Natural Gas from Shale

Socioeconomic impacts for Bulgaria

(Draft)

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[1] The report reflects solely the opinion of KC2 Ltd. and in no manner is influenced by considerations related to the company's business and its clients.

Content

Abbreviations

The report uses the following specific abbreviations

- GVA - gross value added;
- GDP – gross domestic product;
- bcm - billion cubic meters
- BEF - Bulgarian Energy Forum
- BGN - Bulgarian Lev, the local currency;
- BNB -Bulgarian national bank, the central bank of Bulgaria;
- *Bulgargas* - Bulgaria's state-owned gas supplier;
- bcm – billion cubic meters;
- dca - decare, a metric unit used in Bulgaria, equal to 1,000 m^2
- DKEVR - from Bulgarian: State Commission for Energy and Water Regulation;
- EA - Employment Agency, a government body that counts the unemployed and delivers training and employment services;
- ECB - European Central Bank;
- EIA - Environmental Impact Assessment
- FDI - foreign direct investment
- MIE - The Ministry of the Economy and Energy;
- NEA - National Employment Agency;
- NEK - The National Electric Company;
- NGS - Natural gas from shale
- NOI - National Insurance Institute;
- NSI - National Statistics Institute of Bulgaria - the country's statistics office;
- NZOK - National Healthcare Fund;
- Tcf - trillion cubic feet;
- Tcm - trillion cubic meters
- USEIA – United States Energy Information Agency.

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- Stoyan Panchev, a freelance economist, for his contribution in coordinating the work, checking the Commercial Registry for financial reports of service providers and editing this report.
- The final version was drafted by Dr. Krassen Stanchev.

Executive Summary

Bulgaria's citizens and economy, which currently pay higher price for natural gas relative to their income, are likely to benefit from shale natural gas production in the country. This report articulates what are the costs and benefits of such perspective, and most importantly, describes the knock-on effects that shale natural gas production will cause on Bulgaria's economy and welfare.

The purpose of this report is to outline opportunities that could be potentially missed by Bulgaria. . We examine the direct, indirect and induced impacts of shale gas exploration and production on the economy, the employment tax revenues of the state and local budgets, and the probable side effects of greater energy diversity and security.[2]

Methodology[3]

The impacts are measured in two perspectives: first, on the sample block of Novi Pazar and socioeconomic conditions in the region in order to outline the effects on local communities, and then, these effects are extrapolated for the entire country on a pro rata basis on other blocks under exploration.

The direct, indirect, induced and knock-on effects are measured in constant 2013 EURs. The knock-on effects are those, which arise from lower prices. They affect the economy as a whole since natural gas is used as an energy source and a raw material. We examine in detail a possible situation when one new supplier of natural gas emerges - the volume of the produced natural gas from shale gas pushes the price down, leading to a decrease in the production costs for different value chains, while the respective output goes up, so that freed resources could be shifted towards investment, job creation, consumption, and wages.

The estimation of the country's Full-Potential is calculated for the sample and two additional blocks, Lovech and Koynare, which are assigned to different investors, taking into account natural gas price elasticity effect that typically emerges from competition. In this calculation we do not include the Vranino block in Eastern Dobrudja.[4]

The calculations are made for a period of 40 years, of which 10 years of exploration and 30 years of extraction and increased natural gas consumption. It should be also noted that the development of natural gas from shale is different from typical investment projects since "capex" and "opex" stages overlap.

We define three probable scenarios for the sample block: **Limited Exploration** or failure to identify technically recoverable resources, **Pessimistic Potential** and Optimistic Potential scenarios. The estimation on **Full Potential** is made on the basis of the Optimistic scenario. The purpose of this exercise is to outline thinkable limits of respective socioeconomic impacts.

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[2] See the text and Annex 1 for greater detail on methodology and assumptions.

[3] See more detailed description in Attachment 1 to the Report.

[4] See for details: USEIA, Op. cit., p. X-23 -- X-24 and "Hydrocarbon Potential and Prospects of NE Bulgaria and Offshore Black Sea – An Overview." Sofia, Institute of Geology and Mineral Resources, 26 January 2011.

For the sample block of Novi Pazar, we assume the only available official estimation that recoverable shale gas resources could be in the range of 0.3 to 1.0 Tcm[5] and make a conservative estimation on the lower end of 300 bcm.

The difference between the two shale development scenarios on this block is described below.

The Low Shale scenario envisions that the volume of extracted and supplied natural gas from shale is 4.8 bcm per year, which pushes the whole-sale price down by 25%. The Optimistic Potential scenario is calculated on the premises that the volume of extracted natural gas from shale is 9.6 bcm per year, where the whole-sale price decreases by 30%. Investment costs for both scenarios are the same since production volumes depend on how rich the shale gas formations are.

Findings

Limited exploration (sample block)

In case when companies explore the respective blocks but not find technically recoverable resource, the costs are fully at the expense of the exploring companies, and socioeconomic impacts resulting from the exploration activities (seismic tests, appraisal and pilot drilling) are to be fully restored at the expense of the exploring agent.

If we evaluate only the sample block of Novi Pazar, the impacts on the economy would be the following:

- Wages, social insurance contributions, income taxes, profits, depreciation, fees and permits, or the gross value added of direct, indirect and induced activities, will be EUR 86.9 million for seven years;
- The seismic stage (tests of 500 linear kilometers, 2D seismic lines, for an eight-month period) will employ at least 166 workers; appraisal drilling and pilot wells will employ 364 workers for a period of five years - 125 core personnel employed in direct drilling, administration and maintenance of the logistics site, and 239 jobs created in the local economy for subcontractors and service providers;
- The overall fiscal impact of this employment would be EUR 1.55 million in direct taxes. Induced consumption spending by workers' households would bring to the national budget nearly EUR 0.7 million in VAT and excise duties. The exploration permit is likely to cost the exploring company at least EUR 30 million;[6]
- EUR 3.2 million will be spent on consumption within the local economy. The average monthly salary is expected to be nearly three times higher than the average monthly salary for 2013, since the exploration activities mobilize highly qualified specialists and geologists;
- If the exploration fails to prove recoverable natural gas from shale, some of the resulting facilities will remain in the local community as a net benefit in terms of a developed local resource: a case in point here are the fees for water use, easements rights, rents paid to land owners, and the costs of water wells that we assume will be needed for the appraisal drilling (approximately EUR 340 thousand).

[5] Ibidem.

[6] This is the total of the so-called signature payment - a direct and unconditional revenue of the central budget. The environment impact assessment and other related procedures are included in the direct and indirect costs.

Low Natural Gas from Shale

When the sample block is developed, the following effects are likely to take place:

- Natural gas dependency ratio will be significantly lower compared to the zero shale gas scenario, approximately 70-71% compared to EU Commission estimate of 94% for the 2006-2012 period;
- During this 30-year extraction period the necessary investment would be EUR 6.78 billion (240 production wells per cycle meaning a total of 1,200 production wells for the whole period), while the expected net sales (of 4.8 bcm per year) of the company would be worth EUR 34.8 billion;
- Direct contribution to the annual average new value added to the economy will account for 1.7% of GDP and 1.98% of total GVA for the entire period[7];
- The expected increase of value added will accelerate the economic growth rate by 0.59 percentage points or EUR 239.7 million a year for a 30-year period;
- The direct investment impact is an increase of annual fixed capital formation by 2.83% of overall annual investment in the country (or more than 1/20 of the current fixed capital formation measured in constant prices)[8];
- The expected total number of personnel involved in the natural gas extraction is 1,755; subcontractors would hire 635 people to facilitate the main gas extraction activities – drivers, machine operators, building personnel, engineers, lawyers, consultants, etc.; the immediate induced business is likely to create 120 long-term jobs;
- Knock-on job creation effect would be 23,612 workers;
- The total fiscal impact would be EUR 8.2 billion for the period.

The fiscal revenue channels are summarized in the following table.

Summary fiscal effects (Low Shale, in EURO bln)

Key fiscal effects	EURO (bln)
TOTAL FISCAL CONTRIBUTIONS	8.2
VAT AND EXCISE DUTIES	2.4
ROYALTIES	0.9
SOCIAL SECURITY AND PERSONAL TAX	1.5
CORPORATE TAX	1.6
LOCAL TAXES AND FEES	0.5
KNOCK-ON IMPACT	2.5
BUDGET SAVINGS	1.7

Optimistic Shale

- Gas dependency ratio will be lower than in the previous scenario - 55-62%;
- The annual average value added will account for 3.2% of GDP and 3.7% of the overall gross value added in the economy, contributing approximately EUR 1.3 billion to the GDP per year (the calculation is based on the 2013 volumes of GDP of EUR 40.4 billion and GVA - EUR 34.7 billion);

[7] The calculation is based on the 2013 volumes of GDP of EUR 40.4 billion and GVA - EUR 34.7 billion.

[8] The calculation is based on the 2013 volume of investment of EUR 8.3 billion

- The expected increase of value added will accelerate the economic growth rate by 0.74% or EUR 299 million a year for a 30-year period;
- The investment of EUR 13.5 billion for the period (480 production wells per cycle or total 2 400 production wells) would make possible a gross output of EUR 78.5 billion;
- Accounting for direct, indirect, induced and knock-on effects the gross output of the project would be around EUR 103.6 billion, which is 18% higher than the estimated gross output of the country in 2013 (EUR 87.2 billion).

Knock-on (competition) impacts

The table below allows for some comparison between different interconnected stages of natural gas from shale development.

A comparison of different stages effects to Optimistic Potential Scenario

Key Figures	Seismic stage	Appraisal	Extraction
Human capital (jobs)	166	364	2,555
Knock-on (jobs)	-	-	29,526
Employment (contracted man/years)	102	263	46,000
Multiplier (direct vs others)	1.76	2.91	17.82
Consumption (EUR)	472,000	3.2 mln	0.795 bln
Fiscal impacts (EUR)	664,000	1.6 mln	2.7 bln

Source: KC2 Ltd.

- The full shale gas potential scenario would provide 29,526 jobs based on expected creation of GVA in the business. In economic terms this means EUR 3.7 billion contributions to the state budget, out of which EUR 2 billion would come from higher wages. The household consumption made possible by the shale gas extraction is estimated at EUR 2.6 billion for 30 years.

Impact on local employment

Total estimated workforce under the Optimistic Potential scenario is 32,611 people for the whole investment and extraction period. Nearly 70% of these new jobs will employ local workforce (22,827 people). This figure represents 5% of the current level of unemployment in Bulgaria, which is considered to be relatively high. Compared to the actual unemployment data for the four districts of North-Eastern Bulgaria, the number of the jobs created by this scenario is equal to 44% of all unemployed in the area and to 2.3% of the population of municipalities in the extraction area.

Full Production

In the event that all blocks are developed, the following macroeconomic effects are likely to be seen.

During this 30-year-exploitation-drilling phase the total investment is estimated at EUR 22.5 billion (800 production wells per cycle or 4 000 production wells for the whole period). The expected net sales of the extraction companies (for the above mention volume of natural gas of 16 bcm per year or 480 bcm for the whole period) is estimated at EUR 103.4 billion.

Direct contribution of the project is even more significant than in the Optimistic scenario as the annual average value added will account for 5.1% of GDP and 6% of the overall GVA in the economy,

contributing approximately EUR 2.1 billion to the GDP[9]. This implies that shale gas operators will have substantial share of industrial production in the country.[10]

In terms of investment the direct effect will be more significant as the projects will account for 9.3% of overall investment in the country. The calculation is based on 2013 volume of investment - EUR 8.3 billion.

The two tables below provide information for job creation, welfare (household consumption) and fiscal benefits resulting from shale gas development stages.

Job Creation by Shale Gas Development Stages

Job creation	Direct	Indirect	Induced	Knock-on
Seismic stage	282	135	81	
Appraisal stage	375	597	120	
Production stage	3,000	1,058	200	33,200

Key Impacts on Jobs, Household Consumption, and State and Local Budgets for Different Stages of the Full Potential Scenario

Area of impact	Seismic stage	Appraisal stage	Drilling stage
Human capital (jobs)	498	1,092	4,241
Knock-on (jobs)	-	-	33,200
Employment (man/years)	306	789	76,338
Multiplier (direct vs others)	1.76	2.91	12.48
Consumption (EUR)	1.4 mln	9.6 mln	1.325 bln
Fiscal impact (EUR)	1.99 mln	4.8 mln	3.4 bln

The table below compares the values of investment, job creation, knock-on effects, fiscal impacts and GVA between different scenarios.

Main Economic Effects of Different NGS Scenarios

Scenario	Investment (mln. EUR)	Jobs (number)	Knock-on (mln. EUR)	Fiscal impact (mln. EUR)	GVA (mln. EUR)
Limited Exploration	256	530	0	23	167
Low Shale	9 480	25 897	7 190	8 210	28 541
Optimistic Shale	16 863	32 611	8 987	12 984	48 758
Full Potential	26 835	39 031	10 106	18 064	73 721

[9] Reference values for GDP, GVA and investment are for 2013.

[10] Calculation, again, is based on 2013 volumes of GDP of EUR 40.4 billion and GVA of EUR 34.7 billion.

Economic and Social Impacts from Prospective Explorations and Production of Natural Gas from Shale in Bulgaria

Introduction

This study of socioeconomic impacts of natural gas from shale (NGS) exploration and production in Bulgaria has been initiated by KC2 Ltd. The idea is to outline the potential costs and benefit for the economy from such development, thus contributing to the rational public debate and policies. In Bulgaria such debate has not even started yet, but it takes place in the EU, both on the level of the EU institutions and in the member states.

We expect that the shale gas exploration and development will be encouraged in Bulgaria on sound environmental grounds, rather sooner than later. Such developments have recently taken place in France[11] and UK,[12] and in East European countries like Poland, Lithuania, Ukraine and Romania.[13] Bulgaria's delay in starting exploration, combined with the available information in reserves, may alienate investors.

In our view, the EU and Bulgaria legal frameworks provide a sound background for NGS exploration and production. This is why our focus is the impact on the economy and the jobs.

The study is a typical analysis of projects associated with economic development; the classic cost-benefit analysis of direct, indirect and induced impacts is modified to reflect the peculiarities of NGS process. The methodology is explained in detail in the Attachment 1, additional information is provided in the text in necessary.

Macroeconomic Impacts of Shale Gas Extraction

Why Bulgaria needs natural gas from shale?

Natural gas from shale could reduce Bulgaria's energy dependency, and provide economic growth, new jobs and fiscal benefits.

A safe and environmentally sound exploration is crucial for this process if guaranteed by a strong regulatory and monitoring regime for exploratory extraction activities. In late 2013, this approach towards natural gas from shale was undertaken by scientific institutions (e.g. Académie des Sciences of France), public health authorities (e.g. UK Department of Health), and the European Commission. Recently, on 22 January 2014, based on 2013 impact assessments and recommendations, the Commission adopted a Recommendation that aims at ensuring greater clarity and predictability to

[11] See: The Academy of Sciences Says France Should Pursue Shale, 23 November 2013, at:http://www.naturalgaseurope.com/academy-sciences-france-shale-schiste-gaz-huile.

[12] Next steps for shale gas production, Department of Energy and Climate Change, 17 December 2013, at: https://www.gov.uk/government/news/next-steps-for-shale-gas-production .

[13] Technically Re coverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries Outside the United States, USEIA, June 2013, p. VIII-1 a.f., and X-1 a.f.

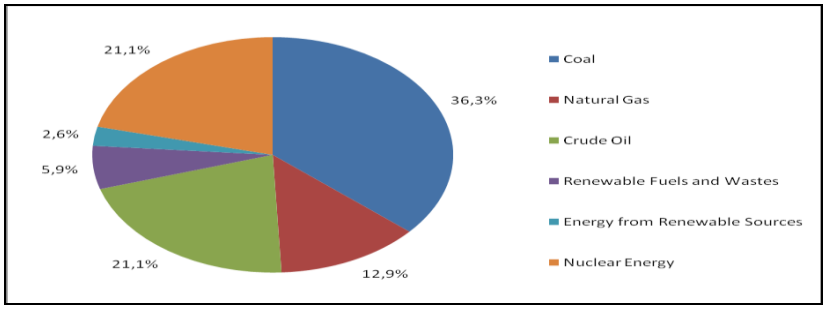
public authorities, market operators, and citizens of the EU, with regards to extraction of unconventional hydrocarbons, such as shale gas.[14]

We believe that Bulgaria environment and mineral rights frameworks are sufficiently strong to meet the highest EU and global standards. For this reason, in this study we focus mainly on economic and social impacts of potential shale gas activities in the country.

Natural gas in Bulgaria

About 13% of Bulgaria's energy demand is met by natural gas in 2012[15].

Figure 1: Share of Respective Energy Source in Gross Domestic Consumption of Energy in Bulgaria in 2012



Source: NSI.

Sources like coal, crude oil and nuclear energy account for much larger share of the total energy demand than natural gas. This constellation results from relatively high prices of natural gas in the country, probably due to lack of diversification of supplies and sufficient infrastructure, especially for household consumption. The price setting system in the country's energy market shifts industrial consumer preferences towards sources other than natural gas. *Bulgargas*, the public supplier of natural gas, often sells to local consumers below the purchase price. However, this cross-subsidization has little impact on household consumers' incentives to use natural gas.[16]

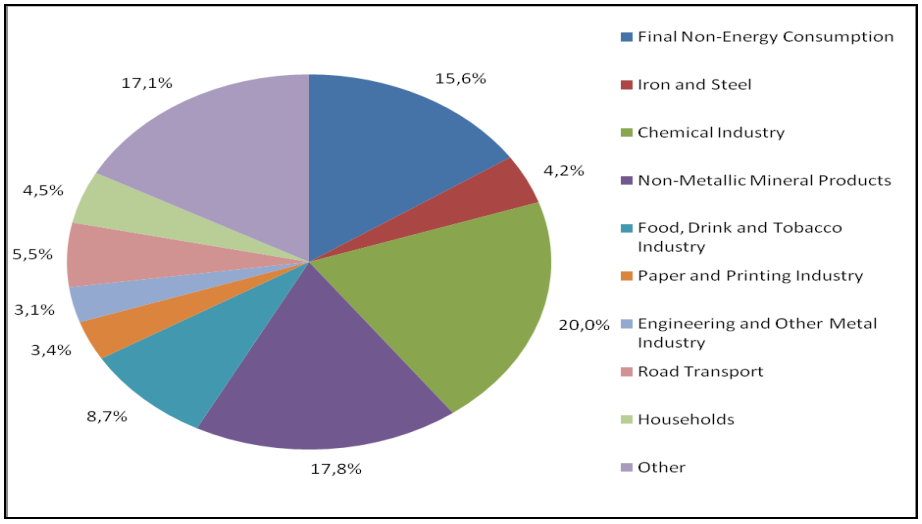
Non-energy consumption accounts for around 15.6% of the final consumption of natural gas. Major consumers of natural gas in Bulgaria are the industries of chemical and non-metallic mineral products, with respectively 20% and 17.8% of the final consumption.

[14] See the recommendation and the impact assessments at: http://ec.europa.eu/environment/integration/energy/unconventional_en.htm .

[15] Own calculations based on NSI data on the overall energy balance sheet, see: http://www.nsi.bg/en/content/5057/overall-energy-balance-sheet.

[16] In fact, this is a case of a quasi-fiscal subsidy; we take it into account in the analysis of potential fiscal impacts.

Figure 3: Final Consumption of Natural Gas in Bulgaria in 2012



Source: NSI.

Gas consumption is significantly lower in other energy-intensive industries like iron and steel, non-ferrous metal industry, ore extraction, etc. The household consumption of is more or less negligible despite the increasing number of residential buildings suitable for using natural gas.

Import dependency and diversification

In 2013, Bulgaria produced only about 10% of the natural gas delivered to the economy due to depletion of extraction and increased imports.

Reserves are being depleted so imports may soon/eventually become the only source of natural gas. However, new natural gas exploration and extraction is planned and infrastructure diversification is also under way by building interconnectors. The interconnectors to Romania are scheduled to be operational in 2014, while the pipelines to Turkey, Greece, and Serbia are still to be designed and build.

Market conjecture for Bulgaria is specific: Bulgaria has higher natural gas dependency than benchmark countries (Poland and Romania). Poland's natural gas dependency is currently 75%[17]. Romania is quoted by EUROOSTAT as one of the EU countries with lowest energy dependency rate (below 30%) along with Denmark, Estonia, Czech Republic and UK.[18] At the same time, Romania's natural gas dependency is also 75%, while the overall EU is 62%. Bulgaria is mentioned by the EU as one of the many countries "importing almost all of their gas needs", 94% for the period 2006-2010.[19]

[17] See: http://polishshalegas.pl/en/benefits/for-poland, or for greater detail: Andrzej Cylwik, Katarzyna Piętka-Kosińska, Katarzyna Lada andMaciej Sobolewski, Ekonomiczny potencjał produkcji gazu łupkowego w Polsce w latach 2012-2025. Analiza scenariuszowa, CASE, WArsaw, 2012, 53, at: http://www.case-research.eu/sites/default/files/publications/CASE_shalegas_nastrone_0.pdf.

[18] EUROostat, Energy production and exports, August, 2012, at: http://epp.EUROostat.ec.EUROopa.eu/statistics_explained/index.php/Energy_production_and_imports .

[19] Member States' Energy Dependence: An Indicator-Based Assessment, DG Economic and Financial Affairs, Occasional Papers 145, April 2013, p. 12, 14, and 82-93, at: http://ec.EUROopa.eu/economy_finance/publications/occasional_paper/2013/pdf/ocp145_en.pdf. Using the EU definition of nuclear fuel, this paper estimates the total primary energy dependency at 47%. However,

Nevertheless, the long-term import dependency could be avoided by extraction of natural gas from shale. As energy source, gas could replace the coal, which fails to meet environment standards in electricity generation and household heating, and when electricity and heating used by households and companies gradually switch to natural gas.

Another advantage of extraction of natural gas from shale is greater energy security, since major interruptions of gas supplies could be very harmful to the economy. Such crisis occurred in 2009 because of problems between Russia and Ukraine. As a result, the recession deepened, worsening the economic performance of the country. In order to secure the energy supply, the production of fuels should be maximized and the energy should be used more efficiently. Additionally, a diversification of the energy supply will strengthen the bargaining position of the buy-side of the market.

The experience of other countries is similar. According to UK government advisor Alan Riley,[20] the impact of the shale gas production in the United States has been stunning. United States production of shale gas has increased from 1% in 2001 to around 35% in 2011. The USEIA data estimations indicate that the United States has 25 trillion cubic meters (tcm) of technically recoverable resources of shale gas combined with conventional resources enough to support the United States for 200 years.[21]

The availability of shale gas in the United States has led to falling prices well below European or Asian levels. This led to a major increase in gas usage, undermining the coal market. The use of coal fell from 50% in 2005 to around 30% of all power generation[22].

In addition, low gas prices contributed to the revival of the manufacturing industry by creating grounds for chemical and other energy intensive sectors/companies to return to the United States.

The gas market is different from any other energy market due to the "point to point" nature of pipeline gas and the significant transport costs of liquid natural gas. It should be noted that while there is no global gas market with a single price, market developments on one part of the planet can have a significant effect on other parts of the globe. For example, when shale gas production in the United States started the market for LNG collapsed, causing a major fall in gas prices in British and Dutch hubs. As a result, Gazprom had to offer significant discounts to a number of its key EU customers[23].

What was also significant in the case of the United States is the extra supply brought to the market. Given the reduced needs for imports and the increased fossil fuel exports, the market supply on the global level became higher, leading to lower prices.

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taking into account that the nuclear fuel for the *Kozloduy* NPS is supplied by Russia, the primary energy dependency of Bulgaria is 72% (see: Plamen Tzevetanov a.c., Elektroenergetikata na Bulgaria: razvitie i obshtestvena tzena, Sofia, BAS Marin Drinov, 2009, str. 73 - the source is in Bulgarian). For the same reason, the EU paper makes similar unrealistic assessment for Estonia and Lithuania.

[20]Alan Riley, The Geostrategic Implications of the Shale Gas Revolution, at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/224434/evidence-alan-riley.pdf

[21] For EU and US sources of shale gas extraction prospects see paragraph Sources in Annex 1.

[22]According to US Energy Information Agency's data.

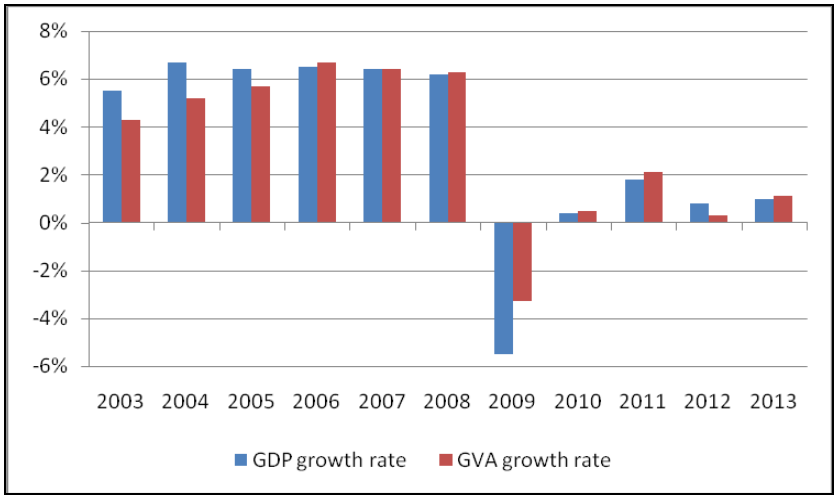
[23]Alan Riley, Op.cit.

Overall description of economic impacts

Current Economic Situation

The framework of Bulgaria's economic development during the last 10 years is set by NATO and the EU. Synchronization of legislation to the Acquis Communautaire and reforms, such as the introduction of a currency board arrangement, privatization of state-owned enterprises, product and services markets liberalization, and lowering and flattering income taxes between 2003 and 2008, put Bulgaria on the track of higher economic growth and faster catching-up to the EU average levels. The growth was fueled by record inflow of FDI (e.g. 28-29% of GDP in 2007 and 2008), resulting from combination of good profitability prospects, abundant liquidity (on the international capital markets), and low perceived risk at the time.

Figure 4: GDP and GVA Growth Rates in Constant Prices



Source: NSI and *KC2 Ltd*. estimations.

The average annual GDP growth rate in the years preceding the crisis of 2009 was 5-6%. In the years after the crisis, the growth is not impressive, and the GDP decline of 2009 will be restored only in 2014.

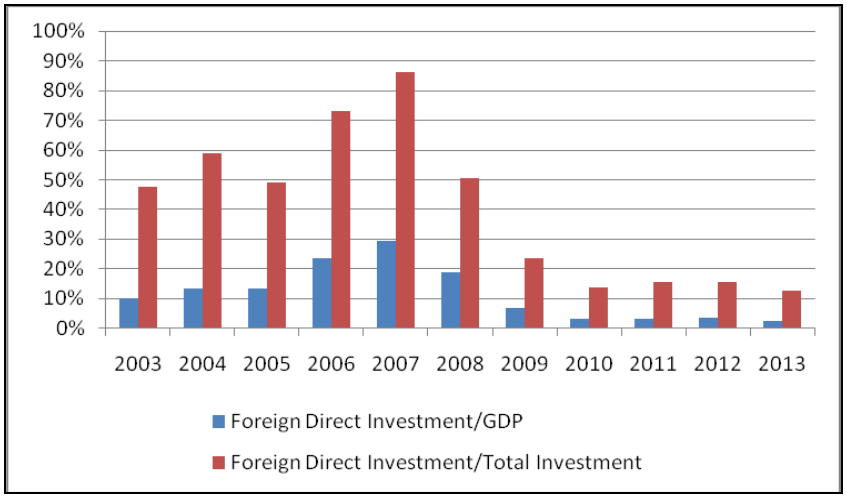
In 2007, Bulgaria joined the EU as the poorest country. In 2013, it is still the poorest one, having income per person of only 48%[24] of the EU average, as measured in constant prices[25].

In 2013, Bulgaria's economy grew by roughly 1% in constant prices. FDI downward trend continues, contributing to the overall decrease of the volume of investment in the country. The economy is driven mainly by exports, while consumption growth is negligible. On the supply side, the best performing sector in terms of value added is agriculture; the growth of the industrial and services sectors is relatively small.

[24] KC2 Ltd. estimations based on EUROSTAT data.

[25] This is the purchasing power standard used for international comparisons. It assumes the same price level in compared economies and then the level of income per inhabitant is calculated with regard to this price level.

Figure 5: FDI as Share of GDP and of Total Investment in Bulgaria



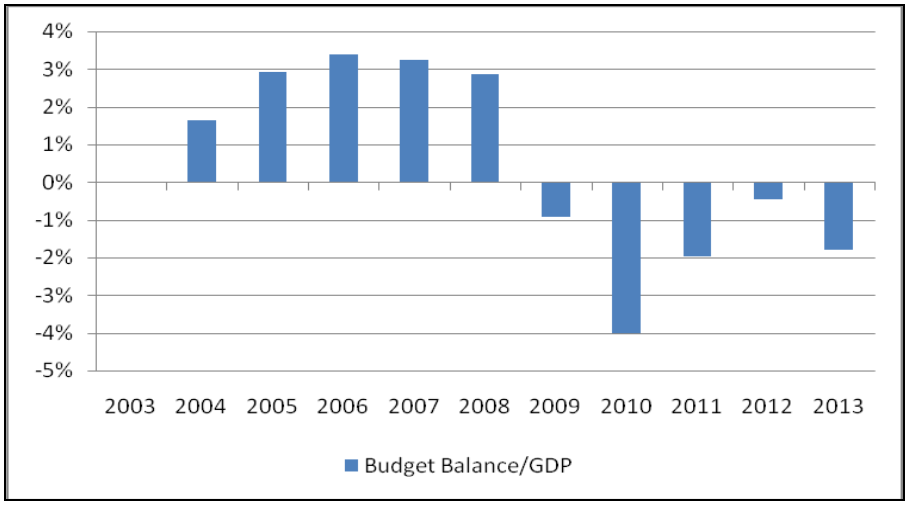
Source: BNB, NSI and *KC2 Ltd*. estimations.

The lower share of FDI in the post-2009 period (irrespectively the fact that FDI's still contribute around 50% of the annual fixed capital formation), combined with the decline in the overall investment, created the need for new source of financing to become available in the economy. Domestic saving could potentially be such source, as they have reached historically record levels of above 40% of GDP. The economic uncertainty, high level of unemployment (above the EU's average), attractive returns on bank deposits in the past, the need to service old household and corporate credits – all these factors lead to increased savings rate and lower propensity to consume. Unfortunately, this is not sufficient to offset the drop in foreign and total investment in the Bulgarian economy.

Labor market is one of the most negatively affected. The adjustment to the crisis happened at the expense of lost jobs. In 2013, the unemployment rate stayed relatively stable at around 12.8% of the workforce compared to an EU average of 10.9%[26]. The number of employed persons does not show any upward trend either, despite a small increase in mid-2013 in comparison to the previous year. Meanwhile, the average real wage increased by 3.9% during the year, i.e. the real income of wages is higher in 2013 as the rate of inflation is 0.9%.

[26]According to EUROSTAT data.

Figure 6: Budget Balance as a Percent of GDP



Source: Ministry of Finance and NSI.

The fiscal sector seems stable compared to the EU average as the budget deficit is 1.8% of GDP. However, last five years are characterized by a clear budget deficit tendency leading to higher government debt and higher interest expenditures to service this debt. Political instability in the country could also contribute to higher required returns by investors as the perceived risk of the country increases, providing for higher interest rates on government securities. In December 2013, the leading credit rating agency *Standard & Poor's*, revised Bulgaria's outlook from stable to negative. Yet, the fiscal track record of the country is still considered strong.

The overall performance of Bulgaria's economy in 2013 is better than the EU average but is not sufficiently good to allow for catching up in terms of income and living standards at the pace of pre-crisis years. This generates public discontent and political populism, "but the long-waited revival of the economy is a challenging process in which unconventional solutions should be sought.

In the context of the economic legacy of 2013 and the prospects for 2014, we attempt to identify and analyze the impacts of the provisional extraction of natural gas on production costs, investment, new jobs creation and business activity, and the probable positive effects on national and local budgets.

Description of the sample block for shale exploration and production

The preliminary estimations for Bulgaria reserves indicate about 300 bcm[27] of technically available resources for the block of Novi Pazar[28], which could be enough to satisfy the 2013 consumption of natural gas for 87 years ahead[29]. If those reserves estimations prove to be accurate and there are no

[27]According to USEIA, see footnote 6.

[28] Technically recoverable resources represent the volume of estimated in-place natural gas, which is recoverable using the current exploration and production technology, without regards to cost. Economically recoverable resources come from technically recoverable natural gas, for which the costs of discovery, development, production, and transport, including a return on capital, can be recovered at a given market price.

[29]*KC2 Ltd*. calculation based on Bulgaria's natural gas consumption in 2013.

major changes in the industrial and consumption structure, Bulgaria may sustain itself through its own natural gas resources till 2100.

As indicated by USEIA, the Sofia University, and BAS Shale Gas Research Group, the block covers more than 4,000 square kilometers. It includes and neighbors four districts (Shumen, Varna, Dobrich and Silistra), it includes several smaller towns (Novi Pazar, Kaspichan, Pliska, Kaolinovo, Tervel, Valchi Dol, Suvorovo and Aksakovo); twenty municipalities and 219 villages. For 2012, the population of the area is approximately 969 thousand people, the regional unemployment (18.6%) is higher than the average for the country (12.3%), and the family income is 11% lower than the national average. (If we exclude Varna, the income is 13-14% lower than the country average).[30]

Economic Impacts

We have attempted to demonstrate the effects of a hypothetical shale gas project in Northeastern Bulgaria through the following macroeconomic indicators:

- Gross output: A measure of the total quantity of goods and services produced by a company or a project with all inputs in the product/service factored in;
- Gross Value Added: the value of a good or service, excluding the input in it. It is typically measured in total wages, social insurance contributions, income taxes, profits, depreciation, royalties paid by a particular project or enterprise;
- Investment – measures the fixed capital that a company invests in a certain project or enterprise.

The above are examples of direct effects to the economy of a typical NGS activities.. Additional benefits could result in related industries such as thermal power plants or chemical factories, which will profit from a cheaper, more easily accessible, and lower in carbon emissions, natural gas. The effects that stem from a less costly resource that materialize through the industrial and consumption value chains are called knock-on-effects and further reinforce the overall competitiveness of a country's economy through impacts on technology innovation, labor, and education (skill building).

Reviewed and outlined are three distinct scenarios for the development of a gas from shale formations project with associated set of benefits and effects.

"Limited Exploration" Scenario (8 Years Duration)

Under this scenario the project is developed over an eight-year period and results in no discovery of recoverable resource. There two options:

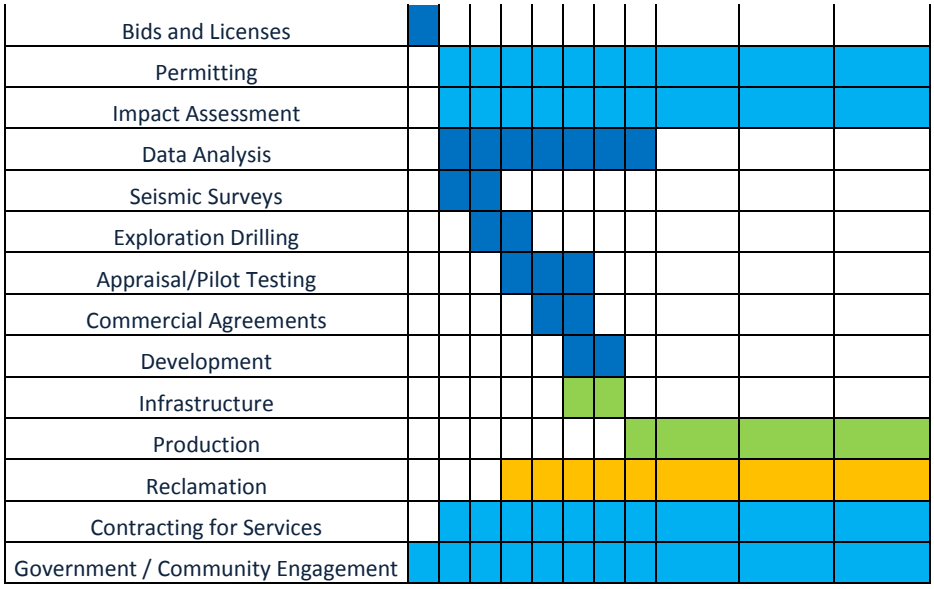
- Conducts exploration, generates geological data that confirms a given resource level, but does not continue forward into a production phase
- Conducts exploration but does not turn in data confirming a given resource level

For economic assessment purposes we distinguish two project phases: seismic/geophysical data acquisition phase and exploration/assessment drilling phase. Importantly, all work done within those two phases would be at no risk to the Bulgarian government.

Table 1: Timeline of standard NGS developments

activity/years	1	2	3	4	5	6	7	8	9 … 10	11 … 20	21 … 40

[30] Other blocks for shale gas exploration are very similar as a socioeconomic legacy.



In the span of those two phases an oil and gas company takes data on the geophysical qualities of the terrain on which it will be working and performs test drilling to determine whether there is a technically recoverable resource, what are its estimated quantities, and where the most productive drilling locations are.

Even though this scenario does not envision long-term benefits stemming from a proven resource base, the benefits associated with services induced by the exploration company over the eight-year period should not be underestimated. Such benefits are: increased sales by services providers, temporary job generation, revenues to the national budget, success bonus payment that typically accompanies the license execution, exploration fees, direct and indirect taxes, municipal taxes and fees (e.g. water use fees, land lease and easement right payments, rents). There are positive externalities such as water wells and, perhaps, waste deposit facilities that will remain municipal property after they have been built by the investor.

The major impact in terms of gross output arises only from investment activities as there are no sales or profits during these initial phases. Additional or indirect GVA is a result of suppliers' activities. Its share in the national economy is rather small.

The GVA of direct activities is EUR 90.8 million for seven years. This is a significant local effect, but not a considerable contribution to the total GVA of Bulgaria. In other words, the effect is visible in terms of investment (and costs to the exploring agent) but is still insignificant as a knock-on effect on the economy.

Table 2: Economic Impacts of Limited Exploration Scenario (in million EUR), over 8 years

Total	Direct	Indirect	Induced	Total effects
Gross Output*	**241.0**	**117.8**	**3.7**	**362.4**
Gross Value Added	**90.8**	**75.0**	**1.4**	**167.3**
Investment*	**241.0**	**14.6**	**0.5**	**256.0**

Source: *KC2 Ltd*. calculations. **Note*: Output and Investment are the same thing as there are no sales

The table above quantifies the benefits of a typical NGS project over 8 years. The estimated direct capital investment over roughly 5 years covers the activities associated with drilling of appraisal and

pilot wells. The assumed number of wells is 4, while the total direct investment including office and personnel costs is EUR 241 million for whole the period.

The GVA impact number shows that the project and its suppliers will add value to the national and local economy of approximately EUR 167 million through salary payments, taxes, and fees, even without the benefit of any profit from gas sales. Since there is no extraction of natural gas from shale, and thus not sales are realized, prices remain the same. Companies in the metallurgical, petrochemical, fertilizer and related industries, as well as households in Bulgaria, do not benefit from a reduction in prices.

Hence, in this scenario there are no knock-on effects. The positive effects from the efforts of the exploring agent to prove NGS resources and identify, at its own costs, the geological potential of the country are the following:

- An upfront bonus payment upward of EUR 20 million will result in a direct inflow to the state budget;
- The seismic phase work will support 27 jobs in local hospitality and other local service providers over more than 8 months;
- Income-induced effects of approximately EUR 664,000 inflow to the national budget through social security payments, personal and value added tax, and excise duties;
- Average monthly salaries for the project can be several times higher than the average Bulgaria gross salary as of 2013 as this stage mobilizes mostly highly qualified specialists and geologists;
- The types of jobs that such exploration project will support are: engineers, geodesists, truck drivers, machine-operators, drill site builders, construction workers, water wells and waste water reservoir professionals, lawyers, environment experts, real estate brokers, finance specialists, and services sector jobs induced by consumption on the project.
- The tax impact created by project-related jobs is estimated at EUR 1.6 million;
- The cash that will enter the economy as a result of project-induced consumption is approximately EUR 3.2 million.

Table 3: Job creation of the Limited Exploration compared to Production of NGS (Optimistic Scenario)

	Direct	Indirect	Induced	Knock-on effects
Seismic	94	45	27	
Appraisal drilling	125	199	40	
Extraction	1,800	635	120	29,526

Source: KC2 Ltd.

Low Shale Scenario, Life Span 40 years

This scenario assumes that there is a proven economically recoverable resource that is produced under the current strict EU environmental and operational frameworks. The volume of gas we have assumed under this scenario is 4.8 bcm per year. The value of 4.8 bcm is derived from the assumption of minimum 48% proven technically recoverable resource from the total estimated (by USEIA) volume of reserves, which is extracted over a period of 30 years. It comes in addition to geophysical/seismic data collection and exploration and appraisal drilling phases. The total life span of a project under this scenario is 40 years.

A key feature of this scenario is the source of significant alternative supply of natural gas that is of domestic origin and has the potential to generate competition on the Bulgarian natural gas market, pushing prices downward as a result of supply outweighing demand. It is important to note that currently Bulgaria consumes gas of only 2.9 bcm (2013 data), with most of the consumption taking place in the electricity generation sector. KC2's projections are for a 25 percent drop in the whole-sale price of natural gas reaching approximately EUR 241.6 per 1,000 m^3, compared to the present fixed price of EUR 322.1. We envision that this market dynamic would cause, due NGS price competitiveness effects, an increase in domestic consumption to potentially 4.3 bcm.

Eventually, we project a gas dependency ratio dropping down to around 70-71%.[31]..

Economic Impacts

The major effects arise from NGS production phase which is associated with a significant volume of investment and sales (in constant prices).

Table 4: Economic Impacts of Low Shale Scenario (in million EUR)

Total	Direct	Indirect	Induced	Knock on	Total effects
Gross Output	41,809.9	947.9	480.2	18,441.0	61,679.0
Gross Value Added	20,659.3	504.7	187.2	7,189.9	28,541.2
Investment	7,021.6	117.3	59.4	2,281.7	9,480.0

Source: KC2 Ltd.

During the 30-year production phase total investment is estimated at EUR 6.78 billion including 480 wells operated by 5 cycles (or total 2 400 wells), while the expected net sales (of 4.8 bcm per year or 144 bcm for 30 years) of the company is estimated at EUR 34.8 billion.

Direct contribution of the project for the entire period is quite significant as the annual average new value added to the economy will account for 1.7% of GDP and 1.98% of total GVA. (The calculation is based on the 2013 volumes of GDP of EUR 40.4 billion and GVA of EUR 34.7 billion.)

In terms of investment, the direct effect is more significant as the project will contribute on average 2.83% of the overall investment in the country on annual basis (based on volume of investment for 2013 - EUR 8.3 billion), or roughly, 1/30 of the current fixed capital formation measured in constant prices[32]. The multiplier in terms of indirect and induced activities is rather small but the competitiveness, or knock-on effect, for the economy as a whole is impressive.

The knock-on effects of extraction of natural gas from shale on the overall economy are not associated to the direct, indirect or induced activities of the project itself. Instead, they stem from the lower price of natural gas. This price is expected to decrease as a result of increased competition in gas deliveries. Natural gas is used as an energy source for households and companies, and as a raw material for some industries. Considerably lower energy costs will generate a boost in productivity, and thus, a new value added to the economy. There will be a sustainable long-term impact not only for GVA but also in term of job creation, investment, and gross output.

[31] This would be a significant improvement compared to EU Commission estimate for Bulgaria natural gas dependency of 94% for the 2006-2012 period.

[32] Gross fixed capital formation was 20.5% of GDP in 2013.

Expected increase of value added will accelerate the annual average economic growth rate by 0.6%, or EUR 238.4 million per year, for 30 years (the production phase of the project), thus increasing the GDP at the end of period by 20% in constant prices.

It should be noted that this forecast is rather conservative because it does not account for the dynamic effects arising from changes in consumer preferences that could reinforce the impacts. Also, in order to be consistent with the conservative approach, we did not calculate the direct and indirect effects associated with the follow up activities to restore the environment in its original condition.

Job creation

As the extraction stage is a mix of constant building and development of new wells in conjunction with extraction of gas, the total number of personnel rises to 1,755 workers.

The contractual arrangement for most of them is long-term, since their contribution will be needed for the period of 30 years. Core staff includes 800 jobs (total for 8 crews) to sustain drilling process and 200 jobs to maintain the site during exploitation and extraction of natural gas from shale (57% of all human capital).

Business service providers will create jobs for 635 people to facilitate the main gas extraction activities – drivers, machine-operators, building personnel, engineers, lawyers, consultants, etc.

Induced (immediate) business that would serve the shale gas operator will develop 120 jobs for a long-term period.

There would be an extraordinary accumulation of resources and human capital that are constantly engaged in the process. The immediate fiscal impacts of the workforce would reach EUR 380 million and economic effect of consumption in the local region would be EUR 476 million (see details below).

This phase will engage at least 40 000 man/years in the process of shale gas development. The average monthly salary will reach nearly 3.6 times the average gross salary in the Bulgarian economy for 2013.

Fiscal Impacts

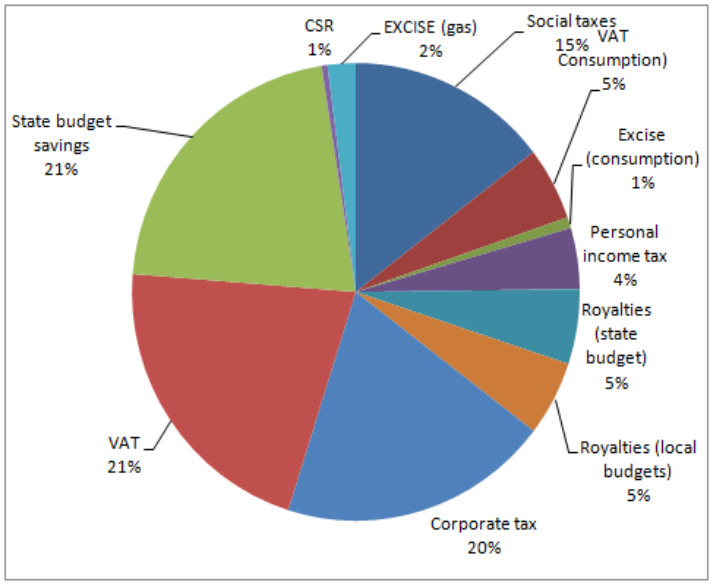
Fiscal impacts of a shale gas project is accumulated through different economic channels based on consumption, turnover, profitability, use of natural resources, staff wages, social activity, etc. The availability of a primary energy source like natural gas from shale demonstrates interesting and non-trivial fiscal impacts.

Table 5: Summary fiscal effects (Law Shale, in EUR bln)

Key fiscal effects	EUR (bln)
TOTAL FISCAL CONTRIBUTIONS	8.2
VAT AND EXCISE DUTIES	2.4
ROYALTIES	0.9
SOCIAL SECURITY AND PERSONAL TAX	1.5
CORPORATE TAX	1.6
LOCAL TAXES NAD FEES	0.5
KNOCK-ON IMPACT	2.5
BUDGET SAVINGS	1.7

This scenario will generate total fiscal contributions of EUR 8.2 billion for the period. This is mainly based on knock-on jobs creation effect (23,612 jobs) and the expected natural gas sales. On annual basis the fiscal impact is 1.8 % of state budget revenues or additional revenue of EUR 38 per capita.

Figure 7: Distribution of fiscal impacts (Low Shale)



VAT and Excise duties will generate tax revenues of EUR 2.4 billion. Of this figure, 20% can be attributed to households consumption of the workforce associated with the natural gas from shale development; knock-on activities effect on VAT is estimated at EUR 0.787 billion.

Royalties represent a percentage of revenues and are estimated at EUR 870 million for the 30-year period, half of them contributing directly to the state budget by increasing the current annual revenue from concession fees by 15%.

The other 50% are earmarked to municipal budgets of the concession areas. Annual local impact is considered to be EUR 16 million per annum and include community (CSR) programs, municipal taxes and fees, and local concession revenues. This annual contribution is equal to 8% of all regional municipal revenues in the four districts of the area (including district centers of Shumen, Dobrich, Silistra and Varna).

Personal and corporate income taxes will contribute EUR 1.95 billion, or 3.3% of total direct tax revenues in per annum. Social security payments will amount to EUR 1.19 billion (both employer and employee payments). This figure represents 1.29% of current social security budget contributions per year.

Table 6: Fiscal Impacts of Low Shale Scenario (in EUR mln, 40 years)

FISCAL EFFECTS (mln. euro)	Direct	Indirect	Induced	Knock-on	TOTAL
Social taxes	188.99	27.86	5.84	971.15	1 193.84
VAT Consumption)	-	-	79.42	345.25	424.67
Excise (consumption)	-	-	11.91	51.79	63.70
Personal income tax	55.99	8.26	1.78	287.71	353.74
Royalties (state budget)	434.85	-	-	-	434.85

Royalties (local budgets)	434.85				434.85
Corporate tax	625.74	565.06	189.96	220.57	1 601.33
VAT	1 269.53	31.02	11.50	441.83	1 753.88
State budget savings	1 748.61	-	-	-	1 748.61
CSR	35.36	-	-	-	35.36
EXCISE (gas)	164.51	-	-	-	164.51
Local taxes & fees	1.50				1.50
TOTAL	4 959.93	632.20	300.41	2 534.43	**8 210.84**
CONSUMPTION*			476.49	2 071.53	2 548.02
SOCIAL PRIVATE**	77.15	11.38	2.45	396.39	487.37

Source: NSI data and KC2 Ltd. estimates
Notes: *This is the volume of consumption generated by the extraction activities. **Includes typical contributions to private pension and healthcare funds.

The knock-on fiscal effect is still the largest of all - EUR 2.53 billion for 40 years (30.8% of all fiscal impact).

There is an additional fiscal saving of EUR 58 million a year, which is *Bulgargas'* current loss for realizing sales below the purchase price.

The table above provides exact figures of fiscal contribution by different budget channels. The calculations do not take into account local taxes and fees for direct and indirect effect, since it is assumed that subcontractors and service providers pay those irrespective of the extraction facilities while the new vehicle and road taxes are associated with the core business.

Induced and know-on effects related to increased VAT and excise contributions are calculated at the average propensity to consume, based on the NSI household and GDP data.

The CSR includes estimation of cash spent on community project, workforce training, work safety courses, and the like.

Optimistic Shale Scenario

Assumptions

This scenario assumes that there is a political decision in favor of exploration and extraction of natural gas from shale. Currently, strict frameworks to protect and monitor the environment are in place and preliminary estimates of the economically recoverable volumes of deposits are confirmed.

Such decision would provide grounds for a successful shale natural gas extraction project.

The volume of extracted natural gas from shale is 9.6 bcm per year. In comparison to the limited shale gas scenario, the necessary investment is the same but the economic effects are even more prominent. This is due to the fact that the assumed volume of extractable natural gas is twice the amount in the limited shale gas scenario. Hence, the same investment of EUR 13.5 billion (480

production wells per cycle, a total of 2 400 production wells for the whole period) generates even greater socio-economic impacts.

The Optimistic shale scenario includes three phases as well, same as for the limited shale gas scenario. The seismic exploration phase will take two years, the appraisal drilling phase will take five years, and the extraction phase will take thirty years. Overall, the project will be developed over a 40-year period. A subsequent environmental investment is required by the standard framework and natural gas development practices, however such an investment is not included in the calculations.

Higher natural gas quantity supplied to the market will lead to even lower price compared to the limited shale gas scenario: we expect the whole-sale price to drop by 30% to EUR 225.5 from its present level of EURO 322.1. Again, the quantity supplied will be higher than the quantity demanded pushing down the prices. Domestic consumption will reach 4.5 bcm as a result of lower gas prices[33]. Gas dependency ratio will be lower than the one in the previous scenario - 55-62%. It cannot reach zero because of the gas market and pipeline access liberalization, and we expect other players to lower price as a result of the increased competition.

Economic impacts

During the 30-year exploitation-drilling phase, the total investment is estimated at EUR 13.5 billion, while the expected net sales of the company (for the above mention volume of natural gas - 9.6 bcm per year, or 288 bcm for the whole period) are estimated at EUR 64.9 billion[34].

Direct contribution of the project is even more significant than in the previous scenario as the annual average value added will account for 3.2% of GDP and 3.7% of the overall GVA in the economy, contributing approximately EUR 1.3 billion to the GDP.[35]

In terms of investment the direct effect will be slightly greater as the project will contribute to 5.5% of overall investment in the country[36]. The multiplier in terms of indirect and induced activities is once again small, but the competitiveness effect for the economy as a whole is much stronger - the expected price decrease of 30% makes probable additional economic activity, job creation, investment, and sales.

Expected increase of value added will accelerate the annual average economic growth rate by 0.74 percentage points, or EUR 299 million per year for the 30-year duration of the extraction phase.

In constant prices this means a GDP growth of 26.6% at the end of period. Again, this forecast is rather conservative because it does not account for the dynamic effects arising from changes in consumer preferences that could reinforce the impacts.

Because of the larger volume of sales the productivity generated by the same EUR 13.5 billion investment is higher: the direct gross output is EUR 78.7 billion.

[33]The same price elasticity of the demand as in Limited Shale Gas Scenario is applied, implying higher consumption.

[34] See details on project stages in Annex 1.

[35]Reference values for GDP, GVA and investment are for 2013.

[36] For the time being, the largest FDI in contemporary Bulgaria has been AES-Galabovo construction of Maritza East One Thermal Power Plant, which contributed to 3% of the overall investment in 2009.

Accounting for direct, indirect, induced, and knock-on effects, the gross output of the project is calculated at EUR 103.9 billion, which is 19% higher than the estimated gross output of the country for 2013 (EUR 87.3 billion).

Table 7: Economic Impacts of Full Shale Gas Potential Scenario (in mln. EUR)

Total	Direct	Indirect	Induced	Knock on	Total effects
Gross Output	78,680.1	1,373.9.	797.9	23,051.3	103,903.2
Gross Value Added	38,886.3	631.3	253.5	8,987.4	48,758.5
Investment	13,742.0	170.0	98.7	2,852.2	16,862.9

Source: KC2 Ltd.

Knock-on effects on jobs, state and local budgets

The positive impacts arise from probable changes in the industrial value chains of the economy, changes in the industrial cost of production, and development of new capacity throughout the whole economy.

The knock-on impact will generate between 20,000 and 30,000 full time new jobs.

The full shale gas potential scenario assumes 29,526 jobs based on expected creation of GVA in the business. In economic values this means EUR 3.17 billion contributions to the state budget, of which EUR 2 billion come from higher wages. The household consumption made possible by the shale gas extraction is estimated at EUR 2.6 billion for 30 years.

The limited shale gas scenario reckons a creation of 23,621 jobs and economic and fiscal effects are at 80% of the alternative scenario.

The table below compares key figures for the different interconnected stages of shale natural gas development.

Table 8: A comparison of different stages effects to Full-Shale-Gas Potential Scenario

Key Figures	Seismic stage	Appraisal	Extraction
Human capital (jobs)	166	364	2,555
Knock-on (jobs)	-	-	29,526
Employment (contracted man/years)	102	263	46,000
Multiplier (direct vs others)	1.76	2.91	17.82
Consumption (EURO)	472,000	3.2 mln.	0.795 bln.
Fiscal impacts (EURO)	664,000	1.6mln.	2.6 bln.

Source: KC2 Ltd.

The expected 92% knock-on effect on jobs indicates the impacts on both competition and prosperity. The multiplier is derived empirically as a ration between the workforce, involved in natural gas extraction activities, and the potential jobs created by industrial and household consumers. The figures below visualize the knock-on job creation effects.

This scenario includes a wide range of fiscal impacts – VAT payments (EUR 4 billion), excise duties (EUR 413 million), royalties (EUR 1.6 billion), social security and health care payments (EUR 1.6 billion), income taxes (EUR 471 million), CSR (EUR 65 million), other budget savings (EUR 1.75 billion).

Table 9: Summary fiscal effects (Full-Shale-Gas Potential, in EUR bln, 40 years)

Key fiscal channels	EUR bln
TOTAL FISCAL CONTRIBUTIONS	13.0
VAT AND EXCISE DUTIES	4.5
ROYALTIES	1.6
SOCIAL SECURITY AND PERSONAL TAX	2.0
CORPORATE TAX	3.0
LOCAL TAXES AND FEES	0.8
KNOCK-ON IMPACT	3.7
BUDGET SAVINGS	1.7

Source: KC2 Ltd.

All effects can be, once again, grouped in terms of their relation to the core project activities as direct, indirect, induced, and knock-on. They are unevenly distributed between the three basic stages of the project – seismic, appraisal wells, exploitation drilling. Using the same methodology as within the previous scenario, we can summarize the fiscal impacts for the 40-year realization period of the full natural gas from shale potential. Table 10 and Figure 9 below demonstrate the share of different fiscal contributions in the total fiscal impact.

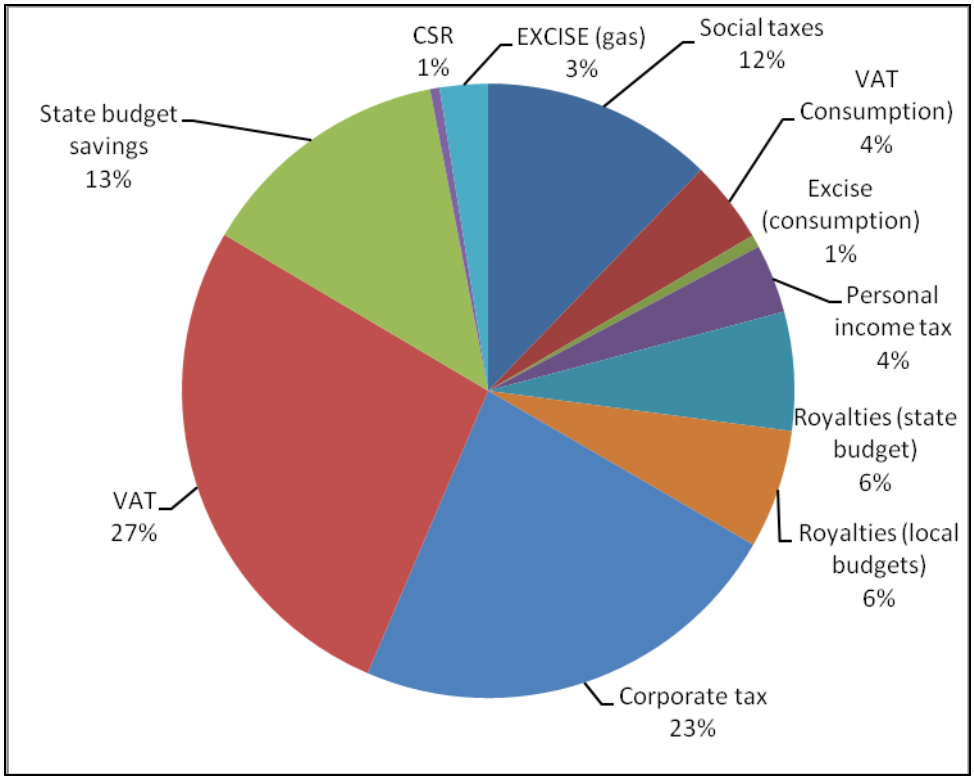
Table 10: Fiscal Impacts of Full-Shale-Gas Potential (in EUR mln, 40 years)

FISCAL EFFECTS (mln. euro)	Direct	Indirect	Induced	Knock-on	TOTAL
Social taxes	339.65	27.86	5.84	1,213.93	1,587.28
VAT Consumption)	-	-	132.98	431.56	564.54
Excise (consumption)	-	-	19.95	64.73	84.68
Personal income tax	100.62	8.26	1.78	359.64	470.30
Royalties (state budget)	811.72	-	-	-	811.72
Royalties (local budgets)	811.72	-	-	-	811.72
Corporate tax	1,168.05	966.54	324.94	539.24	2,998.77
VAT	2,384.11	35.27	11.52	1,080.17	3,511.07
State budget savings	1,748.61	-	-	-	1748.61
CSR	65.51	-	-	-	65.51
EXCISE (gas)	329.01	-	-	-	329.01
Local taxes & fees	1.50	.	.	.	1.50
TOTAL	7,760.50	1,037.93	497.01	3,.689.27	**12,984.71**
HOUSEHOLD CONSUMPTION*	-	-	797.86	2589.39	3387.25
SOCIAL PRIVATE**	138.64	11.37	2.45	495.48	647.94

Source: NSI data and KC2 Ltd. estimates

Notes: *This is the volume of consumption generated by the extraction activities. **Includes typical contributions to private pension and healthcare funds.

Figure 15: Distribution of fiscal impacts (Full-Shale-Gas Potential)



Source: KC2 Ltd.

Assessment of specific impacts on the regional economy (sample Block)

Total estimated workforce under this scenario is 32,522 people for the whole investment and extraction period. Nearly 70% of these new jobs will employ local workforce (22,765 people). This figure represents 5% of current relatively high level of unemployment in Bulgaria. Compared to the actual unemployment data for the four districts of North-Eastern Bulgaria, the number of the jobs created by the Full-Shale-Gas Potential scenario is equal to 44% of all unemployed in the area, and to 2.3% of the population of the municipalities in the extraction area.

The contribution to individual municipal budgets can be presented in monetary terms. The total extraction area for shale natural gas is 4,037.58 km^2. Assuming the royalties on the output will be distributed according to the respective municipal territories, the results would be the following, as provided in table 11.

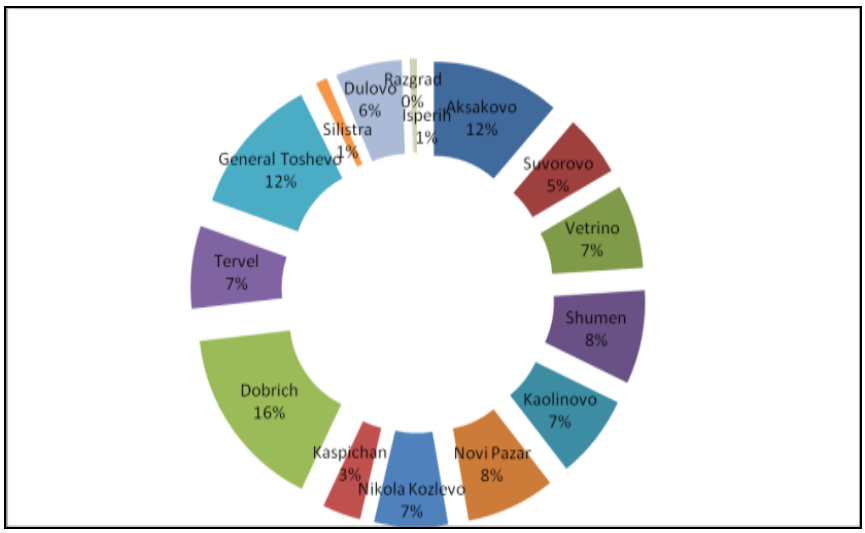
Table 11: Assessment of Concession Fees as Contributions to the Municipal Budgets (Sample Block)

Municipality	Territory (km^2)	Share in territory	Extraction km^2	Share of project area	Royalties per year (EUR mln)	Royalties - 30 years (EUR bln)
Aksakovo	460.54	100%	460.54	11.41%	3.33	0.1
Suvorovo	215.88	100%	215.88	5.35%	1.56	46.9
Vetrino	292.33	100%	292.33	7.24%	2.11	63.5
Shumen	652.30	50%	326.15	8.08%	2.36	70.9
Kaolinovo	293.53	100%	293.53	7.27%	2.12	63.8
Novi Pazar	317.65	100%	317.65	7.87%	2.30	69.03
Nikola Kozlevo	264.33	100%	264.33	6.55%	1.91	57.4

Kaspichan	275.06	50%	137.53	3.41%	0.99	29.9
Dobrich	1,296.16	50%	648.08	16.05%	4.69	140.8
Tervel	575.64	50%	287.82	7.13%	2.08	62.5
General Toshevo	982.24	50%	491.12	12.16%	3.55	106.7
Silistra	515.89	8%	41.27	1.02%	0.29	8.9
Dulovo	566.33	42%	237.86	5.89%	1.72	51.6
Razgrad	655.43	1%	4.59	0.11%	0.03	0.99
Isperih	402.24	5%	18.91	0.47%	0.13	0.04
TOTAL	-	-	4,037.58	-	29.25	0.877

Source: KC2 Ltd. calculations.

Figure 16: Share of different municipalities in total local concession revenues

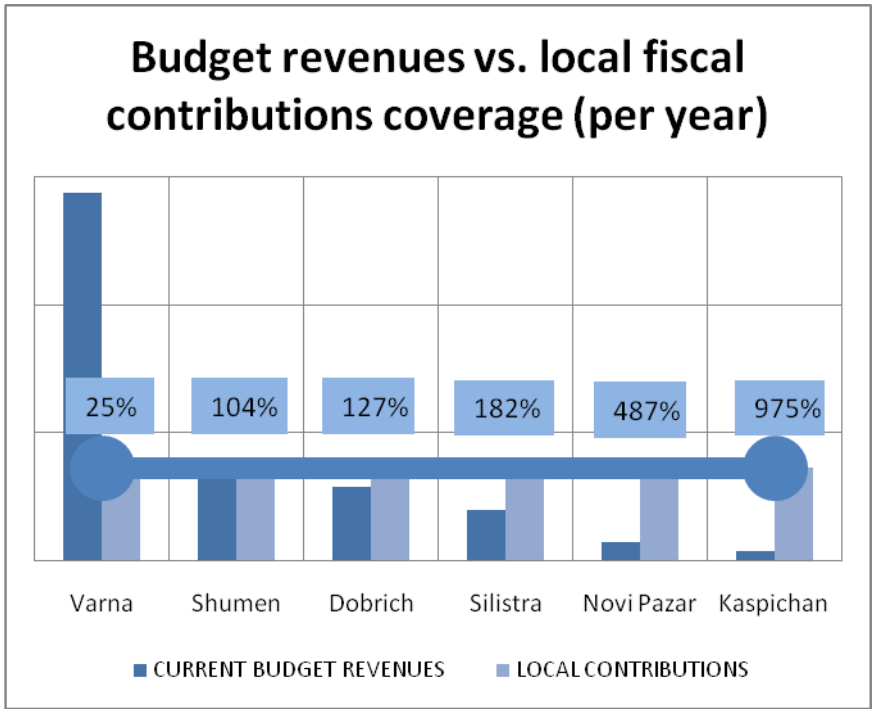


Source: KC2 Ltd. calculations

The distribution of the total royalty payments to individual local municipalities is presented in the figure above.

It is also important to recognize the ratio of the concession revenues to all municipal revenues (from all sources), including the central budget subsidy. Figure 17 demonstrates the volume of this fiscal impact for the four districts and some of the municipalities.

Figure 17: Optimistic Shale: Fiscal Impacts in Relation to Municipal in the Sample Block



Source: KC2 Ltd. calculations.

Even Varna, the richest municipality in North Eastern Bulgaria will receive 1/4 of its revenue from the shale gas extraction. The impact on poorer district centers would be even more impressive; disadvataged municipalities, such as Novi Pazar, Kaspichan, etc., have the potential to become relatively rich.

Full-Potential Scenario

The estimation of the country's Full-Potential is made for the sample and two additional blocks, Lovech and Koynare, which are assigned to different investors, taking into account natural gas price elasticity effect that typically emerges from competition. In this calculation, we do not include the Vranino block in Eastern Dobrudja.[37]

Novi Pazar Block is approximately 4,000 km^2. The other two blocks are approximately 3,000 km^2. We believe that the competition between NGS producing companies would keep the investment costs relatively low, if and when production starts.

The purpose of the assessment of the Full-Potential scenario is to outline the possible limits for NGS developments in the country. The presented calculations are conservative, since we do not include the above mentioned block.

Assumptions

This scenario assumes that there is a timely political decision in favor of exploration and production of natural gas from shale, the current strict frameworks to protect and monitor the environment are

[37] See for details: USEIA, Op. cit., p. X-23 -- X-24 and "Hydrocarbon Potential and Prospects of NE Bulgaria and Offshore Black Sea – An Overview." Sofia, Institute of Geology and Mineral Resources, 26 January 2011.

in place, and the preliminary estimates for economically recoverable volumes of deposits are confirmed.

This would mean a success of the above mentioned projects for shale natural gas extraction. Not a single company, but three different enterprises will extract natural gas from shale in the country.

The expected volume of extracted natural gas from shale is 16 bcm per year from different deposits. Total extraction area is increased approximately by 2/3 compared to the Optimistic Potential Scenario, so the total investment is also higher. The volume reaches EUR 22.5 billion (800 production wells per cycle, or a of 4 000 production wells for the whole period). As expected, economic effects are even more significant than those presented in the previous scenario. This comes from the fact that the assumed volume of extractable natural gas is 60% greater than in the Optimistic-Potential Scenario. Hence, higher volume of investment generates greater economic impacts.

The Full-Potential scenario includes three phases, the same number as in the former scenarios. The seismic exploration phase takes two years, the appraisal drilling phase takes five years, and the extraction phase takes thirty years, making the overall project duration 40 years. Again, the subsequent environmental investment, required by the standard framework and natural gas development practices, is not included in the calculation.

The higher quantity of natural gas supplied to the market will lead to even lower price compared to the Optimistic Potential Shale Gas Scenario: we expect the whole-sale price to drop by 33.1% to EUR 215.5 from its present level of EURO 322.1. Once again, the quantity supplied will be higher than the quantity demanded, pushing prices down. Domestic consumption will reach 4.5 bcm as a result of lower gas prices[38]. Gas dependency ratio will also be lower than in the previous scenario – probably below 30%, depending on international competition.[39]

Economic impacts

During the 30-year exploitation-drilling phase the total investment is estimated at EUR 22.5 billion while the expected net sales of the extraction companies (for natural gas of 16 bcm per year, or 480 bcm for the whole period) are estimated at EUR 103.4 billion.

The direct contribution of the project under this scenario is even more significant than the previous scenario as the annual average value added accounts for 5.1% of GDP and 6% of the overall GVA in the economy, contributing approximately EUR 2.1 billion to the GDP.[40] This implies that the shale gas operators will hold a substantial share of the industrial production in the country.

In terms of investment, the direct effects are slightly stronger as the three blocks will contribute 9.3% of total investment in the country (based on the 2013 volume of investment). The multiplier in terms of indirect and induced activities is again rather small, but the effect on competitiveness in the

[38]The same price elasticity of the demand as in the Optimistic Potential Scenario is applied, implying higher consumption.

[39] It cannot be zero because of the gas market and pipeline access liberalization and we expect other players to lower price facing the competition. The foreign competition is expected to be strong from NGS operations in the region, especially Romania, Ukraine and Russia, where estimated deposits are larger and the exploration is at a relatively advanced stage compared to Bulgaria.

[40]Reference values for GDP, GVA and investment are for 2013.

economy is much stronger as the expected price decrease of 33% creates conditions for greater additional economic activity, job creation, investment, and sales.

The expected increase in value added will accelerate the annual average economic growth rate by 0.83 percentage points or EUR 336.7 million per year for the 30-year duration of the extraction phase.

In constant prices this means a GDP growth of 26.6% at the end of period. Again, this forecast is rather conservative because it does not account for the dynamic effects arising from changes in consumer preferences that could reinforce the impacts.

Because of the larger volume of investment, in the amount of EUR 22.5 billion, the direct gross output is EUR 103.4 billion.

Accounting for direct, indirect, induced, and knock-on effects, the gross output of the projects reaches around EUR 155.8 billion, which is 78.5% higher than the estimated gross output of the country for 2013 (EUR 87.3 billion).

Table 12: Economic Impacts of Full Shale Gas Potential Scenario (in million EUR)

Total	Direct	Indirect	Induced	Knock on	Total effects
Gross Output	126,644.6	2,446.9	810.4	25,919.9	155,821.8
Gross Value Added	62,146.9	1,152.2	316.0	10,105.9	73,720.8
Investment	23,224.6	302.8	100.3	3,207.1	26,834.7

Source: KC2 Ltd.

Job creation and fiscal impacts

The full potential scenario assumes exploitation of all shale gas resources, which will result in direct or indirect creation of almost 40,000 long-term jobs in the economy. This is 9.09% of the current average number of unemployed in Bulgaria. NGS production will boost the induced employment (knock-on effect) through the value chains, since it would be more than 12.5 times higher than the workforce engaged in production.

Table 13: Job Creation by Shale Gas Development Stages

Job creation	Direct	Indirect	Induced	Knock-on
Seismic stage	282	135	81	
Appraisal stage	375	597	120	
Drilling stage	3,000	1,058	200	33,200

Source: KC2 Ltd.

New jobs will generate at least 77,000 man/months of constant activity for 40 years ahead. Personnel consumption will allocate EUR 1,336 bln. to the economy, or EUR 44 mln. per annum.

The fiscal impact that job creation has on state budget will reach EUR 3.4 bln., which will allow for additional public expenditures of EUR 15 per capita.

Table 14: Key Impacts on Jobs, Household Consumption and State and Local Budgets

Some key impacts	Seismic stage	Appraisal stage	Drilling stage
Human capital (jobs)	498	1,092	4,241

Knock-on (jobs)	-	-	33,200
Employment (man/years)	306	789	76,338
Multiplier (direct vs others)	1.76	2.91	12.48
Consumption (EUR)	1.4 mln	9.6 mln	1.325 bln
Fiscal impact (EUR)	1.99 mln	4.8 mln	3.4 bln

Source: KC2 Ltd.

The full potential scenario doubles the pessimistic scenario fiscal effects on the economy estimated at up to EUR 18 bln, of which 7.7% goes to local communities' budgets. This, other things equal, will increase state budget revenues by 7.5% on an annual basis, if we assume a constant 2014 state budget revenue structure. This gives an opportunity for annual public expenditures of at least EUR 83 of per capita.

The public social security system will be supported by 3.3% increase in annual revenues.

The value of paid VAT and excise duties is estimated at EUR 6.5 bln, or 3.7% of 2013 direct tax revenues as a main source for budget financing.

Royalties will triple current concession revenues in state budget.

Corporate taxes from direct, indirect, and induced business will add another EUR 4.6 bln to budget revenues for 30 years, a 20% increase per annum.

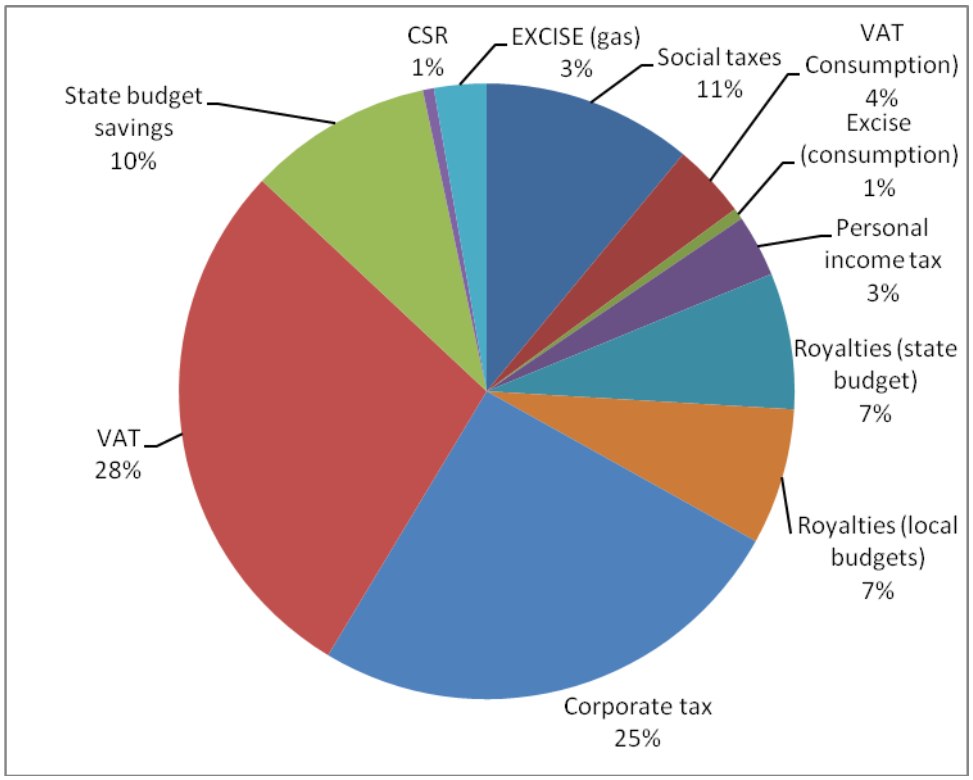
The Table and the Figure below provide more detail on the potential fiscal impacts.

Table 15: Distribution of fiscal effects by different categories (EUR, mln.)

FISCAL EFFECTS (mln. euro)	Direct	Indirect	Induced	Knock-on	TOTAL
Social taxes	566.98	46.92	10.22	1,364.98	1,989.10
VAT Consumption)	-	-	222.44	485.26	707.70
Excise (consumption)	-	-	33.37	72.79	106.16
Personal income tax	167.99	13.91	3.03	404.39	589.32
Royalties (state budget)	1,292.88	-	-	-	1,292.88
Royalties (local budgets)	1,292.88	,	,	,	1,292.88
Corporate tax	1,860.41	1,604.69	539,47	606,35	4,610.92
VAT	3,819.07	71,89	19,44	1,214.60	5,125.00
State budget savings	1,748.61	-	-	-	1,748.61
CSR	104.01	-	-	-	104.01
EXCISE (gas)	496.48	-	-	-	496.48
Local taxes & fees	1.50	-	-	-	1.50
TOTAL	11,350.81	1,737.41	827.97	2,534.43	**18,064.56**
HOUSEHOLD CONSUMPTION*	-,	-	1,334.65	2,911.59	4,246.24
SOCIAL PRIVATE**	231.44	19.16	4.17	557.14	811.91

Source: KC2 Ltd.

Figure 18: Distribution of fiscal effects

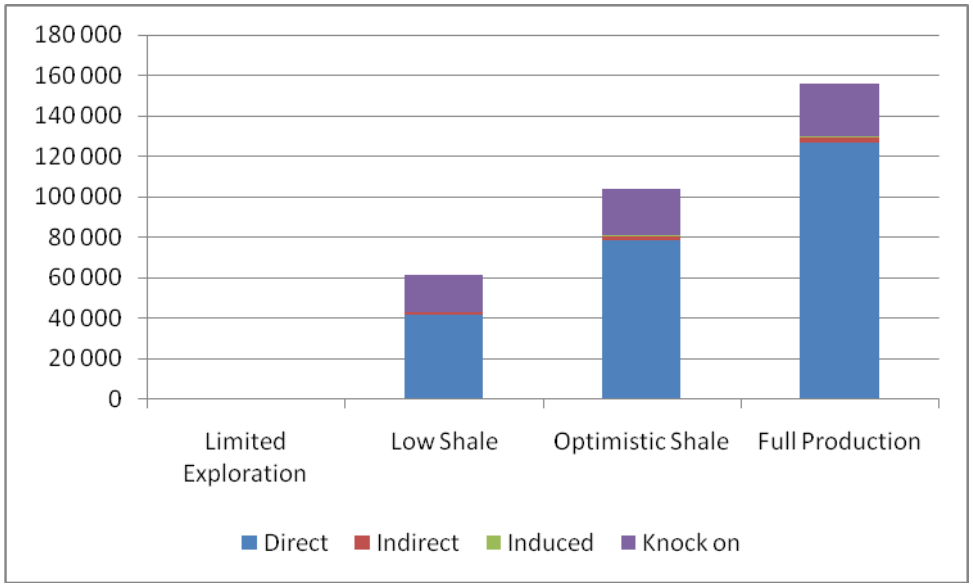


Source: KC2 Ltd.

Summary of Economic Impacts Across All Scenarios

The figures below summarize the impact on gross output for the different scenarios elaborated in the study.

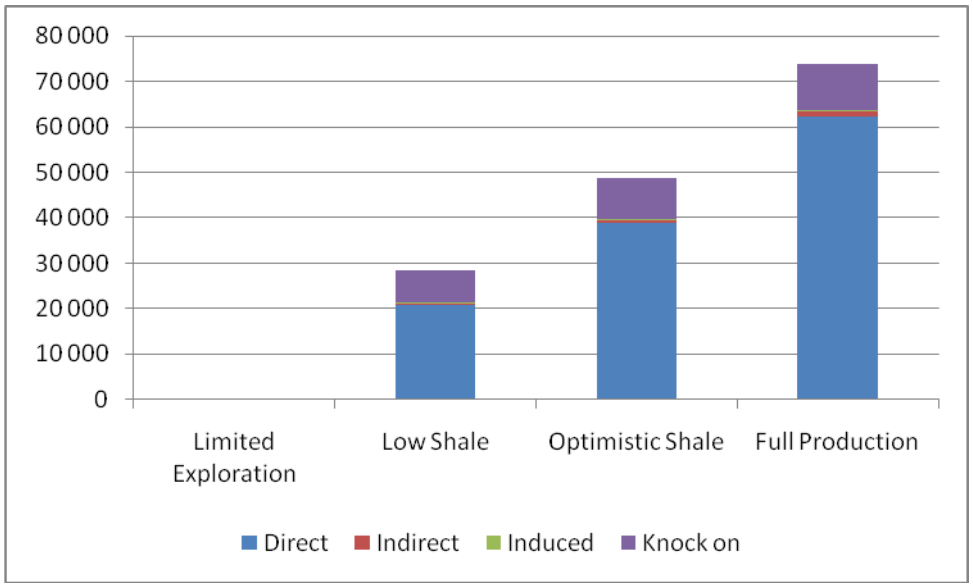
Figure 8: Contribution of Direct, Indirect, Induced, and Knock-on Effects of Different Scenarios in Terms of Gross Output for the Whole Lifespan of the Project (EUR millions)



Source: KC2 Ltd.

The Figure below shows the impacts of different scenarios in terms of gross value added.

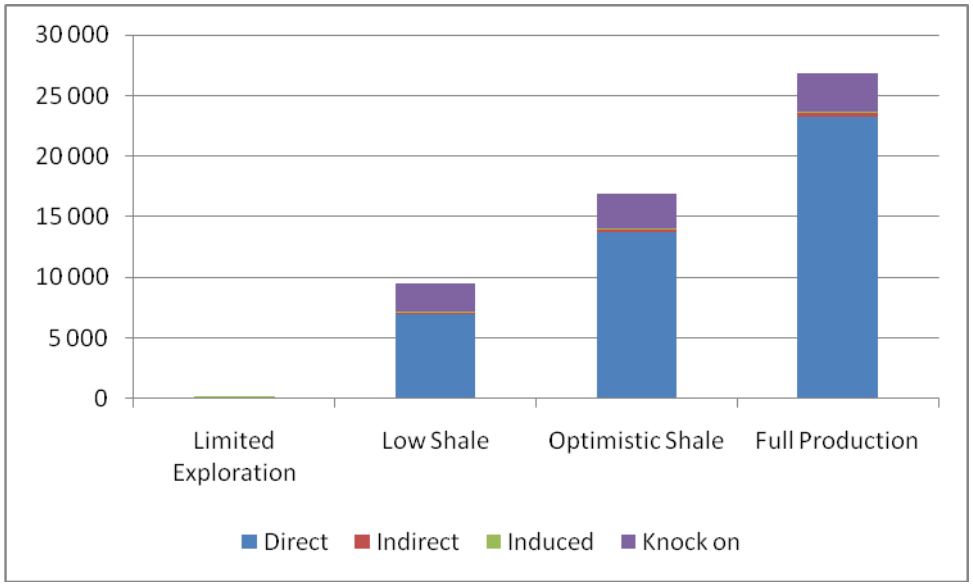
Figure 9: Contribution of Direct, Indirect, Induced and Knock-on Effects of Different Scenarios in Terms of Gross Value Added for the Whole Lifespan of NGS Production (EUR millions)



Source: KC2 Ltd.

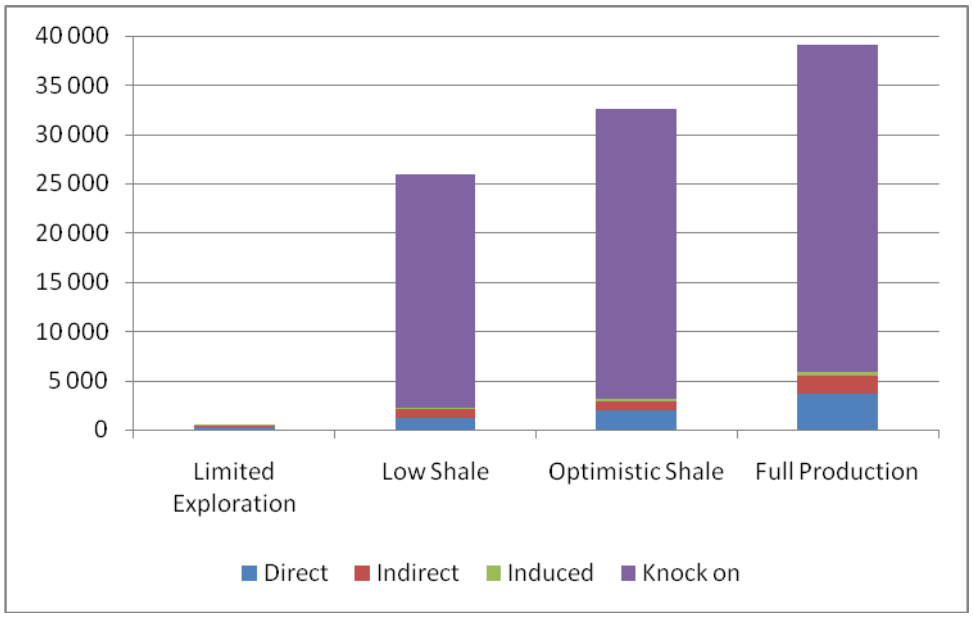
The Figure below summarizes the impacts of different scenarios in terms of investment.

Figure 10: Contribution of Direct, Indirect, Induced and Knock-on Effects of Different Scenarios in Terms of Investment for the Whole Lifespan of NGS Production (EUR millions)



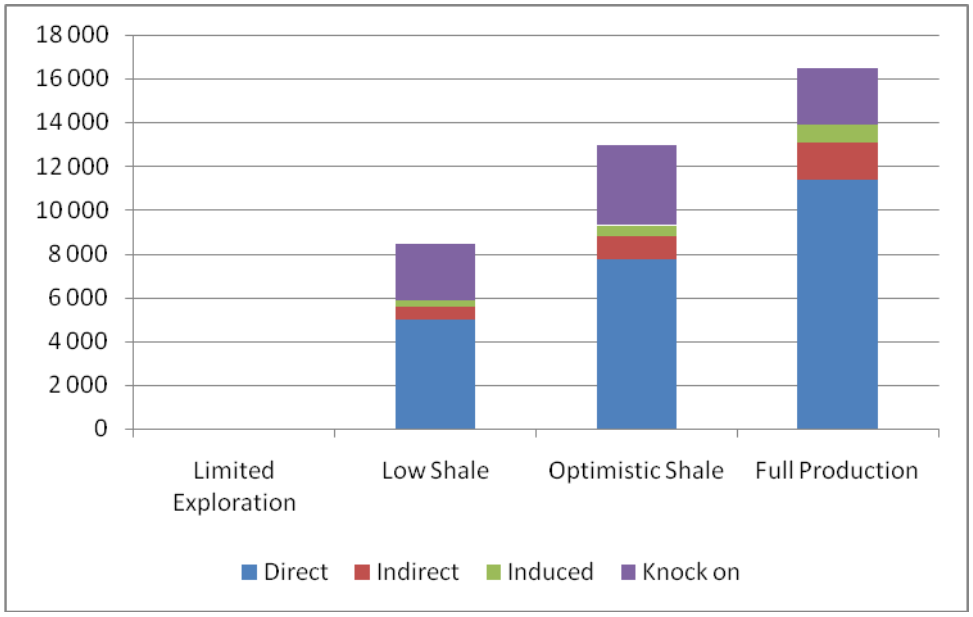
Source: KC2 Ltd.

Figure 11: Contribution of Direct, Indirect, Induced and Knock-on Effects of Different Scenarios in Terms of Human Capital for the Whole Lifespan of NGS Production (Number of jobs)



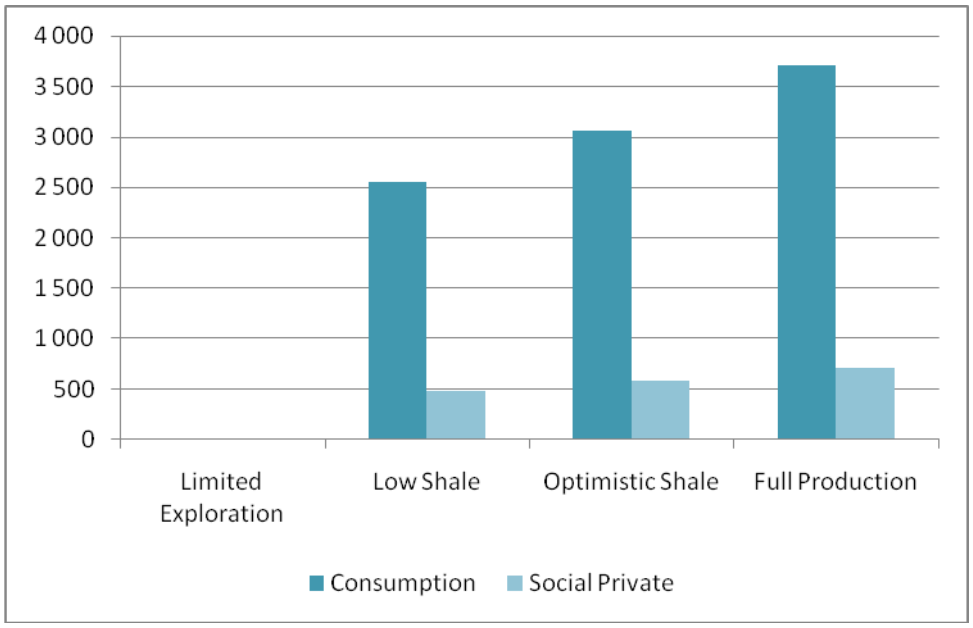
Source: KC2 Ltd.

Figure 12: Contribution of Direct, Indirect, Induced and Knock-on Effects of Different Scenarios in Terms of Fiscal impact for the Whole Lifespan of NGS Production (EUR millions)



Source: KC2 Ltd.

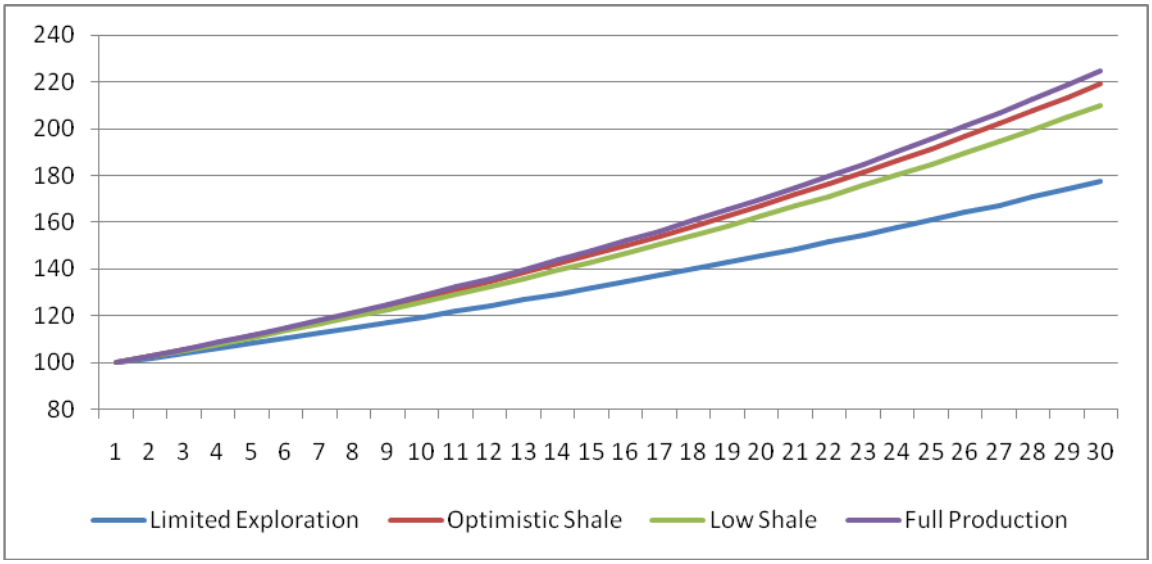
Figure 13: Contribution of Different Scenarios in Terms of Consumption and Social private for the Whole Lifespan of NGS Production (EUR millions)



Source: KC2 Ltd.

The Figure below shows the expected growth rate of GDP in constant prices depending on the knock-on effects in different shale gas scenarios for Bulgaria.

Figure 14: GDP Growth Path in Different Shale Gas Scenarios



Source: KC2 Ltd.

Our economic model is based on 2% average annual growth rate. The Low Shale Scenario contributes incrementally 0.59% per year or 18.3% higher GDP at the end of the period. The Optimistic Potential Scenario forecasting 0.74% additional growth per year results in 23.4% higher

GDP than in the Baseline Scenario (at the end of the 30-year period), while the Full Potential Scenario estimates 0.83% additional growth per year leads to 26.6% higher GDP at the end of 30 year period.

Annex 1: Shale gas process, methodology and sources

Shale gas development (description and lifespan)

A single gas well could be operational for up to 30 years, with its economic lifespan up to 40 years. Many of the activities described in the following text will be repeated several times or conducted simultaneously throughout different sectors of the same gas field. The operator could be exploring one area, testing and appraising another, and collecting gas from a third one.

The whole process starts with companies competing for a contract that would allow them to start looking for natural gas deposits. This goes along with lengthy negotiations (lasting from several months to a couple of years) with government agencies over contract details. After obtaining exploration permits, the operator would work with regulators and land owners, commission EIA reports and start work with local service providers and communities.

The field work begins with seismic testing (lasting 1-2 years) to gather information on the structure of the geological strata, allowing geologists to locate promising spots for further development. The data is collected by a team of engineers. The next step is to undertake exploration drilling on predetermined locations taking into account conclusions from ecological, geological and socio-economical research conducted thus far – this takes around 2 years to complete.

If results from exploration drilling indicate significant shale gas reserves, the company continues with pilot testing – a process that lasts 2-3 years, in order to determine whether a certain well is economically viable. During this phase horizontal drilling and hydraulic fracking are usually used. Pilot testing is followed by negotiations with government agencies and large companies that are interested in signing long term contracts for the extraction of natural gas in economically promising wells (lasts another 2 years). If all previous phases show outcomes that are up to the operator's standards, a final development plan is put into place (this takes 1-2 years) that includes the number and locations of drilling sites and the necessary easement right and infrastructure for the project (well pads, access roads, utility corridors, water and electricity lines, gas gathering lines, water management facilities, etc.).

It may take 1 or 2 years to build the infrastructure and initiate the cycle of drilling (extractions) wells, conduct additional EIAs, and plan for a re-cultivation of the eco-system around each individual site (as a follow–up to the exploration).

Thus, the process continues throughout the whole 30-40 year period and involves a large number of local businesses that perform essential tasks in many of its stages. The nature of the process, at every step, requires close work and smooth relations with government agencies and local communities, and presupposes a number of activities, in addition to the core gas extraction business.

The involvement of businesses, government and communities is also accounted for in this impact study.

Project stages

Classic impact study methodology (i.e. measuring the potential direct, indirect, induced, and knock-on effects) has been amended to fit the peculiarities of shale gas projects. In such projects construction and operation phases overlap, drilling sites may become wells, pilot well(s) are transformed into operational sites, additional infrastructure is being built and restoration activities often coincide with the periods of core business activity. It is also typical that there are relatively long periods of preparatory activities in-between project stages, which include licenses, permits, easement right, lease agreement, water use contracts and EIAs. Existing shale gas projects worldwide demonstrate increasing complexity, technological innovation and growing opportunities for local and international service providers.

Similar to other socio-economic impact studies[41], we distinguish and measure the impacts as related to the following stages:

I. seismic exploration of the area;
II. appraisal and exploration drilling (including a pilot well);
III. exploitation/extraction of shale gas resources with impacts on competitiveness;
IV. remediation of the area (follow-up environmental activities);

The construction phase starts at appraisal stage (it may include logistic site, administration and monitoring office and the like) and is most active in the exploitation phase (iii).

Measurement in constant EUR definitions of impacts

The impacts are measured in constant 2013 EUR or BGN. We do not calculate returns of investment or net present values. This approach is justified by the fact that investment is expected to take place throughout the process, but we take into account that after a relatively large investment at the start of extraction stage the costs of the operations become marginal. More importantly, the economic footprint of this stage depends on choices made on the gas market by industrial consumers and households who take part in different value chains.

At each of the above stages we distinguish direct, indirect, and induced effects.

Direct are the impacts that stem from the initial project investment/expenditures, including subcontractors and suppliers.

Indirect are impacts created through increased sales by suppliers to the direct activity.

Induced effects are impacts created by additional supplier expenditures, through income earned by project-related employees and company owners. For example, such induced economic activities are generated in the recreational, hospitality, and food industries, real estate sector, etc. However, the extraction phase is characterized with most significant knock-on effects since the supply of gas changes the value chains in industrial, power and residential sectors.

Knock-on effects are impacts apart from the direct, indirect or induced effects of the project. Actually, they arise from the lower prices which affect the economy as a whole because natural gas is used as an energy source and as a raw material. As the new supplier of natural gas emerges on the

[41]See, e.g.: Andrzej Cylwik, Katarzyna Piętka-Kosińska, Katarzyna Lada and Maciej Sobolewski, Ekonomiczny potencjał produkcji gazu łupkowego w Polsce w latach 2012-2025. Analiza scenariuszowa, Warsaw, CASE, 2012, *at*: http://www.case-research.eu/sites/default/files/publications/CASE_shalegas_nastrone_0.pdf.

local market and quantity supplied is higher than the quantity demanded the price will be pushed down. As a result, the production cost of businesses will decrease and the heating cost of households and companies will decline. The freed resources will be shifted towards investment, job creation, consumption, and wages.

Gross output is the total of net sales, investment, and change in inventories at market prices.

Gross value added is the difference between gross output and intermediate consumption of goods and services necessary for production, at market prices. Expressed another way, gross value added is the total of wages, social security contributions (payroll taxes), income taxes, royalties, profit of the company, and depreciation.

Investment is the cost of acquisition of fixed assets.

Job creation effects are calculated as numbers of full-time jobs opened as a result of the shale gas exploration and production. As a result of the project, additional sales of goods and services are made. The average cost per employed person is calculated. The revenues of the companies are divided by the sales per employee, and thus the number of jobs supported by the project is obtained.

Fiscal impacts are combined and individual effects of: concession fees, direct and indirect taxes (including those on household consumption of generated income), local and social taxes to state owned NOI and NZOK. Here we also calculate contributions to private pension and healthcare funds since they constitute an alternative to state systems and contribute to overall welfare. The assumption for the concession fee (royalties) is 2.5% of revenues. It is 2.5 times higher than the UK fee and is higher than the Polish regulation of 1.5% royalty for shale and 5% on conventional gas. (Typically, the capital intensive nature of the process does not allow for sliding scales and classic corporate income taxation on shale gas sales.)[42]

Since currently the state owned natural gas supplier sells to end-consumers at a price below the purchase price, we take into account **fiscal savings** that result from shale gas extraction.

The competitiveness impacts are part of the overall macro-impacts, but whenever necessary, we distinguish classic induced impacts in a narrow sense - businesses that emerge or increase their capacity to serve core shale gas extraction activities. Most often these are to be observed in the local economy, in services and related activities, as "immediate" induced impacts. The "long term" induced impacts represent the effects on competitiveness (lower energy bills, greater efficiency and output of industrial users, greater energy security, etc.)

For each of the gas development stages we compiled tables of activities, and assessed related prices on inventories, employment and costs of labor, using current prices on related activities and/or proxy-prices for similar projects in the EU, Poland and Romania. The assessment was produced by the interdisciplinary team of *KC2 Ltd*: economists, oil and gas exploration experts, geologists, environmental expert and sociologists. This allowed us to calculate economic (business) activity

[42]See for global and EU practice: Unconventional Gas: Potential Energy Market Impacts in the EUROopean Union, EC Joint Research Center, September 2012, pp. 113-122, at: http://ec.EUROopa.eu/dgs/jrc/downloads/jrc_report_2012_09_unconventional_gas.pdf. The assumption takes into account the differences in the tax systems; for details on Poland's tax system see: Filip Černoch, Petr Ocelík, Jan Osička, , Veronika Zapletalová, Shale Gas in Poland and the Czech Republic: Regulation, Infrastructure and Perspectives of Cooperation, IIPS of Masarik University, Brno, 2012, at: http://www.iips.cz/data/files/Publikace/Shale_Gas.pdf .

multipliers (see below) for each of the mentioned project stages based on empirical information tested by the team. More details are provided in the relevant sections of the Report.

Multipliers and scenarios (assumptions)

We calculated the multipliers anticipating that the maximum volume of shale gas reserves (as estimated by US EIA) will be confirmed. (Even if the reserves are half of this estimate, they will be sufficient to cover about 30 years of increased natural gas consumption.)

Using the above sources and distinguished stages of the project, we have been able to calculate the following multipliers, specific for each of the stages:

I. seismic - 1.66;
II. appraisal and exploration (including a pilot well) - 2.4;
III. production - 4 and 6, depending on the scenario - "Low Shale" or "Optimistic Shale";
IV. estimation of country potential, or Full NGS Potential - 1.66 of the Optimistic scenario;
V. remediation - 1.66.

We can outline three possible scenarios: no-NGS, low NGS and optimistic production of NGS (on the sample block) and full-shale country potential (all blocks.

The legacy in natural gas dependency is that Bulgaria is one of the many EU countries "importing almost all of their gas needs" or 94% for 2006-2010 consumption.[43]

Another peculiarity for Bulgaria is the virtually absent household consumption, while the core user is the industrial sector. This means that, according to existing practicalities of energy pricing in Bulgaria, the consumer choice of energy source would depend on electricity prices (for both household and industrial consumers), while the energy sector consumes two times less natural gas than the industry. (See Annex 3 for international comparisons.)

By the time of the operation phase (roughly 10 years from now), we expect that Bulgaria would liberalize its energy market but the payment arrears in the power sector (mostly debts of NEK) would remain a significant factor of electricity pricing. Nevertheless, we anticipate that by the start of the operation phase, Bulgaria and the EU will amend framework conditions and will move towards hub-based pricing of natural gas. Also, by that time we expect lower levels of overall political risks in the country's power sector and greater economic stability. The expected situation resulting from this constellation is explained below.

We take as benchmark the price of $300 per 1000 cm, which is lower than the current *BulgarGas* supply price (BGN 630[44] or $442.9 at today's exchange rate of 1.4225) at the assumption of 25%

[43]Member States' Energy Dependence: An Indicator-Based Assessment, DG Economic and Financial Affairs, Occasional Papers 145, April 2013, p. 12, 14, and 82-93, at: http://ec.EUROopa.eu/economy_finance/publications/occasional_paper/2013/pdf/ocp145_en.pdf. Using the EU definition of nuclear fuel, this paper estimates the total primary energy dependency at 47%. However, taking into account that the nuclear fuel for the *Kozloduy* NPS is supplied by Russia, the primary energy dependency of Bulgaria is 72% (see: Plamen Tzevetanov a.c., Elektroenergetikata na Bulgaria: razvitie i obshtestvena tzena, Sofia, BAS Marin Drinov, 2009, str. 73 - the source is in Bulgarian). For the same reason, the EU paper makes similar unrealistic assessment for Estonia and Lithuania.

[44] See: http://www.dker.bg/pagebg.php?P=401&SP=404.

decrease in the (public) supply price. According to specific scenario, this price may change; details are explained in the respective sections.

The general assumptions of the natural gas price are the following:

- The 25% decrease is more optimistic than expected effect of Polish shale gas effects in the first 10 years (which is 15-16%), although Poland expectations is to reach 40% lower than current per 1,000 cm after the 10th year; the reasons for our assumption were explained in the previous paragraph;
- The EU is not likely to reach the predicted US natural price decrease (up to expected 50% down) as result of shale gas extraction. There is a consensus among analysts that in the EU the costs of shale gas exploration and development would be 35-40% higher than in USA, due to: access to technology, costs of mineral rights and concessions, including environment protection costs in areas with higher density and taxes (including information costs and taxes on R & D);[45]
- The price-setting mechanism is fixed and will remain fixed until 2018-2020, influenced by current regulatory patterns, which use electricity prices for attaining social-policy objectives;
- Benchmark prices on petrol and electricity are expected to rise, especially electricity prices in Bulgaria; electricity price in Bulgaria is expected to rise by 40% in five years, according to BEF calculations (not published);
- Political attempts to postpone liberalization in order to cross-subsidize other segments of the power sector seem possible and likely; given the fact that Bulgaria imports more than 90% from *Gazprom*, and taking into account the pricing approach of *Gazprom Export*,[46] we think that hub-based pricing for Bulgaria will take place later than in other EU member states, thus crowding out consumer option to use gas before the project starts;
- The current retail price of natural gas for Dobrudza and Varna household consumers is $623.53 or 611.46 per $m^3$for industrial consumers - and it will remain at this level of around $600 by the time exploration starts ;[47]
- Liberalization is the key factor to bring the price of natural gas down: third party access to pipeline is almost secured; diversification is likely to take place in five-six years.

Macroeconomic assumptions

By the time NGS exploration and production companies commence their full-scale operations in, presumably 2020, we expect the following assumptions would prove realistic.

[45]See similar reasoning at KPMG (2011): "Greater competition, high production costs and low margins are curbing the appetite for investment shale gas production start-ups." Shale Gas – A Global Perspective, KPMG International, 2011, p. 7, at: http://www.kpmg.com/Global/en/IssuesAndInsights/ArticlesPublications/Documents/shale-gas-global-perspective.pdf.

[46]See a review of the argument in: Jonathan Stern, Howard Rogers, The Transition to Hub-based Pricing in Continental EUROope: A Response to Sergei Komlev of Gazprom Export, The Oxford Institute for Energy Studies, Oxford Energy Comment, February 2013, at: http://www.oxfordenergy.org/2013/02/the-transition-to-hub-based-pricing-in-continental-EUROope-a-response-to-sergei-komlev-of-gazprom-export/ .

[47] See: http://www.dker.bg/PDOCS/gas-prices-1_13_1.pdf.

- The average inflation for the period to be relatively high - 3.5%, mostly due to suppressed energy prices and government interventions at the beginning of the period but also because of the quantitative easing monetary policies of the ECB, which lead to inflationary effects being directly imported to Bulgaria due to fixed exchange rate of the local currency to the Euro.
- GDP growth - 2% per annum; we believe that in 2014 the economy will recover from its 5% of GDP decline from 2009 and will gradually resume its stable growth path from the 1998-2008 period without reaching its average growth rate from that period (about 3-4% per annum). On the average, however, Bulgaria will be growing twice faster that the EU, due to the lower relative starting position of 40+% of the GDP per capita compared to the EU average.
- GDP per capita will be growing a bit faster - at 2.5-2.6% per year, due to the declining population. Real income (gross salary) growth will be 5%. The key factors here are the same - low starting point and demographics but also we take into account the history since 1998 when real gross wages grew by 8% per year.
- Unemployment will remain around the EU average - currently 12.1% of the active population, but a bit (roughly 1-2%) higher since the number of low-skilled workers currently mostly pertains to the unemployed, while the skilled labor is practically employed (the unemployment among university graduates is 3.5-4% in 2013). Irrespective of the trend, new jobs are to be opened in relatively high-value added sectors of the economy.
- FDI's will stabilize after 2020 at the level of 4-5% of GDP, despite the fact that in the past (2007-2008) they were as high as 27 and 29% of GDP.
- Fiscal framework will remain relatively stable with income taxes flat or almost flat and relatively low, close to current levels of 10% on corporate and personal income. (Possible amendments to the flat tax system - e.g. higher, 15% tax on upper 10% of wage/income earners - will not change the corporate taxes and will not lead to a significant effect in terms of budget revenues.) But we expect payroll taxes (pay-as-you-go pensions and health taxes) to rise due to large current deficits of the state-owned funds, demographic trends and delayed reforms. Indirect taxes will remain the most substantial revenue source for the national budget (50% of the revenues at the moment) and will not be changed significantly. Also we do not expect the new transatlantic (EU - USA) trade and investment agreement, that is to be enforced after 2017, to significantly lower technology transfer costs (mostly due to the relatively high EU VAT policies).

How fiscal contributions have been calculated?

Direct fiscal effects come from the core project activities and include social security and personal income tax payments of direct jobs, royalties and corporate tax, VAT, excise on gas, local taxation, CSR and budget savings.

Social security payments are calculated on the base of gross salaries of core personnel at seismic, appraisal and drilling stages of the project for the relevant periods, described in Annex 1. They include both employer and employee's installments for pension insurance, common disease, health, motherhood, unemployment. These effects increase as most workers hired are referred to high-risk categories with maximum risk coverage. The actual percentages of Bulgarian social security

legislation are applied. Social security to private pension and other funds is also a major economic influence apart from fiscal contributions.

Personal income taxes are based on after-social taxes income and are set at a 10% flat rate.

The use of a national source (gas formations) is always an object of concession fees, aimed at rewarding the owner of the source, or society in a common sense, and compensation of alternative or foregone benefits of that source. For the calculation we apply the existing regulation on gas concessions which specifies a 2,5% minimum fee on sales per annum.

Higher percentages of up to 30% are stipulated, but not quite likely, as the investments in shale gas extraction are significant and spread over the whole 30 year period of expected production activity. Royalties are allocated 50/50 to national and local municipality budgets.

Corporate taxes are calculated based on profit forecasting of the core business. These profits are simulated through application of gross profit margin of the mother company's statements (18%) to the forecasted yearly turnover, based on different price and activity scenarios.

Direct value added tax is calculated using the average share of VAT contributions to the GVA for the whole economy (12%). Excise duties are worked out from expected sales of gas, and current excise regulations per Joules/m3.

Budget savings is a specific fiscal contribution that materializes a government policy to set unfavorable prices of gas for its own intermediary companies which leads them to constant losses that are eventually covered by the taxpayers. The shale gas project assures such a decrease in input prices that will disband the accumulation of losses and prevent the budget from subsidizing artificially the low energy costs of end consumers.

Local contributions include local taxes and fees for transportation vehicles, property and buildings, waste, etc.

CSR is estimated at 115,000 EUR per year for the periods of seismic studies and appraisal wells drilling. The exploitation phase is characterized by constant and conscious investment of 0,1% of all sales into a long-run investment into local community welfare.

VAT and excise duties impact is considered an induced fiscal effect and is largely based on the consumption of all hired people into the project, all the suppliers and the concomitant business. VAT revenues are calculated using the rule: consumption*[tax rate/ (1+ tax rate)]. Excise duties are forecasted as a percentage of paid 'consumption' VAT on average, in accordance with current legislation.

Indirect and induced fiscal impacts include social security payments and personal income taxes of supplier and accompanying business personnel. Calculation is made based on the number of arranged staff for activities related to the core project and the individual gross annual salary, divided into white and blue-collar jobs. These side effects contain also VAT and corporate taxes paid by supporting business companies of the project. Both contributions are calculated as a percentage of generated GVA (12% and 60%).

The knock-on fiscal effect is brought to the table by the massive reaction of the economy to the lower production and energy costs resulting from the competitiveness of the shale gas production method. New business creation and the improved margin are a source of additional VAT and corporate income tax revenues to the state, and supplementary social security payments, personal

income taxes and induced VAT and excise duties through consumption of all new jobs uncovered (between 20 and 30 thousand people depending on different scenarios for the production stage of the project).

Sources

For macroeconomic historic data and impacts (investment, GDP, FDI, employment, etc.) we use NSI, EA and BNB statistics. For the field survey questionnaires we used our in-depth interviews in the region and the Regional Economic Profiles of the Institute for Market Economics (updated November 2013).[48]

For construction-specific information we take the most recent (October 2013) price list of all construction-related suppliers and service providers, plus we use our own in-depth interviews and financial reports mentioned above;

For proxy prices and natural gas reserves we use the statistics and reviews of shale gas exploration and development available from US EIA, the EU, OGP, KPMG, Bulgarian Energy Forum and the Bulgarian Oil and Gas Association.

Numbers regarding drill sites, work force, etc., are borrowed, checked against conditions in Bulgaria and experiences of Poland and Romania[49], and then should be extrapolated based on above mentioned studies of EIA[50], OGP-Poyry[51], Marcellus Center[52], and European Commission JRC Studies on Unconventional Gas[53].

For local expectations, impact, and prices in the concession area, we use the polling conducted by *Alpha Research* and the in-depth interviews.

Other relevant sources are quoted in the text.

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[48] See: http://www.regionalprofiles.bg/en/ .

[49] Insights on Poland we found on Chevron Poland (http://www.chevron.pl/en/) and Polish Shale Gas (http://polishshalegas.pl/en/main-page) websites; Romania related information as provided by Chevron Bulgaria.

[50] Technically Recoverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries Outside the United States, U.S. Department of Energy, June 2013, see: http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf .

[51] Macroeconomic effects of EUROopean Shale Gas Production. A report to the International Association of Oil and Gas Producers (OGP), Poyry/Cambridge Econometrics, November 2013, see: http://www.poyry.co.uk/sites/poyry.co.uk/files/public_report_ogp__v5_0.pdf .

[52] Marcelius Center (of Pennsylvania State University) Studies are updated regularly and are available at: http://www.marcellus.psu.edu/resources/publications.php .

[53] Unconventional Gas: Potential Energy Market Impacts in the EUROopean Union,EC Joint Research Center, September 2012, at: http://ec.EUROopa.eu/dgs/jrc/downloads/jrc_report_2012_09_unconventional_gas.pdf.