

Shale and Eastern Europe—Bulgaria, Romania, and Ukraine

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Abstract This study uses data from diverse scientific and government sources in order to evaluate the impact of unconventional shale gas development on Bulgaria, Romania, and Ukraine in terms of economics, policy, and interdependence. In addition, the study is exploring a number of factors, related to shale gas controversies in the three countries, as well as the future potential of shale gas development in Eastern Europe.

Introduction

Following the rapid development of shale gas in North America, US-based companies explored the possibility to develop shale gas resources in the rest of the world, focusing on Europe as well. Several preliminary studies of the Energy Information Administration of the US Department of Energy showed substantial resources in Bulgaria, Denmark, France, Germany, the Netherlands, Poland, Romania, Russia, Ukraine, and the United Kingdom. Some of these countries have a well-developed natural gas market, supplied by both Russia and external sources (Nigeria, Norway, Qatar, etc.), while others are entirely dependent on the long-term contracts with Gazprom. The closest neighbors to Russia, situated on the Black Sea shores, are Bulgaria, Romania, and Ukraine. Their gas imports currently are almost entirely dependent on Russia, while they also may hold substantial shale gas and other unconventional hydrocarbon resources. Both their offshore Black Sea conventional and unconventional resources, as well as shale gas deposits, are

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underexplored and underdeveloped. If the three countries embrace shale gas as a viable option, and if the geological, political, economic, legal, regulatory, and technical conditions are at place, unconventional gas could play a major role in the three countries' energy balances, energy import dependence, fiscal positions, unemployment, and GDP growth.

General Information About Bulgaria, Romania, and Ukraine

Bulgaria, Romania, and Ukraine are situated in Eastern Europe. As of 2014, Bulgaria has a territory of 110,879 km² (42,811 mi²) and a population of 7.2 million. Romania's territory is 238,391 km² (92,043 mi²) and its population is 19.9 million. Ukraine's territory is 603,500 km² (233,000 mi²), excluding Crimea (27,000 km² or 10,000 mi²), which is de facto controlled by Russia. Ukraine is the largest country wholly situated in Europe and its population is 45.4 million, excluding Crimea with its 2.3 million.

Bulgaria and Romania are ranked as "upper-middle-income" countries, and Ukraine is a "lower-middle-income" country (World Bank 2015). In 2014, the GDP per capita (constant 2005 US\$) for Bulgaria, Romania, and Ukraine was, respectively, 4916 USD, 6196 USD, and 2081 USD. The World Bank data show that energy use in Bulgaria, Romania, and Ukraine is, respectively, 162.6, 99.5, and 323.4 kg of oil equivalent per 1000 USD of GDP (constant 2011 PPP). Bulgaria and Romania rank, respectively, first and fifth in the EU by lowest energy efficiency, measured through the same indicator (Eurostat 2015b).

All three countries are net importers of oil and gas, and this affects negatively their trade balances. An analysis of the Directorate-General for Economic and Financial Affairs of the European Commission shows that Bulgaria has the third largest total energy trade deficit in the period 2009–2013, amounting to about 6.4 % of GDP, while the share of energy in total trade is 19.4 % (European Commission 2014). Romania has a better total energy trade deficit—only about 2.3 % of GDP and the share of energy in its trade is 7.8 % for the period 2009–2013. Regarding gas trade balance, it is negative for all member-states of the EU, and the largest deficit for the same period is in Lithuania, Slovakia, Hungary, and Bulgaria. In Bulgaria, its value is 2.3 % of GDP and in Romania is 0.5 % of GDP. In Ukraine, the rising gas prices in the period 2005–2012 have led to a rapid increase in the annual cost of gas imports: from less than 4 bn USD in 2005–2014 bn USD in 2011–2012 (Sarna 2013), which accounts to about 4.7 % of GDP.

Energy Portfolio and Natural Gas Usage in Bulgaria, Romania, and Ukraine

Being situated at one of the important crossroads between the East and the West, Bulgaria, Romania, and Ukraine are usually seen as countries that could help to improve the European Union's overall energy security. Energy security in Eastern and Southeastern Europe has always been an issue in the East–West foreign relations, but became a more pressing matter after the natural gas supply crisis in January 2009, when Russian supplies through Ukraine stopped for about a month for the first time in more than 30 years.

Most of the countries in the region are heavily dependent on Russian gas supplies with no alternatives: Ukraine—for up to 80 % of its consumption, Romania—up to 25 % in the last decade, and Bulgaria—for over 90 % of its consumption. The 2009 crisis prompted the EU to vote specific legislation for ensuring better security of gas supplies (European Parliament 2010), including specific financial instruments for developing gas supply infrastructure (European Commission 2013). However, still not enough is done in terms of promoting indigenous production of gas from both conventional and unconventional sources in this region of Europe.

Bulgaria

Bulgaria is the most promising energy transit route for both Russian and alternative gas deliveries to Europe. Currently, the country transits Russian gas to its neighbors Turkey, Greece, and Macedonia. It was the landing point for the offshore gas pipeline South Stream, which was intended to supply with 63 Bcm (about 2.22 Tcf) of gas per year Italy and Austria, as well as the other transit and adjacent countries: Croatia, Greece, Hungary, Macedonia, Romania, Serbia, Slovakia, Slovenia, etc. The alternative “Southern Gas Corridor,” which has to bring gas supplies from the Caspian Region, the Middle East, and the Mediterranean, has two alternative routes on the Balkans—through Bulgaria and through Greece. Bulgaria itself has a potential for natural gas production: onshore, offshore, and unconventional (shale gas and coalbed methane).

Bulgaria and Romania were the fifth and sixth largest exporters of electricity in the European Union in 2014, after France, Germany, Sweden, and the Czech Republic (ENTSO-E 2015). Bulgaria's net physical exports were 9451 GWh, and Romania's net exports were 7130 GWh in 2014. The energy balances of Ukraine show that in 2013 the country had net electricity exports of 854 ktoe or about 9932 GWh (State Statistics Service of Ukraine 2015).

There is currently only one underground gas storage in Bulgaria—“Chiren,” operated by Bulgartransgaz EAD. The total working capacity of the storage is 500 mcm (17.7 Bcf) and its maximum daily withdrawal rate is about 4–5 mcm (141–177 MMcf). According to “stress tests” by the European Commission, the

capacity and the withdrawal rate would not be enough to cover the winter daily demand of about 12 mcm (424 MMcf) during a new gas supply cut. In order to increase the security of gas supply, Bulgartransgaz intends to increase the working capacity of the storage to 1 Bcm (about 35.3 Bcf) and its daily withdrawal rate to 8–10 mcm (0.28–0.35 Bcf). There is also an option for a second gas storage at “Galata”—a depleting shallow offshore gas field, operated by Petroceltic. Its working capacity may be up to 800 mcm (28.2 Bcf), but as of August 2015 there is still no decision on the future of the gas field.

According to Bulgarian government’s data, Bulgaria had an overall dependence on energy imports for 37.8 % of its consumption in 2013—a better position than the average for the EU, which is dependent for 53.2 % of its imports (Ministry of Energy of Bulgaria 2015). However, nuclear energy, which has a 21.0 % share in primary energy use, is considered as local according to Eurostat methodology. In Bulgaria, there are 4 nuclear units under decommissioning (a total of 1760 MW) and 2 operational units with a total capacity of 2000 MW. All of the above are Russian design and the latter are still supplied only with Russian nuclear fuel. Also, the only oil refinery in Bulgaria, Lukoil Neftochim, which holds almost 50 % of the local fuels market, is 100 % subsidiary of the Russian energy company Lukoil. Thus, Bulgaria is dependent on Russia for about half of its oil and fuels, for more than 90 % of its gas consumption and for 100 % of its nuclear fuel imports. The largest local energy resource is lignite coal, which is used for power production, but is also subject to stricter carbon, sulfur, and nitrogen emissions regulations. There is a Russian influence in gas distribution as well, where Overgas Inc. AD, 50 % owned by Gazprom, is responsible for 59 % of the gas retail market.

The majority of power generation in Bulgaria is owned by the state through the 100 %-owned Bulgarian Energy Holding EAD (BEH). BEH is the 100 % shareholder in the following companies: NPP Kozloduy (2000 MW), the lignite-fired TPP Maritsa East 2 (1600 MW), the public supplier NEK EAD (with hydro capacities of 2700 MW, including all the pumped storage hydro power plants with a total capacity of 940 MW), and the whole transmission network and TSO under the subsidiary company ESO EAD. NEK EAD also has two PPA contracts with two US-owned lignite thermal power plants for 100 % of their production—TPP AES Galabovo (670 MW) and TPP ContourGlobal Maritsa East 3 (908 MW). BEH is also the 100 % shareholder of the public supplier for natural gas Bulgargaz EAD and the national gas transmission system operator Bulgartransgaz EAD.

The Bulgarian power sector has been diversified with a rapid growth of renewable energy sources in the period 2011–2012. The poorly structured supporting scheme for renewable energy through feed-in tariffs has initially led to applications for 12,000 MW of new RES capacities in a market with a minimum consumption of about 2500 MWh/h and peak at about 7500 MWh/h. Currently, there are 1040 MW of photovoltaic power plants, 701 MW of wind, and 47 MW of biomass power plants (Georgiev 2015).

NEK EAD has concluded a contract with Rosatom for the construction of a new NPP—“Belene,” but later canceled the project and is being sued by the Russian company for a compensation of 1 bn EUR (1.11 bn USD). As of August 2015, the

arbitration case is expected to be resolved in the autumn of 2015, without clear signs of who will win it.

Data from the national incumbent wholesale supplier (Bulgargaz 2015) show that Bulgaria consumed 2.485 Bcm (87.7 Bcf) of natural gas in 2014, and 91.99 % of this gas was imported from the Russian Federation. In 2013, the country used 2.539 Bcm (89.6 Bcf) and the imports were 89.13 %. The rest of the consumed gas is produced locally—right offshore the Black Sea coast, from a small field at the end of its life, operated by the British company Petroceltic. The share of natural gas in the national gross energy consumption was only 14.2 % in 2013 (Eurostat 2015a). However, about 38 % of this gas is used for district heating services in the large towns of Bulgaria, including the capital city of Sofia. Leaving these plants without gas in the coldest days of the winter could cause not only discomfort for the households and businesses, but also a crisis with the electricity supplies, if all homeowners switch at once to backup electric heating devices. Another large consumer of gas in Bulgaria is the industrial sector—it used 760 ktoe (about 32.3 Bcf) for energy purposes in 2013 and 207 ktoe (8.8 Bcf) for non-energy petrochemical products such as fertilizers. Most of the industry is not able to quickly switch to a reserve fuel and needs security of energy supplies as well.

Currently, there is no real gas market in Bulgaria. The country buys all the gas it needs from Gazprom and receives it via one pipeline (through Ukraine, Moldova, and Romania), and this gas is sold internally by the incumbent Bulgargaz EAD—a subsidiary of the state-owned Bulgarian Energy Holding EAD and by the largest owner of local gas distribution companies—Overgas Inc. The remaining 7–8 % of gas supplies are also delivered to Bulgargaz, which wants to include alternative sources in the mix in order to keep end user prices down. Bulgargaz sells the gas at regulated prices to industrial consumers, power companies, and households. There is no diversification in the national gas market and this makes business and household consumers extremely vulnerable to supply crises and price changes. The gas is purchased via long-term contracts, dependent on oil price swings and with no real connection to the gas spot markets in Central and Western Europe.

Natural gas has a lot of growth potential in Bulgaria. Currently, only about 3 % of households use natural gas, as this market segment was not developed until the 1990s, but the Energy Strategy of Bulgaria until 2020, which was adopted in 2011 (Ministry of Economy, Energy, and Tourism of Bulgaria 2011), envisions a further development of gas use in households. About 75 % of municipalities in the country are not connected to the gas transmission network, leaving businesses and households without the possibility to use natural gas. The document also puts as a priority the replacement of the electric energy with natural gas for domestic heating and for housekeeping needs, which would “contribute to three times higher saving of primary energy” and “should be viewed as one of the methods for improvement of the energy security.”

According to the strategy’s text, in order to guarantee the state’s energy independence “with strict adherence to the environmental requirements,” there would be development of new natural gas fields “including, without being limited to, shale gas and deep water wells in the Black Sea,” which will be “actively supported.”

One of the 11 priority actions in the strategical document is the “priority investment in geological exploration of new oil and gas fields, including those of shale gas, and deep water drilling in the Black Sea.”

There are also about decade-old plans for building gas interconnectors to Romania, Greece, Serbia, and Turkey. And last but not least, gas transmission projects such as the EU-supported Nabucco and the Russian South Stream, if they are ever built, would cross the country, promising the possibility of new connections to the gas network, for instance for some of the municipalities that now have no access to gas and no distribution networks. All of these developments augur well for gas consumption in the coming years.

With these developments of national consumption, the issue of diversification through additional import sources and local production becomes even more pressing.

Romania

Romania is also dependent for its gas consumption on imports, but only for 11.9 % of its supplies in 2013 (Eurostat 2015a). Its gross annual consumption of natural gas is 32,346 ktoe (about 1.37 Tcf) and the local production ensured the larger part in the last several years. Data from the national incumbent wholesale supplier (Transgaz 2015) show that Romania stopped importing gas during the spring of 2015 as a result of higher local conventional gas production. Imports were as low as 2 % from the needed gas quantities during the second half of 2014, improving the overall energy security of Romania during the political crisis between Russia and Ukraine in 2014 and 2015.

The final energy consumption in Romania is distributed more evenly between the energy sector, the industrial consumption, and the residential sector. In 2013, about 25 % of the energy was used for direct consumption by households and about 24.4 % was used by the industry for its energy needs. About 34.1 % was used by the energy sector for transformation—in cogeneration or heating-only power plants.

According to the national report of the Romanian energy regulatory agency, the country had a total of 4349 MW installed renewable energy capacities in the end of 2013. There are 2594 MW of wind, 531 MW of hydro power plants; 66 MW of biomass, and 1158 MW of photovoltaic capacities. The total installed generating capacity of the Romanian power system is 20,082 MW. The maximum gross consumption in 2013 was 9158 MWh/h and the minimum consumption for the same year was 3648 MWh/h (Romanian Energy Regulatory Authority 2014). The market development progress report for Romania (European Commission 2015b) shows that in 2013 the electricity generation was distributed between thermal power plants (46.2 %), hydro power plants (25.9 %), nuclear energy (19.9 %), and renewables (8 %). According to the data in the report, the state-owned companies Energy Complex Oltenia (operating lignite thermal power plants), Hidroelectrica, and Nuclearelectrica (operating the NPP Cernavoda) are the three largest generators in Romania with a total market share of 69.7 % in 2013.

The gas market in Romania provides consumers with choice of supplier, and in 2013, there were almost 3000 consumers who bought gas at non-regulated prices. According to data from the draft Romanian Energy Strategy (Ministry of Energy of Romania 2015), the share of non-regulated gas market was 54.2 % of the total gas consumption in 2013. In the same year, about 85 % of the gas consumed in Romania was produced locally and imports from Russia and Hungary accounted for 15 % of the total quantities. The national gas transmission network, operated by Transgaz, has a total length of 13,127 km, including 553 km of transit pipelines. The link to Bulgaria is able to transport up to 883 Bcf p.a. and is currently supplying Bulgaria, Macedonia, Greece, and Turkey via the “Transbalkan pipeline.”

Romania’s gas production and trading company Romgaz operates six underground gas storage facilities with a total active capacity of 2.77 Bcm (97.8 Bcf). Their current maximum flow is about 22 mcm/day (0.78 Bcf/day), and Romgaz intends to invest in its increase up to 30 mcm/day (1.06 Bcf/day). About 70 % of the shares of the company are owned by the Romanian state and the rest are traded on the Bucharest Stock Exchange and the London Stock Exchange.

Ukraine

Ukraine’s gas transmission network is an integral part of the gas transport system, connecting producing fields in Russia and the Caspian Region with the consumers in Europe. The most important pipelines are “Druzhba” (“Friendship” in Russian language) and “Urengoy–Pomary–Uzhgorod.” About half of Russia’s gas exports to Europe are delivered via Ukraine and some of the countries supplied through these routes are Austria, Bulgaria, Croatia, the Czech Republic, France, Greece, Germany, Hungary, Italy, Macedonia, Moldova, Poland, Slovakia, Slovenia, and Turkey.

Data from the national transmission system operator (Ukrtransgaz 2015) show that the country has the potential to transport up to 140 Bcm p.a. (about 4.9 Tcf) and has 12 underground gas storage facilities with a total working capacity of 31 Bcm (1.1 Tcf). This network is an important part of the logistics for supplying the fluctuating seasonal demand with a steady flow of gas from the producing fields. The total length of pipelines is 38,500 km, with 22,160 km of them for transit purposes.

Foreign gas companies, as well as Gazprom, have expressed their interest in owning and/or operating the country’s extensive gas infrastructure, which includes pipelines and strategic gas storage facilities. However, the latest developments in Crimea and Eastern Ukraine pose a threat to both the country’s unity and its gas sector development. The potential gas production will depend on future developments in the Russia–Ukraine conflict.

According to the Energy Strategy of Ukraine (Ministerial Council of Ukraine 2013), the country consumed between 76 Bcm (2.68 Tcf) in 2005 and 50 Bcm (1.77 Tcf) in 2009 of natural gas per year during the last decade. In 2010, the total national consumption amounted to 57 Bcm (2.01 Tcf), making Ukraine one of the largest consumers of natural gas in Europe. Of these quantities, in 2010 about 18

Bcm (0.64 Tcf) were consumed directly by households and 11 Bcm (0.39 Tcf) were used for supplying the central heating systems in the large towns of the country. The second largest consumer of gas in 2010 was the industrial sector with about 40 % of the total quantity, and the largest industrial consumer was the steel industry. The latest data by the national statistics (State Statistics Service of Ukraine 2015) show a total primary energy supply of gas in 2013 amounting to 39,444 ktoe, equal to about 1.68 Tcf. About 57.3 % of this gas has been imported. The Energy Strategy predicts a stable consumption in the country until 2030—varying from 47 Bcm (1.66 Tcf) p.a. in the pessimistic scenario to 53 Bcm (1.87 Tcf) p.a. in the optimistic one.

The gas market in Ukraine is still not deregulated and does not provide for choice of gas supplier. However, the Energy Strategy until 2030 envisages a gradual deregulation and liberalization of the gas market at two stages—the first one will preserve the state regulation over wholesale supplies while ensuring diversification, while the second stage will include deregulation of prices, privatization of gas distribution grid companies, and the state would keep control over some of the gas imports.

Almost 48 % of Ukraine's power is produced in nuclear power plants by 15 operating reactors. There are five NPPs in Ukraine: “Chernobyl” (4000 MW, stopped), “Khmelnysky” (2000 MW), “Rivne” (2800 MW), “South Ukraine” (3000 MW), and “Zaporizhia” (6000 MW, the largest nuclear power plant in Europe). Until 2008, Ukraine was supplied with nuclear fuel and nuclear services entirely by Russian companies. Then, the country made several attempts to diversify its nuclear fuel supplies through additional contracts with “Westinghouse” and intensified these efforts after the crisis in Crimea and Eastern Ukraine (World Nuclear Association 2015). The second largest share in the power generation mix is held by coal with about 35–40 %.

Cultural, Economic, and Political Connections Among the Three Countries

Bulgaria, Romania, and Ukraine share a similar post-WWII history. They were part of the Eastern Bloc—Ukraine as part of the USSR, while Bulgaria and Romania had their de jure independence, but were close allies of the Soviet Union in both the Warsaw Pact and the Comecon.

In the end of 1989, after the fall of the Berlin Wall, both Bulgaria and Romania overthrew their Communist regimes and started a process of democratization together with a westernization of their economies. Then, Ukraine seceded from the USSR in 1991, but did not follow the exact example of the other former members of the Eastern Bloc.

Bulgaria and Romania (together with Estonia, Latvia, Lithuania, Slovenia, and Slovakia) joined NATO on March 29, 2004. Five years earlier, in 1999, Hungary, the Czech Republic, and Poland also joined the North Atlantic Treaty. Then, in April 2009, Albania and Croatia followed, while Ukraine and Georgia were told that they

could eventually become members. The latter has been criticized by the leaders of the Russian Federation and is seen as one of the reasons for the Crimea crisis and the War in Eastern Ukraine, which started in 2014. Even though Ukraine is still not a part of NATO, it has developed an Individual Partnership Action Plan (IPAP) with the organization. Such IPAPs have also been signed between NATO and several other East European countries: Armenia, Azerbaijan, Bosnia and Herzegovina, Georgia, Kazakhstan, Moldova, Montenegro, and Serbia in the period 2004–2015. All these developments are seen by the leaders of the Russian Federation as a threat to its geopolitical and economic position in Europe and in its closest vicinity, as these countries have been part of either the Eastern Bloc or the USSR.

Even a quarter of a century after the transition started, Bulgaria, Romania, and Ukraine have deep economic (including energy-related) and political ties to Russia. Some of the connections are based on the contacts between the KGB and the former secret services of Bulgaria, Romania, and Ukraine. Thus, any attempts to change the balance of interests in the three countries in political or economic terms lead to an internal opposition, which is usually pro-Russian. Some of the latest events are the Euromaidan and the successive crisis in Ukraine, the internal support for the Russian South Stream pipeline in Bulgaria, and the anti-shale gas protests in both Romania and Bulgaria.

Bulgaria and Romania are the poorest nations among the 28 members in the European Union. They both joined the EU in 2007 and are still struggling to improve the rule of law, the economy, and the overall living standard of their citizens. On May 7, 2009, Ukraine, among other East European countries (Armenia, Azerbaijan, Belarus, Georgia, and Moldova), signed a Joint Declaration with the member-states of the European Union, with the main goal “to create the necessary conditions to accelerate political association and further economic integration between the European Union and interested partner countries” (European Commission 2009). The initiative is known as the “Eastern Partnership.”

Both Romania and Bulgaria have been very active in seeking alternative options for gas supplies—originating in Russia or the Caspian. The Nabucco gas pipeline project would have crossed both countries, if constructed, and would bring gas from Azerbaijan, Turkmenistan, and eventually Iran to Southeastern and Central Europe. Russia was considering landing points of South Stream in the EU both in Romania and Bulgaria. In addition, there are several other potential gas projects—a successor of Nabucco, called Eastring, as well as a CNG option for transport through the Black Sea, called AGRI (abbreviation for Azerbaijan, Georgia, Romania Interconnector).

Ukraine has been exploring diverse options in order to improve the security of its gas supplies. The common trait of all scenarios is the attempt to diversify imports away from Gazprom. Some of the alternatives are reverse flows on existing pipelines (the one with Slovakia has already been implemented), new pipeline routes, LNG imports through the Black Sea, and increased local production of conventional and unconventional gas. However, gas supplies from Slovakia are dependent on supplies from Russia through a different route, new pipelines to the Caspian region could not bypass Russia, Turkey most probably would not allow LNG supplies through the Bosphorus, and local production could not be increased

substantially in the short term. The most viable of all options proved to be the reverse flow from Slovakia, and it supplied up to 12.7 % of the Ukrainian consumption in 2014 with the additional benefit of lower spot prices as a result of oversupply in Central and Western Europe (Bochkarev 2015).

History of Shale Gas Development and Its Present Situation in Each Country

According to an analysis by the Energy Information Administration of the US Department of Energy, Bulgaria, Romania, and Ukraine have “significant prospective shale gas and oil resources.” The EIA has analyzed three potential sedimentary basins: “Dniepr-Donets,” “Carpathian Foreland,” and “Moesian Platform” (Energy Information Administration 2013). The same report aggregates data from different studies and estimates for the potential of shale gas deposits and claims that there could be technically recoverable shale gas deposits of 195 Tcf and 1.6 billion barrels of shale oil and condensate in the three countries.

Bulgaria

The EIA estimates that Bulgaria has technically recoverable unproved resources from wet shale gas amounting to 17 Tcf.

However, Bulgaria was the second member-state of the EU to enact a moratorium and a ban on hydraulic fracturing in January, 2012. The Bulgarian government was initially extremely enthusiastic about the prospects of shale gas. The Energy Minister Traycho Traykov (2009–2012) has even said in 2011 that 1 trillion cubic meters of gas (35.3 Tcf) could be found in Bulgaria, which would cover the country’s consumption for 300 years (Tsolova 2011). The government believed that shale gas production would improve diversification of supplies and bring various economic benefits: domestic gas supply at reasonable prices, revenue from royalties and taxes, increased employment, investments in infrastructure and improved geological knowledge.

After the rise of shale gas exploration and production in the USA and the start of exploration in Poland, American companies turned their attention on Bulgaria. In June 2011, Chevron became the first company to receive a 5-year exploration license. Eventually, the organized protests against shale gas have led to the company’s pulling out of active development of this project. One of the reasons for the government to stop shale gas development in Bulgaria with a moratorium, voted by the Bulgarian Parliament in January 2012, may be the lack of enough information regarding the exploration and production activities.

A national survey, conducted by ESTAT on the request of the Bulgarian government, actually showed that 72.1 % of the respondents did not know the company Chevron and 10.2 % could not answer the same question about its reputation (ESTAT 2012). The study concluded that “there is a serious information deficit regarding the

topic of shale gas exploration and production, which leads to a high level of anxiety among the population.” Also, the lack of official information about the environmental effects has led to multiplying of the fears of the population and left free space for alternative information sources, the study says. The first question of the survey, “Do you know what shale gas is?” actually received 28.3 % answers of “I do not know anything about it” and 57.1 % answers of “Partially.” The lack of information and awareness about the issue, almost a year after the license of Chevron had started, could be attributed to communication mistakes made by the Bulgarian government and the company itself. While the government was communicating mainly the final effects of local gas production—energy independence and lower prices of natural gas, the company was not present enough in the public space: both nation-wide and locally, where shale gas deposits would have been developed.

Later in 2012, a consortium of the French company Total, the Austrian company OMV, and the Spanish company Repsol signed a contract with the Bulgarian government for exploration of one of the most promising conventional gas fields in the offshore Black Sea—“Khan Asparuh.” The initial studies show potential reserves between 1.5 and 3 Bcf. The three companies paid an advance of 40 million EUR (44.44 million USD) and the exploratory drilling costs are expected to be over 100 million EUR (111.11 million USD). In April 2015, the Bulgarian government published additional tenders for two additional blocks in the Black Sea: “Silistar” and “Teres.” The three Black Sea blocks are seen by the government as the only current viable option for local gas production.

Romania

Romania is both a transit country for Russian gas and a gas producer for part of its energy consumption. The country has stepped up in developing its shale gas potential in the last couple of years, managing to permit exploration activities despite opposition of environmentalist groups. According to EIA data, Romania has an unproved wet shale gas potential of 51 Tcf. As a gas producer, the country has a tradition and sustained know-how in exploration and production activities, as well as technical resources for fossil fuels production. The country is exploring all available options for improving its energy security—gas exploration and production offshore and onshore, as well as new possible routes for non-Russian gas supplies—through the Black Sea and through the newly built interconnector with Bulgaria.

The draft Romanian Energy Strategy (Ministry of Energy of Romania 2015) evaluates current natural gas proved reserves at 150 Bcm (5.3 Tcf). About 93 % of the reserves are located onshore and the current annual production is about 11 Bcm (0.39 Tcf). However, the document suggests that the use of new technologies may increase the volume of reserves in the coming years. One of the undergoing conventional gas projects offshore the Black Sea is “Neptun”—a 50-50 joint venture of ExxonMobil E&P Romania Ltd. and OMV Petrom S.A., which may increase Romania’s proved reserves by 40–80 % and the country’s annual production by up to 60 % if its potential

is proved by the exploratory drilling activities. The document does not give its own estimate of unconventional shale gas resources, but quotes the numbers of the EIA.

Romania experienced similar to Bulgaria tensions and protests, related to shale gas exploration. The main target for anti-shale protesters was the US company Chevron, which had licenses in both countries. Right after the moratorium against shale gas exploration was enacted in 2012 in Bulgaria, as a result of a strong public campaign, similar protests took place in Romania as well. The campaigns had not only similar goals, but also the same organizers. According to analyses by researchers on this topic, activists from both countries merged their campaigns in border towns and brought the motto “Two Countries, Same Water—Two Nations, One Fight” (Devey et al. 2014). Other analyses connected the anti-shale campaign with Russian interests and financing (Labelle and Goldthau 2014). The blame that Russia was financing anti-shale protests in Southeastern Europe was also voiced by the NATO Secretary General Anders Fogh Rasmussen, who said that “...Russia, as part of their sophisticated information and disinformation operations, engaged actively with so-called non-governmental organisations—environmental organisations working against shale gas—to maintain European dependence on imported Russian gas” (Jones and Chazan 2014). Despite all suspicion, there are no hard evidences that the protests were financed externally. The conclusion that there should have been a Russian connection to the anti-shale protests was only based on the analysis of who wins and who loses if local shale option is not developed. An analysis in NY Times suggests (Yardley and Becker 2014) that “with the death of shale gas, South Stream’s rationale was stronger than ever”—after Nabucco’s cancelation, South Stream was the only option for a large natural gas project in Bulgaria and Romania.

Even if there may be an influence from abroad regarding the protests in Romania, local referenda in December 2012 showed a strong opposition to shale gas drilling near the Black Sea resorts of the country. The referenda were not considered legally binding due to the low activity, but even so about 86 % of the voters were against shale gas development (Visan 2013). According to the policy brief of the Romania Energy Center, overall public support for shale gas development is low because of the unknown factors and the lack of information regarding the production of this resource. The same report quotes a public opinion poll from April 2013, which showed that 41.5 % believed “shale gas drilling is a danger to both the environment and humans,” while 16 % of the respondents did not know details and could not comment and other 20 % have never heard of the issue.

Ukraine

Ukraine is one of the countries with the highest potential for shale gas production, according to the EIA—128 Tcf of unproved wet shale gas technically recoverable reserves and 39 Tcf of proved natural gas reserves. The International Energy Agency estimates the coalbed methane resources at almost 3 Tcm (105.9 Tcf) and the technically recoverable shale gas resources at 1.2 Tcm (42.4 Tcf). According to

the IEA, these resources are “around one-third less than remaining recoverable resources of conventional gas” (International Energy Agency 2012).

Currently, Ukraine ranks fifth in Europe in terms of gas production and local production is 20 Bcm (0.71 Tcf) p.a. on average for the last several years. According to the national Energy Strategy (Ministerial Council of Ukraine 2013), the potential resources of conventional gas in Ukraine are 5.4 Tcm (190.6 Tcf), 80 % of them being in the Eastern part of the country. Eastern Ukraine is also responsible for about 90 % of the country’s gas production. The energy ministry of Ukraine evaluates the total unconventional resource potential of the country, including tight gas, coalbed methane gas, shale gas, and deep Black Sea offshore deposits somewhere between 20 and 50 Tcm (706–1765 Tcf). Full-scale production of shale gas alone may reach 11.6 Bcm (0.41 Tcf) p.a. by 2030, but would need 35–45 bn USD of investments, the report says. Under the pessimistic scenario of the strategic document, gas production would reach 30 Bcm (1.06 Tcf) p.a. between 2020 and 2030, while the optimistic scenario, which includes shale gas and other unconventional gas developments, puts the production of Ukraine at 47 Bcm (1.66 Tcf) p.a. during the same period.

Policy Similarities and Differences Across the Three Countries

The European Union’s Energy Policy relies on three main pillars: competitiveness and affordability, sustainability, and security of supply (European Commission 2010). While electricity and natural gas are considered common markets within the borders of the European Union, still the choice of energy resources is left up to each country’s policy. Individual member-states can choose whether or not to develop nuclear energy, unconventional oil and gas resources, and other energy options. There is a common environmental legislation, which focused until now mainly on wastewater disposal and carbon emissions as part of energy production and consumption. There is also no joint effort on energy diplomacy issues, including negotiation of energy transit routes, prices of energy resources, etc. Each country is responsible for its own energy supplies and energy security. These conclusions are valid for both Bulgaria and Romania as members of the EU, but also for Ukraine, which is bringing its policies closer to the EU ones as part of the Eastern Partnership process.

The current centerpiece of European energy policies is the initiative for creating an “Energy Union.” The “Energy Union Strategy” was announced by the Vice-President of the European Commission Maroš Šefčovič on February 25, 2015. He defined it as “the most ambitious European energy project since the Coal and Steel Community” (European Commission 2015a), the latter being a cornerstone for the founding of the European Union.

The term “Energy Union” has been introduced by the current President of the European Council Donald Tusk, while he was still prime minister of Poland, in March 2014 (Premier.gov.pl 2014). He said that the European Union should

“demonstrate more solidarity between member-states” in terms of energy, and proposed 6 main priorities:

1. Creation of an effective gas solidarity mechanism in case of supply crises.
2. Increased financing from the European Union’s (EU) funds of infrastructure ensuring energy solidarity, in particular in the east of the EU—even up to 75 % of projects’ value.
3. Collective energy purchasing.
4. Rehabilitation of coal as a source of energy.
5. Shale gas extraction.
6. Radical diversification of gas supply to the EU.

The Energy Union Strategy implementation will create new possibilities for member-states of the EU to diversify their energy resources and to increase their energy security. Even if the current version of the strategy has softened some of the six priorities above, it shows the strong will of the European leaders to tackle the energy security vulnerabilities of the EU members and even of the countries in the Eastern Partnership.

With regard to environmental regulations in the EU—they have a mixed effect on natural gas exploration and production. On the one hand, natural gas should have gained a momentum with carbon regulations across the EU and should have replaced a considerable part of coal for electricity and heat production, as stipulated by the European Commission’s 2050 Energy Roadmap (European Commission 2011). Also, gas-fired power plants were considered the best solution for balancing intermittent wind and solar power.

However, there are a number of environmental regulations that limit the industrial activities in Europe, and they could be a hinder for both conventional and unconventional oil and gas drillings. A special report by the International Energy Agency, published in the World Energy Outlook 2012 (International Energy Agency 2012), presents some of the policy challenges, related to unconventional oil and gas production. The report considers that “there are above-ground factors that are likely to impede rapid growth in unconventional gas production, the most significant of which is the high population density in many of the prospective areas.” In addition, the report summarizes the specific regulations in the EU in five groups: (1) water protection, enforced through the Water Framework Directive, the Groundwater Directive, and the Mining Waste Directive; (2) chemicals use, limited by the REACH regulation; (3) protection of natural habitats and wildlife; (4) the required environmental impact assessments for new investment projects; and (5) the liability for operators with large penalties for environmental damage.

The specific environmental legislation in the European Union also includes the “Natura 2000 network” territories. This is an EU-wide network of nature protection areas, established under the 1992 Habitats Directive of the European Union. The aim of this network is to assure the long-term survival of Europe’s most valuable and threatened species and habitats. About 33.9 % of Bulgaria’s territory and about 17.9 % of Romania’s territory are designated for the “Natura 2000 network” and may be off-limits for shale gas drilling and production. This network could diminish

substantially the ultimately recoverable resources for both countries (ICF GHK 2014). Additional territories may be excluded because of their proximity to population centers. For Bulgaria's territory, they are estimated at 8 % of the country's total area, and for Romania, the share of the territory is 10 %. Thus, the ultimately recoverable resources vary in the minimum and maximum scenarios between 183 and 1000 Bcm for Bulgaria (6.48–35.3 Tcf) and between 172 and 1445 Bcm for Romania (6.07–51.01 Tcf).

There are other specific factors for shale gas development in Bulgaria, Romania, and Ukraine, which are different from the policies and regulations in the USA and could have quite different effects on exploration and production. While there is private ownership of mineral rights in the USA, in Europe the mineral rights are owned by the state. This means that even if there are large quantities of gas on private and municipal lands, still the central government will be the one to negotiate and lease mineral rights and then will be the one to receive the larger chunk of payments for the extracted resources. This makes private owners, especially in agricultural regions, anxious and reluctant to shale gas development. Also, these communities are not used to such industrial activities. Exploring and producing shale gas in Pennsylvania, Texas, or Oklahoma has its traditions, while the local population in shale-rich regions of Eastern Europe would face an entirely new experience.

Another difference between the USA and the three countries is the entrepreneurship and financial infrastructure. While the independent oil and gas producers in the USA are able to collect capital from the financial markets, the situation in Eastern Europe is not the same. If shale gas is developed, it will be done mostly by foreign companies with the respective experience and access to finance. The growth of this sector would be based primarily on foreign capitals and entrepreneurship and not on local independent producers.

And last, but not least, exploring for shale gas and producing it would require specific human capital and technologies on site. There is no personnel with experience for shale gas exploration and hydraulic fracturing in Bulgaria, Romania, and Ukraine. Also, there are not enough modern drilling rigs in place that could be used for the exploration and production stages of shale gas fields. Data from the "International Rig Count" (Baker Hughes 2015) show that between January and July 2015 there have been a total of 108–128 rigs in Europe, most of them based on traditional technology. The latest data for Bulgaria from June 2014 show only 1 operating rig and Romania had between 8 and 11 rigs in the first 7 months of 2015.

A team under the leadership of the Institute for Energy and Transport at the Joint Research Centre of the European Commission has aggregated the challenges mentioned above into a matrix, combining two sets of factors (Pearson et al. 2012) (Table 1).

All the summarized challenges above show the disparities between Europe and the USA in terms of economic, legal, regulatory, environmental, social, and logistical factors. These differences mean that the shale gas revolution could not be "exported" without being adapted to local factors.

In addition to this, the gas infrastructure in the three countries is designed and constructed mainly as a system for transporting natural gas from the East (from

Table 1 Summary of the main challenges for accessing land for shale gas development in Europe

	Regulatory	Environmental	Social	Technical/Logistical
Environmental	<ul style="list-style-type: none"> • Water management • Natural/protected sites 			
Social	<ul style="list-style-type: none"> • No subsurface property rights • Duration/intensity of drillings • Proximity to residential areas • Noise/visual impacts 	<ul style="list-style-type: none"> • NIMBYism • Community impacts 		
Technical/Logistical	<ul style="list-style-type: none"> • Well size, spacing and density • Zoning restrictions • Multi-well pad permitting • Smaller land parcels 	<ul style="list-style-type: none"> • Inaccessible terrain • Force majeure • Obligation to conduct environmental impact assessment 	<ul style="list-style-type: none"> • Population density • Utility line placement 	
Economic/market	<ul style="list-style-type: none"> • Royalties for the state • Permitting costs • Licensing/concessions 	<ul style="list-style-type: none"> • Waste disposal • Site protection 	<ul style="list-style-type: none"> • Lack of financial incentives for land-owners/local communities • Higher labor costs 	<ul style="list-style-type: none"> • Equipment/rig transport • Access to distribution/transmission system • Service availability

Source Pearson et al. (2012)

USSR and later from the Russian Federation) to Southern and Western Europe and is still primarily owned, operated, and used by the incumbent state-owned integrated gas companies of Bulgaria, Romania, and Ukraine. The entrance of new producers both for conventional and unconventional resources would require a higher level of liberalization and third-party access to the gas transmission grids as well as investing in new branches of the national gas infrastructures.

Future Potential of Shale Gas Development in the Three Countries and the Region

An analysis on the socioeconomic impacts of shale gas for Bulgaria (KC 2 Ltd. 2014) indicates that the country may see between 7.0 and 23.2 bn EUR (7.78–25.78 bn USD) direct investment for the “low-shale” and “full-potential” scenarios, if shale gas is developed. The analysis predicts an annual production between 4.8 and 16 Bcm (169.5–565 Bcf) for a period of 30 years and the new jobs created would be between 26,000 and 39,000. The total fiscal effects for the period according to the pessimistic and optimistic scenarios are between 8.2 bn EUR and 18.1 bn EUR (9.11–20.11 bn USD) and the share of shale gas’s value added in the GDP would be between 1.7 and 5.1 %. The two scenarios show an additional growth of GDP as a result of shale gas development between 0.59 and 0.83 % per year leading to an accumulated GDP growth for the whole 40-year period of the project between 18.3 and 26.6 %.

A similar socioeconomic impact study for Romania (Romanian National Committee of World Energy Council 2013) predicts the creation of 4517 new direct and 13,552 new indirect jobs (a total of 18,069) at the national level in addition to 4800 new direct and 14,400 new indirect jobs (a total of 19,200) at the regional level. Thus, the total effect of shale gas development on the Romanian job market would be over 37 thousand new direct and indirect jobs. The report also considers that natural gas prices in Romania could be reduced by up to 30 % with shale gas development, while the new exports of gas could bring up revenues accounting for up to 0.5 % of GDP each year between 2023 and 2030. The report is covering the period between 2013 and 2030 with extraction starting in 2023. According to the authors of the study, “Romania has to explore and exploit new conventional and particularly unconventional oil and natural gas fields in order to meet the requirements in domestic consumption and maybe an additional quantity for export” considering the reduced production of oil and gas from the current conventional sources.

A report prepared for the Ministry of Energy and Coal Industry of Ukraine (IHS CERA 2012) predicts that Ukraine’s gas potential would be developed from several sources: advanced recovery from producing fields; development of marginal discoveries; exploration within existing conventional plays or in new areas of Southern Ukraine, including the offshore Black Sea; tight gas sands; and unconventional gas resources, including both shale gas and coalbed methane. In the base-case scenario of IHS CERA, unconventional gas production could reach a plateau of about

25 Bcm (882.8 Bcf) p.a. by 2030. The optimistic scenario predicts a plateau of at least 30 Bcm (1059.3 Bcf) p.a. for the same period. Thus, the total production of gas in Ukraine, including the development of existing conventional resources, could increase from the 2010s' levels of below 20 Bcm (706.2 Bcf) p.a. to at least 70 Bcm (2741.7 Bcf) p.a. in the first half of the 2030s. The report also envisages that the capital costs for shale gas and coalbed methane development could reach between 2 and 3.5 bn USD (in 2011 dollars) annually if and when unconventional development takes off, while the total investments needed for the upstream gas sector may reach 10 bn USD p.a. for some of the years between 2012 and 2035, without taking into account the investments needed for the related support infrastructure. However, IHS CERA predicts "unconventional gas will emerge more gradually in Europe than in North America" for reasons related to cost and politics.

Currently, there is also a great insecurity of shale gas development in Ukraine, related to the War in Eastern Ukraine. This is where the "Dniepr-Donets" Basin is located and it accounts for most of Ukraine's onshore hydrocarbon reserves (Energy Information Administration 2013). In the beginning of 2013, Shell has been awarded Ukraine's first formal shale gas exploration license in the "Dniepr-Donets" basin—the Yuzovska field with an area of 7800 km² (3012 mi²) under a PSA. Chevron has negotiated a PSA for the Oleska field in Western Ukraine near the border with Poland. The military conflict in Eastern Ukraine eventually has canceled both investments. In mid-2015, Shell notified Ukraine that it will pull out of its project due to force majeure (Olearchyk 2015). In the beginning of 2015, Chevron also pulled out of its Oleska project in Western Ukraine.

The other shale basin in Ukraine under risk is in Crimea's Black Sea shores. It is part of the Silurian belt. After a tender in 2012, a consortium of ExxonMobil Exploration and Production Ukraine B.V. (40 % of the shares, operator of the block), Shell (35 %), OMV/Petrom (15 %) and NJSC Nadra Ukrainy (10 %) won the Skifska offshore field in the Black Sea. In June 2015, a year after the accession of Crimea by Russia, the US Ambassador to Ukraine announced that ExxonMobil is not going to develop the field. Shell had announced its exit from the project earlier. As a final cancelation step, ExxonMobil Exploration and Production Ukraine B.V., a Netherlands-based company, announced the closing of its Kyiv office in the beginning of August 2015 (Interfax-Ukraine 2015).

The Italian oil and gas company Eni, the French company EDF, and two Ukrainian companies (Vody Ukrainy and ChornomorNaftogaz) also have a PSA agreement offshore the southeastern coast of Crimea for a 540 mi² block. In March 2014, the Eni management was still not aware of the new Crimea government's intentions over the PSA, but the project had not started. Another venture of the Houston-based Vanco Energy Company with Russia's Lukoil and the Ukrainian businessman Rinat Akhmetov for the Prykerchenska block is also on the hold in the same area. ChornomorNaftogaz itself operates 17 blocks in the Sea of Azov and the Black Sea offshore Crimea. The company announced in March 2014 that it would seek compensation for the confiscation of its assets in Crimea "by targeting the assets of Gazprom and other Russian companies globally" (Platts 2014).

Potential threats for the development of shale gas in Europe and in Eastern Europe in particular include the difference in the legislative bases in comparison with the USA (in terms of mineral rights ownership), lower dynamics of entrepreneurship and venture capital, lack of enough knowledge and technologies for unconventional oil and gas production, as well as higher environmental sensitivity in comparison with other parts of the world. These threats have the potential to delay or even stop indefinitely the exploration and production of shale gas in Eastern Europe.

On February 20, 2015, Chevron announced its decision to stop shale gas exploration in Romania after the exploration activities performed in 2014. According to an analyst (Mihalache 2015), the business decision of Chevron is based on several factors: the unsatisfactory results from exploration activities, the anti-shale protests, and public perception in general against shale gas, as well as the oil price drop in the last year. The expert also considers that the “Chevron experience” could bring positive change to Romania, if the government concentrates on the Black Sea offshore projects, where additional pipeline infrastructure is needed. The Black Sea offshore has become the new oil and gas “frontier” in the region with concessions granted to international companies in Bulgaria, Romania, and Ukraine.

There are a number of uncertainties, related to shale gas development not only in Southeastern Europe, but in general in Europe, a report by the European Parliamentary Research Service says (Erbach 2014). According to the experts, quoted in the same report, “more exploratory drilling is needed to assess the real extent of technically and commercially recoverable resources in Europe.”

Another risk factor is time. The time needed for licensing and exploration may delay the first gas to be produced with almost a decade. In addition, the report says, shale gas in Europe would be neither cheaper, nor more abundant than in the USA. Its effects on the energy situation of Europe would be only marginal, even if it reduces the gas import dependency of the member-states, but there would be other positive effects such as economic growth and job creation. The report also predicts that potential imports of shale gas to Europe would take several years, and thus, the shale gas development both in the USA and in Europe would not have short-term effects on EU’s energy security.

Conclusion

In terms of geology, the prospects for shale gas development in Bulgaria, Romania, and Ukraine are promising. However, they still seem premature because of the lack of exploratory drilling activities in order to prove the exact volumes of ultimately recoverable reserves. The interest of foreign investors for concessions in the three countries in the last 5 years indicates that both oil majors and independent US producers are ready to risk their capital and invest in shale gas development.

Studies for all the three countries show that the development of local unconventional gas resources would be beneficial in terms of thousands of new jobs,

income for the local and national governments, as well as for reducing the energy import dependence and the negative energy trade balances. Moreover, all three countries are eager to break their dependence on one external source of gas, Russia, and the local production of gas is one of the most preferred options.

The main hurdles for shale gas development in this region of Europe are not the geological conditions, but the other specific local factors in place. There are significant differences between the USA and Europe in terms of legislation, regulation, social acceptance of this business, environmental requirements, logistical implications, etc. The shale gas revolution could not be easily “exported” from its birthplace in North America to Eastern Europe. In order to develop the potential shale gas deposits, investors will need to accommodate themselves under the specific factors, present in Europe.

The geopolitical situation may be even more significant for the further development of shale gas in Eastern Europe. Local production in Bulgaria, Romania, and Ukraine would make these countries and maybe even some of their neighbors more independent from their historical supplier—the Russian Federation. The current dependent state of all the three countries, for example, makes them more eager to participate in Russian pipeline projects, crossing the region. A change in the energy balances of any of them would provide a new bargaining chip in the regional geopolitical game. Thus, a future of shale gas in Eastern Europe may prove to be possible only under a wider geopolitical accord between the contemporary global players in the world gas market.

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