling a 2,000-meter horizontal well in the US averages $3.9 million, compared to as much as $11 million in Poland.[28]

27 *Source: IHS Global Insight, The economic and employment contributions of shale gas in the United States, December 2011*

28 *Source: Bloomberg, Shale-Gas Drilling Cost in Poland Triple US, Schlumberger Says, November 29, 2011*

Land access

Unlike in the US, where land owners generally own the rights to minerals on their property, underground reserves in CEE countries are considered to be the sole property of the state; land owners in the region, therefore, are not incentivized to cooperate with exploration companies. On top of paying a royalty to the state, developers have the choice to either pay a rental fee or acquire the land from the land owner, which increases costs and can delay progress with exploration or production activities. Fragmented land ownership can also make this situation even more difficult.

In addition to differences in rights ownership, population density within CEE region is generally greater than that of shale formation areas in the US. In Central and Eastern Europe, open agricultural areas are available for exploration, while drilling around buildings, roads, overhead power lines, drinking water production areas, and environmentally protected land is restricted,[29] which are all more difficult to avoid in the region.

Geological risks

Due to the fact that early exploration activity is still ongoing, precise information regarding the amount of shale gas resources and reserves available in CEE is limited, while there is a risk that preliminary estimates may differ from those of subsequent evaluations. For example, in early 2012, the Polish Geological Institute significantly lowered its estimate of the amount of shale gas available in the country, by as much as 93% from previous estimates by EIA.[30, 31]

The other risk is related to the geological settings of different shale gas properties. As the geological setting varies significantly by shale formation, the technology known to work effectively in one formation might be ineffective in the case of others. Based on preliminary data, shale depths in Europe are 1.5 times greater[32] than those in the US, underground temperatures increase faster with depth, and there are different porosity properties in CEE as compared to formations in North America.

2.3. Implications of shale gas development

Affect on energy security

One of the most important incentives behind shale gas development is its potential to reduce each country's dependency on imported gas, thereby increasing domestic energy security.

As the role model for European shale gas development, the US has been a net importer of natural gas, with Canadian piped (90%) and North African LNG (10%) imports covering approximately 16% of domestic consumption.[33] After American shale gas production increased 12-fold during the last decade,[34] it now accounts for about 23% of domestic production,[35] thereby

29 *Source: Oxford Institute for Energy Studies, Can unconventional gas be a game changer in European gas markets?, December 2010*

30 *Source: US Energy Information Administration, World shale gas resources, April 2011*

31 *Source: Polish Geological Institute, Assessment of shale gas and shale oil resources of the lower paleozic Baltic-Podlasie-Lublin Basin in Poland, March 2012*

32 *Source: Oxford Institute for Energy Studies, Can unconventional gas be a game changer in European gas markets?, December 2010*

33 *Source: US Energy Information Administration, US natural gas imports by country, February 29, 2012*

34 *Source: US Energy Information Administration, Shale Gas and the Outlook for US Natural Gas Markets and Global Gas Resources, June 21, 2011*

35 *Source: US Energy Information Administration, Annual Energy Outlook 2012 Early Release Overview, 2012*

significantly decreasing the amount of imported gas.[36] As a result, the US is expected to become a net exporter of LNG by 2016, and could become an overall net exporter by 2021.[37]

Prices

Should the production of shale gas reach a significant percentage of domestic consumption, domestic and import prices are expected to decrease because of increased competition from new supply sources. Future price development will depend upon the liberalization of national markets, and on the potential to export excess capacities.

While the shale gas boom in the US has been on-going for a number of years, natural gas spot prices have decreased since 2009, and have since decoupled from the price of crude. The suppliers of imported piped gas and LNG have adapted to oversupply by decreasing prices. Gas prices in the US are therefore expected to be less than half of what they otherwise would have been without shale gas development.[38]

Emissions

The potential replacement of coal-fired power plants by gas-fired power plants would result in increased electricity generation efficiencies, and a decrease in CO_2 emissions.

Coal plays a significant role in the total primary energy supply of many CEE countries, accounting for 36% of the region's total generation mix in 2009. It is followed by gas and oil, at 24% and 22%, respectively.[39, 40] Around 81% of the coal was utilized by the power generation sector, with the remaining 11% used by the industrial sector.[41, 42]

However, it should be noted that while the electrical conversion efficiency of coal-fired power plants is around 40%, the efficiency of gas-fired power plants is around 58%.[43] Moreover, whereas CO_2 emissions per MWh of coal-fired power plants are between 0.142 to 0.777 tons (depending on the technology), gas-fired plants emit an average of 0.403 tons.[44]

Economic impact

According to various sources, the development of shale gas resources in the CEE region will lead to new investment flows into the region, as well as the creation of jobs and higher tax revenues.[45]

36 *Source: US Energy Information Administration, December 2011*

37 *Source: Annual Energy Outlook 2012 Early Release Overview, US Energy Information Administration, 2012*

38 *Source: IHS Global Insight, The economic and employment contributions of shale gas in the United States, December 2011*

39 *Source: International Energy Agency, Energy balances of OECD countries (2011 edition), 2011*

40 *Source: International Energy Agency, Energy balances of non-OECD countries (2011 edition), 2011*

41 *Source: International Energy Agency, Energy balances of OECD countries (2011 edition), 2011*

42 *Source: International Energy Agency, Energy balances of non-OECD countries (2011 edition), 2011*

43 *Source: International Energy Agency, Projected costs of generation electricity, 2010*

44 *Source: International Energy Agency, Energy technology perspectives 2010, 2010*

45 *Source: IHS Global Insight, The economic and employment contributions of shale gas in the United States, December 2011*

By 2010, shale gas development in the US is estimated to have created 600 thousand jobs and contributed $76 billion to GDP. It is estimated to potentially add another one-million jobs by 2035,[46] while its GDP contribution could triple.[47] Tax payments by the shale gas sector were estimated to be $18.6 billion, while capital expenditure amounted to $33.3 billion in 2010 (of which 75% was on upstream activities such as drilling and hydraulic fracturing equipment; 25% on infrastructure, such as pipelines).[48]

Technology transfer

Shale gas development has the potential to bring technology and knowledge transfer from North America to the CEE region. Since shale gas exploration and extraction was developed by North American companies, the technology resides with many of these firms.

Shale gas resource estimations

Although initial assumptions on the size of potential shale gas reserves in the CEE region are substantial, these initial estimates are subject to revision. For example, the Polish Geological Institute has recently reduced its estimates for the Baltic-Podlasie-Lublin Basin in order to reflect a significantly lower assumption of 346-768 Bcm of recoverable shale gas, down from the initial 5.3 Tcm estimate by the EIA.[49, 50] Although this may initially be cause for some hesitation, in Poland's case, these results only suggest that the country will have less shale gas available for export, while substantial reserves remain for domestic supply.

46 *Source: IHS Global Insight, The Economic and Employment Contributions of Shale Gas in the United States, December 2011*

47 *Source: IHS Global Insight, The Economic and Employment Contributions of Shale Gas in the United States, December 2011*

48 *Source: IHS Global Insight, The Economic and Employment Contributions of Shale Gas in the United States, December 2011*

49 *Source: Polish Geological Institute, Assessment of shale gas and shale oil resources of the lower paleozic Baltic-Podlasie-Lublin Basin in Poland, March 2012*

50 *Source: US Energy Information Administration, World Shale Gas Resources, April 2011*

Photo: / Statoil

3. Comparison of shale gas in the US and CEE

3.1. Geology

Preliminary studies suggest that there are more than 650 shale formations worldwide, in 142 basins. This amounts to 456 Tcm of shale gas, of which 40% is estimated to be economically recoverable.[51] Geographically, the US and CIS countries are estimated to account for nearly 60% of available shale gas resources worldwide. Europe, however, accounts for a much lower 7% of global shale gas reserves, though these estimates are subject to change, as land surveys and exploration proceed.[52]

In general, the properties and definition of a shale formation are similar in both the US and Europe, although characteristics such as depth, underground temperature, porosity, and clay content vary across basins and formations. While shale gas is an unconventional gas made up of coal-based methane, gas from tight sandstones and methane hydrates, it is usually located near conventional reservoirs, in old sedimentary rock which contains mainly clay and quartz.

Most shale formations in the US are spread over a large basin area, within which mining developments have concentrated on a number of "sweet spots", sometimes referred to as "hogs", which generally produce at least 4 Mmcf/day.[53] This concept might encounter difficulties in Europe, which is more densely populated, as such developments would bring drilling rigs closer to inhabited areas. The lack of free land for drilling stations might become yet another issue for European shale gas developments. Furthermore, the fact that known reserves of shale gas in Europe are located 1.5 times deeper on average than similar formations in the US might raise a problem of increased temperatures. In some areas of Europe, the geothermal gradient is very high: for every 15-20 meters of drilling depth, the temperature rises by 1 degree Celsius (as compared to the worldwide average of around 33 meters).

Still, there are a number of promising opportunities in Europe, where no or only a few reliable resource assessments have been conducted. Some of these include the entire Baltic basin, where only Polish territories have been partially explored, the Lublin basin in Poland, the Pannonian-Transylvanian basin in Hungary and Romania, as well as the Carpathian-Balkanian basin of Romania and Bulgaria. In the US, exploration of the Marcellus, Barnett, and Haynesville formations, for example, has already been ongoing for years.

51 *Source: US Energy Information Administration, World Shale Gas Resources, April 2011*

52 *Source: World Energy Council, Focus on Shale Gas, 2010*

53 *Source: Gazprom Export, Shale Gas, May 5, 2011*

Figure 5: Eastern European shale basins

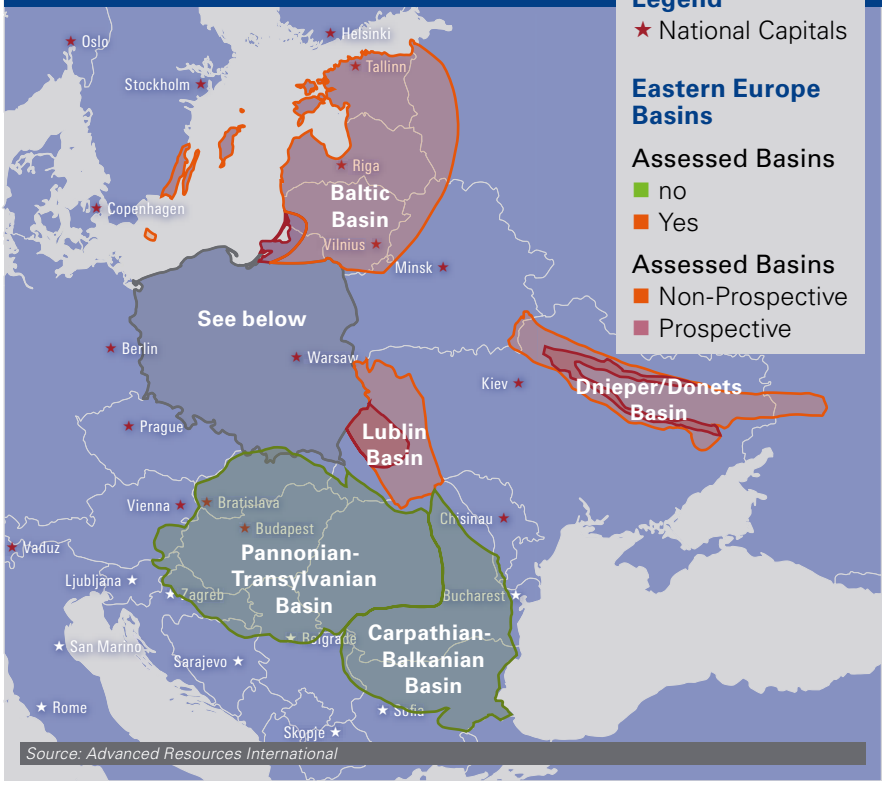
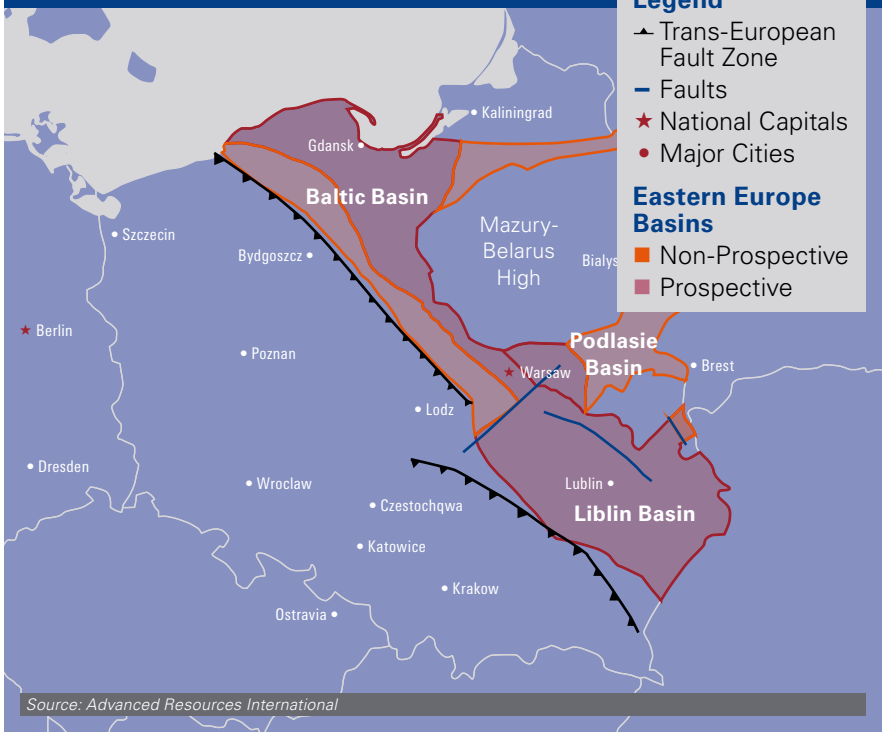


Figure 6: Polish shale basins



3.2. Technology

Shale gas development has been made possible through the combination of horizontal drilling and hydraulic fracturing technologies, successfully transforming the unconventional gas industry over the years. In short, the technology addresses the need to drill horizontally through the shale bed, thereby perforating the rock to release enclosed gas. Recently in the US, the expanded usage of pad drilling, whereby multiple wells are drilled from a single location, minimizes the operational footprint. In Europe, this technology could see further development due to issues related to scarce land resources and high population density. In addition, because many wells in the US produce steep output decline rates, the fracturing process is constantly being refined and increasingly utilized by drillers. Although the general design of rigs is expected to be similar in both the US and Europe, the equipment used in European shales should account for greater depths and possibly higher temperatures at the drilling depth.

Nevertheless, the availability of drilling and fracturing equipment in Europe is limited, as compared to the US. As of early 2012, there were nearly 2,000 land rigs available in the US, as compared to only 72 rigs in Europe.[54] This situation is not likely to change soon. Apart from the difficulty and expense of transporting existing US rigs to Europe, the majority of the US rig fleet is already deployed domestically, with no spare capacity to be transferred to Europe. In order to develop shale gas resources, European drillers would therefore have to order new equipment, either from the US or local manufacturers, which in both cases is a lengthy (9 to 12 months per rig on average) and capital-intensive process. Market conditions in Europe may, also present obstacles for the acquisition of financing and development of domestic shale gas infrastructure on a large scale.

Therefore, in order to acquire and transfer the technology, there has recently been strong appetite among European and other foreign companies to acquire equity positions in US shale gas developments. In CEE, too, there have been a number of acquisitions related to the development of the shale gas sector.

Table 2: Recent M&A activity in the CEE shale gas sector

Country	Company	Acquired entity	Share acquired	Value ($)	Date
Bulgaria	Transatlantic Petroleum	Direct Petroleum Bulgaria(1)	100%	34.5 million	February 2011
Lithuania	Tethys Oil	UAB Minijos Nafta(2)	25%	17.3 million	January 2012
Poland	LNG Energy	Kunagu Real Estate	100%	9.28 million	May 2010
Poland	LNG Energy	Joyce Podlasie and Maryani Podlasie	50%	4 million	February 2011
Poland	San Leon Energy	Realm Energy	100%	17.7 million	August 2011
Poland	Petrolinvest	Eco Energy(3)	40+48%	70.4 million	March 2012
Poland	Petrolinvest	Silurian	60%	25,000	December 2010
Poland	Eni	Minsk Energy Resources	100%	n/a	December 2010

Note: (1) As part of the transaction Transatlantic Petroleum acquired Direct Petroleum Morocco and Anschutz Morocco Corporation as well.
(2) As part of the transaction Tethys Oil bought 20% interest in UAB LL Investicijos.
(3) Petrolinvest acquired 88% interest in Eco Energy in two stages.
Source: KPMG analysis based on information by Platts Energy in East Europe, Natural Gas Europe, Infrastructure Journal, Mergermarket, LNG Energy Ltd

54 *Source: KPMG analysis based on information by WTRG, Baker Hughes and Rigdata.com*

Historically, there are fewer firms operating in natural gas exploration and production in Europe, as compared to the US, as the European oil and gas business has been reliant mostly on large, multinational corporations rather than small and medium-sized drillers. As such, the onshore drilling service industry in Europe is currently less developed as compared to that of the United States. On the other hand, the US shale industry has been continuously developing since the 1980s due to favorable taxation and regulation of unconventional developers. Europe could potentially skip this lengthy and capital-intensive process by partially adopting some solutions used by its overseas counterparts, and by basing its drilling capabilities on North American best practice.

3.3. Regulation

The European regulatory stance towards the development of shale gas resources varies greatly across individual countries. Even though Europe is considered to be a unified entity through the EU and other treaties, individual countries still have full authority to define a large portion of their national legislation. A perfect example of this national individuality can be drawn from countries such as France and Bulgaria, where temporary bans on hydraulic fracturing have been introduced due to concerns with the process's environmental impact. A strong contrast may also be seen between France – a country characterized by strong local nuclear power producers, which have lobbied against shale gas developments – and Poland, where the shale gas industry lobby is arguably the strongest in Europe, thus making that country the regional pioneer in shale gas development.

Coordinating the interests of EU member states, the member states of the Energy Community,[55] and other market players is a complex process. By contrast, the US allows more regulatory discretion at the state level, including on shale gas development.

Neither the EU nor the Energy Community has passed any trans-national legislation on shale gas, nor is there any draft legislation planned, as of 2012. At the same time, the EU's *Energy Roadmap 2050* only mentions shale gas as a potential energy resource to be researched further. Some individual countries, such as Poland, have argued against any EU-wide legislation on shale gas, citing each member state's sovereignty over its own natural resource developments.

US legislation regarding land and mineral rights has played a major role in spurring the development of shale gas there. As such, the rights to natural land and their soil minerals are generally granted to the land owner, with the exception of some western states. In addition, many land areas are deemed public and federal, and therefore do not belong to a private entity, which complicates the local permitting process.

This is a major difference as compared to the permitting process of EU/ Energy Community member states, where land ownership does not grant the automatic ownership of underlying minerals, as every ground resource, unless legally specified, is owned by the state. This, in turn, hinders the range of possibilities for private individuals to benefit from shale gas development, except through a land-leasing option – thereby providing less incentive for overall social approval of the exploration process.

With no specific regulations available for shale gas exploration and production, most European countries are currently guided by legislation for the regulation of conventional gas, and by EU-wide environmental directives. As a result, the

55 *Note: The Energy Community is a regional organization of southern and eastern European non-EU countries extending the EU's internal energy market and regulatory framework.*

European Commission does not have power over laws on subsoil resources, leaving the development of those regulations to the national policies of member states.

Looking forward, it is reasonable to assume that any future regulation among EU/Energy Community member countries will be based on the provisions of the EU's environmental policy, as per its Treaty articles (Article 174).

3.4. Taxation

There is currently no specific tax legislation for shale gas in any European country. In the majority of these countries, the only taxation that can be applied to shale gas-related activities is that of existing tax regulations governing conventional gas development. However, the principles related to conventional gas development are not always suitable for shale gas exploration, because of the distinct technologies used for extraction and inherent differences among the respective business models. The current tools for levying taxes on gas production in various countries include licensing fees, product sharing agreements, and special hydrocarbon taxes. As is common practice worldwide, such taxation methods are known to be applied through a combination of measures, as is shown in the table below.

Table 3: Selected shale gas taxation and fee comparison

Country	Taxation and Value Derivation		
	Tax or value sharing regulation	Description	Rate/Payment
PL	Mining Usufruct Fee	Agreed upon between the exploration company and the Minister of the Environment	n/a
	Concession Fee	Paid by concession holders intending to explore or extract mineral deposits	For sole exploration and exploitation: PLN 109.97/m^2* For joint exploration and exploitation: PLN 219.94/m^2*
UA	Rent payment	Calculated by multiplying the base rate by a factor calculated as the average customs value of 1000 m^3 of imported gas, divided by US $179.5	Base rate: UAH 237/1000m^3, or UAH 118.5/1000m^3 on deposits below 5000m
	Subsoil use payment	Payment for exploitation of underground minerals	Base rate: UAH 37.78/1000m^3 of natural gas
	Production share payment	Determined by PSA	n/a
US	In addition to state and local tax regulations:		
	Royalty payment	Paid on the amount or value of gas production removed or sold from leased land	12.5%

Note: **As of 2011 regulations.*
Source: *Global Legal Group, International Comparative Legal Guide to Gas Regulation 2012, International Law Office, Energy & Natural Resources – Poland, 2011 DLA Piper, Polish shale gas from the tax perspective, 2012*

In all cases, gas derived from shale is an energy product, and thus falls under the scope of the EU's excise tax regime. Yet the excise is applied in the last phase of the development cycle of gas, and generally has more of an ultimate effect on end users.

As an acknowledged pioneer in European shale gas development, the Polish government started to work on new tax laws for shale gas exploration and production in December 2011, with the law to be presented during the first half of 2012.[56] The government's aim is to create a clearer environment for potential investors.

In order to encourage further investment in shale gas development within the CEE region, other countries will also need to refine their tax systems and take into consideration the particularities of the technologies used for shale gas exploration and production, as well as the local regulations that apply to the industry. While some governments have begun drafting relevant tax legislation, most CEE countries have not yet planned any change to their tax codes with respect to shale gas development.

3.5. Environment

Environmental concerns regarding shale gas extraction are one of the main questions facing the industry today, and they remain a strong obstacle for the expansion of the global shale gas business. The most salient issues in both the US and in Europe are similar, including concerns with ground water contamination, usage of scarce fresh water resources, the possibility of greenhouse gases escaping to the atmosphere, and potential provocation of seismic activity in regions where hydraulic fracturing is used. Political factors influencing governmental decisions on shale gas in various countries should also not be disregarded.

Some studies indicate that the drilling and fracturing of a single well in the US requires up to 17 million liters of fresh water.[57] Given the nature of deeper shales and the higher geothermal gradient in Europe, the amount of water to be used is expected to be even greater. At the same time, the water which returns to surface after the fracturing process contains salt (depending on the shale salinity) and potentially, depending on the location, radioactive elements as well. Water management and the effective disposal of fracturing fluids are crucial issues to be addressed.

In addition to water resource management, a major public concern is the risk of groundwater contamination. As wells are drilled and the shale fractured, the water pumped into the opening is mixed with a number of chemical additives, some of which are toxic and can be quite harmful to health and the environment. Because companies are required to disclose chemicals used at differing times and degrees, depending on local regulations, the exact amount of potentially dangerous chemicals in hydraulic fracturing areas can be difficult to determine.

56 *Source: Warsaw Business Journal, Poland drafting law to tax shale gas production, February 23, 2012*

57 *Source: Hydraulic Fracturing, Hydraulic Fracturing Facts, 2012*

Experts suggest that it is unlikely that the water mixture can contaminate water aquifers directly through the drilling process, as long as the drilling is execute according to required quality standards.[58] This is due to the fact that groundwater is located at a shallower level than shale gas. However, there are concerns about whether the flowback water may leak from wastewater pipelines, and thus pollute the environment and water supply.

In spite of these concerns, exploration and production companies claim that the majority of issues can be solved through technological advancements and operational improvements, as well as higher-quality execution, and stricter safety standards. These issues are likely to be more closely considered by regulators in the CEE region, compared with the US, and will require special consideration by potential developers.

3.6. Logistics

Once recovered, shale gas requires transmission infrastructure in order for it to be delivered to consumers.

Natural gas pipelines are the most common means of transporting fuel within the CEE region, both locally and over long distances. Pipeline infrastructure is undergoing significant development in CEE, while current capacities are sufficient to handle existing transmission volumes. The pipeline infrastructure would require significant investment, however, if significant quantities of shale gas supply were to come online.

Water usage related to shale gas exploration can become a logistics issue. Economically, it can strain a project's rates of return, given the substantial additional cost of supplying water from distant sources. Currently, two options are used in the US to supply water to drilling locations –tank trucks and, if the water source is available within two to three kilometers of the site, pipelines. The main sources of water are surface water, groundwater, municipal potable water, and flowback water from previously fractured wells.[59]

Similar solutions are expected to be adopted in Europe, although the availability and impact of increased fresh water usage needs to be researched further, given the European realities of higher prices and environmental concerns. In addition, given that distances in Europe between potential shale gas formations and population centers are shorter, there is a risk of an emergence of competition for water resources which could effectively raise the cost of water even higher. It is therefore necessary to develop cost-effective solutions for the sourcing, disposal, and treatment of for scarce fresh water resources used during the shale gas extraction processes, to minimize the risk of hazardous leaks and address public concerns.

58 *Source: Massachusetts Institute of Technology, The Future of Natural Gas, June 2011*

59 *Source: Office of Fossil Energy, United States Department of Energy, July 2010*

4. Public acceptance of shale gas development

4.1. Overview

Public awareness of shale gas has gained momentum in recent years, particularly with regard to hydraulic fracturing and its highly publicized potential dangers. Environmental groups and civil opposition to shale gas have raised a number of concerns, while scientific study in support of hydraulic fracturing has been viewed with skepticism.

Social concern with shale gas drilling has encouraged governments to invest more efforts in scientific research, and European countries in particular have been keeping a close eye on public opinion, while endorsing the acceptance of new energy sources as possible solutions regarding energy security and greater independence from gas imports.

In light of this, some European countries have already developed strong stances on shale gas, giving rise to a palpable split between some EU countries. Whereas shale gas exploration has been indefinitely banned in Bulgaria because of bitter public opposition to hydraulic fracturing practices, Poland's population is largely in support of shale gas because of its economic advantages and the energy independence it would bring.[60]

4.2. Country-specific views

Poland

The Polish political leadership has been actively supporting shale gas, emphasizing that it will bring economic growth and environmental progress (emission reduction) as well as increase energy independence.[61]

In highly gas-dependent Poland, the general population is well-aware of and keen on the benefits of shale gas. The nation's long-standing mining tradition, supported by the fact that a majority of the country's electricity is coal-based, also lowers its concerns about the safety of hydraulic fracturing. Organized opposition has therefore not been widespread in Poland, as the population has shown a preference for technologies perceived to be less harmful to the environment than coal.[62]

The Polish Geological Institute has conducted a study to test the safety of drilling, and concluded that hydraulic fracturing does not damage nature or the environment.[63] Locally, the region of Pomerania has experienced public concerns regarding the negative effects of hydraulic fracturing, and the provincial government has agreed to conduct a survey of its effects, in the hopes of building up public confidence.[64]

60 *Source: Financial Times, Poland hopes to tap big reserves of shale gas, August 9, 2011*

61 *Source: Natural Gas Europe, Europe's shale gas debate: enough gas for 60 years, October 5, 2011*

62 *Source: Spiegel Online, Poland hopes shale gas will free it from Gazprom, February 9, 2012*

63 *Source: The Wall Street Journal, Poland finds fracking safe, March 2, 2012*

64 *Source: Natural Gas Europe, Authorities hope documentary on shale will soften protests in Kashubia, March 6, 2012*

Bulgaria

Concerns have been raised over hydraulic fracturing in Bulgaria, however. After Chevron was granted a permit in May 2011 to explore shale gas in the country, Bulgaria's nationalist party proposed a moratorium on shale gas exploration in November of that year, which was later rejected by the Parliament.[65] Unfazed by this, protests by local citizens, non-governmental organizations, and opposition parties against shale gas drilling started during the summer of 2011, and heated up in January 2012.[66]

Exploration activity had just started when the government, citing environmental concerns, canceled Chevron's shale gas permit.[67] The next day, it also announced a ban on fracturing to explore shale gas, until environmental studies prove its security.[68]

Other CEE countries

Among other countries with shale gas potential, public opposition to shale gas-related activities has arisen, sometimes before any major exploration has even commenced.

In Romania, NGOs and citizen groups have begun to organize in the Bârlad area,[69] coordinating with their counterparts in Bulgaria because of the large shale gas reservoir that straddles the border between the two countries.[70] Romanian parliamentary opposition has recently proposed a ban on hydraulic fracturing, while local protests have been supported by members from both the governing and opposition parties.[71]

In Hungary, the first exploratory test drills by ExxonMobil started in 2008 in the Makó trough.[72] As exploration efforts in Hungary have not resulted in any full-scale extraction possibilities, public opposition has remained relatively low. In the Czech Republic, some mayors and civilian groups[73] of affected regions have started to oppose any shale gas activity, particularly the northern areas of Náchod, Trutnov, and Broumov.[74] In March of this year, protests and petitions have been initiated against exploration in Basgas Energia Czech's 777km^2 concession areas, citing concerns over groundwater contamination.[75]

65 *Source: Natural Gas Europe, Bulgarian MPs reject shale gas moratorium, November 22, 2011*
66 *Source: Natural Gas Europe, Analysis: Bulgaria shale gas and the wider geo-economic game, February 5, 2012*
67 *Source: Reuters, Bulgaria cancels Chevron's shale gas permit, January 17, 2012*
68 *Source: Reuters, Update – Bulgaria bans shale oil and gas drilling, January 8, 2012*
69 *Source: Natural Gas Europe, Romania: Shale Gas Battle Set to Begin, March 20, 2012*
70 *Source: Natural Gas Europe, Analysis: Bulgaria shale gas and the wider geo-economic game, February 5, 2012*
71 *Source: Natural Gas Europe, Romania: Shale Gas Battle Set to Begin, March 20, 2012*
72 *Source: IHS, ExxonMobil drill second well in Makó trough, January 26, 2009*
73 *Source: Czech Position, Local Czech rally against shale gas drilling in Bohemia, March 6, 2012*
74 *Source: Energia, Energia Cesi podpisujú petíciu proti tazbe bridlicového plynu, March 13, 2012*
75 *Source: Czech Position, Local Czechs rally against shale gas drilling in Bohemia, March 6, 2012*


876 345 145
215 745 321
113 216 906
234 34 312
876 345 890
215 745 465
113 216 410
234 34 657
876 345 890
215 745 465
113 216 410
234 34 657
1233
987
234
34
657
1233
987
234
34
657
1233
987
876 345 145
215 745 321
113 216 906
234 34 312
432 412 978
234 34 312
432 412 978
234 34 312
432 412 978
234
432
150
98
56
45
42
45
36
23
0
20
40
60
80
100
120
140
160
1
2
3
4

5. Economics of shale gas

5.1. Investment/operation costs

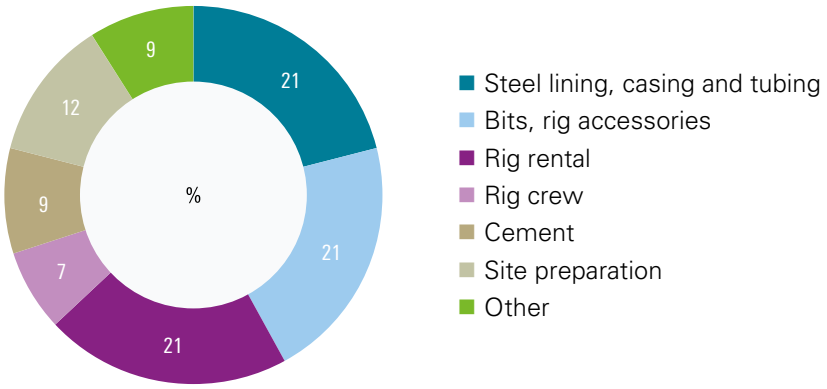
Exploration cost structure

Drilling a shale gas well for exploration in the US typically costs anywhere between $3[76] and $10 million,[77] depending on depth and location, whereby drilling at Haynesville can involve a depth of 1,200-1,800m.[78] By 2010, all-in costs, based on the exploration, acquisition, and developing of new reserves and for proven and developed reserves, started at $223/Mcm.[79] However, such figures pale at the cost of drilling a well in Europe, which can cost up to 40% more than one at Haynesville.[80] As a comparison, drilling costs in Poland lie in the area of $10-15 million.[81]

Because of differences in the physical properties of the ground, more powerful rigs and pumps are required in Europe. For the hydraulic fracturing process, a larger supply of water is needed, which can cost up to 10 times as much as it does in the US.[82] Moreover, there is 77% less renewable water per capita in Poland, for example, as compared to the US.[83]

Among the total costs of shale gas exploration and development, activities related to the execution of drilling are estimated to account for 40% share, while completion and facilities represent the rest.[84]

Figure 7: Share of drilling capital expenditures in the US



Note: Other includes insurance, land lease, etc.
Source: IHS Global Insight Inc., December 2011

76 *Source: IHS Global Insight Inc, The Economic and Employment Contributions of Shale Gas in the United States, December 2011*
77 *Source: Platts Insight, Prices and Profits: US Shale Gas, December 2011*
78 *Source: The Economist, Fracking here, fracking there, November 26, 2011*
79 *Source: Gazprom Export, Shale Gas, May 5, 2011*
80 *Source: Deutsche Bank, European Gas: A First Look at EU Shale-Gas Prospects, October 2011*
81 *Source: Polish Geological Institute, Shale Gas – Do Economics and Regulation Change at the German-Polish Border, December 12, 2011*
82 *Source: Oxford Institute for Energy Studies, Can Unconventional Gas be a Game Changer in European Gas Markets?, November 2, 2011*
83 *Source: Schlumberger Business Consulting, Unconventional Gas 2.0 Energy Perspectives, Summer 2011*
84 *Source: IHS Global Insight Inc., The Economic and Employment Contributions of Shale Gas in the United States, December 2011*

Because there are fewer companies in Europe focused on unconventional gas development, the cost for their services tends to be higher, by approximately 20%, as compared to their North American counterparts.[85] Also, there are a smaller number of rigs in Europe – 72 existed as of February 2012[86] – only a handful of which could address European depth requirements.[87]

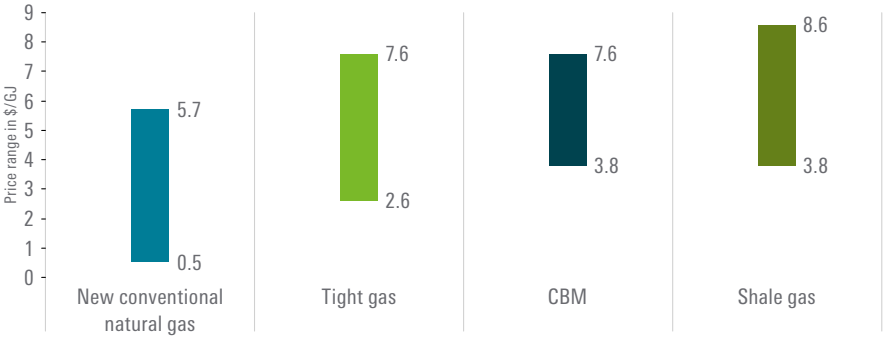
Comparison of exploration costs in the CEE region

Exploration costs around the CEE region vary. In Poland, for example, a 2,000m deep well has been estimated to cost around $11 million, almost 3 times as much as drilling a well of that depth in the US.[88] By 2010, PKN Orlen had spent more than PLN 100 million ($33 million) on the preliminary stage of exploration.[89] In Hungary, a collaboration involving ExxonMobil and MOL spent an estimated $50 million on shale gas exploration in the Makó trough where it drilled three wells in 2009.[90] In 2011, Ascent Resources raised £17 million ($26 million) to drill three exploratory wells at the Slovenian-Hungarian border.[91]

5.2. Comparison with other types of natural gas

Production costs vary between conventional and unconventional gas resources, and among unconventional gas resources themselves.[92]

Figure 8: Production cost range of conventional and unconventional gas



Note: Estimated ranges for 2010 in the United States
Source: IEA ETSAP, May 2010

While the costs for unconventional gas production are expected to decline, the development of their production costs will depend greatly on the concurrent development of other energy sources, and, especially in Europe, the level of regulatory action.

85 *Source: Oxford Institute for Energy Studies, Can Unconventional Gas be a Game Changer in European Gas Markets?, November 2, 2011*
86 *Source: Baker Hughes, Baker Hughes announces February 2012 rig counts, March 7, 2012*
87 *Source: Drilling Contractor Magazine, European Shale Gas: a long road ahead, July/August 2011*
88 *Source: Bloomberg, Shale-Gas Drilling Cost in Poland Triple US, Schlumberger Says, November 29, 2011*
89 *Source: PKN ORLEN SA, Shale Gas, July 2010*
90 *Source: Upstream, ExxonMobil, MOL pull out of Hungary team, February 19, 2010*
91 *Source: SmallCapNews, Ascent Resources cheered by gas flow rates from latest well in Slovenia, November 2, 2011*
92 *Source: IEA ETSAP, Unconventional Oil & Gas Production, May 2010*

5.3. Cooperation and cost sharing

On both sides of the Atlantic, several large international oil and gas companies have entered into agreements concerning the exploration and development of shale gas. In particular, ExxonMobil paired with Hutton Energy in 2011 to agree to a 51%-49% share of four of its exploration areas in Poland.[93] A number of other joint-ventures were formed over the course of 2011, with perhaps the most notable being one between Encana and PKN Orlen.[94]

For their part, PGNiG[95] and 3Legs Resources,[96] both active in Poland, have sought to support their shale gas exploration activities by listing their shares.

Conclusion

The costs and financing associated with shale gas are influenced by a number of factors that prevent the North American experience from being easily replicable in Europe. Aside from the differences in the physical characteristics of rock, depth ranges, and water availability, these costs are also governed by particular market forces, such as the availability of specialists, necessary equipment used for exploration and extraction measures, and existing infrastructure.

Within the CEE region, exploration and extraction costs can vary significantly, with estimated break-even levels being higher than those in the US. On the other hand, it is expected that shale gas will nonetheless be produced at competitive rates, as compared to the importation of Russian conventional gas in the years to come.

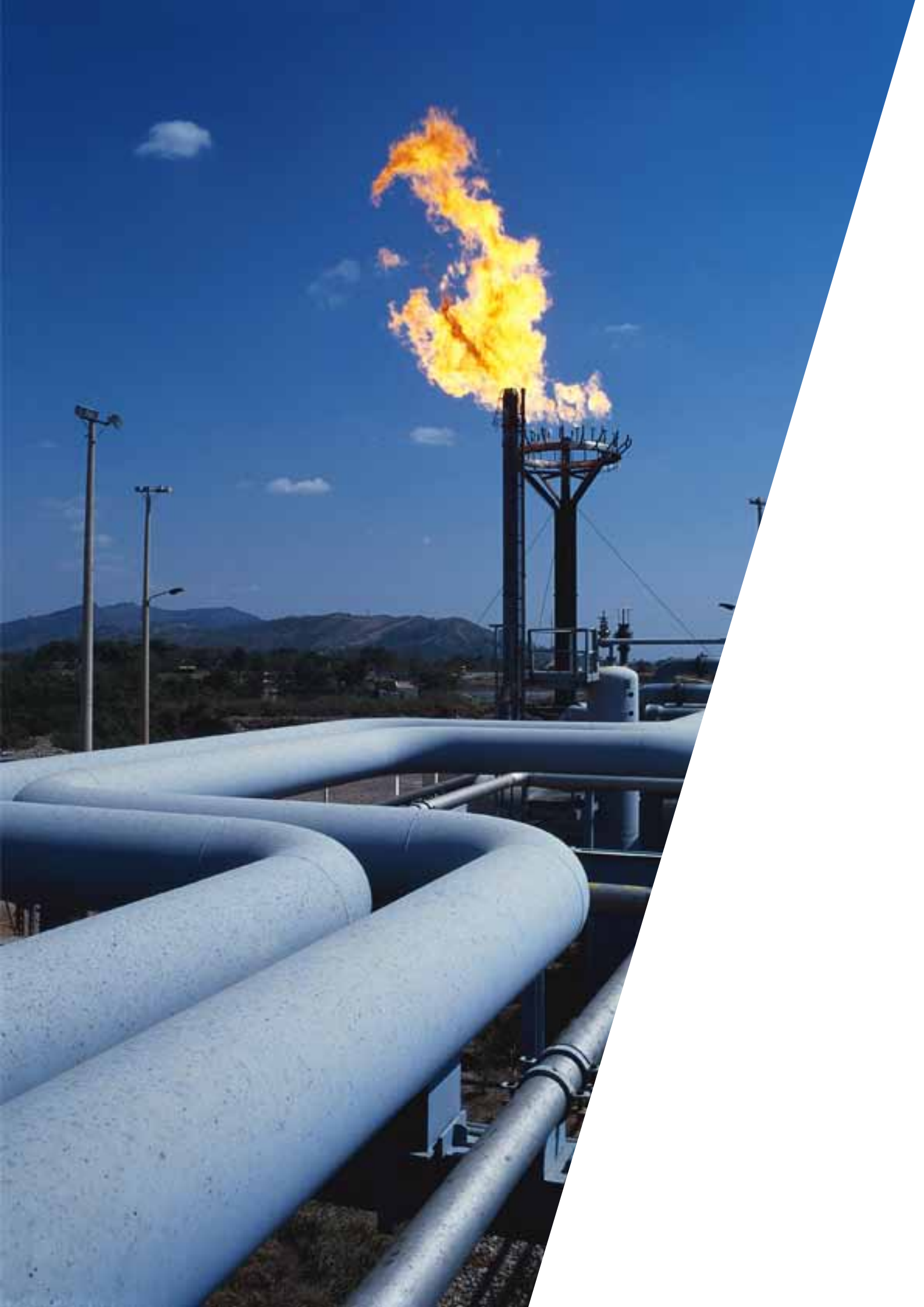
Due to the higher costs and risks of E&P in Europe, more joint venture activity is likely, and locally tailored methods of financing will continue to be necessary to support CEE exploration projects. Such collaboration will be crucial to realizing regional and domestic plans for energy security, thereby providing a way for larger companies to enter local markets with capital and experience, while simultaneously giving domestic players the opportunity to contribute their local knowledge, and also satisfying their need for capital.

93 *Source: Ernst and Young, Shale gas in Europe: revolution or evolution?, December 5, 2011*

94 *Source: Platts Energy in East Europe, Encana set for shale deal with PKN, September 23, 2011*

95 *Source: Platts Energy in East Europe, PGNiG to list drilling contractor, July 15, 2011*

96 *Source: Platts Energy in East Europe, 3Legs raises $102m in IPO, June 17, 2011*



6. Country profiles

Overview

Geologically and politically heterogeneous, the countries of the CEE region are characterized by a number of historical and energy sector-specific differences. Some markets have been able to heavily rely upon one or another single type of energy to satisfy their local demand needs, while others are fortunate to have had a more balanced mix of domestic primary energy resources. Accordingly, shale gas reserves vary by country, as do their respective levels of domestic experience with oil and gas production.

At the same time, the legal and investment environments of each country are also crucial in shaping their overall shale gas development potential. As EU member states, Poland and Romania both have relatively stable regulatory and legal environments, thereby giving them an advantage over other regional markets that are not quite as stable. For example, despite the vast potential of its reserves, the uncertain regulatory environment in Ukraine makes it a more challenging environment for investors, who continue to see the country as having elevated risks when compared with other regional markets.

Nonetheless, we have categorized Poland, Romania and Ukraine as being the *leading shale markets* in the CEE region, as they generally have the necessary domestic political support, sufficient existing infrastructure, and a higher level of existing upstream experience, which is expected to facilitate the development of shale gas resources within their respective markets.

In addition to these leading countries, we have identified those countries which may be considered to be *secondary shale markets* and *potential shale markets*. Secondary markets are similar to those mentioned above, but they are characterized as somewhat smaller in size, with correspondingly less overall shale gas potential, by volume of reserves. By comparison, potential shale markets include several countries that have largely been unexplored, have limited domestic gas consumption, or where there is currently little or no gas infrastructure available. In these countries, the initial focus is likely to remain on conventional gas exploration and development as a priority, as they develop their domestic gas resources.

Leading shale markets

6.1. Poland

Overview

As of 2010, the two most important sources of energy in Poland were coal and oil, the country's third-largest single source of energy supply came from natural gas.[97]

With imports arriving at seven key entry points (from Belarus at Wysokoje, Tietierowka, Włocławek, and Lwówek; from the Czech Republic at Cieszyn; from Germany at Lasów; and from Ukraine at Drozdowicze)[98] and six local cross-border connections,[99] natural gas consumption is highly dependent on foreign supply, which covers 63% of domestic consumption.[100]

There is a long-term contract in place between PGNiG, the largest oil & gas company in Poland, and Gazprom Eksport, which is effective until December 31, 2022, with an annual contracted volume of 9.0 Bcm.[101]

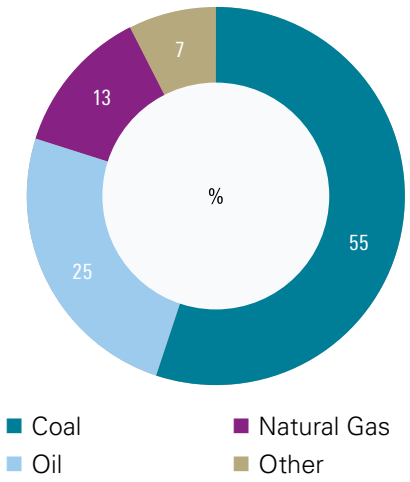
Domestic production totaled 6.02 Bcm in 2010,[102] and was dominated by PGNiG. The main consumers of this production are the residential (27%), industrial (25%), and commercial (14%) sectors.[103]

In 2010, imports amounted to 10.77 Bcm, which exceeded domestic production by approximately 79%.[104] Polish domestic production is expected to offset imports over the long-run, however, thanks to the country's substantial unconventional gas reserves.

Natural gas supply trends

Over the last decade, domestic conventional gas production has continued its overall upward trend, almost exclusively due to PGNiG. In 2010, the company's share in conventional gas production was approximately 98%.[105]

Figure 9: Total primary energy supply of Poland (2010)



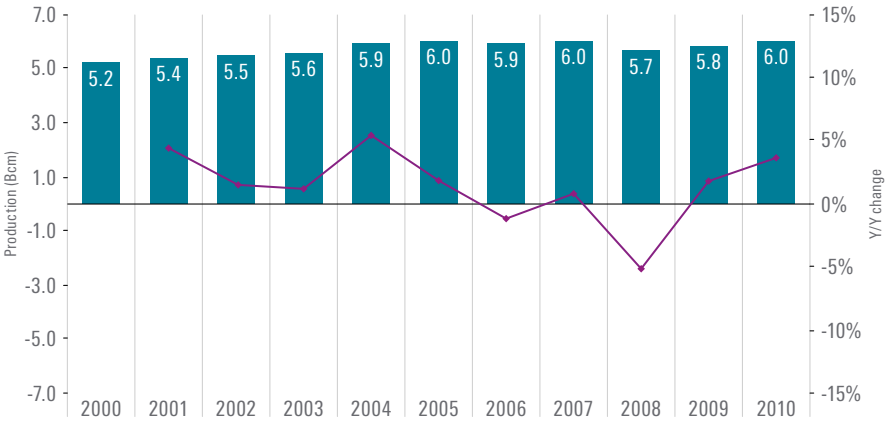
Note: 2010 estimates
Source: International Energy Agency, 2011

Table 4: Gas flows of Poland, 2010

Category	Bcm
Production	6.02
Import	10.77
Decrease/(increase in stocks	0.26
Export	(0.05)
Apparent consumption	(17.00)
Import/consumption ratio	63 %

Note: Change of stocks is calculated based on the difference of closing minus opening stocks
Source: U.S. Energy Information Administration, December 2011

Figure 10: Historical development of domestic natural gas production in Poland



Note: Dry natural gas production
Source: U.S. Energy Information Administration, December 2011

97 Source: International Energy Agency, Natural gas information (2011 edition), 2011
98 Source: Gazoprojekt, Feasibility study of cross-border gas pipeline for improving the logistics in Central and Eastern Europe, November 2010
99 Source: Gazoprojekt, Feasibility study of cross-border gas pipeline for improving the logistics in Central and Eastern Europe, November 2010
100 Source: KPMG analysis based on 2010 data by US Energy Information Administration, December 2011
101 Source: Energy Regulatory Office in Poland, National Report 2011, July 2011
102 Source: US Energy Information Administration, December 2011
103 Source: International Energy Agency, Natural gas information (2011 edition), 2011
104 Source: US Energy Information Administration, December 2011
105 Source: Enerdata, Poland energy report, July 2011

According to the US Energy Information Administration, proved domestic reserves of conventional natural gas amounted to 162.96 Bcm in 2010, with about 60% located in the Polish Lowlands, in the eastern and northeastern part of the country, and the rest in the Carpathians, in the south.[106]

As mentioned above, foreign natural gas imports have key importance in Poland's energy supply, with the long-term Gazprom contract forming the cornerstone of Polish natural gas imports.

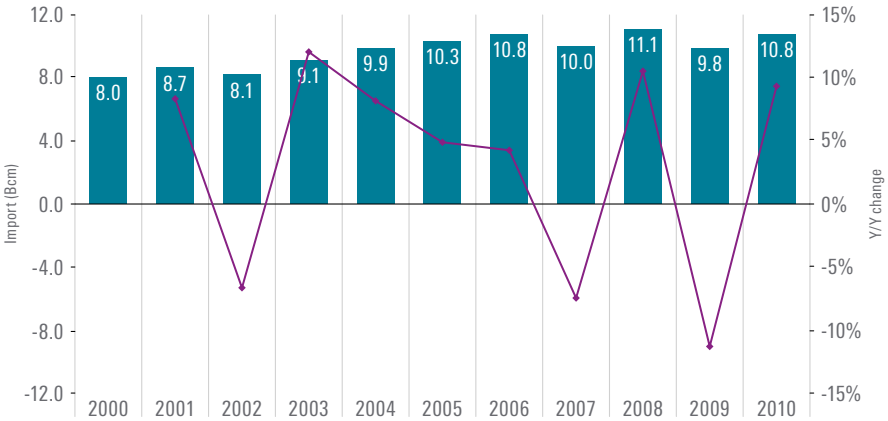
Table 5: Poland import relationships

Partner	Amount per annum (Bcm)	Maturity of contract
OOO Gazprom Eksport	10.0	2022
VNG-Verbundnetz Gas AG	1.0	2016
NAK Naftogaz Ukrainy	0.1	2020
Total	11.1	

Source: Energy Regulatory Office in Poland, 2011

In 2010, imports of Russian natural gas via Belarus and Ukraine amounted to 9.0 Bcm, accounting for about 90% of total imports.[107] The rest of Poland's natural gas imports were of German origin, amounting to 1.0 Bcm.[108] In 2010, imports covered approximately 63% of domestic natural gas consumption.[109]

Figure 11: Historical development of natural gas imports in Poland

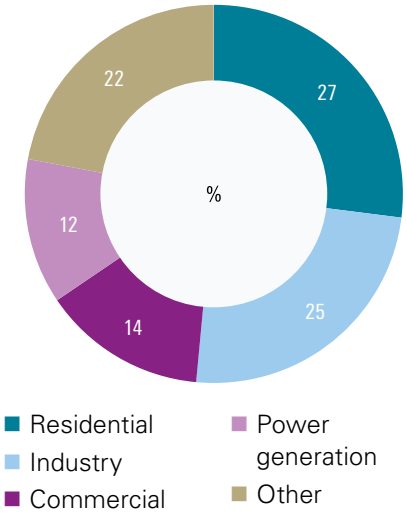


Note: Dry natural gas imports
Source: U.S. Energy Information Administration, December 2011

In order to increase the energy security of Poland, the government is considering various plans to diversify sources and expand the network of natural gas supply. Among these, for example, are the construction of an LNG re-gasification terminal at Świnoujście, and the development of a gas transmission system in Northern Poland.[110]

106 *Source: Energy Regulatory Office in Poland, National Report 2011, July 2011*
107 *Source: Website of PGNiG, January 2012*
108 *Source: Website of PGNiG, January 2012*
109 *Source: KPMG analysis based on 2010 data by US Energy Information Administration*
110 *Source: Energy Regulatory Office in Poland, National Report 2011, July 2011*

Figure 12: Natural gas consumption by sector in Poland (2009)



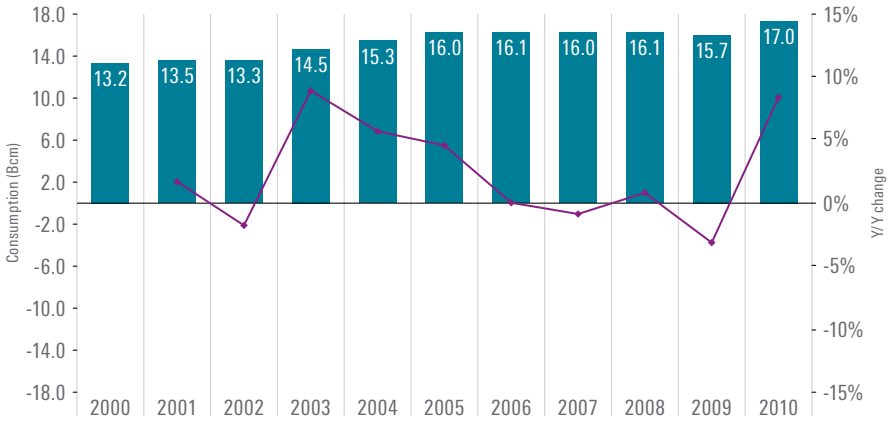
Note: Other includes energy industry own use, losses, transport, agriculture, non-energy use
Source: International Energy Agency, 2011

Natural gas demand trends

The main consumers of natural gas in Poland are the residential, industrial, and commercial sectors, together accounting for about two-thirds of total demand. [111]

Between 2000 and 2010, apparent dry consumption of natural gas in Poland increased from 13.2 Bcm to 17.0 Bcm or by approximately 29%.[112] After steady growth in the first part of the decade, which was mainly driven by economic growth, the dip in consumption in 2009 was caused by the global financial crisis, which in turn forced industrial consumers to reduce their off-take.[113] Following this fall in consumption, a rebound of over 8% made up for any losses, and pushed consumption to its highest point in the decade. [114]

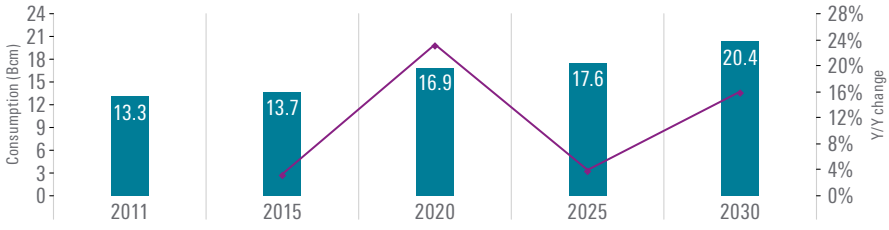
Figure 13: Historical development of natural gas consumption in Poland



Note: Apparent dry natural gas consumption
Source: U.S. Energy Information Administration, December 2011

In addition to this growth in natural gas consumption, the role of natural gas in Poland's energy mix is expected to increase, particularly due to the growing demand of residential end-users, the expected development of high-efficiency steam and gas cogeneration technologies, and the need to provide peak and reserve capacity for wind power plants.[115]

Figure 14: Forecasted natural gas consumption in Poland



Source: Datamonitor, 2010

111 *Source: International Energy Agency, Natural gas information (2011 edition), 2011*
112 *Source: US Energy Information Administration, December 2011*
113 *Source: PGNiG, Annual Report 2010, 2011*
114 *Source: KPMG analysis based on information by US Energy Information Administration, December 2011*
115 *Source: Energy Regulatory Office in Poland, National Report 2011, July 2011*

Nearly all natural gas produced in Poland is sold on the local market.[116]

Gas infrastructure

In 2010, the average daily natural gas demand in Poland was 46.6 Mcm.[117] The nominal daily capacity of the Polish gas infrastructure exceeds these figures at 99.6 Bcm (in 2010).

Table 6: Nominal daily capacities

	Nominal daily capacity (Mcm)
Production	13.1
Import (from East)	45.9
Import (from West)	2.9
Import (from South)	0.3
Gas storage	37.4
TOTAL	99.6

Source: KPMG analysis based on data of Energy Regulatory Office in Poland and PGNiG, 2011

Transmission

Gaz-System, a state-owned company and former subsidiary of PGNiG, operates the natural gas transmission and transport system.[118]

The national transmission system of Poland includes 9,768 kilometers of pipeline with 58 entry and 973 exit points.[119]

The Polish section of the Yamal-Europe transit pipeline, owned by EuRoPol-Gaz, has a total length of 683 kilometers, with 2 entry and 3 exit points.[120]

Import of natural gas is possible from Belarus, the Czech Republic, Germany, and Ukraine, while the current infrastructure allows for export towards Germany only. This limitation in infrastructure has led to the consideration of infrastructure expansion projects including two major interconnections: the **North-South Gas Corridor and Baltic Interconnection** development, involving a new LNG terminal at Świnoujście (see below), a proposed Baltic pipeline to Denmark, and the **Baltic Energy Market Interconnection Plan**, which includes a new interconnector to Lithuania.[121]

Distribution and storage

Poland's distribution system is divided between six companies, which are all owned by PGNiG. They control approximately 116,000 kilometers of gas pipeline, and serve around 6.6 million customers in Poland.[122]

There are eight underground storage facilities in Poland, which are operated by Investgas SA, a subsidiary of PGNiG. The total working capacity of the facilities is 1.84 Bcm[123] with a daily withdrawal capacity of 37.4 Mcm.[124]

A number of plans concerning the development of underground storage facilities include the construction of a new storage facility at Kosakowo[125] and the increase of the working capacity of the facilities at Strachocina over the course of this year,[126] Wierzchowice by 2014[127] and Mogilno by 2015[128] and further expansion by 2020.[129]

LNG

By mid-2014, Poland expects to complete the construction of its first LNG re-gasification terminal at Świnoujście, which will be commissioned as part of the North-South Gas Corridor and Baltic Interconnection plans, with the intention of using it to supply Poland and other CEE and Baltic states.

116 *Source: KPMG analysis based on information by US Energy Information Administration, December 2011*
117 *Source: KPMG analysis based on apparent consumption data of US Energy Information Administration, December 2011*
118 *Source: Energy Regulatory Office in Poland, National Report 2011, July 2011*
119 *Source: Website of Gaz-System SA, January 2012*
120 *Source: Website of Gaz-System SA, January 2012*
121 *Source: ENTSO-G, Gas Regional Investment Plan Central-Eastern Europe 2012-2021, January 2012*
122 *Source: Website of PGNiG, January 2012*
123 *Source: Energy Regulatory Office in Poland, National Report 2011, July 2011*
124 *Source: KPMG analysis based on the website of PGNiG, January 2012*
125 *Source: ENTSO-G, Gas Regional Investment Plan Central-Eastern Europe 2012-2021, January 2012*
126 *Source: ENTSO-G, Gas Regional Investment Plan Central-Eastern Europe 2012-2021, January 2012*
127 *Source: ENTSO-G, Gas Regional Investment Plan Central-Eastern Europe 2012-2021, January 2012*
128 *Source: ENTSO-G, Gas Regional Investment Plan Central-Eastern Europe 2012-2021, January 2012*
129 *Source: Energy Regulatory Office in Poland, National Report 2011, July 2011*

The total capacity of the terminal will be 5 Bcm/year, with a planned expansion to 7.5 Bcm/year by 2017.[130] Based on a long-term contract between PGNiG and QatarGas, the terminal will be supplied with 1.5 Bcm/year of LNG in the period 2014-2034.[131] LNG supplies not covered by QatarGas will be covered by PGNiG through external contracts.[132]

Prospects for shale gas development

Poland is considered to be a major player among CEE countries in terms of shale gas reserves. The reserves are located in three basins (Baltic, Lublin, and Podlasie basins), covering a total of 46 thousand km^2.[133] According to the latest survey of the Polish Geological Institute, Poland's potential shale gas resources found in the entire Baltic-Podlasie-Lublin basin could be as much as 1.92 Tcm, of which a maximum of 768 Bcm is considered technically recoverable.[134]

The critics of Polish shale gas development are generally skeptical about the capability of Poland to handle such big investments in a short amount of time. According to the Oxford Institute for Energy Studies, for Poland to reach annual production levels of 28 Bcm by 2020, it would take approximately 50 rigs executing 700-1,000 drillings every year over 10,000km^2, utilizing 100 million barrels of water.[135] Meeting this requirement can be both difficult and uneconomical, due to varying geological conditions, densely populated areas, the lack of water in large quantities, and high fixed costs of international O&G companies. Other critics also state that Poland does not possess sufficient transmission and storage infrastructure, and has limited export connections,[136] though this is being addressed via several gas infrastructure initiatives.

Shale gas exploration in Poland started in 2007, when the first exploration concession was granted by the Ministry of Environment. Since then, there has been a rush in Poland to acquire exploration concessions to the largest shale gas resources. So far, more than 100 exploration concessions have been awarded and, in the form of joint ventures, major North American E&Ps such as ExxonMobil and Chevron have entered the Polish market to leverage their proven technologies. According to the Ministry of Environment, as of February 2012 there were 111 concessions in the hands of 30 companies for the exploration of unconventional natural gas resources.[137] As of August 2011, based on the square kilometers covered, the top 10 concession holders were:[138] (1) San Leon Energy with 14 licenses covering 11,520km^2, (2) ExxonMobil, (3) PKN Orlen, (4) Chevron, (5) Marathon Oil & Gas, (6) BNK Petroleum, (7) 3Legs Resources, (8) Nexen, (9) ConocoPhillips, and (10) Petrolinvest.

As the rush for concessions has started to subside, the industry's focus has shifted to the acquisition of seismic data and to the drilling of test wells. Already 14 test wells have been drilled and completed as of January 2012, in some cases showing comparable or better reservoir properties than the best

130 *Source: ENTSO-G, Gas Regional Investment Plan Central-Eastern Europe 2012-2021, January 2012*

131 *Source: Energia.gr, Poland Signs LNG Supply Deal With Qatargas, June 29, 2009*

132 *Source: Energia.gr, Poland Signs LNG Supply Deal With Qatargas, June 29, 2009*

133 *Source: US Energy Information Administration, World Shale Gas Resources, April 2011*

134 *Source: Polish Geological Institute, Assessment of shale gas and shale oil resources of the lower paleozic Baltic-Podlasie-Lublin Basin in Poland, March 2012*

135 *Source: Platts Energy in East Europe, Polish shale gas: Game-changer or false down, January 14, 2011*

136 *Source: Platts Energy in East Europe, Shale gas revolution to transform Poland, September 9, 2011*

137 *Source: Ministry of Environment, Register of concessions granted by Minister of Environment for prospecting for, exploration and production of oil and gas in Poland, February 1, 2012*

138 *Source: San Leon Energy, Acquisition of Realm Energy International Corporation, August 2011*

North American formations.[139] For its part, PGNiG announced the drilling of its third well on March 26, 2012.[140] Poland expects the initial test production of shale gas in the country to start in 2014, or 2015 at the latest.[141]

Regulatory bodies and relevant legislation

As in the case of other European Union member countries, the regulatory framework is determined by the EU, while specific legislation is managed at the country level.

The relevant regulatory bodies in Poland include the **Ministry of Economy, the Energy Regulatory Office, the Ministry of Environment**, and the **State Mining Authority**. In terms of the exploration of natural gas reserves, the most important regulatory body is the Ministry of Environment, which is responsible for issuing mining usufruct rights and concessions.

Environmental policy

The Ministry of Environment is responsible for the administration of environmental policy in Poland. The most relevant environmental policies include the **Environmental Protection Law**, the **Law on the Provision of Information on the Environment and its Protection**, the **Geological and Mining Law**, and the **Regulation of the Minister of the Environment** on the detailed requirements for the current inventories of mineral deposit resources. In order to apply for an exploration concession in Poland, the decision of the local authorities must be submitted to the Ministry of Environment.

Tax policy

There is no special tax policy related to shale gas in Poland, however this is expected to change in the near-future. Political parties are currently considering specific tax legislation for shale gas production, but the details of such a special tax are still uncertain.[142] The most important regulation concerning natural gas exploration is the **Geological and Mining Law**. Pursuant to this regulation (valid as of January 1, 2012), companies holding exploration rights are obliged to pay a concession fee depending on their production volume, and a mining usufruct fee.[143]

Conclusion

Poland is widely considered to be the leading market for shale gas development in the CEE region. It has the highest amount of potential shale gas reserves, and the highest concentration of E&P companies investing in exploration activity. Since the granting of the first shale gas concession in 2007,[144] more than 100 shale gas exploration licenses have been issued, as several major O&G companies such as Chevron and ExxonMobil have entered the market, leveraging their experience in North America.[145] Poland's attractiveness is not only driven by its natural resources, but also by its stable regulatory and legal environment, and general support for the development of shale gas from the government and most citizens. With estimated reserves of up to 1.92 Tcm, of which maximum 768 Bcm may be recoverable,[146] Poland's shale gas potential is seen by some as the ultimate solution for the country's energy security, based on its high dependence on imported gas.

---

139 *Source: Platts Energy in East Europe, A pivotal year for Poland, January 13, 2012*

140 *Source: Platts Energy in East Europe, PGNiG drills third shale gas well, April 6, 2012*

141 *Source: Platts Energy in East Europe, Poland eyes shale gas in 2014, January 27, 2012*

142 *Source: Platts Energy in East Europe, A pivotal year for Poland, January 13, 2012*

143 *Source: DLA Piper, Polish shale gas from the tax perspective, October 2011*

144 *Source: IHS, A review of shale gas activities in Poland, January 2012*

145 *Source: Ministry of Environment, Register of concessions granted by Minister of Environment for prospecting for, exploration and production of oil and gas in Poland, February 1, 2012*

146 *Source: Polish Geological Institute, Assessment of shale gas and shale oil resources of the lower paleozic Baltic-Podlasie-Lublin Basin in Poland, March 2012*

6.2. Romania

Overview

As a portion of Romania's total primary energy supply in 2009, natural gas was the largest energy source, with a share of 31%. Oil had the second highest share at 24%, followed by coal with a share of 22%.[147]

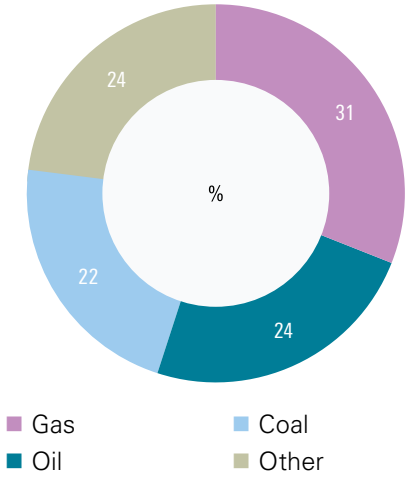
Romania has significant natural gas reserves, with internal production covering 82% of domestic consumption in 2010, while the remaining 18% was supplied by foreign imports.[148] Romania's domestic gas reserves have recently been boosted by the discovery of up to 84 Bcm of offshore natural gas in the Black Sea, which was announced at the beginning of 2012.[149]

Domestic production amounted to 10.47 Bcm in 2010,[150] which was mostly carried out by Romgaz (53.41%) and by OMV Petrom (44.44%), the largest natural gas producers in Romania.[151] The main consumers of natural gas are the power generation sector (27%), while the industrial and residential sectors were second and third, at 25% and 20%, respectively.[152]

Imported gas is pumped into the Romanian gas transmission system at three entry points: Isaccea and Mediesul Aurit, which are both at the Ukrainian border, and Arad-Szeged at the Hungarian border.[153] In 2010, imported natural gas accounted for 2.25 Bcm of Romania's consumption.[154]

Physical exports of domestically produced natural gas from Romania are temporarily unavailable, mainly because of the lack of infrastructure.[155]

Figure 15: Total primary energy supply of Romania (2009)



Source: International Energy Agency, 2011

Table 7: Gas flows of Romania, 2010

Category	Bcm
Production	10.47
Import	2.25
Decrease/(increase in stocks	-
Export	-
Apparent consumption	(12.73)
Import/consumption ratio	18 %

Note: Change of stocks is calculated based on the difference of closing minus opening stocks

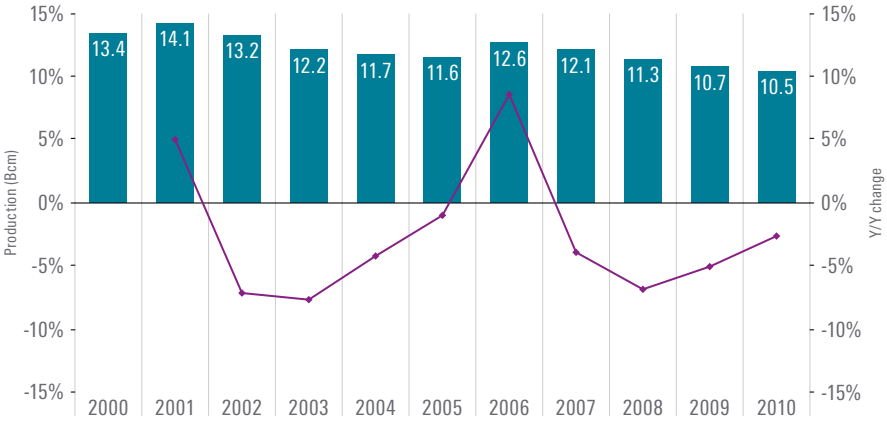
Source: U.S. Energy Information Administration, December 2011

Natural gas supply trends

Between 2000 and 2010, the average domestic production in Romania was 12.12 Bcm, after slightly decreasing from 13.45 Bcm in 2000, to 10.47 Bcm in 2010.[156] During the past ten years, production has been dominated by Romgaz and OMV Petrom. Over the last decade, the combined averaged share of Romgaz's and Petrom's total gas production was above 95%, closing out 2010 with a combined production of 10.33 Bcm.[157] The remaining production was delivered by a number of smaller companies, including Amromco Ploiesti, Amromco New York, Aurelian Oil&Gas, Lotus Petrol, Foraj Sonde, and Wintershall Medias.[158]

147 *Source: International Energy Agency, Energy balances of non-OECD countries (2011 edition), 2011*
148 *Source: US Energy Information Administration, December 2011*
149 *Source: Romania Business Insider, Newly found Black Sea gas reserves could grant Romania energy independence in 2015-2017, March 6, 2012*
150 *Source: US Energy Information Administration, December 2011*
151 *Source: Autoritatea Nationala de Reglementare in Domeniul Energiei, 2010 Annual Report, 2011*
152 *Source: International Energy Agency, Energy balances of non-OECD countries (2011 edition), 2011*
153 *Source: Autoritatea Nationala de Reglementare in Domeniul Energiei, 2010 Annual Report, 2011*
154 *Source: US Energy Information Administration, December 2011*
155 *Source: Autoritatea Nationala de Reglementare in Domeniul Energiei, 2010 Annual Report, 2011*
156 *Source: US Energy Information Administration, December 2011*
157 *Source: Autoritatea Nationala de Reglementare in Domeniul Energiei, 2010 Annual Report, 2011*
158 *Source: Autoritatea Nationala de Reglementare in Domeniul Energiei, 2010 Annual Report, 2011*

Figure 16: Historical development of domestic natural gas production in Romania



Note: Dry natural gas production
Source: U.S. Energy Information Administration, December 2011

According to the US Energy Information Administration, the country's proved natural gas reserves are estimated to be 62.3 Bcm. Based upon 2010 data, the exploitation rate of natural gas resources indicates that the known geological reserves may be exhausted by 2016,[159] though this may be extended in light of the recent offshore discovery in the Black Sea.

The most important natural gas producer is state-owned Romgaz, a joint stock company controlled by the Ministry of Economy, Trade and Business Environment. In addition to its production activities, Romgaz also undertakes a number of other production and storage-related activities.[160]

Romania has three import pipelines, two of them coming from Ukraine and one from Hungary. Imported natural gas from Russia enters the country via the pipelines from Ukraine, through which Romania has a total capacity of 12.7 Bcm per year.[161] In 2010, 100% of Romania's gas imports came from Russia.[162]

Table 8: Natural gas suppliers in Romania

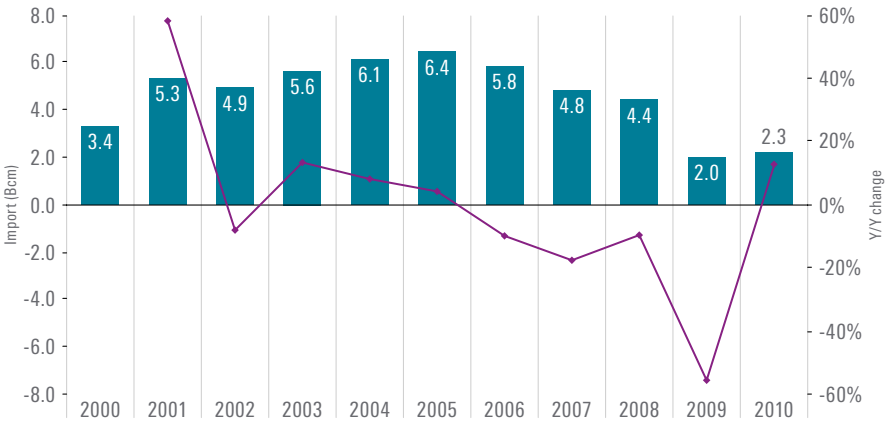
Natural gas supplier	Quantity (Bcm)
Romgaz import	0.59
GDF Suez Energy Romania	0.53
Wiee Romania SRL	0.40
E.ON Energie Romania	0.39
Others	0.34
TOTAL	2.25

Source: ANRE – Annual Report 2010

159 *Source: KPMG estimate based on information by US Energy Information Administration, 2011*
160 *Source: KPMG analysis based on SNGN Romgaz SA company information, February 27, 2012*
161 *Source: Autoritatea Nationala de Reglementare in Domeniul Energiei, 2010 Annual Report, 2011*
162 *Source: BP, Statistical Review of World Energy, June 2011*

In 2010, 12 suppliers imported natural gas,[163] the top four of which accounted for approximately 85% of total imports. [164]

Figure 17: Historical development of natural gas imports in Romania



Note: Dry natural gas imports
Source: U.S. Energy Information Administration, December 2011

The Romanian government is actively seeking to diversify its sources of imported natural gas. Romania has joined the consortium to build the Nabucco pipeline, which is planned to bring Caspian gas to Europe, while it is also exploring the possibility of building a liquefied natural gas terminal at the port of Constanța on the Black Sea, as part of the Azerbaijan, Georgia, Romania Interconnector (AGRI Project).[165] Although Romanian gas imports are expected to increase, alternative sources of supply are aimed at boosting Romania's domestic energy supply.[166] Moreover, the government is striving to limit its dependence on all energy sources that require imports, and has initiated two projects aimed at increasing the cross-border capacities of the country: the Cernauti-Siret pipeline to Ukraine, and the Interconnection with the Bulgarian network at Negru Voda, in southern Romania.[167]

International transit routes for Russian natural gas to the Balkan states pass through Romanian territory. There are three transit pipelines in Romania, one to Bulgaria, and two to Turkey, Greece and other southeast European countries.[168]

New opportunities

In February 2012, OMV Petrom and ExxonMobil Exploration and Production Romania announced the discovery of a significant offshore gas deposit in the Black Sea.[169] Preliminary estimates suggest the size of the deposit to be 42-84 Bcm,[170] which are equivalent to 3-6 times the annual consumption of Romania.[171]

163 Source: Autoritatea Nationala de Reglementare in Domeniul Energiei, 2010 Annual Report, 2011
164 Source: Autoritatea Nationala de Reglementare in Domeniul Energiei, 2010 Annual Report, 2011
165 Source: Autoritatea Nationala de Reglementare in Domeniul Energiei, 2010 Annual Report, 2011
166 Source: National Energy Strategy of Romania for the period 2007-2020 – updated in August 20, 2011
167 Source: National Energy Strategy of Romania for the period 2007-2020 – updated in August 20, 2011
168 Source: KPMG analysis based on SNTGN Transgaz Medias company information, February 27, 2012
169 Source: Natural Gas Europe, ExxonMobil and OMV Discover Huge Gas Field in Romania, February 23, 2012
170 Source: Natural Gas Europe, ExxonMobil and OMV Discover Huge Gas Field in Romania, February 23, 2012
171 Source: Natural Gas Europe, ExxonMobil and OMV Discover Huge Gas Field in Romania, February 23, 2012

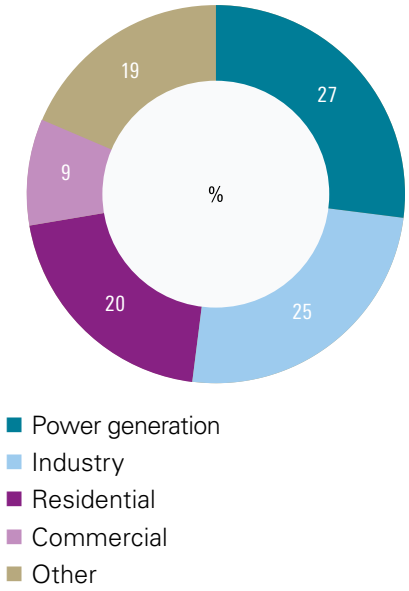
The so-called Neptun block is approximately 170 kilometers off the coast of Romania, while it is being drilled via the Domino-1 well, which is currently targeting a depth of 930 meters.[172] The well started operations at the end of 2011, while total depth is expected to exceed 3,000 meters, with 3D seismic acquisition to finalize sometime in 2012.[173]

Natural gas demand trends

As mentioned above, the main consumers of natural gas in Romania are the power generation, industrial and residential sectors.

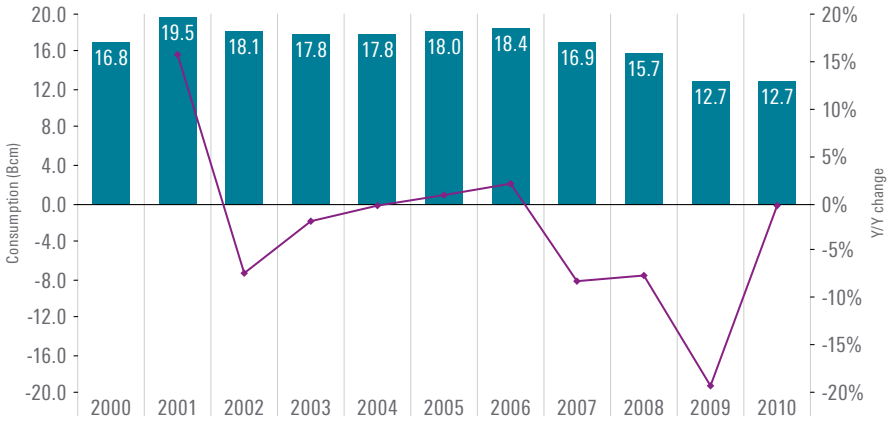
Between 2000 and 2010, apparent dry natural gas consumption in Romania fluctuated around an average level of 16.77 Bcm.[174] The significant decrease in demand during 2009 was caused by reduced consumption due to the financial crisis, and by the temporary restrictions applied on power plants and non-residential consumers during the Russian-Ukrainian gas crisis.

Figure 18: Natural gas consumption by sector in Romania (2009)



Note: Other includes energy industry own use, losses, transport, agriculture/forestry, non-energy use, etc.
Source: International Energy Agency, 2011

Figure 19: Historical development of natural gas consumption in Romania

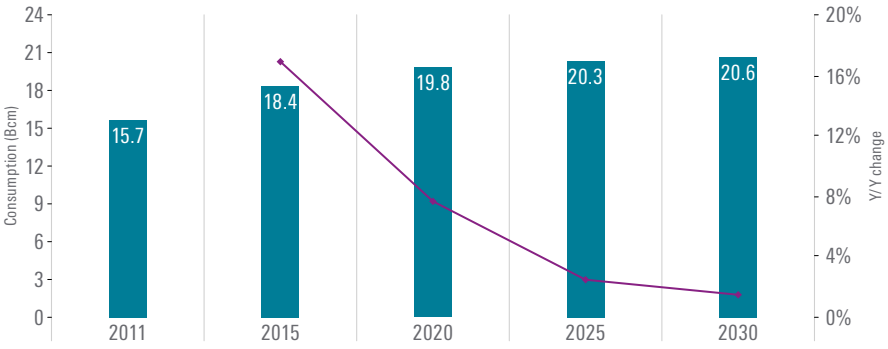


Note: Apparent dry natural gas consumption
Source: U.S. Energy Information Administration, December 2011

The National Energy Strategy of Romania for the period 2007-2020 has set ambitious energy goals for the country,[175] which are expected to affect natural gas demand. These include initiatives to minimize the risk of supply interruption via long-term supply contracts, efforts to modernize and develop existing transmission and distribution infrastructure, and the intensification of exploration and production activity. Romania's natural gas consumption is expected to exceed historical levels by reaching 20.64 Bcm by 2030, largely due to the country's anticipated economic growth.[176]

172 *Source: Natural Gas Europe, ExxonMobil and OMV Discover Huge Gas Field in Romania, February 23, 2012*
173 *Source: Natural Gas Europe, ExxonMobil and OMV Discover Huge Gas Field in Romania, February 23, 2012*
174 *Source: US Energy Information Administration, December 2011*
175 *Source: Based on information from the Romanian Ministry of Economy, Commerce and Business Environment, February 27, 2012*
176 *Source: KPMG analysis based on forecasts by Datamonitor, 2010*

Figure 20: Forecasted natural gas consumption in Romania



Source: Datamonitor, 2010

Gas infrastructure

Transmission

Romania's high-pressure natural gas transmission system is 13,366 km long, and spans across almost the entire country.[177] The transmission network is 553km long, and is operated by SNTGN Transgaz Medias SA, the Romanian TSO.[178] Gas is fed into the high-pressure pipeline system through 3 entry points from import sources, 8 entry points from domestic gas fields, and 8 entry points from domestic gas storage facilities.[179]

In Romania, the exit points are intended only for transit; physical exports of domestically produced natural gas are not possible.[180]

Currently, the Arad-Szeged interconnector allows gas to flow only from Hungary to Romania. However, reverse-flow development at the interconnector is expected to be commissioned by 2015, with the final investment decision to be made at the end of 2012.[181] The reverse flow will have an annual capacity of 4.8 Mcm/day and will enable the physical flow of gas from Romania to Hungary.[182]

Distribution and storage

The gas distribution segment is characterized by the ownership of large, vertically integrated energy companies with only a small part of the market in state ownership; just 5 out of 38 distributors have the State as a minority shareholder.[183] The distribution system includes 40,300 kilometers of pipeline, supplying approximately 3 million consumers.[184] GDF Suez and E.ON Gaz Distributie together own approximately 85% of the distribution network in Romania.[185]

In Romania, there are 8 underground storage facilities, which have a total capacity of 3.135 Bcm as of 2010.[186]

177 *Source: KPMG analysis based on SNTGN Transgaz Medias company information, February 27, 2012*
178 *Source: KPMG analysis based on SNTGN Transgaz Medias company information, February 27, 2012*
179 *Source: KPMG analysis based on SNTGN Transgaz Medias company information, February 27, 2012*
180 *Source: Autoritatea Nationala de Reglementare in Domeniul Energiei, 2010 Annual Report, 2011*
181 *Source: ENTSO-G, Based on ENTSO-G information, February 27, 2012*
182 *Source: ENTSO-G, Based on ENTSO-G information, February 27, 2012*
183 *Source: Autoritatea Nationala de Reglementare in Domeniul Energiei, 2010 Annual Report, 2011*
184 *Source: Autoritatea Nationala de Reglementare in Domeniul Energiei, 2010 Annual Report, 2011*
185 *Source: Autoritatea Nationala de Reglementare in Domeniul Energiei, 2010 Annual Report, 2011*
186 *Source: Autoritatea Nationala de Reglementare in Domeniul Energiei, 2010 Annual Report, 2011*

Table 9: Underground storage facilities in Romania

Underground storage	Capacity (million cubic meters)
Balaceanca	50
Bilciuresti	1,310
Cetatea de Balta	200
Ghercesti	150
Sarmasel	800
Targu Mures	300
Urziceni	250
Nades	75
TOTAL	3,135

Source: ANRE – National Report 2010

Romgaz owns 6 storage facilities, or 88% of the total storage capacity. In addition to Romgaz, another 2 companies own storage facilities in Romania: Depomures (Târgu Mureș underground storage) and Amgaz (Nadeş underground storage).

Prospects for shale gas development

Unconventional resources, such as shale gas and tight gas, are available in Romania in the Carpathian-Balkanian Basin, and in the Pannonian-Transylvanian Basin, however initial exploration efforts suggest that the cost to recover the gas may be quite high.[187] The exact amount of shale gas resources is still uncertain, although there are various studies discussing the unconventional gas potential of Romania.

The country's public authorities have not executed a survey regarding shale gas, and sufficient data is currently not available to establish prospective shale gas areas in Romania. However, the most promising exploration area is considered to be the Carpathian-Balkanian Basin, which is located in the eastern, southern, and southeastern parts of the country.[188]

According to the US Energy Information Administration, the joint reserves for Romanian, Bulgarian, and Hungarian shale gas in this basin is around 538 Bcm.[189]

In July 2010, Chevron Corp. submitted winning bids for three shale gas exploration blocks in the southeastern region of Dobrogea, totaling 2,700km³.[190] Chevron also has exploration rights for a block in Bârlad, in eastern Romania, and expects to begin drilling later in 2012. Local citizens in Bârlad, however, have recently demonstrated against shale gas exploration.[191]

There are a number of other companies interested in shale gas exploration in Romania, which have already signed drilling agreements with the National Agency for Mineral Resources (NAMR), and are awaiting government approval to proceed. Among these are MOL Group, East West Petroleum Corp, in cooperation with Naftna Industrija Srbije j.s.c. Novi Sad (NIS), and Sterling Resources Ltd.[192]

Regulatory bodies and relevant legislation

Regulations in the natural gas sector in Romania are well-defined and clearly follow EU norms.

The relevant regulatory bodies in Romania include the **Ministry of Economy, Commerce and Business Environment**, the **National Energy Regulatory Authority**, the **National Agency for Mineral Resources (NAMR)**, the **Ministry of Environment and Forests**, and the **National Environmental Protection Agency**. Regarding the exploration of unconventional resources, the Romanian National Agency for Mineral Resources is the most relevant regulatory body, as it is responsible for issuing exploration permits.

There is no specific Romanian legislation related to shale gas. The regulations concerning natural gas exploration are regulated by Law no. 351/2004 on Natural Gas and GO no. 445/2009 on the Environmental Impact and GO no. 1798/2007 on the Environmental Authorization Issuing Procedure.

187 *Source: US Energy Information Administration, World Shale Gas Resources, April 2011*
188 *Source: US Energy Information Administration, World Shale Gas Resources, April 2011*
189 *Source: US Energy Information Administration, World Shale Gas Resources, April 2011*
190 *Source: Natural Gas Europe, Romania Requires Legislation to Underpin Shale Exploration, December 2, 2011*
191 *Source: Natural Gas Europe, Romania: Shale Gas Battle Set to Begin, March 20, 2012x*
192 *Source: Natural Gas Europe, Romania Requires Legislation to Underpin Shale Exploration, December 2, 2011*

Environmental policy

NAMR does not explicitly state any special regulations on shale gas in Romania, in which case the regulations for natural gas otherwise apply.[193] Extraction activities in Romania do not fall under the IPPC Directive of the European Union (96/61/EC), and therefore no integrated environmental agreements or authorizations are required.

Tax policy

There are no specific tax regulations related to shale gas in Romania.

The exploration of oil and natural gas is subject to royalty, as material sources such as natural gas belong to the Romanian State. Depending on the type of natural gas and the quantity exploited, the royalty rate varies between 3.5% and 13% for natural gas.[194]

Conclusion

With domestic natural gas production accounting for more than 80% of national consumption, Romania has historically had a low dependency on imported gas, though this is expected to change in the coming years. NAMR officials therefore consider shale gas development to be an important energy supply alternative to increased imports, and experts consider Romania's shale gas potential reserves to be high. Considering its relatively secure legal environment and strong upstream experience, Romania has high shale gas development potential.

Although Romania has regulations covering the natural gas sector, there are no specific articles on shale gas. From an environmental perspective, Romanian legislation does not restrict the extraction of shale gas, or define any specific regulations in this respect.

Shale gas exploration is still in the planning phase in Romania, but there are a number of companies interested in shale gas exploration in the country. If initial exploration efforts yield positive results, then the country could have the opportunity to augment its gas supply and reduce its already limited dependency on foreign gas imports.

193 *Source: Based on National Agency for Mineral Resources information, February 26, 2012*

194 *Source: As per the Romanian Tax Code, Article 22, Paragraph 2*

6.3. Ukraine

Overview

Ukraine has received a large plurality of its total primary energy supply in 2009 from natural gas, at 38%, followed closely by coal (31%) and nuclear (19%).

Ukraine is highly dependent on Russian imports, which cover nearly 68% of domestic consumption. Supplies are based on the country's 10-year contract, which was concluded with Gazprom in 2009.

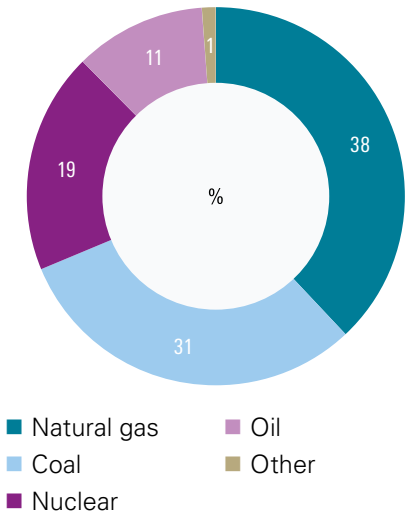
Imported gas is pumped into the Ukrainian gas transmission system at eleven entry points: nine at the Russian border and two at the Belarusian border.[195] In 2010, imported natural gas amounted to 36.0 Bcm.[196]

In addition to imported gas, domestic production amounted to 19.14 Bcm in 2010, which was mostly carried out by state-owned Naftogaz, the largest oil and gas company in Ukraine. The main consumers of natural gas are the power generation (39%), residential (31%), and the industrial sectors (13%).[197]

Natural gas supply trends

Between 2000 and 2010, the average domestic production in Ukraine was 18.98 Bcm, after slightly increasing from 17.8 Bcm in 2000, to 19.1 Bcm in 2010. During the past ten years, production has been dominated by Naftogaz through its three subsidiaries (Ukrgazvydobuvannia, Ukrnafta, and Chornomornaftogaz). In 2010, Naftogaz's share of total Ukrainian production was approximately 89%.[198] The remaining production was delivered by 18 smaller state-owned and private exploration companies, such as Naftogazvydobuvannia and Poltava Petroleum Company.[199]

Figure 21: Total primary energy supply of Ukraine (2009)



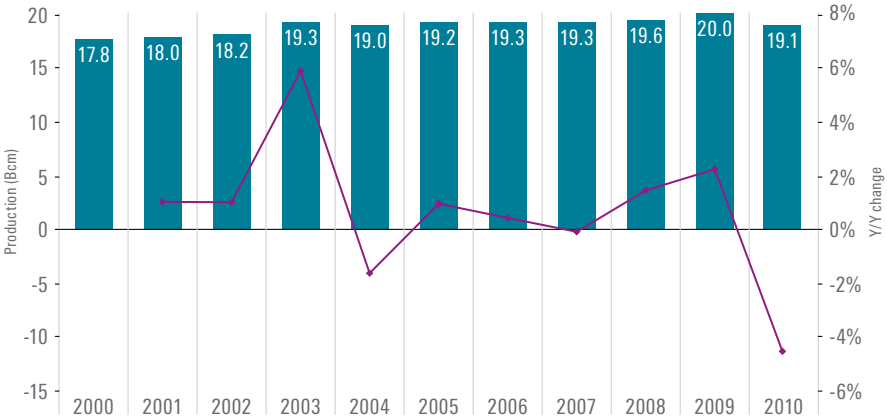
Source: International Energy Agency, 2011

Table 10: Gas flows of Ukraine, 20010

Category	Bcm
Production	19.14
Import	35.99
Decrease/(increase) in stocks	-
Export	(2.57)
Apparent consumption	(52.57)
Import/consumption ratio	68%

Note: Change of stocks is calculated based on the difference of closing minus opening stocks
Source: U.S. Energy Information Administration, December 2011

Figure 22: Historical development of domestic natural gas production in Ukraine



Note: Dry natural gas production
Source: U.S. Energy Information Administration, December 2011

195 *Source: Naftogaz, Capacities and actual volumes of natural gas transit by Ukrainian gas transmission system, 2012*
196 *Source: US Energy Information Administration, December 2011*
197 *Source: International Energy Agency, Energy balances of non-OECD countries (2011 edition), 2011*
198 *Source: KPMG analysis based on information of Naftogaz of Ukraine NJSC*
199 *Source: Kyiv Post, Natural gas extraction in Ukraine drops 5 percent in 2010, January 12, 2011*

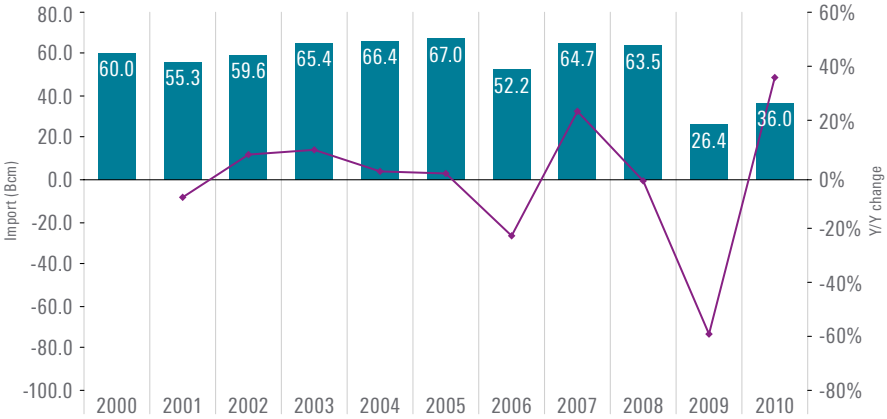
According to the US Energy Information Agency, Ukraine's proven conventional gas resources were estimated to be 1,092 Bcm.[200]

Without the involvement of intermediates, Naftogaz and Gazprom have separate contractual agreements covering the supply of Russian gas to Ukraine, and for the transit of Russian gas to Europe via Ukraine.[201] Both contracts are effective between 2009 and 2019.[202] The contract concerning supplies to Ukraine involves an annual amount of 52 Bcm[203] and a 'take-or-pay' clause, accounting for 80% of the contracted amount.[204]

There have been several disputes related to gas supplies between Russia and Ukraine in the past. While Russia's intention was to introduce European pricing mechanisms and eliminate discounts, Ukraine's preference was to sustain former CIS preferential rates.[205] Major disputes in 2006 and 2009 led to the cut-off of all gas supplies to Ukraine, as well as disruptions in transit to Europe. While the 2006 standoff lasted for only four days, the latter took almost three weeks during the peak heating season in January 2009, affecting both Ukrainian and European residential and industrial consumers.[206, 207, 208, 209]

The total amount of imported gas transported to Ukraine via pipeline in 2010 was 36.0 Bcm.[210] It is our understanding that the significant decrease in 2009 was mainly related to the suspension of Russian gas supplies, and the drop in demand due to the financial crisis.

Figure 23: Historical development of natural gas imports in Ukraine



Note: Dry natural gas imports
Source: U.S. Energy Information Administration, December 2011

200 *Source: U.S. Energy Information Agency, December 2011*
201 *Source: Information Directorate of OAO Gazprom, Russian gas deliveries towards Ukraine initiated, January 20, 2009*
202 *Source: Information Directorate of OAO Gazprom, Russian gas deliveries towards Ukraine initiated, January 20, 2009*
203 *Source: Kyiv Post, Gazprom: not possible to reduce Ukraine's agreed gas buy for 2012, January 12, 2012*
204 *Source: Information Directorate of OAO Gazprom, Russian President Dmitry Medvedev meets with Alexey Miller, January 11, 2012*
205 *Source: Carnegie Endowment for International Peace, Natural gas pricing and its future, 2010*
206 *Source: Information Directorate of OAO Gazprom, Gazprom suspends gas shipments to Ukraine, January 1, 2006*
207 *Source: Information Directorate of OAO Gazprom, Gazprom and Naftoraz Ukrainy finally settle standoff surrounding cooperation in gas sector, January 4, 2006*
208 *Source: Information Directorate of OAO Gazprom, Gas supplies to Ukraine cut 100 per cent, January 1, 2009*
209 *Source: Information Directorate of OAO Gazprom, Russian gas deliveries towards Ukraine initiated, January 20, 2009*
210 *Source: U.S. Energy Information Agency, December 2011*

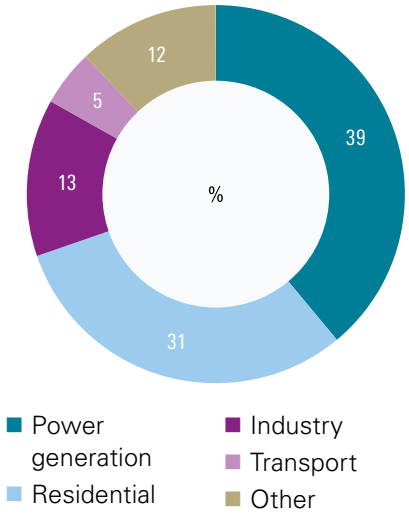
The government of Ukraine is considering a number of initiatives to increase the energy security of Ukraine, primarily through the diversification of the sources of natural gas supply and/or supply routes, and through the renovation of existing gas infrastructure.[211, 212]

Natural gas demand trends

As mentioned above, the main consumers of natural gas in Ukraine are the power generation, residential, and industrial sectors.

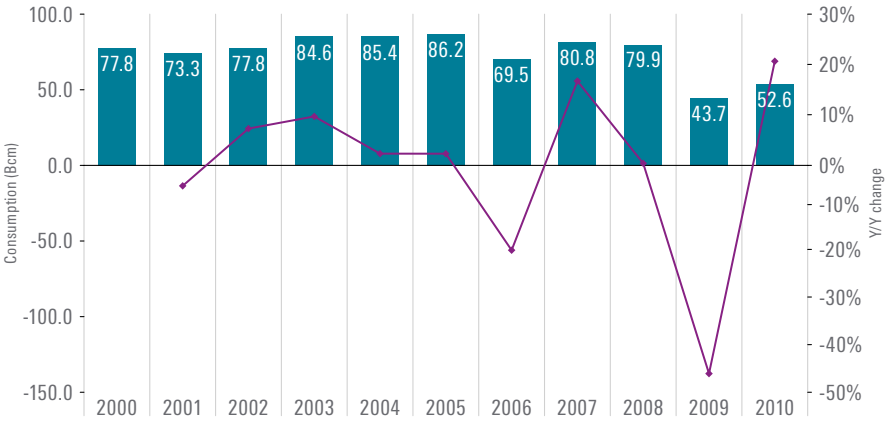
Between 2000 and 2010, apparent dry natural gas consumption in Ukraine fluctuated around an average level of 73.79 Bcm. Consumption is mainly driven by residential heating, cogeneration plants, and steel production. The significant decrease in demand during 2009 was caused by reduced consumption due to the financial crisis, as well as the temporary restrictions applied on consumers during the 2009 January gas crisis.

Figure 24: Natural gas consumption by sector in Ukraine (2009)



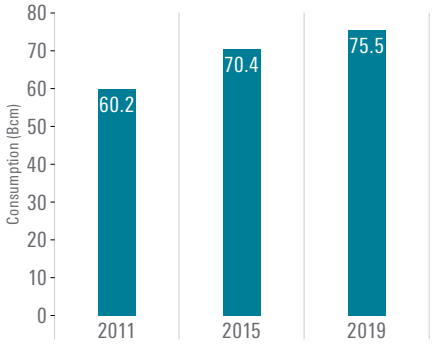
Note: Other includes energy industry own use, losses, commercial, agriculture, non-energy use
Source: International Energy Agency, 2011

Figure 25: Historical development of natural gas consumption in Ukraine



Note: Apparent dry natural gas consumption
Source: U.S. Energy Information Administration, December 2011

Figure 26: Forecasted natural gas consumption in Ukraine



Source: Datamonitor, 2010

In an effort to reduce natural gas demand in the country, Ukraine has adopted two special initiatives. The first one, in 2006,[213] sought to decrease the country's energy-intensity, with the aim of reducing domestic reliance on natural gas. The second initiative, approved in 2010,[214] is aimed at phasing out tariff subsidies to residential consumers. Despite these measures, Ukraine's natural gas consumption is expected to increase to historical levels and reach 75.5 Bcm by 2019,[215] largely due to economic growth.

While Ukraine did not have any exports between 2000 and 2005, it exported an average 2.75 Bcm of dry natural gas per year between 2006 and 2010.[216]

211 *Source: Cabinet of Ministers, Energy strategy of Ukraine for the period until 2030, 2006*

212 *Source: U.S.-Ukraine Business Council, Prosperous society, competitive economy, effective state – Program of economic reforms 2010-2014 (unofficial English translation), September 17, 2010*

213 *Source: Cabinet of Ministers, Energy Strategy of Ukraine for the Period until 2030, 2006*

214 *Source: U.S.-Ukraine Business Council, Prosperous society, competitive economy, effective state – Program of economic reforms 2010-2014 (unofficial English translation), September 17, 2010*

215 *Source: Datamonitor, Oil and Gas Supply – Europe and the Former Soviet Union, March 2010*

216 *Source: KPMG analysis based on information by US Energy Information Administration, December 2011*

Table 11: Nominal daily capacities

Category	Nominal daily capacity (Mcm)
Production	56
Import	789
Gas storage	250
TOTAL	1,095

Source: KPMG analysis based on information by Naftogaz

Gas infrastructure

In 2010, the average daily natural gas consumption in Ukraine was 144.0 Mcm,[217] with an average monthly peak consumption of 217 Mcm in January.[218] At approximately 1,095 Mcm per day, the nominal daily capacity of the Ukrainian gas infrastructure substantially exceeds this figure.

Transmission

Ukraine's high-pressure natural gas transmission system is 38,550 km long, including 22,160 km of regional pipelines, and is owned and operated by Ukrtransgas, which is a subsidiary of Naftogaz.[219]

Physical natural gas imports are not possible from the west and south, since the pipelines to Romania, Moldova, Hungary, Slovakia, and Poland are unidirectional, coming from Belarus and Russia to European countries.[220]

To modernize Ukraine's antiquated transmission system and diversify the sources of imports, several projects are underway. The major plans include the rehabilitation and upgrade of gas pipelines and compressor stations, and the introduction of European operating standards, among others.[221, 222]

Distribution and storage

Natural gas is supplied to residential and industrial consumers through a 369,000 km long network of low-pressure distribution pipelines.[223] With 13.43 million apartments and private houses, approximately 78% of urban and 38% of rural households are connected to the system.[224] While approximately 147,000 industrial consumers are supplied via low-pressure pipelines of regional distribution companies, a few large industrial companies are directly connected to the high-pressure transmission system by their own pipelines.[225, 226]

There are 13 underground storage facilities in Ukraine that are owned by Naftogaz, of which 12 are operated by Ukrtransgaz (total capacity of 31 Bcm/year) and one by Chornomornaftogaz (1 Bcm/year).[227, 228, 229]

LNG

At the end of 2011, Ukraine had no LNG liquefaction or re-gasification infrastructure in place. However, by 2015, a new LNG re-gasification terminal at one of four Black Sea ports is being considered, with the aim of supplying Ukraine with gas from North Africa, the Middle East or the Caspian region.[230] The total capacity of the proposed terminal would be 5 Bcm/year by 2015 with a planned expansion to 10 Bcm/year by 2016.[231] The construction of the terminal has recently been delayed for financing reasons,[232] however, while there are concerns about the feasibility of shipping LNG via the Bosporus straight.[233]

217 *Source: KPMG analysis based on information by US Energy Information Administration, December 2011*
218 *Source: KPMG analysis based on information by Ministry of Energy and Coal Industry of Ukraine*
219 *Source: Ukrtransgaz , Activities – Pipeline divisions, 2012*
220 *Source: Naftogaz, Capacities and actual volumes of natural gas transit by Ukrainian gas transmission system, 2012*
221 *Source: Cabinet of Ministers, Energy strategy of Ukraine for the period until 2030, 2006*
222 *Source: U.S.-Ukraine Business Council, Prosperous society, competitive economy, effective state – Program of economic reforms 2010-2014 (unofficial English translation), September 17, 2010*
223 *Source: Naftogaz, The Company today – Activities – Distribution and consumption, 2012*
224 *Source: Naftogaz, The Company today – Activities – Distribution and consumption, 2012*
225 *Source: Naftogaz, The Company today – Activities – Distribution and consumption, 2012*
226 *Source: EBRD, Energy sector assessment 2010, 2010*
227 *Source: Ukrtransgas, Activities – Underground gas storage, 2012*
228 *Source: EBRD, Energy sector assessment 2010, 2010*
229 *Source: Chornomornaftogaz, 2012*
230 *Source: Invest Ukraine, LNG terminal – project brief, 2012*
231 *Source: Invest Ukraine, LNG terminal – project brief, 2012*
232 *Source: Natural Gas Europe, Ukraine Postpones LNG Terminal Due to Funding Constraints, December 10, 2011*
233 *Source: Interfax-Ukraine, Ukraine in talks with Turkey on technical issues of passage though Bosporus Strait by tankers to future LNG terminal, November 23, 2011*

Prospects for shale gas development

Shale gas reserves in Ukraine have been estimated to be 5.5 Tcm, of which 1.18 Tcm may be recoverable.[234] There are two main shale gas bearing basins, namely the Ukrainian Lublin Basin, which contains an estimated 840 Bcm, and the Dnieper-Donets Basin with 336 Bcm of technically recoverable shale gas.[235]

The uncertain legislative environment in Ukraine, as compared to EU countries such as Poland, has discouraged foreign investors from entering the market, as investors have cited concerns with respect to restrictions on the size of exploration areas and problems with land allotment, among others.[236] Because of these issues, US E&P major Marathon Oil decided to exit the country in 2008.[237] Following the 2010 elections, the new government expressed its willingness to address these issues and, for example, has made important amendments to relevant legislation.[238]

Ukraine joined the Global Shale Gas Initiative in February 2011, through which it has agreed to cooperate with the assessment of unconventional gas resources, the preparation of feasibility studies, and the coordination of regulatory issues and investment promotion.[239]

Shale gas was added to the list of mineral resources of national significance in July 2011,[240] thereby formally recognizing shale gas, and creating the legal basis for tenders for exploration and production rights. Ukraine announced the first tender regarding the exploration and production of shale gas in February 2012.[241] Based on the government's preliminary estimates, the subject deposits are located in the Olesska area (6,324 km^2) and Yuzoska area (7,886 km^2), and hold approximately 800 Bcm to 1.5 Tcm and 2.0 Tcm of gas, respectively.[242] Production is tentatively expected to start in 6-7 years, with an annual capacity of 2-3 Bcm/year and 8-10 Bcm/year for Olesska and Yuzoska, respectively.[243] The winner of the tender is expected to enter into a so-called production sharing agreement (PSA) with state-owned Nadra Ukrainy.[244] The PSA has subsequently been improved, so as to protect investors from possibly unfavorable changes in legislation and to provide an all-inclusive special permit for the exploration and production of shale gas for a period of 50 years.[245]

Several foreign companies have expressed interest in their potential involvement in the development of Ukrainian shale gas. So far, the government has signed five memoranda of understanding with foreign companies, including Eurogas, Shell, ExxonMobil, Chevron, and Eni, while other companies such as PKN Orlen and TNK-BP have also expressed their interest. [246, 247]

234 *Source: US Energy Information Administration, World shale gas resources, April 2011*

235 *Source: US Energy Information Administration, World shale gas resources, April 2011*

236 *Source: Ukrainian Centre for Economic & Political Studies named after Olexander Razumkov, National Security and Defence, Issue 127, 2011*

237 *Source: Gorshenin Institute, Shale gas – Market opportunities and challenges in the EU and Ukraine, December 12, 2011*

238 *Source: CMS Cameron McKenna, Recent developments in Ukrainian oil and gas legislation, 2012*

239 *Source: US-Ukraine Business Council, Unsigned copy of the memorandum of understanding between the Government of the United States of America and the Government of Ukraine on unconventional gas resources dated February 15, 2011, 2012*

240 *Source: Natural Gas Europe, Prospects for Shale Gas Exploration and Production in Ukraine, March 28, 2012*

241 *Source: Platts Energy in East Europe, Ukraine offers shale gas deposits, March 9, 2012*

242 *Source: Platts Energy in East Europe, Ukraine offers shale gas deposits, March 9, 2012*

243 *Source: Platts Energy in East Europe, Ukraine offers shale gas deposits, March 9, 2012*

244 *Source: Platts Energy in East Europe, Ukraine offers shale gas deposits, March 9, 2012*

245 *Source: CMS Cameron McKenna, Recent developments in Ukrainian oil and gas legislation, 2012*

246 *Source: Platts Energy in East Europe, Russian gas prices hold key to shale gas development, December 16, 2011*

247 *Source: Platts Energy in East Europe, Kiev to auction shale gas licenses, August 26, 2011*

While new auctions concerning shale gas exploration permits are expected to follow in the near future,[248] the production of shale gas is expected to start by 2016-2018.[249]

Regulatory bodies and relevant legislation

There are no specific regulations regarding shale gas extraction or production in Ukraine. For companies interested in unconventional shale gas exploration, the **State Service for Geology and Mineral Resources of Ukraine**, also known as the "Geoservice", is the most relevant, as it is responsible for issuing the necessary authorizations for exploration activities.[250] Other relevant regulatory bodies include the **Ministry of Energy and Coal Industry**, the **State Service for Mining Supervision and Industrial of Ukraine**, also known as the "Mining Authority", the **Ministry of Ecology and Natural Resources**, and the **National Energy Regulation Commission**.

The exploration process is regulated by a number of laws and regulations, among them the Mining Law of Ukraine, the Production Sharing Agreements Law, the Gas Market Law, and the Rules of Special Permits Issuance, which details the relevant regulations governing Special Permits.

Tax policy

Two different types of royalties apply to shale gas production in Ukraine, depending on whether it is sold to Naftogaz for residential usage, to other consumers, or for storage. The local production sharing agreement (PSA) regime aims to provide a favorable economic environment to production companies by excluding them from customs duties, VAT and other taxes; however, the State is entitled to a share, as agreed upon in the PSA, of any resulting production.

Environmental policy

There are no specific environmental regulations in place concerning shale gas extraction in Ukraine. However, for natural gas extraction to be carried out, an environmental audit conclusion and an emissions permit must be issued by the Ministry of Environment. Additionally, the "Strategy of State Environmental Policy of Ukraine for the period until 2020" seeks to harmonize domestic environmental regulations with those of the European Union, particularly in accordance with the EU Directive on the prevention and pollution control ('IPPC' 96/61/EC Directive).

Conclusion

In light of its high dependence on foreign natural gas imports, and as a major consumer of natural gas, Ukraine is clearly well-motivated to support the development of its shale gas resources. Estimates by the EIA, suggest that Ukraine's technically recoverable shale gas reserves are approximately 1.18 Tcm,[251] which could cover domestic consumption for approximately 22 years,[252] or could be exported to several European countries that are already connected to the Ukrainian gas transmission system.

248 *Source: Platts Energy in East Europe, Ukraine offers shale gas deposits, March 9, 2012*

249 *Source: Ukrainian Centre for Economic & Political Studies named after Olexander Razumkov, National Security and Defence, Issue 127, 2011*

250 *Source: Global Legal Group, The International Comparative Legal Guide to Gas Regulation 2012: Ukraine, 2012*

251 *Source: US Energy Information Administration, World shale gas resources, April 2011*

252 *Source: KPMG analysis based on information by US Energy Information Administration: World shale gas resources, April 2011*

While Ukraine's accession to the Energy Community and recent regulatory changes related to unconventional reserves are major steps toward improving the country's investment environment, uncertainties remain around the country's regulatory regime, while delays in adopting EU energy regulations have raised concerns. The country's political and legal environment continues to remain a concern for potential investors – however, should the government succeed in improving investor confidence in the country, then Ukraine's large domestic shale gas production potential could be unleashed.

Secondary shale markets

Secondary shale markets

Similar to the *CEE region's leading shale markets*, the *secondary shale markets* – Lithuania, Hungary, and Bulgaria – also have good potential for shale gas development. In general, these countries' political and legal environments present a fairly stable atmosphere in which investment risk is not a primary concern.

However, due to their rather smaller sizes and lower levels of domestic gas consumption, these markets demonstrate correspondingly less investment opportunity for shale gas E&P companies. Shale gas development in these countries will primarily be driven by the economics of extraction and will likely follow the exploration and production examples of larger shale gas countries in the CEE region.

6.4. Lithuania

Overview

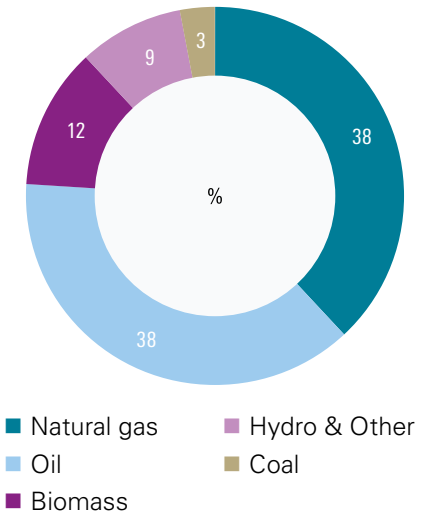
Before the closure of the Ignalina nuclear power plant at the end of 2009, nuclear power was the leading source of primary energy for Lithuania, accounting for approximately one-third of consumption. As a portion of Lithuania's total primary energy consumption in 2010, natural gas and oil had the highest share at 38% each. They were followed by biomass, hydropower, and coal, with shares of 12%, 9%, and 3%, respectively.[253]

Lithuania is fully dependent on Russian natural gas, with imports covering 100% of domestic consumption.[254] The country's gas imports are subject to long-term agreements with the largest and only gas supplier, Gazprom (though gas is partly bought through intermediary LT Gas Stream AG). Key agreements are due to expire at the end of 2012 and 2015 for two of the biggest suppliers to local household and non-household users, Dujotekana and Lietuvos Dujos,[255] and in 2013 for a smaller company, Haupas.[256] Another big importer, Achema, has just re-signed another long-term deal with Gazprom, thereby reinforcing the supply of natural gas.[257]

Gazprom is a 99% stakeholder of Kaunas Heat and Power Plant,[258] and owns 37.1% of Lietuvos Dujos.[259]

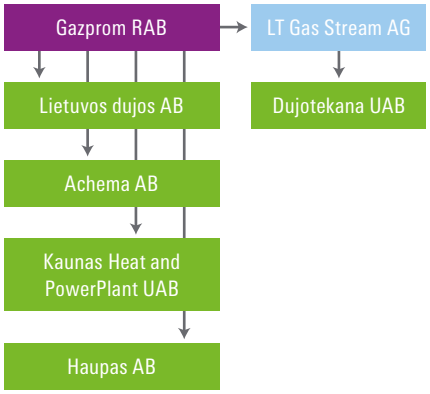
Imported gas is pumped into the Lithuanian gas transmission system at one entry point, Kotlovka, at the Belarusian border. The Lithuanian gas market is not connected to other EU countries, except for the emergency Kiemenai interconnection with Latvia, which is only used in the event of disruptions to the main interconnection with Belarus, or due to a large increase in demand. Otherwise, the Kotlovka connection is sufficient to meet the needs of Lithuanian customers. Lithuania has no domestic production. The main consumers of natural gas are power plants (45%), industry (33%),[260] and the residential, commercial, and agriculture sectors (10%).[261]

Figure 27: Total primary energy consumption of Lithuania (2010)



Source: Lithuania Energy Report, September 2011

Figure 28: Lithuanian natural gas imports by control structure (2011)



Source: Report of natural gas monitoring 2011, Q2, National Control Commission for Prices and Energy

253 *Source: Enerdata, Lithuania Energy Report, September 2011*

254 *Source: National Control Commission for Prices and Energy, Annual Report on Electricity and Natural Gas Markets of the Republic of Lithuania to the European Commission, 2011*

255 *Source: National Control Commission for Prices and Energy, Annual Report on Electricity and Natural Gas Markets of the Republic of Lithuania to the European Commission, 2011*

256 *Source: National Control Commission for Prices and Energy, Annual Report on Electricity and Natural Gas Markets of the Republic of Lithuania to the European Commission, 2010*

257 *Source: Lietuvos Zinios, Vyriausybei nosį nušluostė verslas, February 8, 2012*

258 *Source: Gazprom, Companies with Gazprom's participation and other affiliated entities, March 31, 2012*

259 *Source: National Control Commission for Prices and Energy, Annual Report on Electricity and Natural Gas Markets of the Republic of Lithuania to the European Commission, 2011*

260 *Note: Including non-energy uses*

261 *Source: Enerdata, Lithuania Energy Report, September 2011*

Table 12: Gas flows of Lithuania, 2010

Category	Bcm
Production	0
Import	3.07
Apparent consumption	(3.07)
Import/consumption ratio	100%

Source: U.S. Energy Information Administration, December 2011

Natural gas supply trends

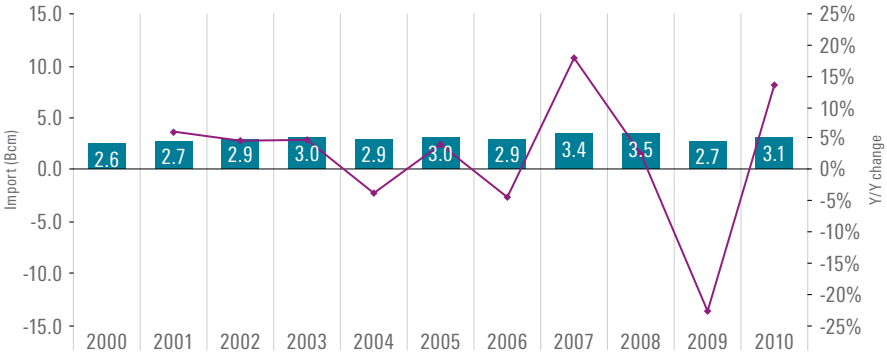
As mentioned above, Lithuania has no conventional gas reserves, and must therefore import natural gas to meet consumer needs.

Based on long-term contracts, Russian natural gas imports play a key role in Lithuania's energy supply. In 2010, imports of Russian gas via Belarus amounted to 100% of total consumption.[262]

Among the five natural gas importers, Achema and the Kaunas Heat and Power Plant imported natural gas primarily for their own use,[263] while the other three importers – Lietuvos Dujos, Dujotekana, and Haupas – exist as suppliers to other users in the country. Achema recently became the biggest importer of natural gas in Lithuania,[264] while the biggest supplier to household and non-household consumers (73.5% market share in 2010[265]), Lietuvos Dujos, is owned by E.ON Ruhrgas International and Gazprom, with shares of 38.9% and 37.1%, respectively, while the remaining 17.7% is held by Lithuania's State Property Fund.[266] Dujotekana (25.4% market share in 2010[267]) sells natural gas to non-household customers only. Haupas is a very small market player, selling less than 1% of total natural gas to customers in the Druskininkai region, who are not connected to the main natural gas system.[268]

Although the Lithuanian gas market is considered to be liberalized, some areas of the market may be less competitive due to the concentration of natural gas suppliers. However, a gas exchange is planned upon the completion of interconnection projects with Poland, and the construction of a liquefied natural gas terminal.[269] In line with demand, the total amount of imported gas transported to Lithuania via pipeline in 2010 was 3.07 Bcm.[270]

Figure 29: Historical development of natural gas imports in Lithuania



Note: Dry natural gas imports
Source: U.S. Energy Information Administration, December 2011

262 *Source: Enerdata, Lithuania Energy Report, September 2011*

263 *Source: National Energy Commission, Lietuvos Energetikos Įrenginių Eksploatavimo Būklės 2008-2009 m. Apžvalga, 2010*

264 *Source: National Control Commission for Prices and Energy, Gamtinių Dujų Rinkos Stebėsenos Ataskaita už 2011 m. III ketv., 2011*

265 *Source: National Control Commission for Prices and Energy, Annual Report on Electricity and Natural Gas Markets of the Republic of Lithuania to the European Commission, 2011*

266 *Source: National Control Commission for Prices and Energy, Annual Report on Electricity and Natural Gas Markets of the Republic of Lithuania to the European Commission, 2011*

267 *Source: National Control Commission for Prices and Energy, Annual Report on Electricity and Natural Gas Markets of the Republic of Lithuania to the European Commission, 2011*

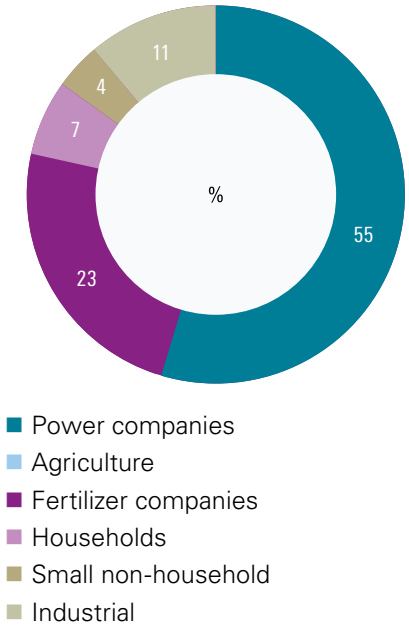
268 *Source: National Control Commission for Prices and Energy, Annual Report on Electricity and Natural Gas Markets of the Republic of Lithuania to the European Commission, 2011*

269 *Source: National Control Commission for Prices and Energy, Annual Report on Electricity and Natural Gas Markets of the Republic of Lithuania to the European Commission, 2011*

270 *Source: US Energy Information Administration, December 2011*

There are several plans to increase the energy security of Lithuania, by diversifying the sources of natural gas supply and/or supply routes, and by reducing the bottlenecks at certain entry points. Some of the major developments involving Lithuania include an LNG terminal at Klaipėda, the Jurbarkas–Klaipėda gas line, the Lithuania–Poland pipeline, and a storage facility in Syderiai.[271]

Figure 30: Gas consumption by sector in Lithuania (2010)



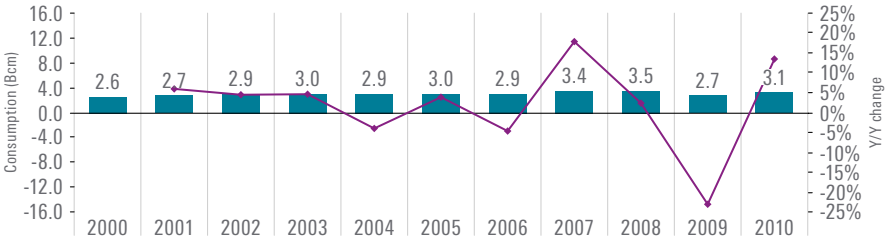
Source: Annual Report on Electricity and Natural Gas Markets of the Republic of Lithuania to the European Commission, 2011

Natural gas demand trends

As mentioned above, the main consumers of natural gas in Lithuania are power plants, but a range of other consumers including fertilizer and other industrial industry companies, households, and small non-household companies also make up the consumer market in the country.

Between 2000 and 2010, apparent dry natural gas consumption in Lithuania fluctuated around an average level of 2.96 Bcm. Consumption is mainly driven by gas-fired power plants, industrial production, and residential heating. The significant decrease in demand during 2009 was caused by reduced consumption due to the financial crisis.

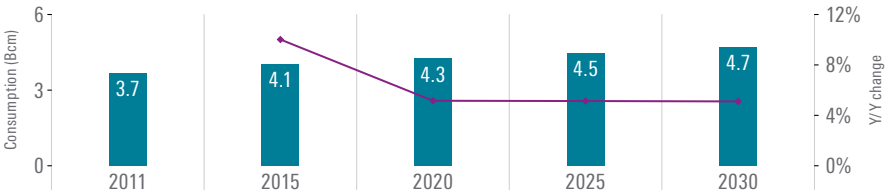
Figure 31: Historical development of natural gas consumption in Lithuania



Note: Apparent dry natural gas consumption
Source: U.S. Energy Information Administration, December 2011

The National Energy (Independence) Strategy of Lithuania[272] defines energy-related goals for the country, which are expected to affect both natural gas supply and demand, and increase the consumption of alternative energy sources. Despite these plans, Lithuania's natural gas consumption is expected to reach 4.71 Bcm by 2030,[273] largely due to the country's continued economic growth. However, other sources forecast a decrease in natural gas consumption if the National Energy (Independence) Strategy is fulfilled.

Figure 32: Forecasted natural gas consumption in Lithuania



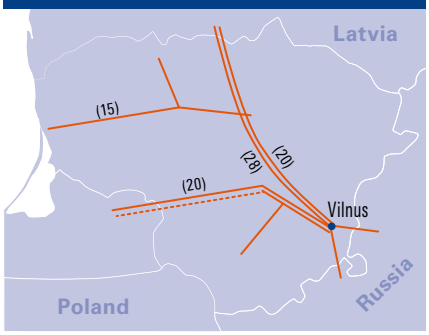
Source: Datamonitor, 2010

271 *Source: Enerdata, Lithuania Energy Report, September 2011*

272 *Source: National Energy (Independence) Strategy, October 6, 2010*

273 *Source: Datamonitor, Gas and Power Fundamentals Outlook: Europe, April 2010*

Figure 33: Lithuanian natural gas imports by control structure (2011)



— Gas pipeline

-- Gas pipeline under construction or planned

(36) Pipeline diameter in inches (major pipelines only)

Source: Petroleum Economist, BP, Enerdata Estimate.

Table 13: Natural gas distributors in Lithuania

Distributors 2011	Amount of natural gas distributed in Mcm (Q1 – 3 2011)
Lietuvos Dujos AB	758.45
Intergas UAB	14.13
Fortum Heat Lietuva UAB	3.15
Druskininku dujos UAB	0.174
Josvainiai AB	1.79
Achema AB	0
TOTAL	777.69

Source: Report of natural gas monitoring for Q1 2011, Q2 2011 and Q3 2011

Gas infrastructure

In 2010, Lithuanian gas consumers used 3.106 Bcm of natural gas. The highest-ever usage of the import pipeline's capacity was 75.4%, thus leaving 24.6% unused. Current interruptible capacity contracts dictate that system users are allowed to have access to these available, unused capacities.[274]

Transmission

Lithuania's high-pressure natural gas transmission system is 1,865km long, and covers almost the entire country. It is connected to the transmission systems of Belarus for imports, Latvia (bidirectional), and Russia (for transit). International connections with these countries are regulated on a contractual basis. The main purpose of the transit transmission network is to provide gas to the enclave of Kaliningrad, Russia. The transmission system is owned and solely operated by the largest natural gas TSO in the Baltic states, Lietuvos Dujos. Lithuania's gas network has a capacity of 11.8 Bcm/year.[275]

The natural gas import infrastructure from Belarus has an import capacity of 9.2 Bcm/year, while the interconnection with Latvia has a relatively smaller import capacity of 730 Mcm/year, but an export capacity of 1.8 Bcm/year. The Lithuania – Latvia interconnection is bidirectional and has the capacity of 5.2 Mcm/day at the cross-border point (127 thousand m^3/day in 2010).[276]

Distribution and storage

In Lithuania, six companies have distribution licenses, however only five are actively involved in the operation of the natural gas distribution system of Lithuania, the biggest one being Lietuvos Dujos.

The distribution system is comprised of 8,120 kilometers of pipeline, supplying approximately 555 thousand consumers (of which 549 thousand are households and 5.8 thousand industrial users).[277]

There is only one operative natural gas storage facility available to Baltic countries, which is located in Inčukalns, Latvia and operated by Latvijas Gāze. The capacity of this facility is 4.47 Bcm (in 2008), of which 2.32 Bcm was active, or regularly extracted, natural gas.[278] Natural gas is supplied during the heating season to customers in Latvia, Estonia, northwestern Russia, and (in smaller amounts) to Lithuania. In 2010, 29.25 Mcm of Lithuanian gas reserves were stored there, which would ensure a 30-day uninterruptible gas supply to household customers during the cold season.[279]

In addition to this commercial storage facility, underground natural gas storage is planned to be built in Syderiai, Lithuania, which will have a minimum useful volume of 500 Mcm, and be completed by the end of 2016.[280] This strategic gas storage would expand Lithuania's gas storage capacity to cover household consumers' natural gas consumption for 60 days, together with the existing Inčukalns storage facility.[281]

274 *Source: National Control Commission for Prices and Energy, Annual Report on Electricity and Natural Gas Markets of the Republic of Lithuania to the European Commission, 2011*

275 *Source: Enerdata, Lithuania Energy Report, September 2011*

276 *Source: National Control Commission for Prices and Energy, Annual Report on Electricity and Natural Gas Markets of the Republic of Lithuania to the European Commission, 2011*

277 *Source: National Control Commission for Prices and Energy, Annual Report on Electricity and Natural Gas Markets of the Republic of Lithuania to the European Commission, 2011*

278 *Source: Latvijas Gaze, Description of the Storage Facility, March 31, 2012*

279 *Source: National Control Commission for Prices and Energy, Annual Report on Electricity and Natural Gas Markets of the Republic of Lithuania to the European Commission, 2011*

280 *Source: National Control Commission for Prices and Energy, Annual Report on Electricity and Natural Gas Markets of the Republic of Lithuania to the European Commission, 2011*

281 *Source: National Control Commission for Prices and Energy, Annual Report on Electricity and Natural Gas Markets of the Republic of Lithuania to the European Commission, 2011*

LNG

By the end of 2014, Lithuania plans to complete construction of a floating LNG terminal in Klaipėda. The new terminal is being built as part of the National Energy Strategy and is intended to diversify the natural gas supply to Lithuania, thereby increasing the energy security of the country. With total capacity projected to be 2-3 Bcm/year, the terminal is expected to cost €200-300 million (approx. $260-390 million).[282] Norway's Hoegh LNG will construct and supply the facility.[283]

Prospects for shale gas development

Unconventional resources, such as shale gas, are under exploration in Lithuania. Shale gas exploration is included in the National Energy (Independence) Strategy as one of the five strategic initiatives. Minijos Nafta plans to launch exploration and test drilling for shale resources in 2012, in the western part of the country.[284] The exact amount of Lithuanian shale gas resources is still uncertain, but the US Energy Information Administration estimated in April 2011 that Lithuania may hold approximately 120 Bcm of shale gas reserves in the southwestern part of the country, not far from the Polish border. Earlier estimates have even put potential amounts of reserves at 480 Bcm, but, these were only theoretical and not based on geological data.[285]

Moreover, according to the Lithuanian Geological Survey, any shale gas in the country lies about two kilometers deep, as compared to four kilometers in Poland, and should therefore be comparatively more easily extractable.[286]

The Lithuanian Geological Survey is planning to undertake an international tender for licenses for hydrocarbons exploration, including shale gas, in 2012. These licenses would cover two additional fields of 2,000 sq km, in addition to current licenses covering about 6,300 sq km,[287] which are held by six companies: Minijos Nafta, Geonafta, Manifoldas, Investicijos, Geobaltic, and Genciu Nafta.[288] Minijos Nafta has been engaged in the exploration of shale gas in Lithuania for the last two years, thus is ahead of its competition. They plan to invest another $3.72 million this year in shale gas exploration activities, and to frack an existing vertical well during the first half of 2012. A new well for shale gas exploration is to be drilled during the latter half of the year.[289]

Regulatory bodies and relevant legislation

The EU determines the principles of Lithuanian gas market regulation, while there is no specific Lithuanian legislation related to shale gas.

The relevant regulatory bodies in Lithuania include the **Ministry of Energy of the Republic of Lithuania**, the **National Control Commission for Prices and Energy (NCCPE)**, the **Geological Survey of Lithuania**, and the **Ministry of Environment of the Republic of Lithuania**. Concerning the exploration of unconventional resources, the Geological Survey of Lithuania is the most relevant regulatory body, as it is responsible for the organization and execution of state geological investigations, as well as state regulation of subterranean activities. It is also the entity that issues exploration and production licenses.

---

282 Source: National Control Commission for Prices and Energy, Annual Report on Electricity and Natural Gas Markets of the Republic of Lithuania to the European Commission, 2011

283 Source: Lrytas, „Klaipėdos naftai" pavesta tęsti suskystintų dujų terminalo projekto įgyvendinimą, February 15, 2012

284 Source: Platts Energy in East Europe, Lithuania to explore shale gas potential, January 27, 2012

285 Source: Natural Gas Europe, Lithuania looks to accelerate shale gas development, May 26, 2011

286 Source: Natural Gas Europe, Lithuania optimistic about shale gas, May 13, 2011

287 Source: Platts Energy in East Europe, Lithuania to explore shale gas potential, January 27, 2012

288 Source: Information based on the database of the Geological Survey of Lithuania, March 2012

289 Source: Platts Energy in East Europe, Lithuania to explore shale gas potential, January 27, 2012

Environmental policy

There are no special restrictions in connection with the exploration of shale gas in Lithuania.

Lithuania's legal regulation in connection with earth depths exploration is compliant with the Directive of the European Parliament and Council (94/22/EC).

Tax policy

There are no specific tax regulations related to shale gas in Lithuania, which is currently not expected to change in the near future, nor is there any special tax allowance for gas exploitation. However, Lithuania does offer some incentives for foreign investors, such as guarantees against expropriation, income tax and profit tax reliefs, depreciation allowance, custom duties relief, and tax-free interest on loans, etc.[290]

From July 2012, the basic rate levied for the exploitation of oil and gas natural resources is variable from 2% to 20%, depending on the location of the natural resource and the quantity exploited. An additional compensation rate of 9% applies for resources that were discovered and explored using state funds, and is reduced proportionally to the privately funded share of the exploration costs, but to no less than 4.5%.[291]

Conclusion

With an estimated 120 Bcm of unconventional reserves in place, and a strong desire to decrease its independence from Russian natural gas imports, the Lithuanian government sees shale gas development as an important energy supply alternative for the future.[292]

Shale gas exploration is still in its infancy in Lithuania, with only one company having undertaken efforts to assess the country's potential shale gas reserves, although it has plans to invest more into exploration over the course of 2012.[293] Like Poland, Lithuania has a relatively stable regulatory and legal environment, which should help to form the foundation for future shale gas development, thereby leaving the economics of extraction as the main driver behind the industry's prospective development. Minijos Nafta is ahead of its competitors in shale gas exploration, while the results of its drilling activities in late 2012 will provide the best indication so far of Lithuania's shale gas potential.[294]

290 Source: As per Article 12 of the Law of Investments

291 Source: KPMG in Lithuania, KPMG Baltics Tax Newsletter, March 2012

292 Source: Natural Gas Europe, LNG, Shale Gas Make Headlines in Lithuania, January 23, 2012

293 Source: Platts Energy in East Europe, Lithuania to explore shale gas potential, January 27, 2012

294 Source: Platts Energy in East Europe, Lithuania to explore shale gas potential, January 27, 2012

6.5. Hungary

Overview

Hungary relies upon natural gas for the largest portion of its total primary energy supply, accounting for 38% of the total supply in 2010 - almost double the share of oil and nuclear, combined.

Hungary is highly dependent on Russian natural gas,[295] with imports from that country covering nearly 80% of domestic consumption.[296] The country's 20-year contract with the largest gas importer, Panrusgáz – a Gazprom subsidiary – is set to expire in the coming years, and will be subject to renegotiation in 2015.[297, 298]

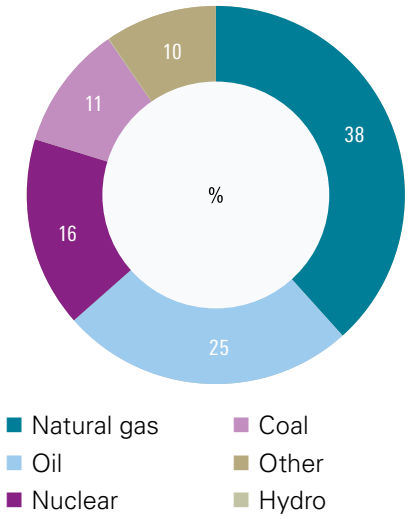
Imported gas is pumped into the Hungarian gas transmission system at three entry points: Beregdaróc, at the Ukrainian border, at Mosonmagyaróvár, at the Austrian border and at Donji Miholjac, at the Croatian border.[299] In 2010, imported natural gas amounted to 9.53 Bcm.[300]

In addition to imported gas, domestic production totaled 2.84 Bcm in 2010, which was mostly carried out by MOL Nyrt., the largest oil and gas company in Hungary. The main consumers of natural gas are the residential sector (35%), power generation (30%), and the commercial sector (17%).[301, 302]

Natural gas supply trends

Between 2000 and 2010, the average domestic production in Hungary was 2.94 Bcm, after slightly decreasing from 3.2 Bcm in 2000, to 2.8 Bcm in 2010. During the past ten years, production has been dominated by state-owned MOL. Between 2000 and 2010, MOL's average share of total Hungarian production was approximately 94%,[303] with production of 2.19 Bcm in 2010.[304] The remaining production was delivered by six smaller companies, such as Magyar Horizont Energia Kft.[305]

Figure 34: Total primary energy supply of Hungary (2010)



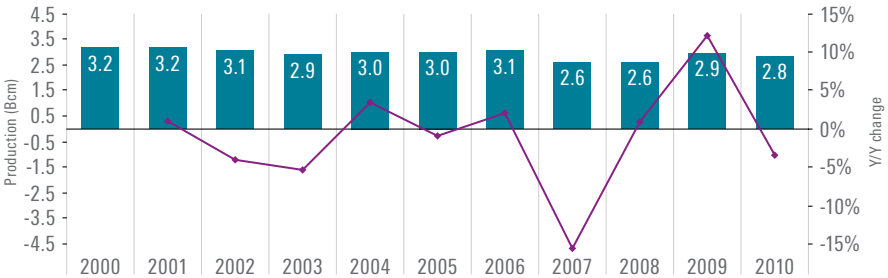
Note: 2010 estimates
Source: International Energy Agency, 2011

Table 14: Gas flows of Hungary, 2010

Category	Bcm
Production	2.84
Import	9.53
Decrease/(increase) in stocks	(0.23)
Export	(0.22)
Apparent consumption	(11.92)
Import/consumption ratio	80%

Note: Change of stocks is calculated based on the difference of closing minus opening stocks
Source: U.S. Energy Information Administration, December 2011

Figure 35: Historical development of domestic natural gas production in Hungary



Note: Dry natural gas production
Source: U.S. Energy Information Administration, December 2011

295 *Source: BP, Statistical review of World energy, June 2011*
296 *Source: US Energy Information Administration, December 2011*
297 *Source: Hungarian Energy Office, Tájékoztató a Magyar Energia Hivatal 2010. évi tevékenységéről, September 2011*
298 *Source: Mergermarket, Panrusgáz: Gazprom to increase stake to 65% by acquiring shares from E.ON, March 2012*
299 *Source: Hungarian Energy Office, Tájékoztató a Magyar Energia Hivatal 2010. évi tevékenységéről, September 2011*
300 *Source: US Energy Information Administration, December 2011*
301 *Note: 2009 data*
302 *Source: International Energy Agency, Energy balances of OECD countries (2011 edition), 2011*
303 *Source: KPMG analysis based on MOL Group's financial reporting tables and US Energy Information Administration production data for Hungary*
304 *Source: MOL Group, 2011*
305 *Source: Hungarian Office for Mining and Geology, Bányászati területek nyilvántartása, December 17, 2010*

According to the US Energy Information Administration, proved natural gas reserves of Hungary was estimated to be around 8.01 Bcm in 2010.

Based on long-term contracts, Russian natural gas imports play a key role in Hungary's energy supply. In 2010, imports of Russian gas via Ukraine and Austria amounted to approximately 80 percent of total consumption.[306] Natural gas imported by Gaz de France and E.ON Ruhrgas Austria was also mostly of Russian origin.[307]

Table 15: Hungary import relationships

Partner	Amount per annum (Bcm)	Maturity of contract
Panrusgáz	9.0	2015
E.ON Ruhrgas	0.5	2015
Bothli Trade AG	0.9	2014
Gaz de France	0.6	2012
TOTAL	11.0	

Source: Hungarian Energy Office, 2011

Among the main importers, Panrusgáz is the largest, and operates as a joint venture between E.ON Ruhrgas and Gazprom.[308] In addition to Panrusgáz, Gazprom is also present in Hungary via another subsidiary, Centrex Hungária, which has a long-term contract with Gazprom that expires in 2028.[309] In line with demand, the total amount of imported gas transported to Hungary via pipeline in 2010 was 9.53 Bcm.[310]

Figure 36: Historical development of natural gas imports in Hungary

Note: Dry natural gas imports
Source: U.S. Energy Information Administration, December 2011

306 *Source: US Energy Information Administration, December 2011*
307 *Source: Hungarian Energy Office, Tájékoztató a Magyar Energia Hivatal 2010. évi tevékenységéről, September 2011*
308 *Source: Mergermmarket, Panrusgáz: Gazprom to increase stake to 65% by acquiring shares from E.ON, March 2012*
309 *Source: Világgazdaság Online, Előretört a Centrex a piacon, July 22, 2011*
310 *Source: US Energy Information Administration, December 2011*

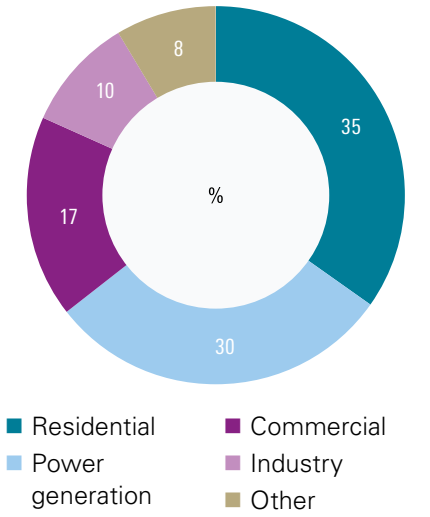
There are several plans to increase the energy security of Hungary by diversifying the sources of natural gas supply and/or supply routes, and by reducing the bottlenecks at certain entry points. Some of the major developments involving Hungary include the South Stream pipeline, and the North-South Corridor interconnection.

Natural gas demand trends

As mentioned above, the main consumers of natural gas in Hungary are the residential, power generation, and commercial sectors.

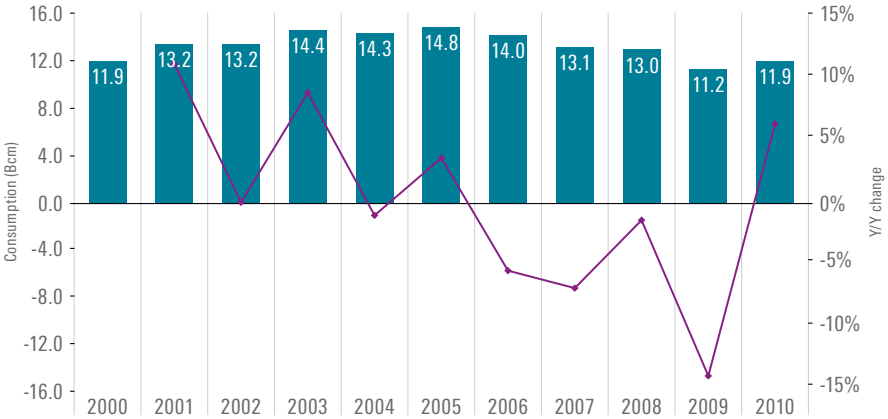
Between 2000 and 2010, apparent dry natural gas consumption in Hungary fluctuated around an average level of 13.19 Bcm. Consumption is driven mainly by residential heating, gas-fired power plants and industrial production.[311]

Figure 37: Natural gas consumption by sector in Hungary (2009)



Note: Other includes energy industry own use, losses, transport, agriculture, non-energy use
Source: International Energy Agency, 2011

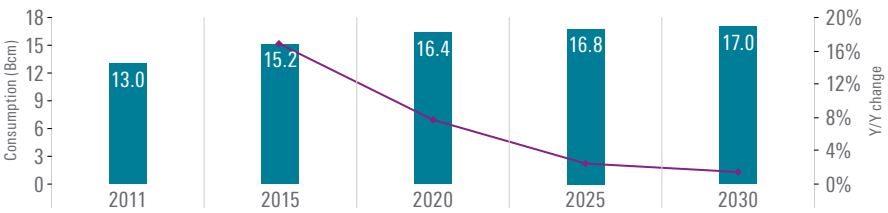
Figure 38: Historical development of natural gas consumption in Hungary



Note: Apparent dry natural gas consumption
Source: U.S. Energy Information Administration, December 2011

The Hungarian National Energy Strategy 2030 defines ambitious goals for Hungary, which are expected to affect natural gas demand. These include the renegotiation of supply contracts to incorporate spot prices in their calculation, as well as demand-side management programs. Despite these measures, Hungary's natural gas consumption is expected to exceed historical levels to reach 17 Bcm by 2030,[312] largely due to the country's continued economic growth.

Figure 39: Forecasted natural gas consumption in Hungary



Source: Datamonitor, 2010

311 *Source: International Energy Agency, Energy balances of OECD countries (2011 edition), 2011*

312 *Source: Datamonitor, Gas and Power Fundamentals Outlook: Europe, April 201*

Between 2000 and 2010, Hungary exported an average 0.04 Bcm of dry natural gas per year, with the highest amount being 0.22 Bcm in 2010.[313]

Gas infrastructure

The highest natural gas consumption on a single day in Hungary was 89.5 Mcm (on February 9, 2005), while the nominal daily capacity of the Hungarian gas infrastructure substantially exceeds this figure, at approximately 182.9 Mcm per day (as of October 15, 2010).[314]

Table 16: Nominal daily capacities in Hungary

	Nominal daily capacity (Mcm)
Production	10.5
Import (from West)	13.1
Import (from East)	56.3
Import (from South-East)	4.8
Import (from South)	19.1
Commercial gas storage	59.1
Steategic gas storage	20.0
TOTAL	182.9

Source: Hungarian Energy Office, 2011

Transmission

Hungary's high-pressure natural gas transmission system is 5,782km long, and covers almost the entire country.[315] The transit transmission network is 370km long, and is operated by FGSZ Földgázszállító Zrt. which, fully owned by MOL.[316] FGSZ is, however, legally unbundled.[317]

Physical natural gas exports are not possible to the west, since the Hungary-Austria Gas (HAG) pipeline is unidirectional, coming from Austria into Hungary.[318] Physical exports are only possible to the south towards Croatia, Serbia, and Romania.[319]

To increase Hungary's cross-border capacities, and diversify the sources of imports, the development of cross border points is expected in the near future. Some of the major expansion plans include the Austrian-Hungarian interconnector extension – which is scheduled for completion in 2012 – and the development of the Slovakian-Hungarian interconnector by 2015.[320]

Distribution and storage

Hungary's gas distribution segment is characterized by the ownership of large, vertically integrated energy companies with only a small part of the market held in state ownership. In Hungary, eleven companies are involved in the operation of the domestic natural gas distribution system.

The distribution system includes 82,624 kilometers of pipeline, supplying approximately 3.5 million consumers.[321]

There are five commercial natural gas storage facilities in operation in Hungary, which are operated by E.ON Földgáz Storage and MMBF Földgáztároló: Pusztaederics, Kardoskút, Hajdúszoboszló, Zsana, and Szőreg-1. The total nominal capacity of the commercial facilities is 4,930 Mcm, with a daily withdrawal capacity of 59.1 Mcm.[322]

In addition to commercial storage facilities, since January 2010, part of Szőreg-1 has served as Hungary's strategic storage facility, with a working capacity of 1,200 Mcm and a daily withdrawal capacity of 20 Mcm.[323] The strategic gas storage may only be used for residential purposes, enough to cover natural gas consumption for 60 days.[324]

313 *Source: KPMG analysis based on information by US Energy Information Administration*
314 *Source: Hungarian Energy Office, Tájékoztató a Magyar Energia Hivatal 2010. évi tevékenységéről, September 2011*
315 *Source: Földgázszállító Zrt., Éves jelentés 2010, 2011*
316 *Source: Földgázszállító Zrt., Éves jelentés 2010, 2011*
317 *Source: Földgázszállító Zrt., Éves jelentés 2010, 2011*
318 *Source: Hungarian Energy Office, Tájékoztató a Magyar Energia Hivatal 2010. évi tevékenységéről, September 2011*
319 *Source: Hungarian Energy Office, Tájékoztató a Magyar Energia Hivatal 2010. évi tevékenységéről, September 2011*
320 *Source: Government of Hungary, Nemzeti Energiastratégia 2030, August 2011*
321 *Source: Hungarian Energy Office, Tájékoztató a Magyar Energia Hivatal 2010. évi tevékenységéről, September 2011*
322 *Source: Hungarian Energy Office, Tájékoztató a Magyar Energia Hivatal 2010. évi tevékenységéről, September 2011*
323 *Source: Hungarian Energy Office, Tájékoztató a Magyar Energia Hivatal 2010. évi tevékenységéről, September 2011*
324 *Source: Hungarian Energy Office, Tájékoztató a Magyar Energia Hivatal 2010. évi tevékenységéről, September 2011*

Prospects for shale gas development

According to the US Energy Information Administration, the joint reserves for Romanian, Bulgarian, and Hungarian shale gas in the Carpathian-Balkanian basin is around 538 Bcm.[325] The most promising exploration area is considered to be the Makó basin, which is located in the southern part of Hungary. [326] The licenses of the mining properties of the Makó belong to MOL and TXM Olaj- és Gázkutató Kft.[327]

The first major milestone of shale gas development in Hungary was in May 2007, when MOL signed a joint venture agreement with ExxonMobil to evaluate the unconventional potential of the Makó and Békés basins.[328] In April 2008, based on the promising results of the joint technical study, MOL started the exploration of the Makó trough. However, the exploration resulted in unfavorable data, and ExxonMobil ended the partnership in 2010. According to MOL,[329] it would have required approximately 2,000 wells to produce shale gas in the Makó trough over a 30-year period, suggesting a significant investment of $150-250 million.[330]

MOL's other partnership at the Makó trough with TXM Olaj- és Gázkutató Kft. (an affiliate of Falcon Oil & Gas) also ended in 2010. In this case, however, MOL decided to withdraw, as the exploration results were below expectations; samples from three fractures did not suggest the existence of any significant reserves. MOL is currently exploring other areas of Hungary, such as the Derecske basin, which may have an estimated resource of 58 Bcm of gas.[331] TXM Olaj- és Gázkutató has continued its exploration activity in the Makó trough, and is currently in partnership with Serbian E&P Naftna Industrija Srbije j.s.c. (a Gazprom affiliate).[332] In December 2011, Ascent Resources, a UK company, announced that it had discovered 11.7 Bcm of unconventional gas near the Slovenian-Hungarian border.[333]

There are a number of other companies involved in shale gas exploration in Hungary, such as RAG Hungary Kft. and Cuadrilla Resources Ltd, which are actively seeking reserves in various parts of the country.[334]

Regulatory bodies and relevant legislation

The EU determines the principles of Hungarian gas market regulation; however, with regard to gas production activities, there are no direct EU regulatory provisions. There is no specific Hungarian legislation related to shale gas, and it is not yet part of the long-term National Energy Strategy.[335]

The relevant regulatory bodies in Hungary include the **Ministry of National Development**, the **Hungarian Energy Office**, and the **Hungarian Mining and Geological Office**. In terms of the exploration of unconventional resources, the Hungarian Mining and Geological Office is the most relevant regulatory body, as it is responsible for issuing exploration permits.

---

325 Source: US Energy Information Administration, World shale gas resources, April 2011

326 Source: Government of Hungary, National Energy Strategy 2030, August 2011

327 Source: Hungarian Office for Mining and Geology, Bányászati területek nyilvántartása, January 13, 2012

328 Source: MOL Group, Unconventional exploration as a way of organic growth in Upstream, 2008

329 Source: MOL Group, Unconventional exploration as a way of organic growth in Upstream, 2008

330 Source: MOL Group, Unconventional exploration as a way of organic growth in Upstream, 2008

331 Source: Natural Gas Europe, Hungary Getting Deeper into Unconventional Gas, November 9, 2011

332 Source: Natural Gas Europe, NIS signs deal with Falcon Oil & Gas for Hungary project, June 9, 2011

333 Source: Index.hu, Gázmezőt találtak a szlovén határnál, December 8, 2011

334 Source: KPMG analysis based on information by the Hungarian Mining and Geological Office

335 Source: Government of Hungary, National Energy Strategy 2030, August 2011

Environmental policy

There are no special restrictions in connection with the exploration of shale gas in Hungary.

In connection with natural gas exploration, government decree Nr. 314/2005 (XII.25.) outlines the steps of the licensing procedure and summarizes the conditions of each activity to be undertaken. The decree is compliant with the IPPC Directive of the European Union (96/61/EC).

Tax policy

There are no specific tax regulations related to shale gas in Hungary, which is currently not expected to change in the near future. However there is a special royalty rate for the production of unconventional gas reserves. The exploration of non-renewable natural resources is subject to royalty, which varies,[336] depending on the type of natural resource and the quantity exploited, between 0% and 30%. If the natural gas is coming from unconventional sources and extractable by special procedures such as fracturing, the royalty rate is fixed at 12%.

Conclusion

With an estimated 3,282.44 Bcm of unconventional reserves[337] – which largely includes other types of unconventional gas – and a strong desire to decrease its overreliance on foreign gas, the Hungarian government sees shale gas as an important energy supply alternative in the future.

The framework of Hungarian legislation is in compliance with the norms of the European Union, although Hungarian regulations primarily cover the natural gas sector, and do not include specific articles on shale gas. From an environmental perspective, Hungarian legislation does not restrict the extraction of shale gas, or define any specific regulations.

Shale gas exploration is still in an early phase in Hungary, with only a handful of companies having undertaken efforts to assess the country's potential reserves. Initial indications are that the economics of extraction may not be competitive, however, thereby tempering the enthusiasm behind Hungary's shale gas potential. On the other hand, although the future of shale gas in Hungary remains a question, the country currently has a rather favorable investment and regulatory environment aimed at supporting future exploration endeavors.

336 Source: Act No. 48/1993 on Mining

337 Source: Website of Hungarian Office for Mining and Geology, January 19, 2011

6.6. Bulgaria

Overview

In 2009, coal was the dominant sources of energy in Bulgaria's primary energy supply in 2009, with natural gas providing the fourth largest source of energy, at 12%. Other major sources of energy supply include oil (24%) and nuclear power (23%).

In 2010, almost all of Bulgaria's natural gas consumption was covered by imports from Russia, which has been supplying the country since 1974.[338] Natural gas imports are based on long-term contracts[339] between the state-owned incumbent national gas company Bulgargaz EAD and affiliates of Russian Gazprom.[340]

Imported gas is pumped into the Bulgarian gas transmission system at a single entry point at Negru Voda at the Romanian border,[341] with imports in 2010 amounting to 2.14 Bcm.[342]

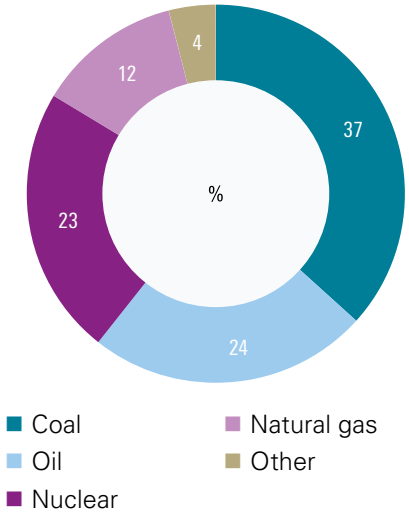
Domestic production of natural gas in Bulgaria was marginal before the Galata offshore gas field in the Black Sea was developed in 2004.[343] Between 2004 and 2008, natural gas production at Galata amounted to approximately 2.0 Bcm.[344] The Galata field was shut down in January 2009 with about 0.2 Bcm of gas reserves left in the ground,[345] and it is now slated to be converted into an underground gas storage facility. As replacements to Galata, Bulgaria's two new offshore gas blocks, Kavarna and Kaliakra, have covered the production of Galata since 2011.[346]

Natural gas consumption in 2010 was almost entirely covered by imports, on account of the small levels of domestic production. In 2010, natural gas was mainly utilized by the power generation (44%), industrial (28%), and transport sectors (9%).[347]

Natural gas supply trends

As mentioned above, domestic production in Bulgaria has historically been relatively insignificant.[348] The Galata offshore gas field is located about 20 kilometers from the eastern port of Varna, in the shallow waters of the Black Sea.[349] With the opening of the Galata in 2004, domestic production increased from around 13-18 Mcm to 528 Mcm in 2005.[350] During the five years of its operation, the total amount of gas produced at Galata was 2.0 Bcm,[351] before its subsequent closure and planned conversion into a gas storage facility.[352] Domestic production in 2009 and 2010 was marginal. [353]

Figure 40: Total primary energy supply of Bulgaria (2009)



Note: Other includes renewables, biofuels & waste, electricity and heat
Source: International Energy Agency, 2011

Table 17: Gas flows of Bulgaria, 2010

Category	Bcm
Production	0.01
Import	2.14
Decrease/(increase) in stocks	(0.00)
Export	-
Apparent consumption	(2.15)
Import/consumption ratio	100%

Note: Change of stocks is calculated based on the difference of closing minus opening stocks
Source: U.S. Energy Information Administration, December 2011

338 Source: Website of Gazprom Export, Partners - Bulgaria, March 2012
339 Source: SEWRC Bulgaria, 2010 Annual Report of the European Commission, July 2011
340 Source: Website of Gazprom, About us - Subsidiaries, March 2012
341 Source: ENTSO-G, Ten Year National Development Plan 2011-2020, 2011
342 Source: US Energy Information Administration, December 2011
343 Source: Website of WIEE, Bulgaria, March 2012
344 Source: SEWRC Bulgaria, 2010 Annual Report of the European Commission, July 2011
345 Source: Offshore Technology, Projects – Galata field, March 2012
346 Source: Melrose Resources plc, 2011 Production and year end reserves report and operational update, February 17, 2012
347 Source: US Energy Information Administration, December 2011
348 Source: SEWRC Bulgaria, 2010 Annual Report of the European Commission, July 2011
349 Source: Offshore Technology, Projects – Galata field, March 2012
350 Source: SEWRC Bulgaria, 2010 Annual Report of the European Commission, July 2011
351 Source: SEWRC Bulgaria, 2010 Annual Report of the European Commission, July 2011
352 Source: Offshore Technology, Projects – Galata field, March 2012
353 Source: SEWRC Bulgaria, 2010 Annual Report of the European Commission, July 2011

Two new offshore gas fields were discovered close to Galata in 2007 and 2008.[354] Kaliakra and Kavarna were brought into production in late 2010 via subsea connections to the existing Galata platform[355] and have a combined ultimate volume of proven and probable reserves of 1.28 Bcm. They are producing at a combined rate of 1.26 Mcm per day.[356] In addition to these two fields, the recently-discovered Kavarna East gas field is set for development in 2012, with further exploration planned to the north of the existing blocks.[357]

The only significant gas producer in Bulgaria is Melrose Resources plc, through its wholly owned subsidiary Petreco SARL.[358] According to Melrose Resources, which is the LSE-listed developer of the Galata, Kaliakra, Kavarna, and Kavarna East offshore gas fields, the 1,790km^2 area controlled by the company has an estimated 1.6 Bcm of proven and probable gas reserves, as of December 31, 2011.[359] The offshore gas fields that are being explored are estimated to include 3.64 Bcm of prospective resources.[360]

Table 18: Bulgarian import relationships

Partner	Amount per annum (Bcm)	Maturity of contract
Overgas Inc	2.5	2012
WIEE	0.6	2011
TOTAL	3.1	

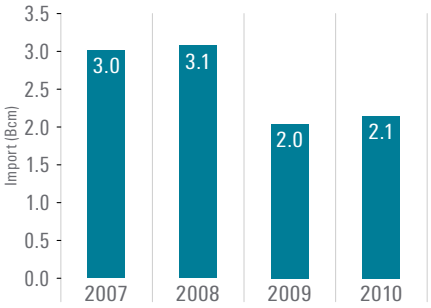
Source: Gazprom Export, OSW, 2012

Based on long-term contracts, Russian natural gas imports play a key role in Bulgaria's energy supply. The main wholesale company in Bulgaria is Bulgargaz EAD, a state-owned company that is responsible for the supply of 99.5% of imported natural gas.[361] In 2010, imports of Russian gas via Romania covered nearly 100% of total consumption, however, with the increase of domestic production, this lessened somewhat in 2011.[362] Bulgaria has two major, long-term natural gas contracts:

Both import partners, Overgas Inc., a Russian-Bulgarian company, and Wintershall Erdgas Handelshaus Zug AG, a Russian-Swiss company, were supplied by Russian natural gas. Overgas also operates as a retail gas provider to end users.[363]

In 2010-2011, Bulgaria made significant efforts to reach a reduction in Russian gas prices with Gazprom, and to contract supplies directly with the Russian giant.[364] However, as of April 2012, the two parties had still not been able to agree on the terms of the new gas supply contract.

Figure 41: Historical development of natural gas imports in Bulgaria



Note: Dry natural gas imports
Source: U.S. Energy Information Administration, December 2011

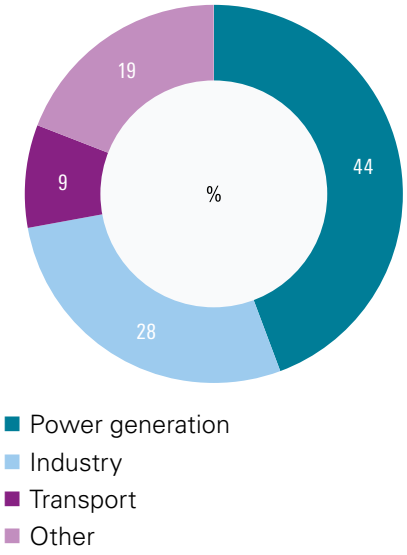
In line with demand, the total amount of imported gas transported to Bulgaria via pipeline in 2010 was 2.1 Bcm.[365]

Bulgaria has been looking for opportunities to diversify its imports, and has entered into negotiations with Azerbaijan, Egypt, and Qatar,[366] as imports could be possible from these countries should a number of contemplated infrastructure developments be completed.

To enhance the flexibility of its transmission system, and in order to increase the security of its supply, Bulgaria is involved in several regional infrastructure projects, including, among others, the South Stream pipeline project and a compressed natural gas discharge terminal in Varna.[367]

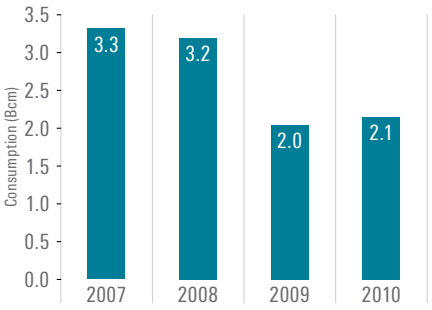
354 *Source: Website of Melrose Resources plc, Bulgaria, March 2012*
355 *Source: Website of Melrose Resources plc, Bulgaria, March 2012*
356 *Source: Website of Melrose Resources plc, Bulgaria, March 2012*
357 *Source: Website of Melrose Resources plc, Bulgaria, March 2012*
358 *Source: International Finance Corporation, March 2012*
359 *Source: Melrose Resources plc, 2011 production and year end reserves report and operational update, February 17, 2012*
360 *Source: Website of Melrose Resources plc, Bulgaria, March 2012*
361 *Source: Enerdata, Bulgaria energy report, May 2011*
362 *Source: US Energy Information Administration, December 2011*
363 *Source: Centre for Eastern Studies Commentary, Bulgarian-Russian games in the energy sector: an outcome is getting closer, October 5, 2010*
364 *Source: Centre for Eastern Studies Commentary, Bulgarian-Russian games in the energy sector: an outcome is getting closer, October 5, 2010*
365 *Source: US Energy Information Administration, December 2011*
366 *Source: Enerdata, Bulgaria energy report, May 2011*
367 *Source: ENTSO-G, Gas Regional Investment Plan Central-Eastern Europe 2012-2021, January 2012*

Figure 42: Natural gas consumption by sector in Bulgaria (2009)



Note: Other includes energy industry own use, losses, residential, commercial, agricultural and non-energy use
Source: International Energy Agency, 2011

Figure 43: Historical development of natural gas consumption in Bulgaria



Note: Apparent dry natural gas consumption
Source: U.S. Energy Information Administration, December 2011

Natural gas demand trends

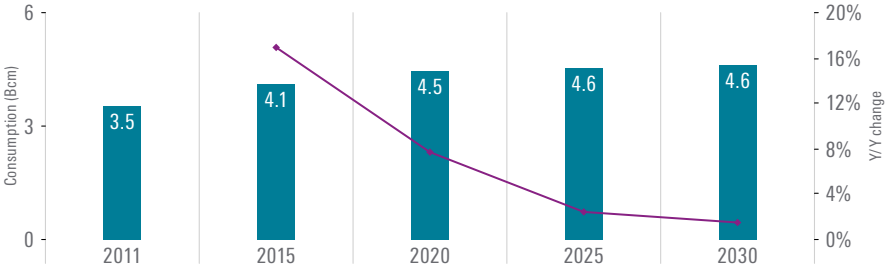
Natural gas in Bulgaria is mainly used by the power generation sector (primarily combined heat and power plants, and heat plants), the industrial sector (primarily non-metallic minerals, chemicals, and petrochemicals), and the transport sector.[368] Gas usage for transport includes the use of gas for pipeline and road transport purposes.[369]

Only 1.5% of total households have access to natural gas,[370] primarily due to the country's underdeveloped transmission and distribution system.[371]

Between 2007 and 2010, apparent dry natural gas consumption in Bulgaria fluctuated around an average level of 2.67 Bcm.[372] Consumption is primarily driven by industrial production. Due to the slowdown in industrial output during the financial crisis,[373] demand for natural gas declined by 35%, from 3.1 Bcm in 2008 to 2.0 Bcm in 2009.[374]

Bulgaria's energy strategy[375] indentifies several measures that could potentially affect the country's demand for natural gas, including the replacement of electricity with natural gas for heating and household purposes, or the expansion of natural gas usage in road transport. Natural gas consumption is expected to exceed historical levels, to reach 4.6 Bcm by 2030.[376]

Figure 44: Forecasted natural gas consumption in Bulgaria



Source: Datamonitor, 2010

Due to the small level of production between 2000 and 2010, which was entirely consumed domestically, Bulgaria did not export any natural gas to other countries.[377]

Gas infrastructure

The average natural gas consumption in Bulgaria on a single day in 2010 was 5.87 Mcm,[378] while the nominal daily capacity of the Bulgarian gas infrastructure greatly exceeded this figure, amounting to 75.9 Mcm/day.

368 *Source: US Energy Information Administration, December 2011*
369 *Source: US Energy Information Administration, December 2011*
370 *Source: Council of Ministers, Bulgarian Energy Strategy by 2020 – Draft version, November 2008*
371 *Source: Council of Ministers, Bulgarian Energy Strategy by 2020 – Draft version, November 2008*
372 *Source: US Energy Information Administration, December 2011*
373 *Source: SEWRC Bulgaria, 2007-2010 National reports to the European Commission*
374 *Source: US Energy Information Administration, December 2011*
375 *Source: Council of Ministers, Bulgarian Energy Strategy by 2020 – Draft version, November 2008*
376 *Source: Datamonitor, Gas and Power Fundamentals Outlook: Europe, April 2010*
377 *Source: US Energy Information Administration, December 2011*
378 *Source: US Energy Information Administration, December 2011*

Table 19: Bulgarian nominal daily capacities

	Nominal daily capacity (Mcm)
Import	72.6
Gas storage	3.3
TOTAL	75.9

Source: KPMG analysis based on information of ENTSO-G, Gas Infrastructure Europe

Transmission

Bulgaria's high-pressure natural gas transmission system is 2,645km long, and connects most of its cities.[379] The transit transmission network spans 945km and is operated by Bulgartransgaz.[380]

The physical flow of gas from other countries is only available at the Romanian border, which is, as with all other current interconnections, unidirectional.[381] Russian natural gas is pumped into the Bulgarian gas system via two entry points at Negru Voda at the Romanian border, while approximately 17.8 Bcm/year[382] is transported through the Bratstvo transit pipeline to Turkey (14 Bcm/year),[383] Greece (3 Bcm/year),[384] and Macedonia (0.8 Bcm/year).[385]

To enhance the flexibility of the transmission system, and to increase its security of supply, Bulgaria is involved in several infrastructure development projects[386] including, among others, the extension of the gas transmission network, the increase of existing domestic storage capacity, and the construction of an additional Bulgaria-Romania interconnection, which is to be completed in 2012.[387]

Distribution and storage

Bulgaria's transmission and distribution system is underdeveloped, on account of several fundamental difficulties and challenges related to its physical and administrative health, such as, for example, unclear legal differentiation between transmission and distribution networks, which foments disputes between companies on both networks.[388] Nevertheless, the planned developments with regard to the transmission and distribution network should improve this situation.

The gas distribution segment is characterized by five major distribution companies, each with market shares exceeding 5%: Overgaz East (18.7% share), Overgaz North (16.58% share), Sofiagaz (14.58%), Citygaz Bulgaria (11.66% share), and Overgaz West (6.56%).[389] Except for Citygaz Bulgaria, the other four major distributors, representing a combined market share of 56.42%, are owned by Overgas, a Gazprom affiliate and the major importer of Russian gas in Bulgaria.[390] In 2010, Overgas' distribution network included 2,057km of pipeline, distributing 302 Mcm of natural gas to 49 thousand consumers.[391]

There is one underground storage facility in Bulgaria, which is located at Chiren. The facility was built using a depleted gas field. It is operated by Bulgartransgaz, and has a working capacity of 450 Mcm and withdrawal rate of 3.3 Mcm/day.[392] Based on the development plans of Bulgartransgaz, the facility's working capacity will be increased to 1 Bcm by 2017.[393]

379 *Source: Website of Bulgartransgaz EAD, March 2012*
380 *Source: Website of Bulgartransgaz EAD, March 2012*
381 *Source: ENTSO-G, Ten Year National Development Plan 2011-2020, 2011*
382 *Source: Website of Gazprom Export, Partners - Bulgaria, March 2012*
383 *Source: Centre for Eastern Studies Commentary, Bulgarian-Russian games in the energy sector: an outcome is getting closer, October 5, 2010*
384 *Source: Centre for Eastern Studies Commentary, Bulgarian-Russian games in the energy sector: an outcome is getting closer, October 5, 2010*
385 *Source: KPMG analysis based on information by Centre for Eastern Studies Commentary, Bulgarian-Russian games in the energy sector: an outcome is getting closer, October 5, 2010*
386 *Source: ENTSO-G, Gas Regional Investment Plan Central-Eastern Europe 2012-2021, January 2012*
387 *Source: ENTSO-G, Gas Regional Investment Plan Central-Eastern Europe 2012-2021, January 2012*
388 *Source: Council of Ministers, Bulgarian Energy Strategy by 2020 – Draft version, November 2008*
389 *Source: SEWRC Bulgaria, 2010 Annual Report of the European Commission, July 2011*
390 *Source: Website of Overgaz, Shareholders, March 2012*
391 *Source: Overgas, 2010 annual report, 2011*
392 *Source: Gas Infrastructure Europe, Gas storage map database, August 2011*
393 *Source: ENTSO-G, Gas Regional Investment Plan Central-Eastern Europe 2012-2021, January 2012*

There are plans to construct an additional gas storage facility by 2018, in order to enhance the security of gas supply and comply with EU Regulation 994/2010 on gas infrastructure.[394]

Prospects for shale gas development

Due to its dependency on imported gas, shale gas is considered to be a potential source of diversification for Bulgaria's energy supplies.

Part of Bulgaria's territory is located in the Carpathian-Balkanian Basin, which is considered to be a prospective area for shale gas development by the EIA.[395] The potential of the Carpathian-Balkanian Basin was first realized by Direct Petroleum Exploration, which estimated the amount of shale gas reserves to be around 300 Bcm.[396] Others, including Chevron and BKN Petroleum, estimate the amount of shale gas reserves to be between 300 Bcm and 1 Tcm at the Novi Pazar area.[397]

Similar to activities in other Eastern European countries, shale gas development has been led by North American companies, with Direct Petroleum Exploration being the first company to enter the market, followed by Canadian Park Place Energy Corp in 2010.[398] The issuance of exploration permits were soon followed by the first discoveries, suggesting approximately 300 Bcm of shale gas in the ground, which in turn caught the attention of Chevron.[399] When the Bulgarian government announced a tender for new exploration permits, Chevron outbid BNK Petroleum by $30 million in May 2011,[400] and was granted permits related to the gas fields near Novi Pazar.[401]

Due to political pressure over environmental concerns, a moratorium related to shale gas production was issued as of January 2012 concerning activities involving hydraulic fracturing in Bulgaria, and the permits that Chevron won have since been revoked. This occurred after protests against shale gas exploration started during the summer of 2011, not long after Chevron's winning bid.[402] As such, other companies with valid licenses (TransAtlantic Petroleum Ltd and Park Place Energy) have suspended their shale gas exploration activities in Bulgaria.[403]

Although shale gas would mean a potential alternative to imported gas, the current political environment has rendered the future of Bulgarian shale gas development uncertain.

Regulatory bodies and relevant legislation

The EU determines the principles of Bulgarian gas market regulation; however, there are no direct EU regulatory provisions concerning gas production activities. There is no Bulgarian legislation specific to the regulation of shale gas.

The relevant regulatory bodies in Bulgaria include the **Ministry of Economy, Energy and Tourism**, the **Ministry of Environment and Water,** and the **State Energy and Water Regulatory Commission**. In terms of the exploration of unconventional resources, the Ministry of Economy, Energy

394 *Source: ENTSO-G, Gas Regional Investment Plan Central-Eastern Europe 2012-2021, January 2012*
395 *Source: US Energy Information Administration, World Shale Gas Resources, April 2011*
396 *Source: Platts Energy in East Europe, Bulgaria's great shale expectations, August 26, 2011*
397 *Source: Platts Energy in East Europe, Bulgaria's great shale expectations, August 26, 2011*
398 *Source: Natural Gas Europe, Bulgaria grants permit for shale gas prospecting, October 7, 2010*
399 *Source: Natural Gas Europe, Direct Petroleum high on Bulgarian shale, November 22, 2010*
400 *Source: Natural Gas Europe, Chevron secures Bulgarian shale concession, May 28, 2011*
401 *Source: Natural Gas Europe, Chevron secures Bulgarian shale concession, May 28, 2011*
402 *Source: Natural Gas Europe, Bulgaria addresses environmental concerns over shale gas, July 19, 2011*
403 *Source: Centre for Eastern Studies, Bulgaria is no longer interested in shale gas, January 25, 2012*

and Tourism is the most relevant regulatory body, as it is responsible for issuing exploration permits. In more detail, these bodies are each given the administration over select responsibilities.

Environmental policy

Due to environmental concerns, hydraulic fracturing has been under a moratorium since the beginning of 2012. The use of other technologies for the exploration and production of natural gas, however, is permitted. Natural gas exploration is subject to a positive environmental impact assessment made by the Ministry of Environment and Water. The Protection of the Environment Act of 2002 details the licensing procedure and summarizes the conditions of applicable activities. The Act is compliant with the IPPC Directive of the European Union (96/61/EC).

Tax policy

There are no specific tax regulations related to shale gas in Bulgaria. Exploration of natural gas is subject to an annual fee based on the size of the exploration area.[404] The production of natural gas is subject to royalty, which is based on the produced quantities and specific conditions.[405] This royalty can vary between 2.5% and 30%.[406]

Conclusion

With a low level of domestic natural gas production, Bulgaria is highly dependent on Russian imports, which are supplied via a single pipeline.[407, 408] However, the Bulgarian government has recently been making significant efforts to diversify and increase the flexibility of its gas supplies.[409] Several infrastructure developments are being considered, which would enable the country to increase its energy security by importing gas from alternative sources at potentially lower prices.

Compared to other European countries, the share of natural gas in Bulgaria's total primary energy supply is quite low, with natural gas being mostly used for industrial purposes.[410, 411] Only 1.5% of households have access to natural gas, as electricity is used by 40% of households for heating and other purposes (EU average 11%).[412] Bulgaria's underdeveloped gas transmission and distribution network stifles residential natural gas consumption.[413] However, based on planned infrastructure developments, the accession of households to the distribution system will present significant potential for the gas sector.[414]

Bulgaria, however, has issued a moratorium on the practice of hydraulic fracturing,[415] and is thus unique among Central and Eastern European countries. However, despite this temporary ban, the potential still exists for shale gas in Bulgaria, as political support could quickly strengthen, should unconventional gas developments advance in the CEE region.

404 *Source: Global Legal Group, The International Comparative Legal Guide to Gas Regulation 2012: Bulgaria, 2012*

405 *Source: Global Legal Group, The International Comparative Legal Guide to Gas Regulation 2012: Bulgaria, 2012*

406 *Source: Transatlantic Petroleum Ltd., Bulgaria overview, May 2011*

407 *Source: BP, Statistical Review of World Energy, June 2011*

408 *Source: Website of Bulgartransgaz, About us – Gas infrastructure, March 2012*

409 *Source: Centre for Eastern Studies Commentary, Bulgarian-Russian games in the energy sector: an outcome is getting closer, October 5, 2010*

410 *Source: International Energy Agency, Energy balances of non-OECD countries (2011 edition), 2011*

411 *Source: International Energy Agency, Energy balances of OECD countries (2011 edition), 2011*

412 *Source: Council of Ministers, Bulgarian Energy Strategy by 2020 – Draft version, November 2008*

413 *Source: Council of Ministers, Bulgarian Energy Strategy by 2020 – Draft version, November 2008*

414 *Source: Council of Ministers, Bulgarian Energy Strategy by 2020 – Draft version, November 2008*

415 *Natural Gas Europe: Bulgaria to 'postpone' shale gas development, January 16, 2012*

6.7. Potential shale markets

Overview

The potential development of shale gas resources among other countries in the CEE region, while relatively small, varies significantly. The Baltic countries of Estonia and Latvia have expressed interest in developing their potential unconventional resources, though the former has focused on its substantial shale oil reserves. Still others, such as the Czech and Slovak Republics, are at very early stages of exploration, while the potential reserves in those countries are not expected to be very large. In the Slovak Republic, extraction could also be limited due to environmental considerations regarding water tables around the Danube, where some shale gas reserves are thought to exist.

Southeastern European countries such as Albania, Bosnia and Herzegovina, and Macedonia are not currently focused on the development of shale gas resources, largely because of their historical reliance on hydroelectric energy or coal, while their territories have also largely been unexplored for any potential gas resources – conventional or otherwise. Other countries such as Croatia or Serbia are thought to have good prospects for shale resources, but gas exploration in those countries is still rather limited.

Furthermore, due to their having little or no experience in gas exploration and extraction, several of these countries have few trained personnel or technological capabilities that can be used to support shale gas production – thereby suggesting that these countries will rely more heavily on foreign expertise, should it be determined that they have recoverable shale gas reserves.

Baltic region

Domestic potential

Estonia depends fully on Russia as its sole source of natural gas, which amounts to 14% of the country's total primary energy supply.[416, 417] The economic downturn had severe consequences on Estonia's gas market, as domestic consumption fell 35%, from 1.0 Bcm in 2007 to 0.6 Bcm in 2009.[418] One of the main factors contributing to this sharp decrease was the suspension of production at Nitrofert AS.[419] As one of the largest industrial companies in Estonia, Nitrofert processed natural gas into fertilizers, and accounted for more than 26% of Estonia's gas consumption in 2007.[420] Other factors that contributed to the decrease in gas consumption were the commissioning of two wood and peat fired cogeneration plants in Tallinn and Tartu.[421]

Eesti Energia, the state-owned energy and electricity company, is responsible for the production of oil shales in Estonia. In 2008, 14 Mt of oil shale was mined and processed into approximately 220,000 tons of crude shale oil.[422] In an ongoing project, Eesti Energia is also constructing a shale oil condensation unit with engineering partner Neste Jacobs, which is scheduled for completion at the end of 2012.[423] If the project succeeds, Estonia's liquid shale oil fuel production will continue to increase, following recent trends.

416 *Source: BP, Statistical review of World energy, June 2011*

417 *Source: International Energy Agency, Energy balances of OECD countries (2011 edition), 2011*

418 *Source: Estonian Competition Authority, Estonian Electricity and Gas Market Report 2010, 2011*

419 *Source: Estonian Competition Authority, Estonian Electricity and Gas Market Report 2010, 2011*

420 *Source: Estonian Competition Authority, Estonian Electricity and Gas Market Report 2010, 2011*

421 *Source: Estonian Competition Authority, Estonian Electricity and Gas Market Report 2010, 2011*

422 *Source: Enerdata, Estonia Energy Report, March 2010*

423 *Source: Neste Oil, Neste Jacobs and Eesti Energia agreed on building a shale oil condensation unit in Estonia, April 29, 2010*

Latvia does not have any natural gas reserves, as all of its supply is imported from Russia. Data from 2009 indicate that gas represents 30% of Latvia's total primary energy share,[424] which in 2010 a total of 1.82 Bcm of natural gas was consumed.[425] The energy sector accounted for 1.2 Bcm of this total, followed by industrial use (302 Mcm), household consumption (155 Mcm), agriculture and forestry (19 Mcm), and others (144 Mcm).[426]

Eesti Gaas is the only importer of gas in Estonia.[427] In November 2011, in a report commissioned by Estonia's national TSO Elering, Finnish consultancy Poyry advised Estonia to nationalize Eesti Gaas in order to further the country's domestic gas interests.[428] However, as the region's only gas supplier and largest stakeholder of Eesti Gaas, Gazprom has voiced its opposition to such a move.[429]

The vertically integrated Latvijas Gāze is the only provider in Latvia's gas sector, with exclusive licenses for exploration, storage, transmission, distribution, and trading of natural gas under the supervision of Latvia's Public Utilities Commission.[430] The gas market was authorized for liberalization in 2001, but Gazprom has opposed this move as well,[431] and Latvijas Gāze will likely remain Latvia's only gas company until 2017.[432]

Assessment of potential

To further reduce the Baltic countries' gas dependency on Russia, LNG terminals have been considered as part of efforts to increasing energy security in the region; in Estonia, a 3 Bcm/year terminal has been planned for construction on the shores of Paldiski.[433] As each of the Baltic countries would like to build a LNG terminal on their own territories, a consensus has not yet been reached on the final location, while the European Commission has been asked to advise on the matter.[434]

Latvia's subsoil is suitable for gas storage, and currently accommodates the third largest storage site in Europe at Inčukalns, with a total capacity of 4.14 Bcm.[435] There is potential for another 11 sites to be developed as gas storage, with an estimated total capacity of 58 Bcm.[436]

Shale gas potential

Latvia's Prime Minister has expressed his country's intention to explore for shale gas opportunities, in order to diversify domestic gas supply.[437] Preliminary indications point to the existence of considerable reserves underneath Latvian soil.[438] Estonia's focus has been more on its shale oil resources.[439]

---

424 Source: Enerdata, Latvia Energy Report, July 2011

425 Source: Latvia Public Utilities Commission, 2010 Annual Report of the Public Utilities Commission of the Republic of Latvia on the National Energy Sector, 2011

426 Source: Latvia Public Utilities Commission, 2010 Annual Report of the Public Utilities Commission of the Republic of Latvia on the National Energy Sector, 2011

427 Source: Eesti Gaas, February 2011

428 Source: Natural Gas Europe, Estonia Advised to Nationalise Eesti Gaas, November 2011

429 Source: Bloomberg, Estonia gas grid nationalization seen as last option, Ansip says, December 21, 2011

430 Source: Latvia Public Utilities Commission, 2010 Annual Report of the Public Utilities Commission of the Republic of Latvia on the National Energy Sector, 2011

431 Source: The Baltic Course, Latvia will support Commission's gas market liberalization plans, February 27, 2008

432 Source: Enerdata, Latvia Energy Report, July 2011

433 Source: Gas Infrastructure Europe, LNG Investment Database, September 2011

434 Source: Natural Gas Europe, Latvia, Poland, Estonia Turn to EU After Hitting LNG Stalemate, November 14, 2011

435 Source: Enerdata, Latvia Energy Report, July 2011

436 Source: Enerdata, Latvia Energy Report, July 2011

437 Source: Natural Gas Europe, Latvia to Pursue Shale Gas Development, July 21, 2011

438 Source: US Energy Information Administration, World shale gas resources, April 2011

439 Source: Estonian Competition Authority, Estonian Electricity and Gas Market Report 2010, 2011

Czech and Slovak Republics

Domestic potential

The origin of most natural gas that is consumed in the Czech and Slovak Republics is predominantly Russian. Out of the total 8.4 Bcm imported in the Czech Republic in 2010,[440] 64.1% came from Russia. The remaining balance is satisfied by natural gas imports from Norway and other EU countries, accounting for 12.4% and 23.5% of supply, respectively.[441] The ratio of domestic production as a portion of total natural gas consumption was merely 2%. Czech domestic production of natural gas was about 0.2 Bcm, while the country's total reserves were estimated at 4 Bcm in 2010.[442] Slovak domestic production is also relatively small, hovering around 0.10 Bcm in the last 4 years.[443]

Natural gas consumption in the Czech Republic has been virtually unchanged during the past decade, where it has remained constant at around 9.13 Bcm.[444] Electricity generation accounts for about 12% of the country's gas consumption, while commercial, public, residential, and agriculture demand account for about half of consumption, of which commercial and residential are expected to experience the strongest growth.[445] In the Slovak Republic, natural gas consumption in 2009 had a relatively balanced split among the residential (29%), industrial (25%), and power generation (21%) sectors.[446]

A major transit country, the Slovak Republic maintains a unique position among European Union countries, supplying about 14% of total EU consumption in 2010.[447] SPP, the Slovak Republic's leading natural gas-related business that is involved in gas imports, transportation and distribution, recently signed a 20-year contract with Gazprom, securing the gas supply from Russia until 2028.[448]

There are eight operational storage facilities in the Czech Republic, with a combined technical storage capacity of 3.1 Bcm. They have an aggregated 51.5 Mcm/day withdrawal capacity, and a 36.8 Mcm/day injection capacity.[449] The Slovak Republic can store up to 2.8 Bcm of gas in two storage facilities. The largest thereof is able to hold 2.2 Bcm and has a maximum withdrawal rate of 30.5 Mcm/day. The two countries' also cooperate on gas storage, as the Slovak Republic has access to an underground facility in the Czech Republic through a subsidy of the Slovak national oil and gas company, SPP, which is used for stabilizing the flow of resources on the Slovak distribution network.[450]

Assessment of potential

Through 2030, the Czech Republic's demand for natural gas is expected to grow by a compound annual rate of 4%, to reach 12.1 Bcm.[451] The fastest growth is expected over the next five years, which is partly attributable to the planned development of new gas-fired power stations, which are expected to balance

440 *Source: US Energy Information Administration, December 2011*

441 *Source: Energy Regulatory Office, The Czech Republic's National Report on the Electricity and Gas Industries for 2010, July 2011*

442 *Source: US Energy Information Administration, December 2011*

443 *Source: US Energy Information Administration, December 2011*

444 *Source: US Energy Information Administration, December 2011*

445 *Source: Energy Delta Institute, Country Gas Profile – Czech Republic, January 2012*

446 *Source: International Energy Agency, Natural gas information (2011 edition), 2011*

447 *Source: Website of Eustream, Our Company, January 2012*

448 *Source: Enerdata, Slovakia energy report, May 2011*

449 *Source: Energy Regulatory Office, The Czech Republic's National Report on the Electricity and Gas Industries for 2010, July 2011*

450 *Source: Website of SPP, Basic information – Transmission and distribution of natural gas, January 2012*

451 *Source: Datamonitor, Gas and Power Fundamentals Outlook: Europe, April 2010*

new renewable energy capacities, such as solar and wind energy. While most countries intend to diversify away from natural gas, the Czech Republic plans to increase the use of gas-fired electricity generation capacity as a percentage in its generation mix, from a relatively low 6.2% in 2009 to 7.6% by 2013.[452]

As Slovak demand for energy has not changed dramatically over the past decade, the historical development of imports has fluctuated only modestly and has ultimately followed a decreasing trend. Peaking at 7.32 Bcm in 2005, the Slovak Republic's imports have seen a small contraction of 1.6% over the course of ten years.[453]

Shale gas potential

A number of domestic and foreign companies have applied for shale gas exploration permits in the Czech Republic. Applicants include the UK's Cuadrilla Resources, Australia-based Basgas, and domestic upstream company Moravské Naftové Doly (MND).[454]

Because there is not expected to be any definitive evidence of the existence of shale gas for another five years, there are no specific regulations in place. The Czech Republic is still at an early stage, whereby only a few companies are engaging in exploration.

Czech O&G company MND has plans to explore a new site for conventional natural gas reserves in southern Moravia, near the border with Slovakia. It plans to sign up a drilling partner by the end of 2013. The drilling required at this site is more than three times the depth of current drilling in the country,[455] while it could potentially mean tens of billions of cubic meters of additional reserves for the country, if successful. In addition to conventional gas, the 644km^2 area will also be explored for shale gas.[456] Basgas has applied for exploration permits covering an area of 93km^2 around Beroun in the center of the Czech Republic, and a 777.5km^2 area around Trutnov in the north-east of the country, where exploration plans have been met with some local resistance.[457] Cuadrilla Resources has also applied for exploration rights for a 946km^2 area in Moravia, between Hranice, Příbor, and Valašské Meziříčí.[458]

In the Slovak Republic, the country's storage and E&P company, NAFTA, entered into a cooperation agreement with the Austrian company OMV at the end of 2007 for two exploration licenses in the Slovak part of the Vienna Basin, for the exploration of hydrocarbons (including shale gas reserves), covering an area of about 1,400km^2.[459] In 2010, the cooperation executed drilling in the Húšky area, near the Slovak-Austrian-Czech border triangle, which did not result in proving the existence of hydrocarbons. Drilling was subsequently carried out in the Závod area.[460] While NAFTA continues to focus its shale exploration activities in this area, any development potential may be limited due to possible concerns over its impact on water tables in the Eastern Slovakian Lowlands, near Bratislava, or on the Danube.

---

452 Source: Business Monitor International, November 21, 2011

453 Source: US Energy Information Administration, December 2011

454 Source: Rigzone, Foreign companies apply for Czech shale gas exploration permits, September 6, 2011

455 Source: Platts Energy in East Europe, MND seeks drilling partner, January 13, 2012

456 Source: Platts Energy in East Europe, MND seeks drilling partner, January 13, 2012

457 Source: Energia SK, Česi podpisujú petíciu proti ťažbe bridlicového plynu, March 13, 2012

458 Source: Business News Europe, Companies prospect for Czech shale gas, August 3, 2011

459 Source: Platts Energy in East Europe, OMV upbeat on Slovak gas production, March 28, 2008

460 Source: NAFTA a.s., Annual Report 2010, 2011

Croatia and Serbia

Domestic potential

Croatia can lay claim to a number of indigenous sources of gas and oil, as the country is able to supply a majority of its own demand from domestic production. There are 17 onshore and 6 offshore gas fields across Croatia, with a total annual output of 1.9 Bcm.[461] This capacity is able to meet the majority of national demand, which includes more than 685,000 gas customers.[462] Croatia's natural gas reserves are estimated to amount to 30.5 Bcm.[463]

While only 30% of Croatia's gas supply originates from abroad, gas supply in Serbia is heavily dependent on imports, with about three-fourths thereof of foreign origin.[464] Natural gas in the latter country represented a 10% share in 2009,[465, 466] about two-thirds of which was consumed by the industrial sector, or 26.6 Mcm, and 27% by the residential and service sector, at approximately 10.8 Mcm. Serbia's remaining consumption went to non-energy uses (5%) and transport (1%).[467]

Gas consumption in Croatia is around 2.9 Bcm per year.[468] Industrial gas consumption accounts for 39% of demand, which is mainly used by the petrochemical industry, while power generation accounts for 24%.[469]

An annual 1.1 Bcm of natural gas was imported to Croatia from Russia within the framework of a long-term contract, which was not extended at the end of 2010.[470] Instead, in December 2010, a 3-year contract was signed with Italy's ENI for the supply of natural gas to Croatia, ending Croatia's 10-year exclusive partnership with Gazprom.[471] Since January 2011, an annual supply of approximately 750 Mcm of natural gas has been imported via this new agreement.[472]

Gazprom still supplies Serbia through state-owned Srbijagas, with 1.4 Bcm of gas in 2011.[473] All natural gas is imported from Russia over one pipeline via Hungary, through an entry point at Kiskundorozsma.[474]

Croatia is connected to Slovenia via a gas pipeline with a capacity of 1.5 Bcm/year. In August 2011, a gas pipeline between Slobodnica and Városföld in Hungary was completed, with a capacity of 6.5 Bcm/year, thereby providing Croatia access to Hungary's gas storage facilities.[475] Plinacro, the national operator of the gas transmission system, plans to increase the capacity of the gas pipeline with Slovenia from 1.5 Bcm to 3.5 Bcm, and to build gas pipelines to Split, Bosnia-Herzegovina, and Serbia.[476]

Local gas production in Serbia has remained at low levels, in recent years staying in the range 0.10 Bcm and 0.35 Bcm.[477]

---

461 Source: US Energy Information Administration, December 2011

462 Source: International Gas Union, International Gas Magazine – The Croatian gas industry, October 2011

463 Source: US Energy Information Administration, December 2011

464 Source: Austrian Energy Agency, Energy in Central & Eastern Europe – Serbia, 2012

465 Source: International Energy Agency, Energy balances of non-OECD countries (2011 edition), 2011

466 Note: Shares of under 0.1% are not included and consequently the total may not add up to 100%

467 Source: Austrian Energy Agency, Energy in Central & Eastern Europe – Serbia, 2012

468 Source: US Energy Information Administration, December 2011

469 Source: Enerdata, Croatia Energy Report, August 2011

470 Source: US Energy Information Administration, December 2011

471 Source: Centre for Eastern Studies, Croatia ends Gazprom's monopoly, December 19, 2010

472 Source: Centre for Eastern Studies, Croatia ends Gazprom's monopoly, December 19, 2010

473 Source: Gazprom, Banatski Dvor UGS facility smoothes out gas consumption peaks in Serbia during abnormally cold snaps, February 22, 2012

474 Source: ENTSO-G, European Ten Year Network Development Plan 2011-2020, 2011

475 Source: Enerdata, Croatia Energy Report, August 2011

476 Source: Enerdata, Croatia Energy Report, August 2011

477 Source: US Energy Information Administration, December 2011

Assessment of potential

Croatia is planning the construction of a 15 Bcm/year LNG regasification terminal on the island of Krk. Current estimates predict the LNG terminal to be operational by 2016 or 2017, although a number of delays in its development have already been experienced.[478] An existing 550 Mcm gas storage facility in Okoli is currently being used, the capacity of which is slated for expansion by 400 Mcm. Plinacro, the TSO, is also considering building another storage facility with an initial capacity of 500 Mcm. A gas storage facility was recently constructed in the Serbian city of Banatski Dvor, under the direct of a joint venture with Gazprom, and has a maximum delivery capacity of 5 Mcm/day, while it can store up to 450 Mcm.[479]

State-owned power utility Hrvatska Elektroprivreda (HEP) is currently building a 230 MW combined cycle power plant, which is scheduled for commissioning in 2012. With the exception of small renewable power generators, HEP is currently the only electricity company in Croatia. Thanks to Croatia's unique geography, hydroelectric power plants provide 52% of the country's total generation capacity. The electricity market was fully opened in 2008, as was the gas market, following the adoption of new gas laws in 2007.[480]

In order to address economic growth and diversify its primary energy supply, Serbia has recently undertaken steps to expand its channels for imports, and build out its gas network. The majority of the distribution network is operated by Srbijagas, and to a lesser extent by Yugorosgaz, which is controlled by Gazprom and local distributors.[481]

Shale gas potential

Although no identified shale formations have been confirmed in Croatia, there is an estimated 18 to 30 Bcm of unconventional gas in the Drava Depression.[482] Both tight gas and deep shale formations, ranging from 3,400 to 4,400 meters, are expected to hold large quantities of gas. Croatia's national oil and gas company, INA, believes that there is even more unconventional gas available, however further exploration still has to take place in order to gain more knowledge and understanding of potential source areas.[483]

Serbia's domestic shale prospects may be expected to advance as its regulatory approach to unconventional resources progresses. In this regard, the country has so far been primarily focused on its shale oil basins. However, NIS invited bids last year for the exploration of unconventional gas in the northern part of the country, at the southern edge of the Pannonian Basin. Drilling was proposed to extend to a maximum depth of 4,500m and extend over five phases, the last of which was expected to terminate in early 2012, over a total area of 532km^2 over two fields.[484] Regardless of these results, the cost-competitiveness of Serbian shale gas development will be weighed against existing gas supply from Russia and related pipeline projects.

478 Source: International Gas Union, International Gas Magazine – The Croatian gas industry, October 2011

479 Source: South Stream, Gazprom and Srbijagas commission South Stream's first facility – Banatski Dvor UGS, November 21, 2011

480 Source: Enerdata, Croatia Energy Report, August 2011

481 Source: Ministry of Infrastructure and Energy, Security of supply statement of Republic of Serbia, September 2011

482 Source: E&P Magazine, Unconventional play takes shape in Croatia, June 17, 2010

483 Source: E&P Magazine, Unconventional play takes shape in Croatia, June 17, 2010

484 Source: Platts Energy in East Europe, Bids sought for shale gas survey, February 11, 2011

Southeastern Europe

Domestic potential

Gas is not a commonly used energy source in southeastern Europe, as most countries in the region have traditionally relied on other resources such as coal or hydro to address their domestic power needs. The share of natural gas as a portion of any one country's primary energy supply never tops 5%, and in many cases is non-existent. However, in countries like Albania, this is mainly due to the fact that much of the country is simply unexplored. In Bosnia and Herzegovina, gas consumption is mainly consumed by its Mittal Zenica steel and Birač Zvornik aluminum plants,[485] aside from households in Sarajevo.[486]

Albania has plans to diversify its supply structure away from its primary sources of oil and hydropower. However, because of insufficient funding, the production of oil has declined rapidly in the country. Albania's exhausted gas fields are able to provide good locations for future gas storage facilities. The country's gas reserves amounted to 0.84 Bcm in 2010,[487] however Albania's depleted gas fields and salt domes could provide 1.1 Bcm of gas storage capacity. [488]

Albania is also expecting to see improvements to its pipeline network, as it lies at the crossroads of several gas pipeline projects, and the Italian Falcione Group agreed in December 2008 to the construction of a 9-12 Bcm/year LNG regasification plant near the Albanian city of Fier, whose construction began in 2010, along with a subsea pipeline to deliver gas to Italy.[489]

Kosovo's primary energy source is coal (lignite), serving 55% of the total energy consumption, and any gas consumption is only limited to bottled LPG,[490] as is also the case in Montenegro.[491] There is no gas production or gas storage in Macedonia, and at present there are no plans to build any.[492] Imported gas is only used in the industrial and power generation sector, such as the TE-TO Skopje power plant, the Zelezarnica steel plant, and the Cementarnica cement plant, and in Skopje's district heating.[493, 494]

The power generation mix of Slovenia is composed of 3 major sources: coal-fired power plants (31.8%), nuclear energy (35.2%), and hydroelectric generators (28.2%).[495] Electricity production totaled 15,317 GWh in 2010, with gas-fired power plants accounting only for 3% of production that year.[496]

In 2010, 47% of Slovenia's gas imports came from Russia, 33% from Algeria, 15% from Austria, 5% from Italy, and another 3% from other countries, totaling 1.04 Bcm.[497] Indigenous gas production amounts to a total of only 7 Mcm in 2010.[498]

---

485 Source: Enerdata, Bosnia-Herzegovina energy report, January 2011

486 Source: The World Bank, The Future of the Natural Gas Market in Southeast Europe

487 Source: US Energy Information Administration, December 2011

488 Source: Acturca, Albania could import LNG from 2009 on Swiss-led plans, May 7, 2006

489 Source: Staffetta News, LNG Albania, construction begins in 2010, November 12, 2009

490 Source: Global Legal Group, The International Comparative Legal Guide to Gas Regulation 2012: Kosovo, March 2012

491 Source: Montenegro Ministry of Economy, Energy Efficiency Action Plan - for the period 2010-2012

492 Source: The World Bank, The Future of the Natural Gas Market in Southeast Europe, 2010

493 Source: Setimes, Macedonia focuses on natural gas energy priority, March 15, 2010

494 Source: Gilani Research Foundation, Project on business and politics in the Muslim world, March 24, 2010

495 Source: Energy Agency of Slovenia, Report on the Energy Sector in Slovenia for 2010, June 2011

496 Source: Energy Agency of Slovenia, Report on the Energy Sector in Slovenia for 2010, June 2011

497 Source: Energy Agency of Slovenia, Report on the Energy Sector in Slovenia for 2010, June 2011

498 Source: International Energy Agency, Natural Gas Information (2011 edition), 2011

Assessment of potential

In Bosnia and Herzegovina, Srbijagas plans to link Republika Srpska to its network with a branch that is able to carry 1.5 Bcm.[499] It also offers an arm of the pipeline to the Federation of Bosnia and Herzegovina.[500] Jadran (Adriatic)-Naftagas[501, 502] (a joint venture of the Russian Neftegazinkor and the Serbian oil firm NIS) and Shell Exploration Company[503] both received oil and natural gas exploration rights in 2011 in Republika Srpska. An international tender for gas exploration and exploitation was called in Montenegro in the same year, with 15 companies expressing interest at the beginning of 2011.[504]

Srbijagas, sister-company of Gazprom majority-owned NIS Energogas, claims the rights to build a pipeline in Kosovo, connecting it to southern Serbia (between Niš and Prishtina[505]).[506] Based on ENTSO-G estimations, Kosovo will probably use approximately 20 Mcm of natural gas in 2015.[507] According to a World Bank study, with the expected development of the gas infrastructure, Kosovo's annual natural gas demand will grow to 900 Mcm by 2025.[508]

The national TSO in Slovenia, Plinovodi, signed an agreement to join the South Stream project in 2009 which will deliver up to 63 Bcm of natural gas per year through Slovenia if the section is constructed.[509] Additionally, TGE Gas Engineering received permission to construct an LNG terminal in Koper in September 2010, which would provide gas for the nearby 234-MW CCGT power plant due next year.[510]

Shale gas potential

Shale gas potential in Albania, Bosnia and Herzegovina, and Macedonia is currently out of scope for most energy companies, as conventional gas exploration is to be executed first.

In Slovenia, Ascent Resources completed a fracture stimulation in November 2011 of a well at Petišovci, where tight gas was found. As of February 2012, tight gas reserves have been estimated to amount to 14.3 Bcm at the Petišovci Project,[511]which would significantly change the state of the Slovenian gas market and render it less dependent on imports.

499 *Source: Natural Gas Europe, Bosnian Federation Reaches Out to Nabucco, August 20, 2010*

500 *Source: Reuters, Serbia's gas monopoly eyes pipeline in Bosnia, October 15, 2009*

501 *Source: Balkans.com, Exploring of natural gas in Bosnia's Republic Srpska starts this year, October 14, 2010;*

502 *Source: Serbia Energy, Bosnia Region, Shell in oil exploration deal, October 17, 2011*

503 *Source: Natural Gas Europe, Bosnian Government signs preliminary exploration deal with Shell, November 3, 2011*

504 *Source: Alexander's gas and oil connections, Montenegro attracts 15 firms for oil concessions, February 21, 2011*

505 *Source: Energy-Community, South East Europe: Regional Gasification Study, October, 2007*

506 *Source: Economic Consulting Associates, South East Europe: Regional Gasification Study – Kosovo Market Report, 2007*

507 *Source: ENTSO-G, European Ten Year Network Development Plan 2010-2019, 2009*

508 *Source: The World Bank, The Future of the Natural Gas Market in Southeast Europe, 2010*

509 *Source: Enerdata, Slovenia Energy Report, December 2010*

510 *Source: Enerdata, Slovenia Energy Report, December 2010*

511 *Source: Natural Gas Europe, Slovenia: Ascent Resources Increases Gas-In-Place Reserves in Petišovci Project, February 2012*

Photo: / Statoil

7. Investment potentials

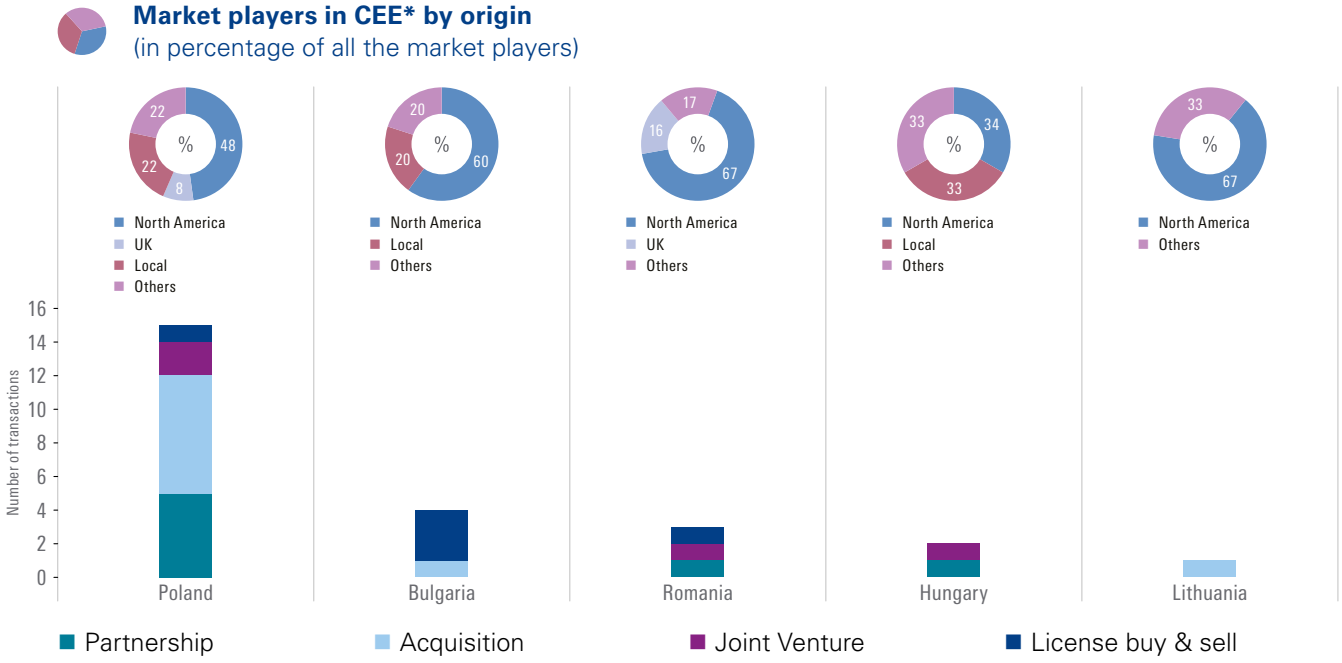
Shale gas transactions in CEE

With substantial funding required for the development of shale gas in the CEE region, a significant portion of investment funds will need to come from foreign partners, which can bring both capital and shale gas expertise. Unlike in North America, however, where much of the initial exploration activity was led by small or mid-size independents, that in many cases were subsequently acquired, state-owned oil and gas companies are expected to play a greater role in the CEE region, as they aim to be actively involved in the development of their country's shale gas reserves.

As a result, a greater proportion of investment flows will likely come into the CEE shale gas sector via joint ventures, in addition to acquisitions. Partnering with state-owned companies or other strong local partners may also be an approach that is preferred by foreign investors, as they stand to benefit from the contacts and market knowledge of their local partners, while at the same time, sharing a greater portion of both exploration and market-specific risks.

As might be expected, most noteworthy investments in the CEE region to date have occurred in Poland. ExxonMobil and Hutton Energy, for example, formed four joint ventures there in 2011 to explore for shale gas, while in 2010, the Italian company Eni acquired Minsk Energy Resources, which holds 3 exploration licenses in Poland. For its part, Eni was able to bring not only capital, but also its experience from work in the Barrett Shale in Texas.[512]

Figure 45: Historical shale gas transactions in CEE, 2009-2012



*Note: Acquisitions include partial acquisitions as well. *Countries: Poland, Bulgaria, Romania, Hungary, Lithuania*
Source: www.naturalgaseurope.com; www.mergermarket.com; www.iijonline.com

512 Source: Mergermarket, March 2012

Other markets, such as Hungary or Romania, have also seen some investment activity, despite the fact that their shale gas formations are at an earlier stage of exploration than those of Poland. And while Bulgaria had been considered a promising target for foreign companies looking for acquisition or joint venture opportunities, its recent ban on shale gas drilling has limited developments there.[513]

There has been some consolidation among local players as well, as such action by local companies has at times been encouraged by the state. The Polish Treasury Minister, for example, has expressed the preference to take maximum advantage of local synergies between companies in the domestic energy sector,[514] and, accordingly, mergers in the country over the last two years have largely been between Polish companies. At the same time, during the period from 2009 to early 2012, acquisitions in Central and Eastern European EU countries accounted for 36% of shale gas-related transactions, while partnerships represented 28% of transactions, joint ventures 16%, with the remainder being for licenses.[515]

As the number of successful drilling operations increase, and as the development of the legal framework for shale gas exploration and production improves over time, the number of companies involved in the shale gas market may be expected to expand. Several further transactions throughout the region are already being considered, particularly between larger multinational companies and local firms, and, if realized, their outcomes could have a significant impact on the speed of shale gas development in CEE.

Shale gas potential index in CEE

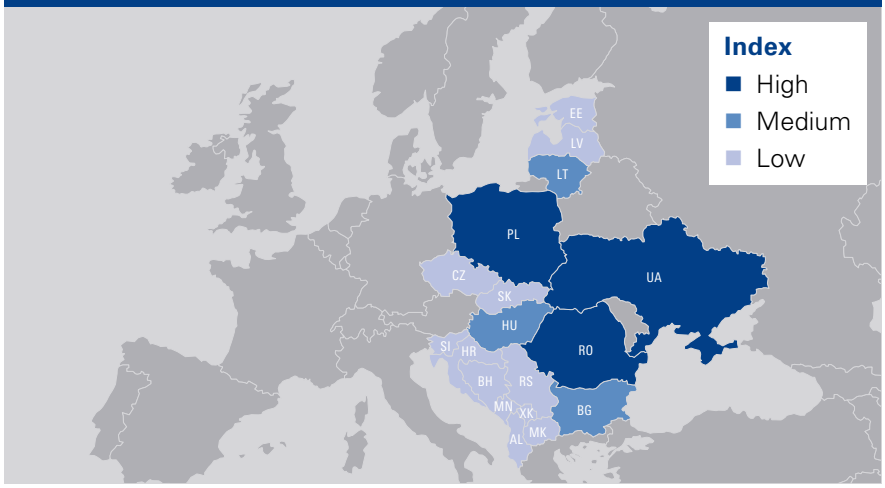
As a complement to our country-specific analysis, we have produced an indicative tool, the **Shale Gas Potential Index in CEE**, by which we have summarized the shale gas development potential of Central and Eastern European countries. In addition to our findings in the sections above, the Index provides a regional overview for potential investors in the sector.

513 *Source: BBC News, Bulgaria bans shale gas drilling with 'fracking' method, January 19, 2012*

514 *Source: Embassy of the Republic of Poland in Cairo, Polish energy sector should consolidate efforts in shale gas search, December 29, 2011*

515 *Source: KPMG analysis based on information from Mergermarket, Natural Gas for Europe and Infrastructure Journal, March 2012*

Figure 46: Shale gas potential index in CEE



As previously indicated, Poland, Romania, and Ukraine have the highest shale gas development potential, followed by Lithuania, Hungary, and Bulgaria, which, while having good initial indications of unconventional gas reserves, have somewhat lower potential than their larger neighbors.

Due to a number of factors, including their relatively favorable investment climate, larger domestic gas market, size of potential shale gas resources, and rather stable regulatory and legal environments, Poland and Romania rank the highest on our index. They are followed by Ukraine, which, despite its less favorable investment climate and somewhat more unstable legal environment, also has a considerable amount of domestic gas resources and shale gas development potential.

Lithuania, Hungary, and Bulgaria are considered to have medium potential due to their smaller sizes, which are mostly offset by their generally predictable investment environments and significant potential amounts of extractable shale gas resources. While Hungary has a favorable royalty regime regarding shale gas development, its fairly challenging geological characteristics have tempered earlier expectations. Bulgaria's riskier investment climate and temporary ban on hydraulic fracturing have also had a mitigating effect on shale gas developments there.

Other countries in the CEE region, due to a limited view of potential shale gas resources, or a historical focus on other energy sources, are characterized as having lower shale gas potential. Should further information on shale gas reserves become available in countries such as the Slovak and Czech Republics, or Croatia, then these countries may become more promising due to their already existing favorable investment climates. Due to the riskier investment environments and relatively undeveloped gas sectors of other southeast European countries, shale gas development in the region might be more complex, and may require additional upstream labor and technological transfer than other, more historically gas-focused countries in the region.

Acronyms

3D	3-dimension
Bcm	Billion cubic meters
CAGR	Compound Annual Growth Rate
CCGT	Combined Cycle Gas Turbine
E&P company	Energy and Petroleum company
EC	European Commission
FGSZ	Földgázszállító Zrt. (Hungarian natural gas transmission company)
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GJ	Gigajoule
GSGI	Global Shale Gas Initiative
HAG	Hungary-Austria Gas pipeline
HEP	Hrvatska Elektroprivreda (Croatian national power company)
NIS	Naftna Industrija Srbije (Serbian national oil company)
HUF	Hungarian Forint
IMF	International Monetary Fund
INA	Industrija Nafte (Croatian oil company)
IPO	Initial Public Offering
km$^{(2)}$	(Square) kilometer
LSE	London Stock Exchange
LNG	Liquefied Natural Gas
m$^{(3)}$	(Cubic) meter
Mmcf	Million cubic feet
Mcm	Million cubic meters
mm	Millimeter
MOL	Magyar Olaj- és Gázipari Nyrt. (Hungarian oil and gas company)
MWh	Megawatt hour
NAFTA	Slovakian oil and gas company
O&G company	Oil and Gas company
OECD	Organization for Economic Co-operation and Development
OMV	Austrian oil and gas company
PGNiG	Polskie Górnictwo Naftowe i Gazownictwo (Polish Petroleum and Gas Mining)
SPP	Slovenský plynárenský priemysel (Slovakian natural gas company)
Tcm	Trillion cubic meters
TPES	Total primary energy supply
TSO	Transmission system operator
UGS	Underground gas storage
USD	United States dollar
VAT	Value added tax

Country abbreviations

AL	Albania
AU	Australia
BA	Bosnia and Herzegovina
BG	Bulgaria
BR	Brazil
CA	Canada
CEE	Central and Eastern Europe
CIS	Commonwealth of Independent States
CN	China
CZ	Czech Republic
EE	Estonia
EU	European Union
EU-15	Pre-2004 EU member states
FR	France
HR	Croatia
HU	Hungary
LT	Lithuania
LV	Latvia
ME	Montenegro
MK	Macedonia
NL	The Netherlands
OM	Oman
PL	Poland
RO	Romania
RS	Serbia
RU	Russia
SI	Slovenia
SK	Slovak Republic
UA	Ukraine
UK	United Kingdom
US	United States of America
XK	Kosovo
ZA	South Africa

Oil & Gas Centers of Excellence

KPMG member firms offer global connectivity. We have 11 dedicated oil & Gas Centers of Excellence in key locations around the world, working as part of our global network. the Centers are located in Beijing, Calgary, Houston, Johannesburg, London, Moscow, Doha/Muscat, Paris, Perth, Rio de Janeiro and Rotterdam. Our Centers of Excellence enable us to transfer knowledge and information globally, quickly, and openly. With regular calls and effective communications tools, we share observations and insights, debate new emerging issues, and discuss what is on our firms' clients' management agendas. The Centers also produce regular surveys and commentary on issues impacting the sector, business trends, changes in regulations, and the commercial, risk, and financial challenges of doing business.

KPMG's Global Oil & Gas Network

Algeria	Brazil	Egypt	India	Korea	New Zealand	Poland	South Africa	United Arab Emirates
Angola	Canada	Finland	Indonesia	Kuwait	Nigeria	Portugal	Spain	United Kingdom
Argentina	China	France	Italy	Malaysia	Norway	Qatar	Sweden	United States
Australia	Colombia	Germany	Japan	Mexico	Oman	Russia	Thailand	Venezuela
Austria	Denmark	Hungary	Kazakhstan	Netherlands	Peru	Saudi Arabia	Trinidad and Tobago	

What can KPMG offer to the shale gas sector

An overview of our audit services to the oil and gas sector

Client business issues/risks	KPMG firms services	Service description
Compliance with accounting standards	International Financial Reporting Standards (IFRS) advisory	– Preparing and helping clients manage the change to IFRS – Provision of training
	US accounts and reporting	– Compliance with US GAAP an SEC requirements – Provision of training
Cost audits	Cost assurance and audit	– Audit of costs incurred by contractors or being claimed as variations
Hydrocarbon emissions	Hydrocarbon emission audits	– Audit of hydrocarbon emissions, carbon storage, and carbon credits
IT projects implementation	IT risk management	– Pre- and post-implementation reviews of major ERP systems – Automated controls reviews
Joint ventures	Joint venture audit	– Audit of JV statements – Assurance over costs subject to cost recovery under production sharing agreements
Major project assurance	Financial management	– Provide assurance to senior management that major projects are well managed and issues are flagged early
	Project governance	– Established approach on all major projects, including IT implementation, outsourcing of back- and middle-office functions, major refinery builds, liquefied natural gas projects, and offshore oil field developments
Quality reporting	Financial statement audit HSE report	– Provision of statutory financial statements audits – Provision of assurance services in relation to HSE reports

An overview of our tax services to the oil and gas sector

Business issues and risks	KPMG firms' services	What we can do
Engaging the "green" agenda	Regulatory and sustainability business strategies	– Clean development mechanism issues – Re-emergence of nuclear energy and tax incentives in certain jurisdictions for nuclear energy – Tax incentives for renewable energy and renewable fuel projects
	Windfall profits	– The potential impact on profits resulting from government-imposed fuel taxes being implemented or contemplated
	Trading energy and emissions	– Tax characteristics of carbon credits
	Transfer pricing	– Implications of Certified Emissions Reduction (CER) forward contracts
	Indirect tax	– Tax credits for production or purchase of "green" products

Business issues and risks	KPMG firms' services	What we can do
Managing joint ventures and other third-party relationships	Tax due diligence	– Addressing tax exposures items – Partnership agreements review – Tax implications of financial instruments
	Tax-efficient structuring	– Worldwide income tax considerations – Modeling cash implications – Business entity selection – Communicating tax planning to the board and management – Purchase price considerations
	Implementation assistance	– Assistance with local tax rulings – Monitoring key tax issues included in contracts – Registration and approval assistance
	Post-venture tax structuring	– Tax structure simplification – Dissolution
Managing major capital expenditure projects and energy investment requirements	Indirect taxes	– Recovery of VAT expenditures – Identification of VAT tied up in financing transactions impacting working capital and cash flows
	Structured financing	– Debt-to-equity requirements and characterization – Principal payments, interest expenses, and cash flow implications of debt and deemed debt obligations – Related-party and cross-border transactions – Indemnity clauses and default provisions – Required opinions and filing requirements
Meeting the increasing regulatory, government, and multiple stakeholder demands	Assessment	– Tax process documentation – Internal control testing – Personnel and process interviews – Identifying opportunities
	Quantification and aggregation	– Provide detailed picture of global tax regulatory and compliance obligation – Gap analysis – Participate in designing an aggregated model – Create concept for mitigation – End user training
	Monitoring and reporting	– Thorough global tax examination work plans – Formalize appropriate global communication channels to support tax process – Build key performance indicators and metrics to measure progress – Controversy – Ongoing monitoring and testing
	Controls	– Review technical merits of planning approaches – Provide methodologies to help mitigate taxes and penalties associated with exposures – Key findings and recommendations discussions – Tax aligned with corporate goals

Business issues and risks	KPMG firms' services	What we can do
Security of supply	Transfer pricing	– Tax efficient supply chain management – Evaluation services – Documentation and reporting
	Indirect taxes	– Customs, trade, and excise duties – Value-added, excise, and sales and use taxes – Severance – Ad valorem taxes
	Mergers & acquisitions	– Mergers and acquisitions in new supply and demand markets – Tax-efficient structuring
	Managing operational efficiency	– Integrating business objectives with tax objectives – Manufacturing deductions – Tax credits for energy-efficient technologies – Tax credits and deductions for research and experimentation – Costs: expenditures vs. capitalization
	Trading energy and emissions Tax due diligence	– Merchant trading – Tax implications of financing instruments

An overview of our advisory services to the oil and gas sector

Business issues and risks	KPMG firms' services	What we can do
Board assurance as to operation of business model and controls	Internal audit	– Internal audit sourcing services to help address significant control and monitoring issues
Capital projects	Major projects programs	– Project advisory and monitoring services to project owners focusing on project governance, processes, and management outputs – Objective feedback on project health or status
Capitalize on different technology investments	Technology optimization	– IT project portfolio optimization – Strategic assessment of major investment areas in IT budget
Climate change	Emission reporting system	– Initial impact assessment – Collecting data and reporting support – Strategic analysis to address climate change
Credit facilities	Debt renegotiations and corporate financial restructuring	– Assist clients in forecasting and identifying future financing needs and funding options – Renegotiation and restructuring financing lines support
	Economic assessment of risk	– Use economic models and forecasting to analyze future elasticity of demand, pricing, costs, return on capital, and other critical performance indicators
	Debt refinancing	– Identify a range of financing options, assess the impact of alternative funding routes
	Liquidity risk assessment	– Assess financial soundness and benchmark current operations against leading practice

Business issues and risks	KPMG firms' services	What we can do
Effective board oversight	Performance measurement and board reporting	– Advise on the changing corporate governance structures
Ensuring business continuity and the capability to recover	Business continuity management	– Assess and guide knowledge management information systems governance, security, and risk management
Financial forecasting	Financial modeling	– Develop financial models and analyze existing forecasts and associated scenarios
Improvements in corporate governance	Corporate governance advisory	– Advise on compliance, leading practices, and Sarbanes-Oxley implementation
Issue recognition and strategy development	Climate change	– Advise on greenhouse gas emissions controls and energy trading
	Corporate responsibility assurance	– Advise on environmental and stakeholder issues, including sustainability reporting reviews, global reporting initiative developments, and greenhouse gas issues and audits
	Decision support	– Assist with end-to-end business intelligence strategy, including measurement definition, reporting design, and performance management
Major transaction management	Transaction services	– Project due diligence for assessment of new ventures, investments, and joint venture support
	Valuations	– Asset and company valuations and independent reports
	Project finance and debt advisory services	– Company and asset mergers, acquisitions, and divestments
Management of the finance function	Transforming the finance function	– Advise on immediate needs, such as meeting new IFRS accounting standards, integrating systems, and coping
	Advisory on shared-service centers	– Assist clients with creating a shared-service center (outsourced or internal) and identify performance improvements
Management of procurement spend	Supply chain optimization	– Help in streamlining cost of procurement, identifying cost-saving opportunities, and reducing overall spend – Use Lean Six Sigma techniques to deliver productivity improvements
Outsourcing versus in-sourcing	Sourcing strategy	– Assist with the design and implementation of new processes and shared-service models – Assist with structuring the sourcing strategy and vendor selection – Service level definition and contract renewal support – Define monitoring controls and processes to mitigate risks in outsourcing relationships
Protection of intellectual property	Intellectual property advice	– Advise on brand, processes, and intellectual property rights
Reporting and communications	Performance insight	– Assist clients to effectively communicate their business performance – Advise on rewards management, the cost of capital, reputation, and licenses to operate – Advise on common reporting processes to help with automation
Risk identification	Enterprise risk management	– Perform a top-down risk assessment to balance the cost of compliance with financial risk – Identify environmental and regulatory risks across segments of the business and help design processes to monitor and manage change
Real-time assurance on capital expenditure management	CapEx monitor	– Assistance with monitoring expenditure for capital intensive projects

Further insight

Recent KPMG Power & Utilities Thought Leadership

Power Sector Development in Europe – Lenders' Perspectives 2011: The report, based on interviews with a selection of top European banks, aims to provide power and utilities market participants worldwide with insight into lenders' perspectives on the future of financing for power and utilities projects in Europe

New Nuclear – An Economic Perspective: We are pleased to announce the launch of a recent whitepaper titled: New Nuclear – An Economic Perspective. This paper discusses recent events at Fukushima Nuclear Power Plant, which have brought the safety record of nuclear power under intense public scrutiny.

KPMG International's Taxes and Incentives for Renewable Energy – 2011 Edition: KPMG's Taxes and Incentives for Renewable Energy – 2011 is designed to help energy companies, investors and other entities stay current with local country policies and programs supporting renewable energy around the world.

Impact of IFRS: Power & Utilities: This paper provides a high level introduction to key IFRS technical accounting matters across companies within the power and utilities industry. It also analyzes how conversion to IFRS may affect information technology systems, people, and business processes.

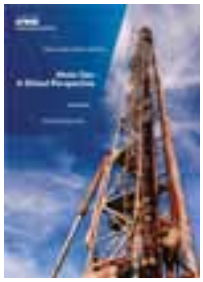
Netherlands Smart Metering Survey: This vision paper provides an insight into the most significant changes that await the energy business.

Green Power: 2012: The KPMG renewable energy M&A report looks at changes and trends in the renewable energy sector to provide insight on where the market is heading.

The Rising Sun – A Point of View on the Solar Energy Sector in India: In this report, KPMG analyzes how solar power can contribute to addressing the energy challenges facing India today.

A New Energy World, New Business Models: This vision paper provides an insight into the most significant changes that await the energy business.

Recent KPMG Oil & Gas Thought Leadership



Shale Gas – A Global Perspective: this publication examines the state of gas development in selected countries and offers views on the prospects of shale gas as part of the world's energy mix and whether this source of energy is a game-changer as some have claimed.

After the Gulf of Mexico oil spill: recent developments in the oil and gas industry. this paper reviews some of the many impacts of the spill, including changes to operating models, contractor relationships, business risks and a number of new and proposed regulations.

Procurement in Oil & Gas, published by KPMG's Global Energy institute, focuses on procurement in the oil and gas industry and highlights trends and tools as well as issues and challenges in both up-stream and down-stream sectors of the industry.

Accounting for Carbon discusses the impact of carbon trading on financial statements. It provides insights and strategies to help organizations understand and manage the business implications of climate change.

Impact of IFRS – Oil and Gas (September 2011): This publication provides assistance to companies in the oil and gas sector who are considering converting to IFRS. It gives an overview of the IFRS conversion process and looks at the impact of coversion on IT systems, people and business processes.

The KPMG Global Energy Conference
The KPMG Global Energy Conference (GEC) is KPMG's premier event for financial executives in the energy industry. Presented by the KPMG Global Energy Institute, the GEC attracts more than 600 professionals each year and brings together energy financial executives from around the world in a series of interactive discussions with industry luminaries. The goal of the conference is to provide participants with new insights, tools, and strategies to help them manage industry-related issues and challenges.
www.kpmgglobalenergyconference.com

Recent Global Energy Institute Webcasts

1. Oil & Gas Trends and M&A Landscape
2. Transfer Pricing Issues in the Oil & Gas Supply Chain
3. Key Tax Developments and Issues Affecting the Oil and Gas Industry
4. Oil and Gas Tax
5. Shale Gas – A global perspective
6. Shale Gas – Merger and acquisition trends

For more information please visit:

www.kpmg.com/energy
www.kpmgglobalenergyinstitute.com
www.kpmg.com/powerconference
www.kpmgglobalenergyconference.com

The KPMG Global Energy Institute (GEI): launched in 2007, the GEI is a worldwide knowledge-sharing forum on current and emerging industry issues. This vehicle for accessing thought leadership, events, webcasts, and podcasts about key industry topics and trends provides a way for you to share your perspectives on the challenges and opportunities facing the energy industry – arming you with new tools to better navigate the changes in this dynamic arena.
www.kpmgglobalenergyinstitute.com

Contact Us

Michiel Soeting
Global Chairman Energy & Natural Resources
KPMG in the UK
T: +44 20 7694 3052
E: michiel.soeting@kpmg.co.uk

Wayne Chodzicki
Global Head of Oil & Gas
KPMG in Canada
T: +1 403 691 8004
E: wchodzicki@kpmg.ca

Péter Kiss
Global Head of Power & Utilities, Head of Energy Sector
KPMG in Central and Eastern Europe
T: +36 1 887 7384
E: pkiss@kpmg.com

Marcin Rudnicki
Partner
KPMG in Poland
T: +48 22 528 1177
E: mrudnicki@kpmg.pl

Steve Butler
Director
KPMG in Hungary
T: +36 1 887 7391
E: williamstephen.butler@kpmg.hu

www.kpmg.com/energy
www.kpmgglobalenergyinstitute.com
www.kpmg.com/powerconference
www.kpmgglobalenergyconference.com