Baringa
Brighter together

Bulgaria
The role of gas in decarbonisation

April 2018

Bulgaria
The role of gas in decarbonisation

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1. Executive summary

This report – a qualitative analysis of the opportunity for gas to support Bulgaria's progress towards a decarbonised energy future – is Baringa's contribution to the debate on the future of gas across Europe. It builds on a key thought leadership event hosted by Baringa on the Role of Gas in the energy mix organised in November 2017 with Eurogas and National Grid, and supported by ENTSOG.

This report is intended to be a helpful input to the preparation of Bulgaria's national energy and climate plan over the course of 2018. The key added value of this analysis and report is an integrated view of the complete energy mix and the combination of power and gas sectoral issues.

The characteristics of natural gas mean that it should play a key role in the future energy mix of Bulgaria. With global prices projected to remain relatively low, gas is an affordable, plentiful fuel, which efficiently delivers and stores significant energy content. It can effectively help address the Energy Trilemma: delivering decarbonisation, maintaining security of supply, and ensuring that energy is affordable.

For Bulgaria to meet its 2030 climate change targets, and in particular the reduction of CO2-emissions, a more detailed plan for the transition of the existing energy mix is needed. Gas can play a significant role in the achievement of these targets if its full potential is realised.

For gas to contribute its full potential in Bulgaria's energy future, there are two focus areas for action by policy makers in the plans to be set out in the national energy strategy for 2020-2030:

- Enabling enhanced market access using the detailed EU-acquis as guidance, and including support for selective infrastructure investment
- Ensuring gas is able to supply the market on a competitive basis by ensuring it is not detrimentally treated via regulation and policy versus electricity

A key first step is for the Bulgarian government, during the course of its strategy definition, to engage thoroughly with gas industry participants and stakeholders (including trade bodies and NGOs) to build a complete picture of the opportunity for gas and the role it can play in Bulgaria's energy future.

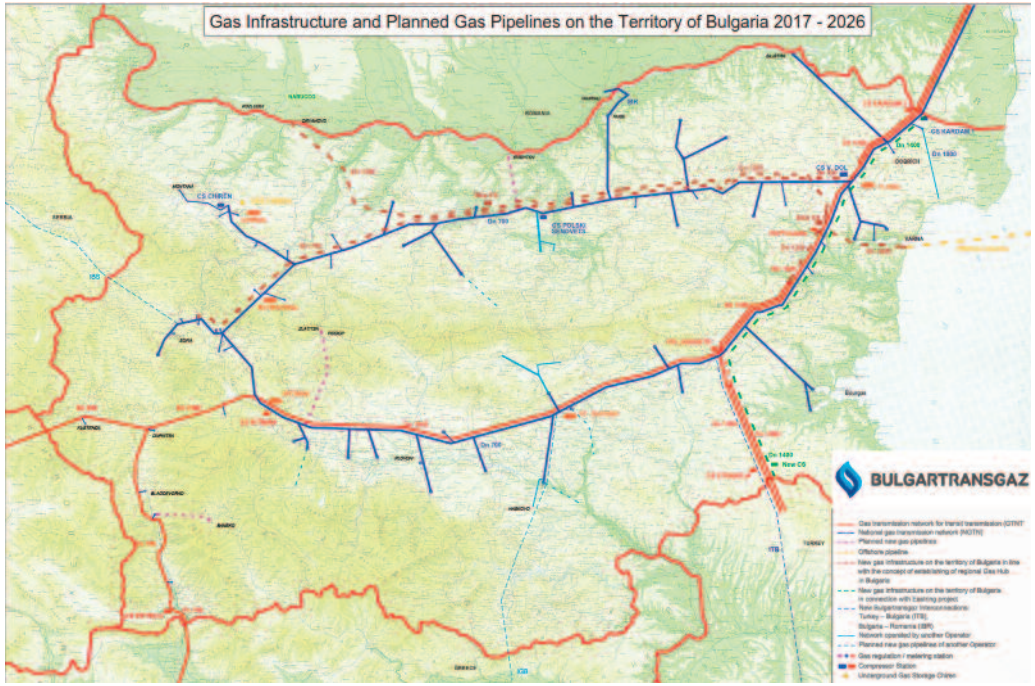
If the status quo for gas in Bulgaria is unchanged, the opportunity for further decarbonised, low cost and secure energy supply in Bulgaria will be missed. Bulgaria will continue to be a relatively small gas market with a flat growth outlook, lacking attraction for competitive suppliers and investors.

The fundamental risk is in Bulgaria not meeting affordably and securely its 2030 European energy and climate targets, and failing to have an appropriate plan for achieving these targets.

2. Introduction

In the last nine years, Bulgaria has taken steps to increase its security of supply in natural gas – reducing the risks of supply shortage as a result of reliance on a single source. Bulgaria has taken a number of positive actions to support diversification. More recently, the Bulgarian government has taken practical steps in signing license agreements for deep offshore Black Sea exploration which could potentially lead to domestic gas production. The government has committed to support these exploration campaigns and linked them to energy security, one important aspect of its energy priorities. In parallel, it has been working to implement European Union energy market reforms that would support diversity of supplier, consumer choice and, ultimately, a reduction in costs via increased competition.

Figure 1 – Bulgaria's gas transmission network



A number of critical infrastructure projects are being developed (supply pipelines and interconnectors with neighbouring states) that will support diversity and security of supply. The map below shows the current state of the Bulgaria's gas network (for a description of gas market and market structure please refer to Appendix A).

Bulgaria has done well in its progress towards 2020 climate change targets – buoyed as it is by its significant hydro and nuclear power capacity and, in principle, increasing renewables development.

Progress has been made, but much remains to be done. The steps towards market liberalisation have not been as rapid or as effective is it could have been and the market remains highly concentrated (as discussed in more detail in section 6). Moving beyond the 2020 climate change targets towards longer term goals for 2030 and 2050 will be challenging and, as yet, there is no clear strategy for delivering these longer-term goals. Gas could play a key part in this transition, but is not being voiced effectively a part of the strategy as yet, nor it appears in relevant key industry planning. For example, there is no significant role for gas generation as part of the draft grid development plans of the state-owned electricity transmission operator ESO for 2018-2027 period.[1]

The relatively minor role which gas plays in the power generation mix, can be seen from the data as gathered by EC-reference case, for period 2000-2015. Whilst Bulgaria does not have a published detailed plan for growing the role of gas in its energy mix beyond 2020, we note that the EC does assume a growing role for gas towards 2030 and beyond. See Figure 2 overleaf.

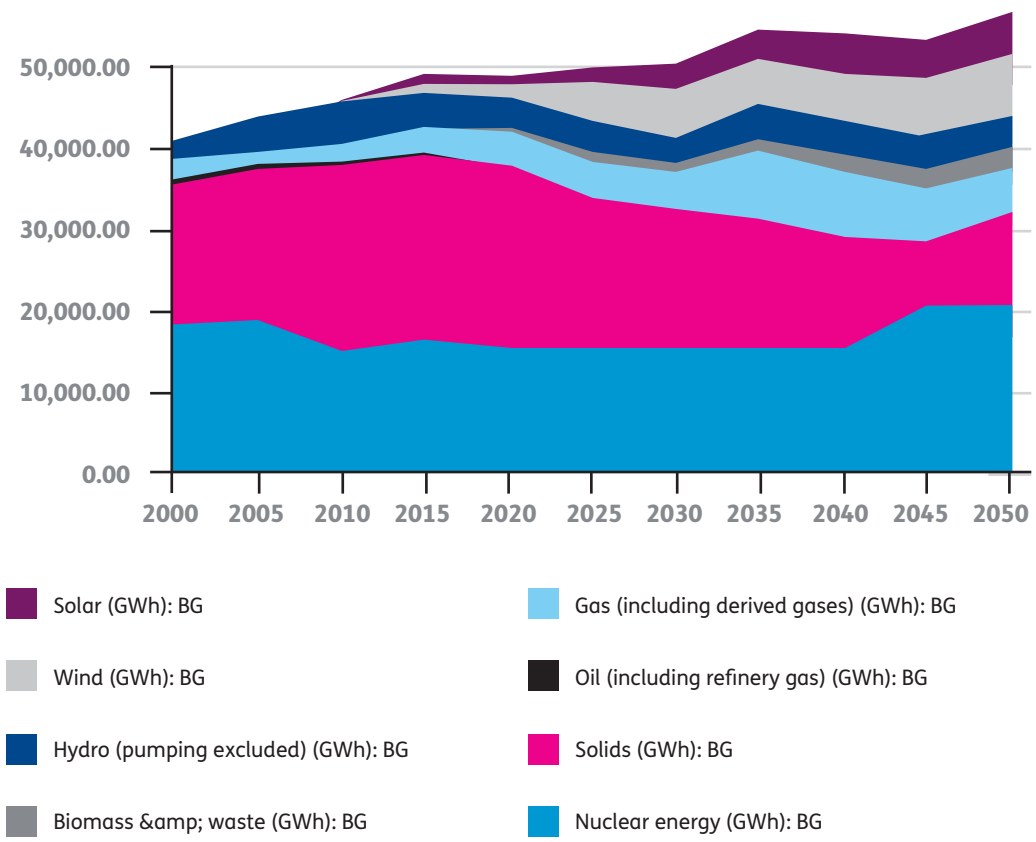
Gas is a relatively minor part of the energy generation mix, as well as of the total primary energy supply of the country (see section 4.1 for more details). An opportunity exists for gas to become increasingly significant in support of Bulgaria' tackling the so-called Energy Trilemma: delivering decarbonisation, maintaining security of supply, and ensuring that energy is affordable.

It is an appropriate time to consider this opportunity as Bulgaria's government contemplates its strategic energy direction of the next 10 and 30 years by working on the national 2030 energy strategy.

In previous energy strategies and more recent publications contributing to the recently initiated energy strategy debate, a growing role for gas has not been a key characteristic.[2] With a large coal element to the energy mix of the country, gas can be part of Bulgaria's energy future both at the national level and within an EU context.[3]

Figure 2 – Generation mix Bulgaria – 2000 – 2050 (EC reference case 2016)

Gross electricity generation by source (GWh): BG, EC reference scenario 2016



With Europe including Bulgaria focusing on Energy Trilemma, the characteristics of gas should mean that it should play a key role in the future energy mix. With global prices projected to remain relatively low, gas is an affordable, plentiful fuel, which efficiently delivers and stores significant energy content. In comparison with other fossil fuels, gas is also low-carbon. Gas offers tremendous potential in Europe's decarbonisation pathways in replacing higher carbon emitting fuels, and working in partnership with renewables to meet energy demand (baseload) and flexibility (peak) needs. Gas is particularly effective in the provision of heat; and decarbonising heat is challenging, with full electrification being very costly. The way gas can meet peak and flexibility needs at a relatively low cost is under-recognised, and perhaps the suitability of doing the same purely with electricity overstated.[4]

This report discusses the current energy situation in Bulgaria – opportunities for gas demand growth, supply, market access as part of the answer to the energy trilemma, and steps that can be taken to realise the opportunity for gas to play a key enabling role in decarbonisation. Note that in the report, we discuss both, the power and gas sector in Bulgaria, as these are very closely linked. We note that the two sectors are also linked by the state-owned Bulgarian Energy Holding (BEH), which financially controls the key market participants such as power and gas TSOs, as well as the two key wholesalers NEK and Bulgargaz in power and gas sectors.[5]

Baringa Partners has undertaken a desktop based information gathering exercise supported by a set of stakeholder interviews to provide the basis for a qualitative analysis and assessment of the current status and future potential for gas in Bulgaria. Stakeholders engaged included representatives of Government institutions, electricity and gas traders, natural gas distributors, renewables generators and investors, infrastructure developers, NGOs active in the market and on energy issues, associations from the gas and electricity sectors, energy sector advisors and experts (collectively referred to in this report as 'stakeholders').

Our hypothesis, set out with supporting rationale in this report, is that gas can play a critical role in Bulgaria's energy future and pathway to decarbonisation, with effective market reforms, followed by some selective infrastructure development, and by creating a level playing field between gas and power. Gas as a part of the energy mix will help address the energy trilemma – delivering decarbonisation affordably and with security of supply.

3. Bulgaria's Energy strategy 2020

3.1. Government energy strategy – update pending

The current National Energy Strategy, adopted in 2011, has a horizon to 2020. A number of challenges have arisen which the next iteration of National Energy Strategy, the development of which is underway, will need to deal with. They include:

- The need to have a clear vision on how to achieve the 2030 decarbonisation targets[6] (and ultimately the 2050 and any interim targets set by the EU);
- Alignment with the EU Clean Energy Package (and other directives) including market liberalization, enhancement of competition and liquidity and reliance on active prosumers;
- The overall financial situation of the energy sector and need to find a market based mechanism to absorb the commitments to renewables producers and high efficiency co-generators benefiting under long-term feed-in contracts as well as other existing long-term commitments (see Appendix B for sector description);
- The new tighter limits on thermal power plants based on EU-legislation regarding Large Combustion Plants posing a threat to Bulgarian coal fired power plants (i.e. LCP BREF[7]).

In mid-2017, the Bulgarian government clarified its priorities in energy for 2017-21. They are generally in line with the 2011 Strategy provisions whilst reflecting some developments in the sector. Particular focus continues to be security of gas supplies and thus support is provided to domestic gas extraction and commercial exploitation of gas interconnectors with neighbouring countries by 2020. There is no mention of the role for gas in delivering the pathway to decarbonisation, and what needs to be done to achieve such a role for gas in Bulgaria.

As part of its 2017-21 programme, the government[8] is currently developing its new National Energy Strategy to 2030, with a vision to 2050. The intention is to develop this strategy in parallel to the national energy and climate plan (NECP) for the years 2021 to 2030. The intention is to benefit from synergies, common analytical tools and data sources. Bulgaria also intends to develop a low-carbon development strategy to succeed the Third National Action Plan on Climate Change (NAPCC) for 2013-2020.

The First Interim Report on the energy strategy, dated 31 October 2017, was published by the Bulgarian Academy of Science in January 2018, following public pressure for transparency. The focus of the report, according to stakeholders that Baringa has interviewed, is mostly around the role of nuclear. It is mostly silent on role of gas or other fuels versus nuclear.

The strategy definition process is expected to continue during 2018, with the Ministry aiming to release a draft by the end of the year.[9]

As with other EU member states, Bulgaria has agreed to meet decarbonisation targets consistent with the COP21 Paris accords. This means that by 2050, the EU should cut greenhouse gas emissions to 80% below 1990 levels, with interim milestones of 40% reduction by 2030 and 60% by 2040.

Bulgaria has committed to the ultimate target and is in the process of formulating its mid-term 2020-2030 path towards the 2050 objective. Before discussing the 2030 targets, we briefly take stock of the 2020 achievements.

3.2. 2020 objectives were set and reached

The EU 20-20-20 targets were formulated in 2009 as the EU-wide targets (to be tailored by Member-States individually), by 2020, to achieve:

- a reduction in greenhouse gas emissions of at least 20% below 1990 levels;
- sourcing of 20% of final energy consumption from renewable sources; and
- a 20% reduction in primary energy use compared with projected business-as-usual levels, to be achieved through improved energy efficiency

Via the Act on Climate Change implemented as part of Third National Action Plan on Climate Change (up to 2020), Bulgaria has modified versions of these targets:

- Based on the National Renewable Energy Action Plan (NREAP), Bulgaria aims to achieve a share of 16% of energy from renewable sources in final energy consumption by 2020
- The individual targets per sector are as follows:
  - Heating and Cooling: 24% of heat consumption met by renewable energy sources
  - Electricity: 21% of electricity demand met by electricity generated from renewable energy sources
  - Transport: 8% of energy demand met by renewable energy sources

Bulgaria is on track to attain its renewable energy target for 2020. The 2016 level of the renewable energy share in final energy consumption stood at 18.8%, well above the 16% target. Bulgaria's renewables share in transport stood at 6.5% in 2015, still below the 2020 target, while the renewables share in heating and cooling and the renewables

share in electricity generation reached 28.6% and 19.1% respectively in 2015.

The renewables share in gross electricity consumption was approximately 15% in 2017, estimated to increase to 18-19% by 2026.[10] This is still short of the target for the electricity sector of 21% of demand being met by electricity generated from renewable energy sources.

With a significant nuclear load, "carbon free" generation is currently around 50%.

Energy efficiency targets in Bulgaria

By 2015, the Bulgarian primary and final energy consumption increased for a second year in a row, reaching respectively 17.9 Mtoe and 9.5 Mtoe. Both values are about 1 Mtoe above the national energy efficiency target for 2020, with the road transport sector and industry recording the biggest annual increases.

Bulgarian primary energy intensity decreased by more than 25% over the 2005-2015 period, and by more than 39% over the last 15 years, despite a small uptick in 2015. During the same period the GDP rose by 28% (at 2010 EUR) whereas the primary energy consumption decreased by about 5%. Bulgaria however remains the most energy intensive economy in the EU by a large margin.

Greenhouse gas emissions targets in Bulgaria

Based on proxy values, in 2016 emissions were estimated at 58.9 mt CO2 equivalent, 43.5% below their 1990 levels. The relative decrease is almost double compared to EU average. Based on national projections, Bulgaria will meet its 2020 emissions target with a margin of 21.7%.

Note that, whilst the greenhouse gas emissions per capita are below the EU average, the greenhouse gas emissions intensity of Bulgaria's economy is the highest in EU, i.e. the Bulgarian economy consumes the greatest amount of energy needed to produce a unit of GDP.[11] This presents an opportunity for the growth of gas in the energy mix, which we discuss later in the report in section 4.3, highlighting the blocking role of relatively cheap power prices versus gas prices.

3.3. Rapid policy evolution has driven decarbonisation, and triggered the issue of affordability

A number of policies have been implemented by the Bulgarian government in support on renewables, and to achieve the 2020 strategy (see for detail Appendix B). These include:

- Feed-in tariffs for renewables and co-generation bonuses. Producers of electricity from renewable sources are entitled against the grid operator to the purchase and payment of electricity at a guaranteed feed-in tariff
- The legal basis for the feed-in tariff is the Energy from Renewable Sources Act (ERSA), which is the main element of the Bulgarian support system. The ERSA also establishes the obligation to purchase and dispatch electricity from renewable sources
- The tariffs are set by the regulatory authority every year on 30th June
- The duration of the subsidy had been 20 years for plants using geothermal energy, biomass and solar energy, 15 years for plants using biogas and hydro power and 12 years for wind power plants.

The costs for the system as a result of the feed-in tariffs, as well as co-generation bonuses, have created financial stress over the past few years. A Single Buyer Model was implemented, meaning all these obligations were transferred to national power utility, NEK, a subsidiary of Bulgarian Energy Holding (BEH) and subsequently to the regulated electricity market. As a result, a 'tariff deficit' arose due to a shortfall of revenues in the system – a product of tariffs that were below the cost borne by the energy companies to generate, transport, and commercialize electricity.[12]

As a result, the government is currently looking at options to replace the Single Buyer Model and integrate renewables contracts into the market environment, via the Independent Bulgarian Exchange (IBEX). Recent changes in the energy regulatory and legal framework propose that all producers above 5 (or 4) MW should sell their generation at the IBEX from mid-2018. For existing renewables with long term PPAs and feed-in tariffs, a new mechanism is being considered – Contracts for Difference (CfD).

All of these changes are now creating an unstable and volatile policy outlook, with many investors in renewables expressing concern, according to stakeholder sentiments.

Whilst government strategy on energy mix has been silent on the role for gas to support

renewables, it has thus far been clear on the priority for the development of the nuclear sector and for broad support of the coal sector. This was demonstrated by extension of the lifetime of units 5 and 6 of NPP Kozloduy as well as preservation of the coal capacities albeit under strict environmental requirements and efficiency standards.

Renewables and nuclear are clear low carbon options and were prioritized in the existing energy strategy (up to 2020) and restated in the Government Programme for 2017-2021.

3.4. Decarbonisation strategy beyond 2020

3.4.1. EU 2030 targets

The EU Commission winter package reinforces the targets to be achieved in the period 2020-2030, through the following measures:

- a reduction in greenhouse gas emissions of at least 40% below 1990 levels[13];
- sourcing 27% of final energy consumption from renewable sources by 2030; and
- a 30% reduction in primary energy use compared with projected business-as-usual levels, to be achieved through improved energy efficiency and by phasing out coal power plants

The single binding CO2 reduction target was submitted by the EU as Intended Nationally Determined Contribution within the climate agreement signed in Paris in December 2015. Bulgaria is part of that commitment.

The governance system for the 2030 targets is seen by energy industry players to focus on the single binding GHG target, and supported by a strong EU ETS. This approach can enable a more cost effective approach to decarbonisation allowing technologies to compete on an equal footing on the basis of a robust carbon market.

3.4.2. Bulgarian strategy to 2030 is not yet formulated

As described above, the Bulgarian Government has initiated the process to develop a strategy up to 2030 with an outlook to 2050, to support the achievement of the EU 2030 targets (and ensure they are on-track for 2050 targets).

Adding renewables capacity is a choice which is identified in the currently valid Ten Year Network Development Plan 2017-2026,[14] developed by ESO (the electricity TSO). It provided for commissioning of new renewables capacities up to 2026 of new 1,119 MW capacities (resulting in total PV and wind capacity of over 2,500 MW). Stakeholder sentiment observed in Baringa's engagement in February 2018 was that, that with volatile policy support, this growth in renewables was at risk (see appendix B on incentives to renewables having been scaled back and changed). The latest draft Ten Year Network Development Plan 2018-2027, released in March 2018, states in section 3.1 that "in the last 2 years no new requests for RES connection were received" from investors. Latest RES growth is strongly adjusted downwards to be adding only 401 MW by 2027 (instead of former 1,119 MW), for commissioning of new renewables capacities.[15] The drop in projections is mostly attributable to withdrawal of PV and wind projects.

Nevertheless, renewables capacity will require balancing/ancillary services to meet the challenge of intermittency. Adding gas generation capacity is one possible option for balancing and regulatory system reserves by ESO (but subject to further technical and economic assessment).

The estimates of generation outlook needs by ESO (including the current March 2018 draft[16]) do not take into account the possible adverse effects of the application of the LCP BREF on thermal (lignite/coal) power plants operation. This should represent a further opportunity for increased use of gas in the power mix, supporting inter alia the challenge of intermittency.

A stable policy outlook, including a clear strategy for 2020-2030, will be needed to attract investors.

3.4.3. Bulgarian strategy in decarbonisation – 2020+ challenging period?

In the face of the post-2020 challenges described above, Bulgaria must take proactive steps to remain on track for 2030/50 targets and gas can play a key role – in particular in substituting coal-fired generation and providing flexibility in support of increased renewables capacity, to contribute to achieving single EU-wide 2030 GHG- targets.

For this to be a viable option however, gas in Bulgaria needs to meet the test of being a secure and cost-effective way of achieving these decarbonisation objectives. To assess how gas can pass these tests, it is necessary to look at key enablers and barriers for gas in the supply situation, the downstream market, infrastructure and market structure. We discuss these topics in sections 5 and 6.

Prior to turning to market issues, we discuss the drivers for role of gas in more detail. To help meeting the 2030 targets, the role of gas in the Bulgarian energy mix should be considered as a key option given characteristics of natural gas as a fuel.

4. Demand – drivers and barriers for growth

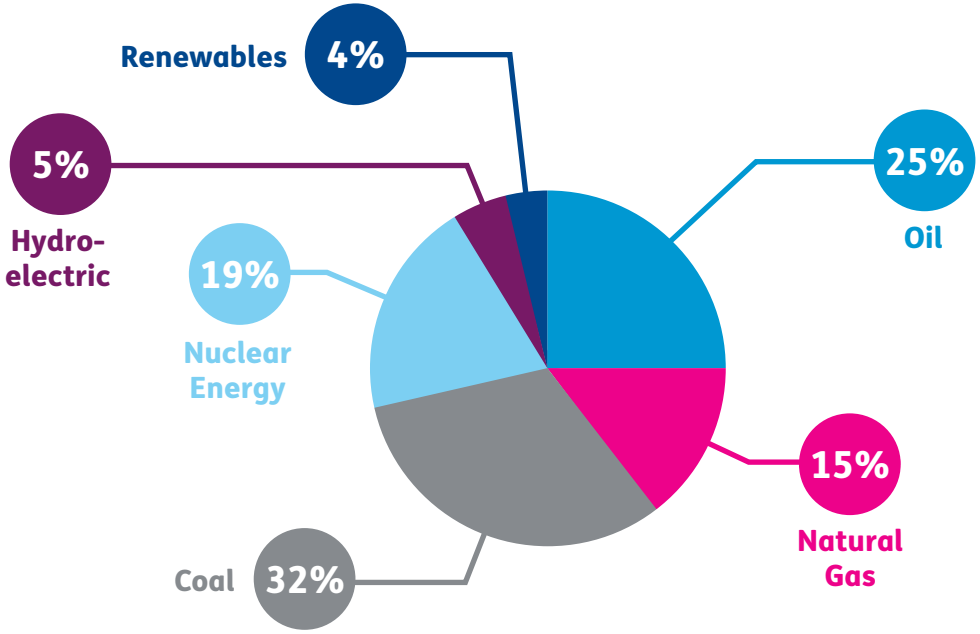
4.1. Gas is currently a small component of the energy mix

Real GDP growth in Bulgaria was 3.4 % in 2016 with broadly similar growth for 2017 and 2018 anticipated showing a very encouraging energy demand growth outlook.[17]

Coal plays a significant role in Bulgaria's primary energy mix, driven by indigenous production of lignite. Oil (in transportation) and nuclear also have significant shares whilst gas remains relatively small – at around 15% of gross inland energy consumption in the country.[18]

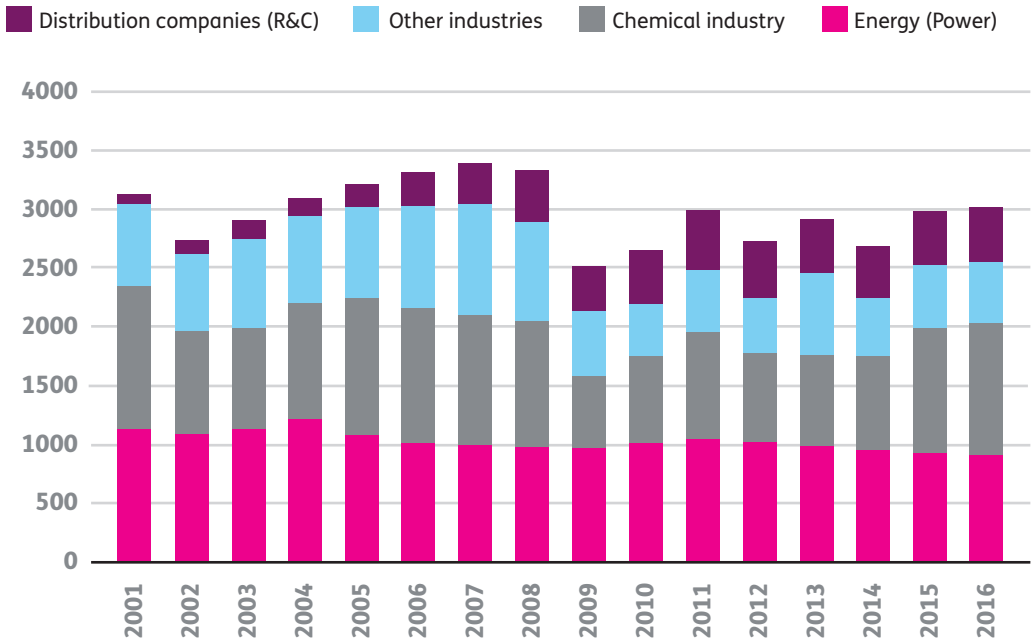
Gas is primarily utilized in industrial processes, with a modest role in the power generation mix and very low consumption in the residential and commercial sectors. Some 10% of industrial consumers represent 80% of demand,[19] with the largest individual industrial consumers in chemicals, fertilizers, and glass sectors as well as some large industrial CHPs. From industrial users, major consumption is in the chemical industry (37% in 2016) and energy sectors (30% in 2016).[20]

Figure 3 – Bulgaria Primary Energy Consumption in 2016 (in %, total 18.1 Mtoe)



Source: BP world outlook 2017 (2016 data)

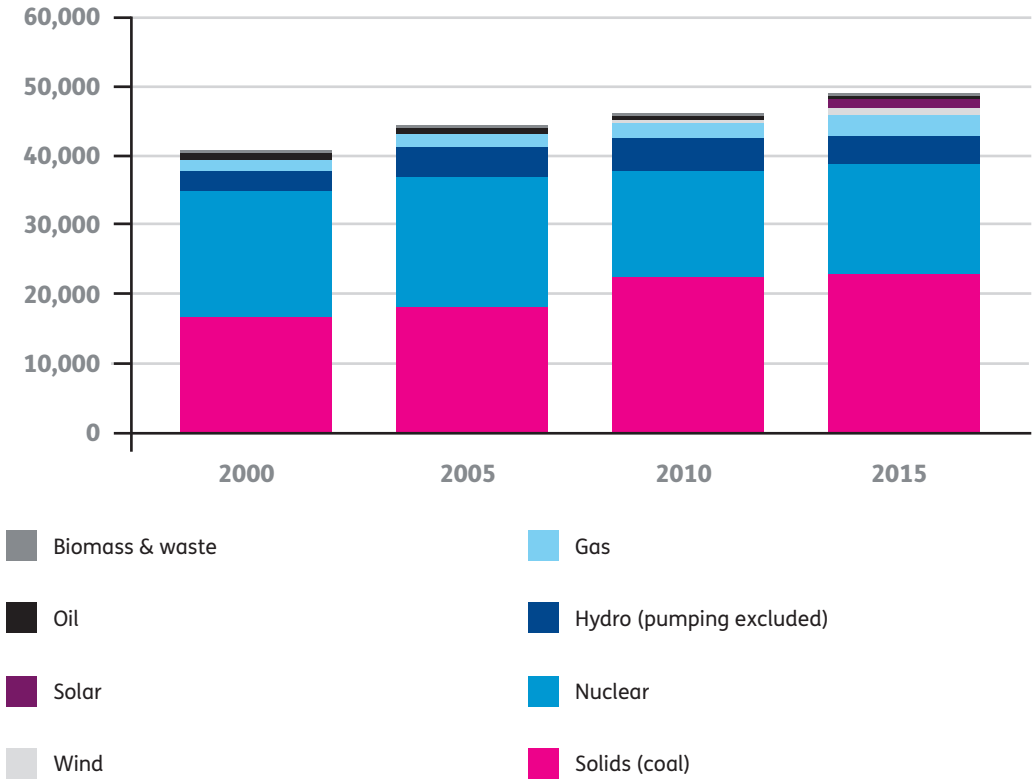
Figure 4 – Gas Consumption in Bulgaria by market sector (million cubic metres)



Source: EWRC, Annual report to EC

Natural gas has a relatively minor share in gross electricity generation, with coal and nuclear dominating.

Figure 5 – Gross electricity generation by source (GWh)



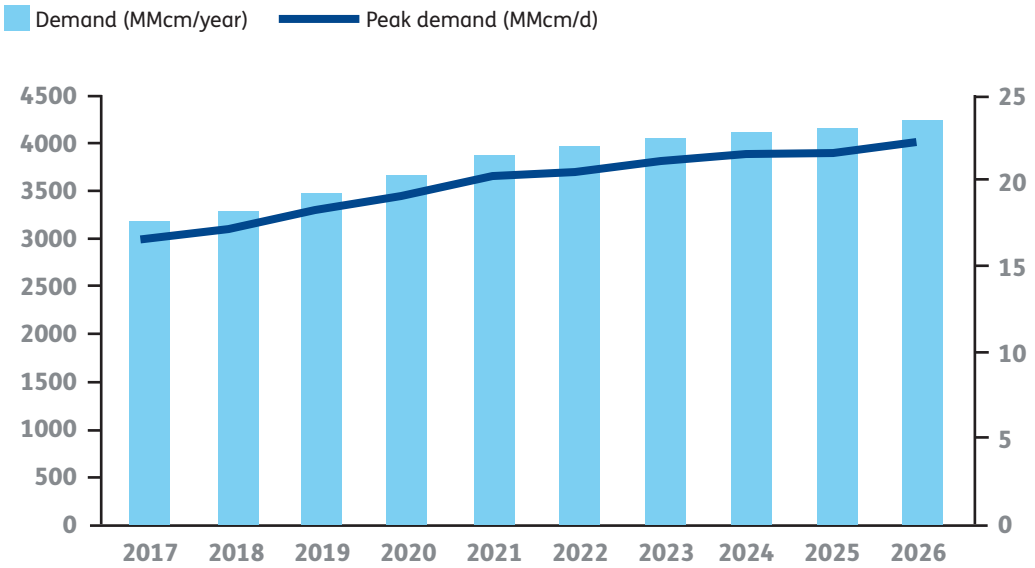
Source: EU Reference Scenario 2016 based on PRIMES, GAINS

4.2. Prospects for gas demand growth

The Bulgarian government is currently in the midst of a process to define future energy strategy (as discussed in section 3) and the role of gas in this strategy should have a major impact on gas demand prospects in Bulgaria.

The most recent projections for gas demand in the next ten years of Bulgaria's gas TSO, Bulgartransgaz (BTG), are captured in Figure 6 below. This assumes growth based on sustained economic growth (GDP growth between 2 and 3 % per year) and associated increase in final energy consumption (a 60% increase by 2024) and an increased market share for gas (19% in 2025 against 14 % in 2015).

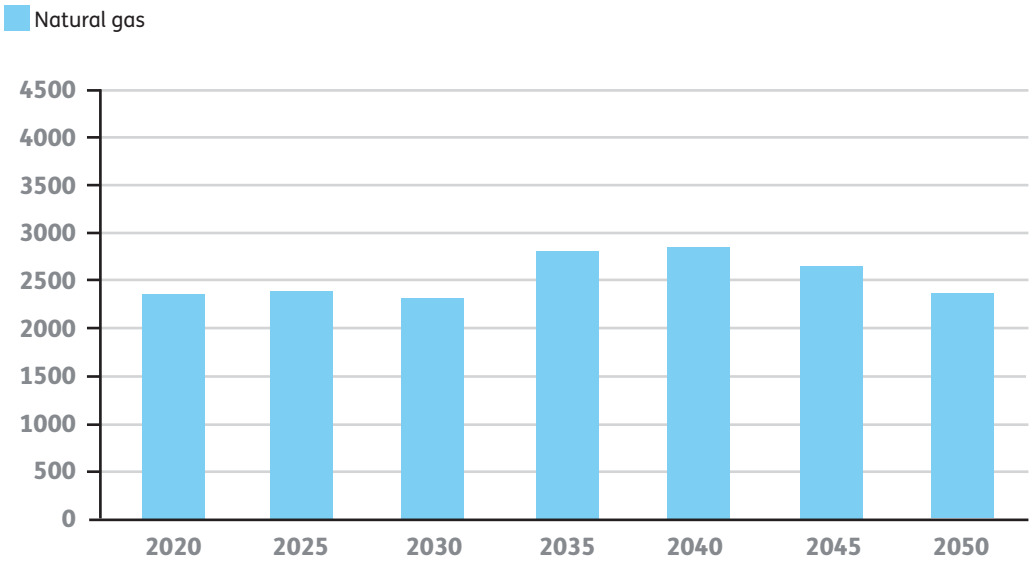
Figure 6 – Bulgartransgaz gas demand projection



Source: Bulgartransgaz

The European Union is less bullish in its demand projections as shown in Figure 7 below.

Figure 7 – EU gas gross inland consumption projection for Bulgaria (ktoe)



Source: EU Reference Scenario 2016 based on PRIMES, GAINS

Given the relatively small role natural gas currently plays in the Bulgarian energy mix, the potential for demand growth is significant. In our stakeholder engagement, we heard sentiments that BTG's projections were optimistic based on 'nothing changing' but could be exceeded with certain policy and market reform changes. And the ways in which gas demand could grow, are described in the next section.

4.3. Drivers and barriers for the increased role of gas in a decarbonisation pathway to 2030

4.3.1. Opportunities for role of gas

There are a number of opportunities to enhance the role of gas within the Bulgarian energy mix, utilising the decarbonising advantage of gas versus coal/lignite in particular. In each major consumption category, opportunity exists, as well as factors inhibiting that opportunity.

Residential

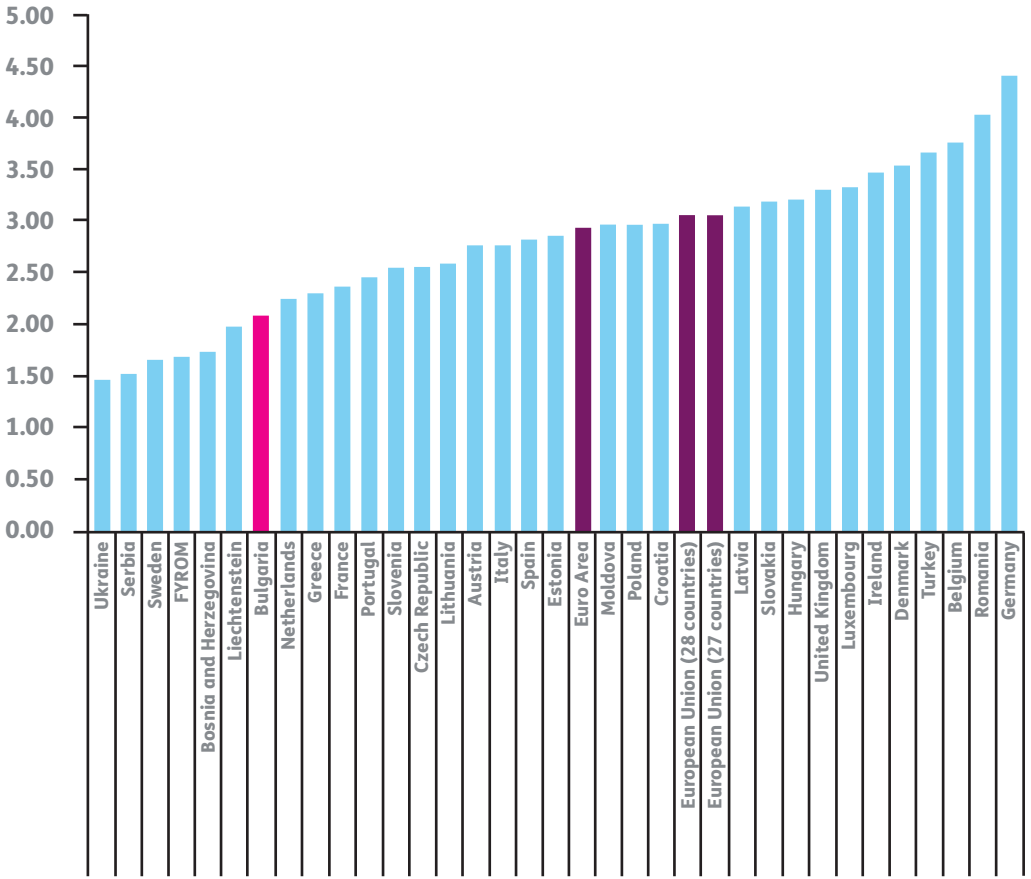
Despite government setting targets of 30% of Bulgarian homes having natural gas by 2020,[21] at the moment there is a much lower number (estimated at 70,000-90,000 of the ~3 million homes in the country or 2-3%). Government efforts have inter alia[22] centred on the provision of grants to subsidise the cost of installation of gas boilers and associated switching costs (typically away for electricity as the source of heat). This scheme has had limited success (2201 households successful applications as of February 28th 2018) but is yet to utilise all available funds (€ 10 million is available – which could support 10,000 installations).

The key inhibitor to the installation of gas in homes is the relative cost of power – with most homes being heated via electricity, consumers must be persuaded to switch form that to gas. This compiles with switching costs, connection to network and initial investment into gas-home equipment (cooking, gas-boiler).

Natural gas has a very minor role in heating, with electricity, coal, district heating dominating the heating market.[23] Bulgarian heating association calculations show that using night electricity tariffs will deliver more competitive heat over natural gas.[24] This market sentiment was confirmed in discussions with stakeholders in February 2018.

Power prices are regulated and compared to other European countries, inexpensive relative to gas, making the case for switching less compelling (as shown in Figure 8 below).

Figure 8 – Ratio of Power:Gas prices in Europe (including taxes and levies)



Source: Eurostat, 2017, weighted average prices using the most recent (2015) data for the quantity of electricity and gas consumption by households, Baringa analysis.

There is frustration amongst the gas distribution companies in Bulgaria that regulation supports electricity at the expense of gas (e.g. the Security of the Electricity System Fund[25]). Since 2017 contributions to the Fund are made also by the two TSOs - electricity (ESO) and gas (Bulgartransgaz). This requirement for the gas TSOs to contribute is seen by stakeholders as unfair. The WorldBank has proposed changes to operation of the Fund. For more details on Funds rationale please see Appendix B on Bulgaria's power markets.

Achieving the government target of 30% of gasification in homes would mean a gas demand increase of approximately 0.7bcm (24% of total gas demand).[26]

Power

In the context of decarbonisation, the power sector offers the greatest opportunity for improvement in Bulgaria – primarily to improve the air quality and reduce CO2 emissions by reducing the share of coal. While in parallel adding more flexible capacity needed when the share of RES in the Power sector grows.

As can be seen from Table 1 below implicitly, coal's role in power generation means that coal is by far the largest contributor to total CO2 in Bulgaria.

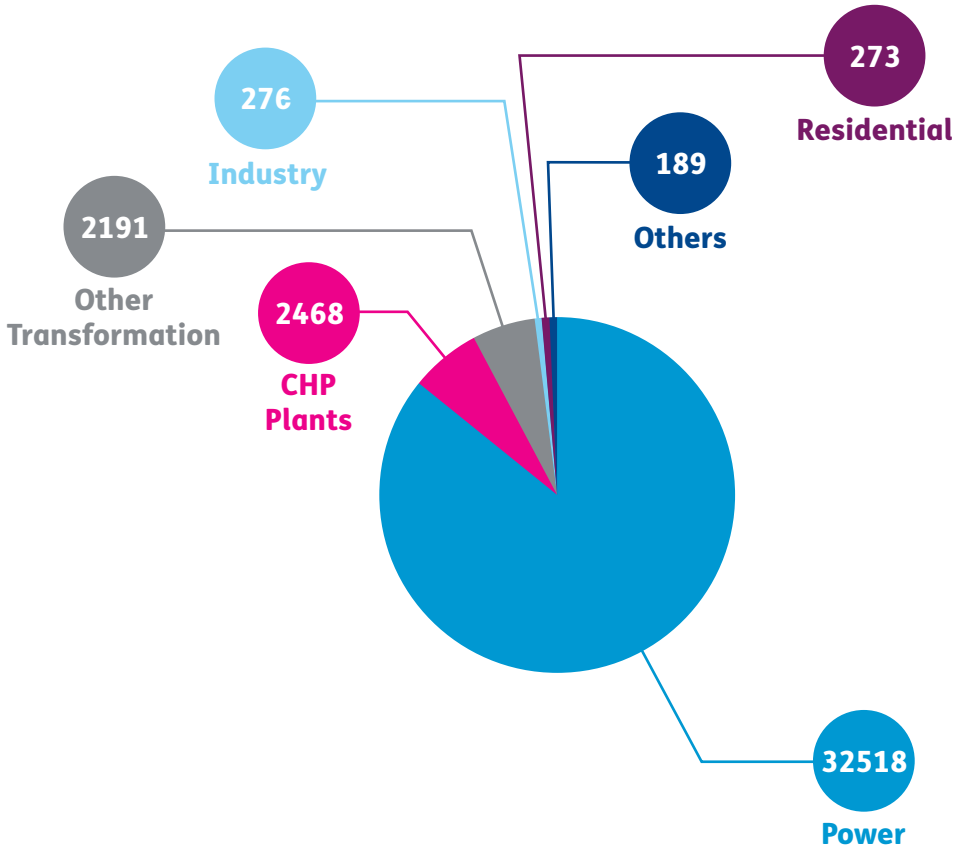
Table 1 – CO2 production in Bulgaria

(mt of CO2 equivalent)	2000	2005	2010	2015
TOTAL GHG emissions (excl. LULUCF)	64.39	67.04	61.17	55.55
CO2 emissions (energy related)	44.27	49.12	45.86	40.07
Power generation/District heating	24.55	27.86	31.21	25.14
Industry	10.59	9.82	3.70	3.98
Residential	1.35	1.22	0.99	0.96
Tertiary	1.21	1.10	0.81	0.72
Transport	5.73	8.35	8.25	8.43
CO2 emissions (non-energy and non-land use related)	3.45	3.96	2.97	2.96

Source: EU Reference Scenario 2016 based on PRIMES, GAINS

Within the role of coal across various sectors in Bulgaria, coal plays its biggest role in power generation. This is shown in the figure below:

Figure 9 – Coal consumption in Bulgaria



Source: IEA, 2015 data, units: kt

Bulgaria's coal-fired power supply is under some pressure via the recently adopted (17 August 2017) Best Available Techniques (BAT) Reference Document for Large Combustion Plants (LCP). The so-called LCP BREF sets, for the first time at the EU level, limits emissions of mercury, hydrogen chloride and hydrogen fluoride from the combustion of solid fuels in LCPs. In addition, the existing emission limits for pollutants including sulphur dioxide (SO2) and nitrogen oxides (NOx) have been tightened.

Existing LCPs have four years to become compliant with the new requirements.

The Ministry of Energy has stated its institutional support to the coal-fired power plants to apply for derogation and set up a coordination unit.[27] Further, there are nine power plants in Bulgaria that already stated their intention to apply for derogation (there is a 6-month period to file the application). The Maritsa-East power plants have combined efforts in requesting a derogation and have jointly hired Amec Foster Wheeler to support their efforts in the application process.

Following some initial expert evaluations, if such LCP BREF compliance investments are to be made, approximately 30% increase in electricity prices could be expected. This could have the twin impact of supporting gas as an alternative source of power supply and for the economic attractiveness of gas in the residential sector (see above).

Some Bulgarian industry stakeholders estimate there is a potential for an increase of 20-30% from current level of gas utilization in the power sector due to switching from coal. Identified options (based on technical suitability) include:

- TPP Varna (3 x 210 MW units)
- TPP Bobov Dol (2 x 210 MW)
- TPP Maritsa 3 Dimitrovgrad (120 MW)

Such switching is still dependent on economic attractiveness and thus relative pricing between gas (wholesale) and power (sales).[28]

Natural gas can have a key role to play in the next phase of Bulgarian power policy. It has clear decarbonisation advantages over coal and other advantages over nuclear and renewables. Gas-fired power generation does not require price support as for nuclear and avoids overly-fragmented supply and network management challenges implied by renewables. It further has the advantage of being able to provide flexibility in association with renewables.

Industry

Although natural gas is already a major source of energy in the industrial sector, there are significant parts of Bulgaria without access to natural gas where industrial consumers rely currently on coal, oil and electricity. There should be a clear economic case to switch from oil to gas and if all industrial consumers currently using oil (in 2015 183 ktoe) switched to gas, it would represent an increase of 0.22 bcm/year. Coal (185 ktoe) and electricity (769 ktoe) offer greater opportunity still. However, as opposed to households, the switching case from electricity to gas is economically more robust, which appears from gas playing a major role in the industrial sector (with opportunity for increased share of gas for SME-consumption, if electricity and gas level playing field is addressed).[29]

Gas network expansion projects are underway to connect some of these municipalities that are not currently connected to the gas grid (for ex. Svishtov, Pirdop, Panagiurishte, Bansko and Razlog[30]) which will begin to connect some of this latent industrial demand to supply, co-funded by EU.

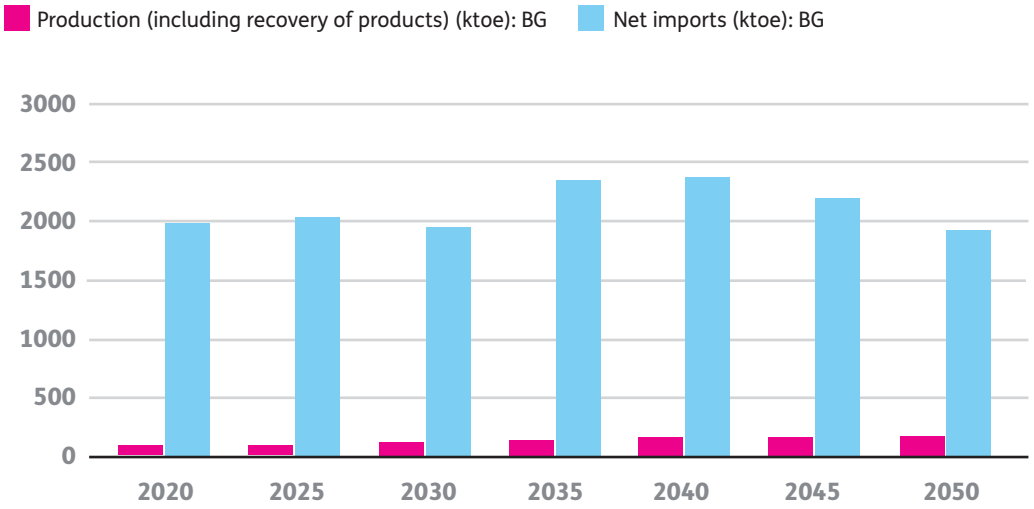
5. Gas supply

5.1. Existing supply sources

The vast majority of Bulgaria's relatively small ~3 bcm/year gas demand is met by supplies under a long-term contract with Gazpromexport, with a very small component of domestic production (80 MMcm/year in 2016 or 2.6% of the total).

The EU projects domestic production to remain modest (see Figure 10 below, where we are taking EU projections for the period from 2020 onwards) although E&P activities underway in the Bulgarian Black Sea have been described as encouraging by the developers (see Appendix A for further detail on local E&P).

Figure 10 – Bulgarian Gas Supply Sources, EC reference case projections (ktoe)[31]



Source: EU Reference Scenario 2016 based on PRIMES, GAINS

The import of gas is carried out by Bulgargaz EAD[32], with the most recent 10-year supply contract signed on 15 November 2012 with Gazpromexport. Under this contract, the wholesale import price is linked via formula to heavy fuel oil and gasoil and the supplies are under a take-or-pay obligation.

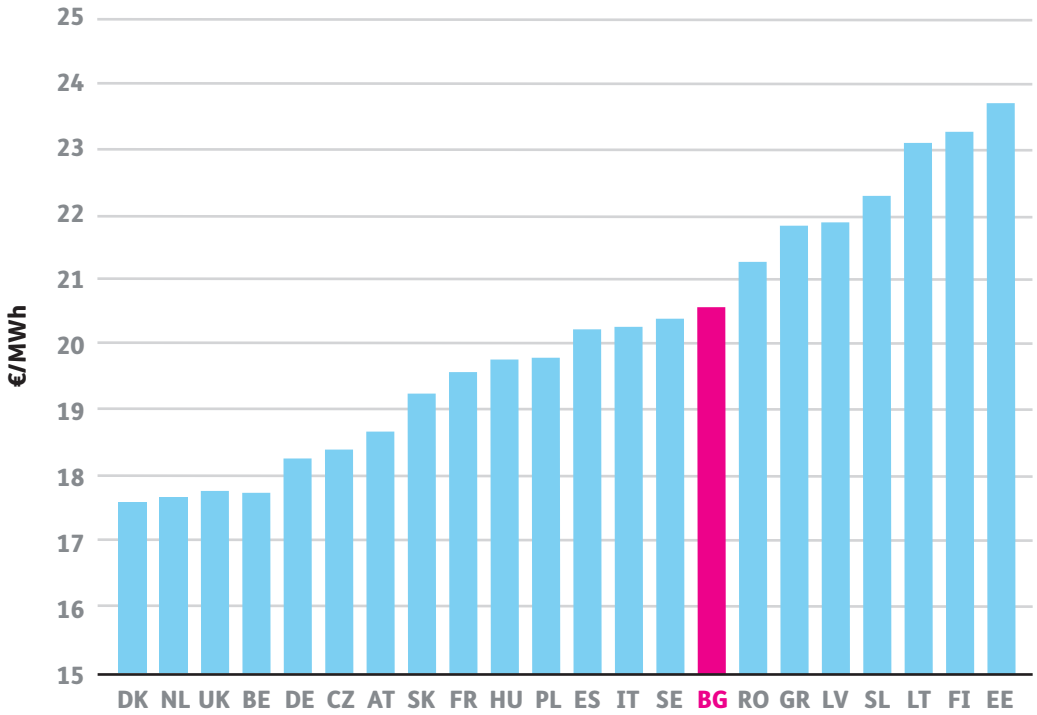
The transit gas transmission network provides for transmission of natural gas to Turkey, Greece and FYROM and has technical capacity of 17.8 bcm/year according to Bulgartransgas. The transit system is technically and commercially interconnected at GMS Ihtiman although only to a very limited extent (limited access – based on February 2018 data, approx. 0.3 bcm/year which amount to approximately 10% of Bulgaria gas demand) to the national transmission network. Capacity in the transit transmission system has been almost entirely booked under long-term contract (up to 2030) by Gazprom, with a 90% ship or pay clause[33] (see Appendix A for details on Bulgarian gas market overview, including infrastructure).

The dependence on a single supply source and single gas import route has led to conclusion by the European Commission[34] that Bulgaria (together with several other Member States) might have been subject to an unfair pricing policy due to obstacles to cross-border gas sales, unfair prices charged and gas supplies conditional on obtaining unrelated commitments from wholesalers concerning gas transport infrastructure. The EC's main concerns are that the Bulgarian gas market is isolated and lacks competition and it is thus the subject of excessively high prices compared to Western European benchmarks, especially liquid traded gas hubs.[35] As can be seen in section 5.2 below, Bulgarian border gas prices are amongst the highest in Europe.[36]

5.2. Pricing of wholesale gas

The wholesale border price paid by Bulgaria for its gas (via pipeline from Russia) is amongst the highest in Europe (see Figure 11 below), alongside other states that are largely reliant on a single source of gas.

Figure 11 – European average border gas prices Q1 2014-Q3 2017



Source: Quarterly Report on European Gas Markets, Market Observatory for Energy, DG Energy

5.3. Infrastructure for new sources being developed since 2009

During the 2009 Ukrainian crisis, which involved a reduction in Russian gas flowing west, Bulgaria was among the most affected EU member-states. When gas supplies were suspended, one of the emergency measures employed was to use three sources of emergency gas, namely i) gas from gas storage Chiren, ii) part of the gas normally used as system line-pack by the gas TSO, and iii) eventually gas via LNG supply (1 MMcm/d of gas, which is about 5% of the maximum daily gas demand in Bulgaria according to 2017 Security of Supply preventive action plan[37]) imported via the Revithoussa LNG-terminal in Greece. Another consequence was the prioritization of the security of gas supplies via diversification of supply sources and routes and a need to quickly increase import infrastructure and other measures to reduce dependency on one source and route. Interconnectors with neighbouring countries were identified as the most feasible option for quick progress on security of gas supplies as well as a must for market integration.

In order to increase market integration, and security of supply within the EU, a variety of projects have been identified by the EU as being Projects of Common Interest (PCI).

These include:

- "IGB", Greece-Bulgaria, compressor station (Reference EU PCI: 6.8.1.);
- "IBS", Bulgaria-Serbia, (Reference EU PCI: 6.10);
- Infrastructure from Bulgaria to Slovakia (currently known as "Eastring"), and the "ITB", Turkey-Bulgaria, (6.25.1, 7.4.2));
- Gas storage "Chiren expansion" (6.20.2); and
- The reinforcement of the internal Bulgarian network and full integration of the transit and domestic system (currently known as "Gas Hub Balkan") (6.25.4).

Source: EC, PCI Interactive map, http://ec.europa.eu/energy/infrastructure/transparency_platform/map-viewer/main.html

It should be noted that there already exists an interconnection with Romania (Trans-Balkan pipeline at Negru Vodu and Interconnector Romania-Bulgaria) through which Bulgaria could import Romanian gas

(especially as further Black Sea development is ongoing in Romanian waters). There is currently insufficient compression on the Romanian side of the border (Interconnector Romania-Bulgaria) to facilitate significant flow, although this is understood to be relatively simple to resolve.[38]

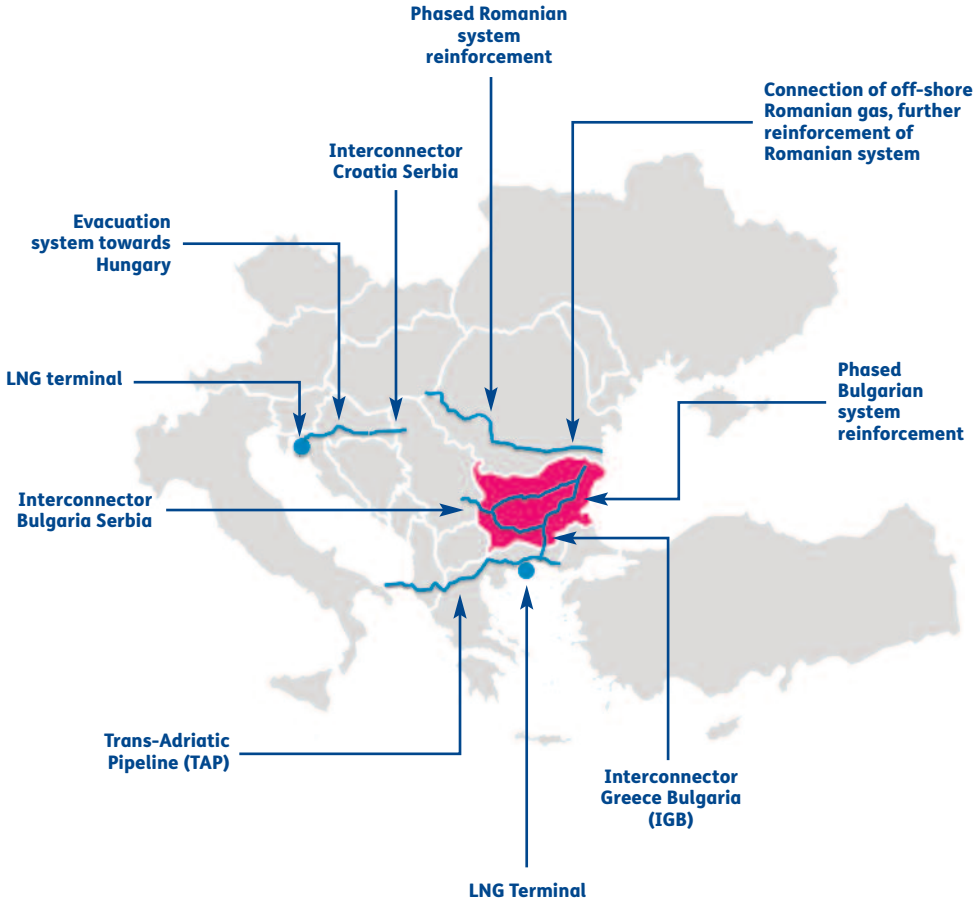
The most advanced of the new projects is the 182 km Interconnector Greece-Bulgaria (IGB). It has initial planned capacity of 3 bcm/year (potentially increasing to 5 bcm/year) and will allow flows in both directions. Partly funded by the European Commission, construction is due to start in 2018, targeting commercial operation by 2020. A market test open season conducted in 2017 resulted in 1.56 bcm/year capacity booking by 5 shippers.

No LNG imports are planned directly in Bulgarian waters although an FSRU (Floating Storage and Regasification Unit) in Greece at Alexandropoulos is being discussed as a joint Bulgarian and Greek project, with a reported capacity of up to 6.1 bcm/year. Its initial plan was to be operational in 2020 although this may now be a challenging deadline. Given gas demand in Greece, the terminal would need to find market demand in the region, inter alia via IGB.

There are also discussions on a new pipeline from Russia, so-called TurkStream. The development of the TurkStream gas pipeline – for which the precise route has not yet been confirmed – could mean an alternative direction of flow for Russian gas entering Bulgaria. It is anticipated that the cross-Black Sea pipeline will make landfall in Turkey and thus utilise the cross-border Bulgarian/Turkish pipeline in reverse flow versus today's direction of travel. This would be consistent with an ongoing – according to public press sources – objective by Gazprom to minimise the volume of gas transiting Ukraine after 2019.

A number of other major regional and EU infrastructure projects have also begun development such as Eastring, TANAP/TAP, Eastmed, LNG projects in Greece and Turkey. All have an impact on Bulgaria – primarily with Bulgaria acting as primarily a transit country, with relatively minor gas demand in comparison to Turkey or Romania. Figure below shows ongoing regional projects under so-called CESEC-initiative by EC[39]:

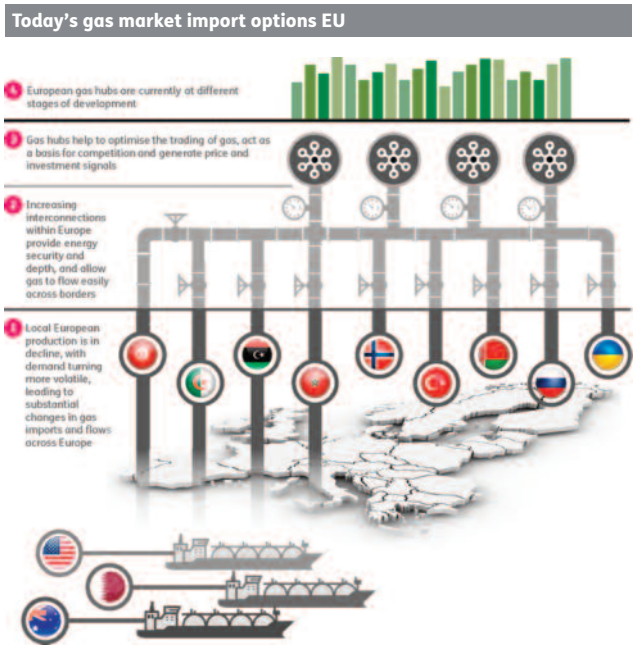
Figure 12 – Regional projects



Source: CESEC 2017, Baringa-analysis

Bulgaria has been keen to position itself within the new developments. A broad number of future gas supply options are available for Bulgaria, as can be seen on the following figure:

Figure 13 – Gas supply options



Source: Baringa

Black sea encouraging finds may offer an option (subject to infrastructure development

Gas developments in Ukraine (Ukraine capacity to be accessible in long term if and when transit contracts expire)

Global LNG (via Greece at present, or – once IGB, ISB and ITB active - via Croatia/KrK, or via North-South route (BRUA, Eastring as options), or via Turkish LNG terminals

African gas, and/or Mediterranean developments (Israel, Cyprus) accessible commercially via Southern Corridor and/or LNG

Norwegian gas, accessible via North-South route being developed (Baltic pipe would connect onwards to central-European infrastructure)

Russian gas, via existing or new route

We see increasing market integration within Europe and globally (LNG), coupled with ample infrastructure currently, and a trend to short-term contracting.

In parallel, encouraging conventional gas potential (Shell, OMV, Petrom) is being explored in direct vicinity of Bulgarian gas market.

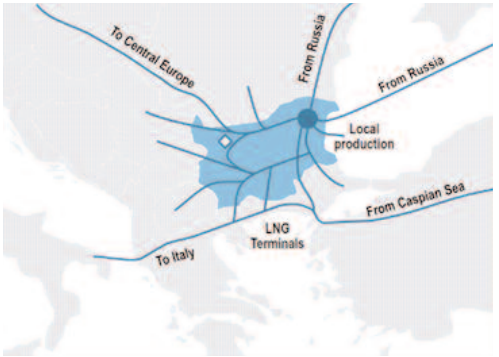
5.4. Development of a Bulgarian gas hub

Bulgaria has ambitions to create a liquid gas hub[40] providing regional and EU-wide benefits. The infrastructure development that goes under the name 'Gas Hub Balkan' is a flagship project for the Government, and a Feasibility Study (FS) has been launched, co-funded under Connecting Europe Facility.[41] Under the FS, at least five options on routes are to be studied (see Figure 14 below) to support increased natural gas supply options, and ultimately consumption in the region.

The Balkan Gas Hub project entails development of the transmission, storage and trading infrastructure. This is planned to include completion of the ongoing upgrade and modernization projects; completion of the interconnection projects; and construction of large-scale entry/exit infrastructure.

Whilst the development of a trading hub remains a laudable target, in the short term there are some key steps that Bulgaria can take to significantly improve security and diversity of supply (and with it support increased competition). Primary amongst these is the completion of the implementation of the Third Package and the introduction of market mechanisms that increase liquidity and competition. As a second step Bulgaria will have to ensure the

Figure 14 – Gas Hub Balkan Feasibility Study: supply routes



Source: EC presentation, Varna, September 2015[42]

Bulgarian-Romanian interconnector receives investment in compression to allow for Romanian gas to be imported, and the successful development of the IGB to enable LNG from Greece and Shah Deniz gas (eventually) to be imported - see Appendix A for details on gas network.

Alongside continued support for indigenous gas development, these steps will alter the landscape of Bulgarian gas supplies – further infrastructure development may not immediately provide such qualitative return on investment. The development of a 'true' hub – supporting trading of all sorts – will require more than infrastructure build-out

after implementing market reforms in line with EU Energy Package legislation.

Progress has been slow since 2009 in creating tangible and effective routes for new gas to enter Bulgaria but if IGB begins construction and the primary 'low hanging fruit' (Romanian pipeline/compression capacity reinforcement) is forthcoming, significant change will be achieved. However, at present market access for new sources remains limited and market structure challenges remain. A well-functioning gas market is required to meet the 2030 decarbonozation target, we discuss what is lacking, in the next section.

6. Unlocking market access

6.1. Access to Transmission capacity is present but limited

Third Party Access (TPA) to transmission and storage capacities has been introduced (see Appendix A for detail), though in practice access is limited. Principally this is due to long term bookings, limited capacities at Ihtiman (TSO data shows in February 2018 that about 10% of annual Bulgarian gas volumes can be transferred between national and international transit systems at Ihtiman), and limited storage capacities offered (approximately 25% of technical capacity is available after reservations for Security of Supply).

Capacity on the transit transmission system – which could have been a reverse flow route to e.g. LNG sources from Turkey – has been booked under long term contracts as mentioned earlier,[43] though some "Non-physical reverse natural gas transport" capacity is being offered at Kulata-Sidirokastro IP (Greece – Bulgaria) and at Negru Voda 1 / Kardam IP (Bulgaria – Romania, Trans-Balkan pipeline).

Capacity at the Romanian-Bulgarian border (Romania-Bulgaria interconnector) is constrained by a shortage of sufficient compression on the Romanian side.[44]

Only 40% of the national transmission system is utilised. Key steps to enabling greater access to this includes the development of IGB (which will interconnect with it) and the interconnection and opening of access to the transmission network (in the longer term).

6.2. Under EU support access is progressing

6.2.1. Critical view on role for gas – the link to market reform

Our findings through discussions with stakeholders point us that role for gas can only grow, if trust in gas, and its security and affordability is introduced through market reforms. The share of gas should be higher to meet the 2030 targets and to support renewables.. The current gas market situation is not fully supporting the opportunity of the share of gas to grow in the energy mix. Under EU support, market reform is progressing. Security of supply, and particularly access to new sources of gas and greater competition are important elements to be explored further in this section.

6.2.2. EU acquis as guidance for change

Whilst there are many options to increase the role of gas in the Bulgarian gas market, the most effective way could be to create market conditions such that gas can compete with other energy sources and for greater competition and consumer choice to exist within the gas sector.

The EU's energy packages provide clear guidance for how markets need to be reformed to work within the EU single market. As demonstrated by the number of queries and challenges being raised by the EU in the direction of Bulgaria, it is clear that there remains much to be done for Bulgaria's gas market to be reformed along these lines.

We also note the ongoing Case 39816, *Upstream Gas Supplies in Central and Eastern Europe*, with possible competitive measures to be implemented for the present Gazprom contracts. This particularly could concern making gas deliveries more competitive across the region (see Appendix C).

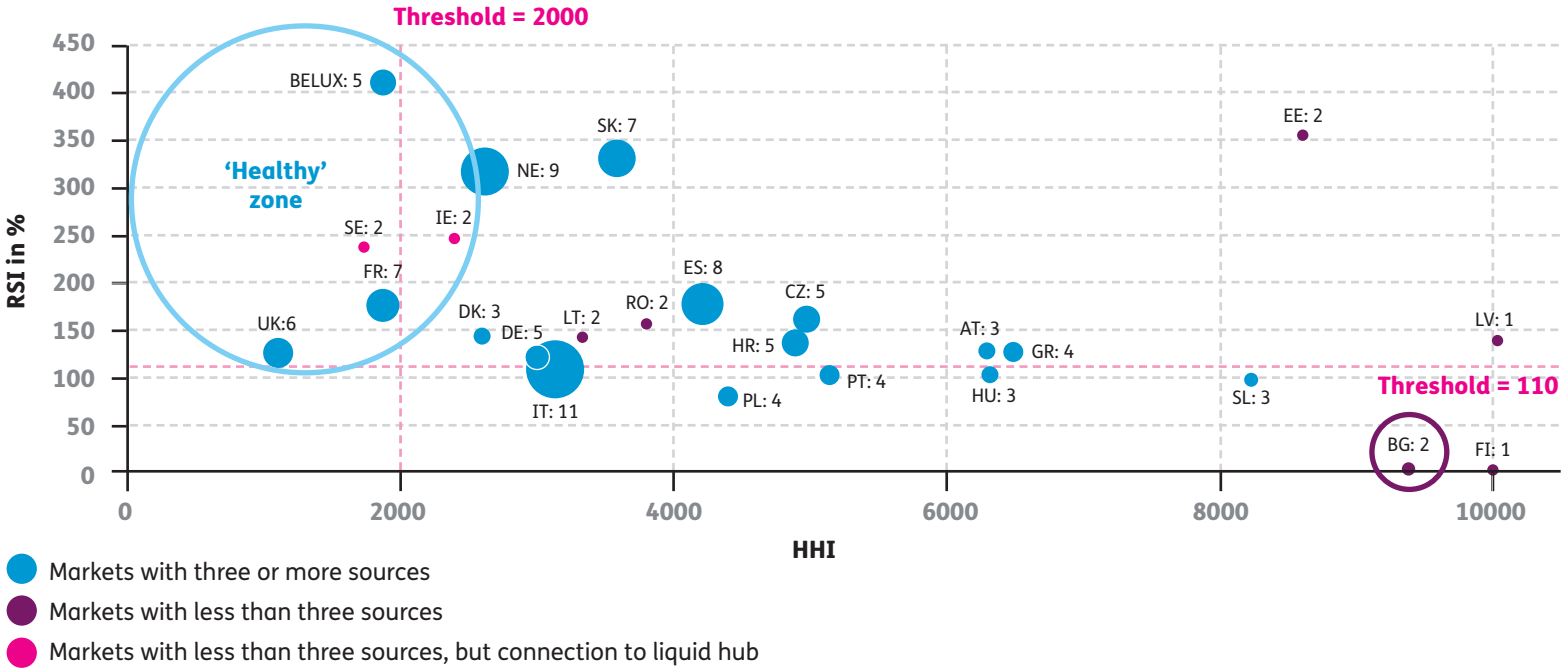
In 2017 it was noted at the Madrid Forum that that the Commission has set up and is chairing an implementation group for EU Network Codes monitoring with the involvement of ACER and ENTSOG. A 1st meeting was held on 2 October 2017. This group is intended to be complementary to other existing groups. The group will have no decision-making powers, but where consensus emerges on certain points, the intention is to draw up informal guidelines. The group's activity will be transparent.[45] The Commission will focus on inter alia Bulgaria, Romania, Greece. This focus is not surprising, given the ACER analysis on current state of market development in Bulgaria.

6.2.3. ACER analysis state of play

ACER analysis shows the amount of work still to be done for the Bulgarian gas market to exhibit the Target Market Health metrics.[46] The graph below shows Bulgaria cannot meet its annual demand without its largest supplier, and its market is extremely concentrated.

Figure 15 – ACER assessment of European gas market development

The upstream supply situation significantly influences the way in which gas markets perform.



- Markets with three or more sources
- Markets with less than three sources
- Markets with less than three sources, but connection to liquid hub

A few MSs to improve interconnection. Together with market oriented access rules market functioning will improve
A few MSs (eg. BG, RO) lack Third Package basics (eg. entry/exist system) which should be addressed

Note: AGTM recommends min. 3 distinct supply origin sources; HHI <2000 for upstream supply companies and a Residual Supply Index >110%, ie. market has the capacity to meet yearly demand without its largest upstream supplier.

Source: Agency for the Cooperation of Energy Regulators and the Council of European Energy Regulators, 2017

Recent developments have been positive in terms of liberalisation and plans for energy policy – in particular, 2017 has seen the approval of entry-exit gas transmission tariff methodology, the implementation of the CAM network code and in general a progressive engagement of the Government within the CESEC (Central and South-Eastern Europe Energy Connectivity) initiative driven by the European commission including Bulgaria.[47]

The eventual development of a well-functioning gas hub in Bulgaria – as a marketplace for suppliers and buyers to trade gas at prevailing market prices – will be an important element in supporting market liberalisation, although as we noted above, there a number of interim steps needed before this goal can be achieved.

Bulgaria has begun this process – a development recommended by ACER, although it has also identified a number of areas for improvement:

1. The Bulgarian gas market has fewer than three sources, and a highly monopolistic character

Reliance on few (in Bulgaria's case, one) supplier/s means typically means high prices and security of supply issues) and that price renegotiation is challenging. Access to an alternative source, for example via opening up access to existing underutilised infrastructure – with alternative pricing – is a helpful tool in achieving price reduction.

2. The Bulgarian gas market needs to improve institutionally

ACER identifies *"Weak political support for gas wholesale market development is the most fundamental concern .... Its clearest and most dramatic expression is the lack of some of the most essential legislative building blocks of the Third Package..."*

ACER further identifies insufficient regulatory transparency with too-short consultation periods, and a desire by stakeholders for more transparency on setting transportation tariffs.

3. The Bulgarian gas market would benefit from improving interconnections

Maximising interconnectivity with neighbouring states and thus access to all sources of supply will enhance security of supply and competition (and thus drive down costs).

4. Bulgarian gas storage access is reserved for security of supply, and not fully available to market.

A more commercial exploitation of gas storage – supported by increased security of supply via better interconnections – should enhance the effective functioning of a gas market.[48]

5. The Bulgarian wholesale pricing is not (yet) based on hub-pricing, but rather oil-linked [49]

The Bulgarian border price has benefited from the reduction in the crude oil price, but prices will increase in line with the oil price and not with other European (hub-priced) gas. As described above, access to alternative sources of supply should create the impetus for delinking – import infrastructure development, and the ability to access that capacity, is the key development here.

ACER analysis shows that progress towards market liberalisation has not been sufficiently rapid or effective. The market remains highly concentrated with limited competition, as shown by the concerns of EC-cases (see Appendix B), and ACER analysis above. Effective market reform measures could create an opportunity for diversity of supply of natural gas. One example of such measures is e.g. using available EU acquis tools like strict congestion management procedures on key entries and exits to free up market access where capacities have been booked long term. Such market reforms, following EU acquis guidance in more detail, will support affordability and security of natural gas.

7. Conclusions – ending the silence on a role for gas in the future BG energy mix

Gas can play a critical role in Bulgaria's energy future and pathway to decarbonisation. The key enablers are effective market reforms and selective infrastructure development aimed at enhancing diversification of supply, and the creation a level playing field between gas and power. We summarise our rationale below.

Gas can grow as a fuel in a decarbonising Bulgarian energy mix, both as baseload supply and in meeting the challenge of intermittency from a growing share of renewables

We have identified a number of key drivers of the role for gas in Bulgaria, including the support to the (moderate) growth of renewables, and most notably the substitution of coal in power generation, as recognised by EU reference scenarios (2016 reference scenario Primes). Bulgaria has a number of power plant sites ready for such conversion.

Market access and selective infrastructure investment – a twin-track to support the role of gas

Energy market reforms must be further progressed – at least to the level required by the EU, and following EU-acquis for detailed guidance.[50] This would be a key step to unlocking market access – something that would be supported by and be supportive of successful development of selective gas infrastructure needed for supply diversification and wholesale market competition.

Specifically, use of congestion management procedures may be needed in order to unlock market access to key import routes blocked until 2030 by 90% ship-or-pay contracts.

Selective investments to support security and diversification of the Bulgarian gas market must also be completed. This includes new interconnectors (specifically IGB[51] for access to Southern corridor gas and LNG imports via Greece), and campaigning for increased capacity in the existing Romanian interconnector through increased compression by the Romanian partners. Combined with the planned interconnection reinforcement project[52], this could be a means of securing access to import volumes as well as an export opportunity for gas reserves under development in offshore Bulgaria and Romania.

Via these and potentially further infrastructure investment – supported by market demand and the EU regulatory framework – Bulgaria could act to link a number of markets, the potential of local and regional production could be realized, and allow Bulgaria to benefit from the transit and export of gas whilst providing a major stimulus to domestic demand growth.

Opportunities for gas demand growth can be unlocked via regulatory reform that ensures gas is able to achieve its power-generation potential and compete fairly with power for customers in the heat sector

Addressing the role for gas will require consideration of the link between the gas and power sectors.

Development of renewable energy sources and complementary gas generation capacities, replacing coal where commercially feasible, is an option to consider for decarbonisation.

An improvement in the economic proposition for gas-fired power (e.g. through cost increases for coal-fired power due to environmental issues) is already taking place through EU-supported developments (such as LCP BREF).

Measures such as reform of the relatively low regulated power price versus gas, and removing or reducing the gas sector (gas TSO) payments to the Security of the Electricity System Fund, can help gas compete on a level playing field with power for the provision of heat in the residential and commercial sector, and address the energy-intensity challenge in the SME-part of the Industry.

Next steps – consultation on national strategy 2020-2030

A key first step is that, during the course of the its strategy definition, the Bulgarian government should fully engage with gas industry stakeholders (including trade bodies and NGOs) to build a complete picture of the opportunity for gas and the role it can play in Bulgaria's energy future.

Gas as a part of the energy mix will help address the energy trilemma – for Bulgaria to deliver decarbonisation affordably and with security of supply. The alternative is that Bulgaria risks, at best, an ineffective progression towards the 2030 and 2050 decarbonisation targets and, at worst, missing them altogether.

Appendix A: Bulgarian gas market – overview

A.1. Overview

The Bulgarian gas market is relatively small, at around 3 bcm/year. The largest demand sector is industry with a low level of use of natural gas by households[53] in the country (only 3% of gas consumed is in households , the lowest in the EU).

Bulgaria is virtually entirely dependent on Russian gas under a long-term supply contract from only one supply route (via Ukraine). Domestically-produced gas makes up the balance, peaking at 10-15% of the total but currently only 2.6%[54] (see A.4 section further). The 2009 gas crisis (in which Russian supplies to Ukraine and beyond were curtailed) left Bulgaria among the worst affected EU Member States and lead to the prioritisation by government of security of gas supplies via diversification of supply sources and support for E&P activity in Bulgaria. Some progress has been achieved recently in this respect. The development of gas interconnections with neighbouring countries is progressing – reverse flow gas interconnection with Romania has been commissioned, and the IGB (Greece-Bulgarian interconnector) is hopeful of starting construction such that it is commercially operational by 2020.

Infrastructure for the transmission of natural gas to users within the country is ring-shaped and can meet current natural gas demand using only around 40% of the system's maximum technical capacity.

Bulgaria is also a key transit country for pipeline gas supplies to Turkey, Greece and FYROM (Russian gas via the Ukrainian route), transiting up to 16 bcm/year. Historically, the two networks were developed and operated separately but since 2014 have been interconnected (physically and commercially) at GMS Ihtiman. This enables the transfer of gas between the two networks, via technical and commercial entry and exit points on the two networks.

At the European level, Bulgaria is involved in the implementation of the EU's strategic initiatives for building the new infrastructure to support diversification of energy supply, namely – a Southern gas route, access to liquefied natural gas and interconnections along the North-South axis.

Despite some progress in regulatory and market reform, Bulgaria lags towards the rear of EU Member States in measures of market liberalisation with the gas market still highly concentrated with limited competition. The incumbent (Bulgargaz) dominates with 98% on the wholesale market; the retail market has three major gas distribution companies with the largest having a 66% market share and the second largest 13%.

Insufficient market liquidity is a major reason why the TSO (Bulgartransgaz) opted to apply interim measures under Regulation (C) 312/2014.

A.2. Gas infrastructure in Bulgaria

A.2.1. Existing gas infrastructure

Transmission

Figure 16 – Bulgarian gas transmission infrastructure

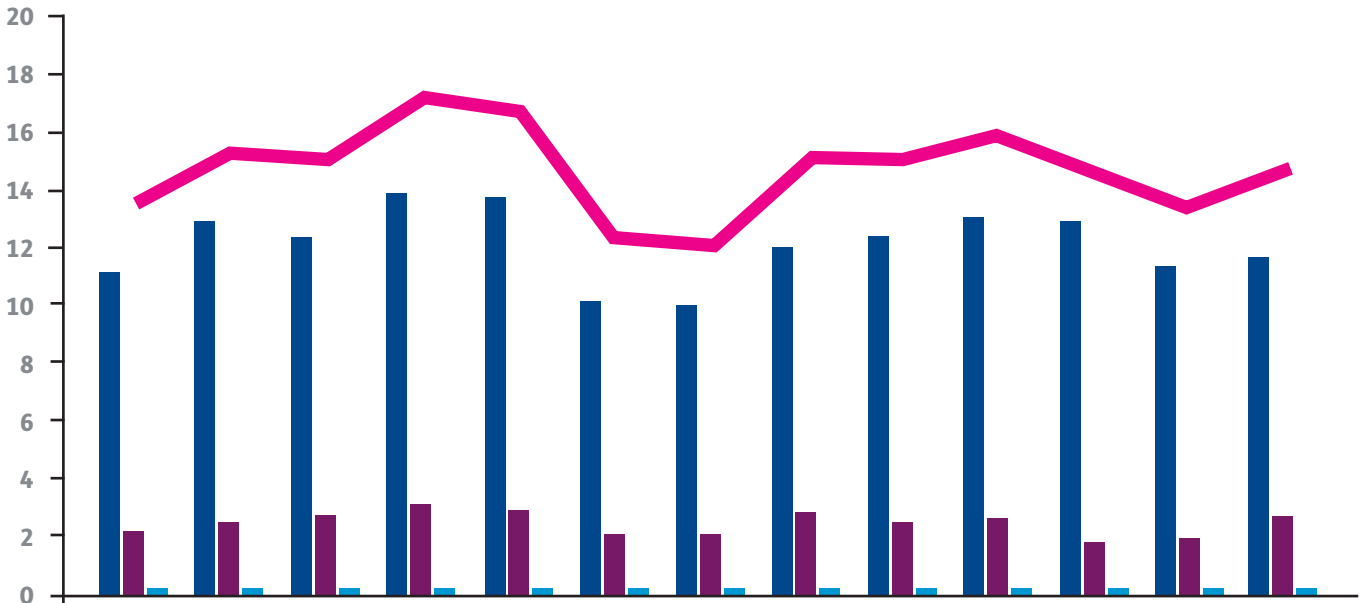
Existing cross-border interconnection points and capacities for physical gas flows in 2016

The gas transmission system operator in Bulgaria is Bulgartransgaz (BTG), part of state-owned Bulgarian Energy Holding EAD. BTG was certified as an Independent Transmission System Operator in 2015 and owns and operates the national and transit transmission gas networks as well as the underground gas storage facility at Chiren.[55]

The national gas transmission network is ring-shaped with a maximum technical capacity of 7.5 bcm/year, pressure of 54 bar and with 115 exit points (AGRS, GMS).

The transit gas transmission network provides for transmission of natural gas to Turkey, Greece and FYROM and has technical capacity of 17.8 bcm/year. Both systems are technically and commercially interconnected at GMS Ihtiman. Capacity in the transit transmission system has been booked under long-term contracts (up to 2030) by Gazprom. The vast majority of transit is for deliveries to Turkey (see Figure 17 below):

Figure 17 – Natural gas transit transmission 2004 - 2016 (bcm/y)



	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Turkey	11.2	13.0	12.4	13.9	13.7	10.2	10.0	12.0	12.4	13.0	12.9	11.4	11.7
Greece	2.2	2.4	2.7	3.1	2.9	2.1	2.1	2.9	2.5	2.6	1.8	2.0	2.7
FYROM	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.2
Total	13.5	15.5	15.2	17.2	16.7	12.3	12.2	15.1	15.0	15.8	14.8	13.5	14.6

Source: Bulgartransgaz, 2017

BTG is responsible for planning and implementing modernization and upgrade projects for the network. Examples include development of "new branches" of the transmission network within the country.

Storage

The Chiren facility has storage capacity of 550 MMcm. Withdrawal capacity is between 1 MMcm/day (minimum) and 4.2 MMcm/day (maximum). Injection rates are 1.5 MMcm/day to 3.5 MMcm/day. BTG plans to upgrade Chiren capacity including an increase in capacity of up to 1,000 MMcm working gas and an increase of withdrawal / injection capacities.

The Chiren UGS facility is an important flexibility source for Bulgaria, and potentially for neighbours Greece and/or Turkey. However, the facility is predominantly used as a major provider of gas supply security for the country (Bulgargaz is obliged to maintain a volume of gas in storage), meaning availability of the facility for commercial utilization is currently quite limited. Upgrade of the facility as well as improved security of supply by other means (e.g. diversification of sources of supply) should increase commercial potential for Chiren.

Interconnectors

The network for national gas transmission is connected to the Romanian network via Interconnector Bulgaria-Romania (IBR), commissioned in 2016. Planned projects for interconnection to Greece (IGB), Serbia (IBS) and Turkey (ITB) are at various stage of development.

Some of the gas interconnector projects (IBS and IGB for example) have been developed by companies other than BTG (i.e. not as regulated projects)[56] although still owned by government owned company (50% share BEH).

In 2016, interconnection agreements were signed between:

1) BTG and the Greek gas transmission operator DESFA for the existing Kulata / Sidirokastro interconnection point on BTG transit transmission network; and

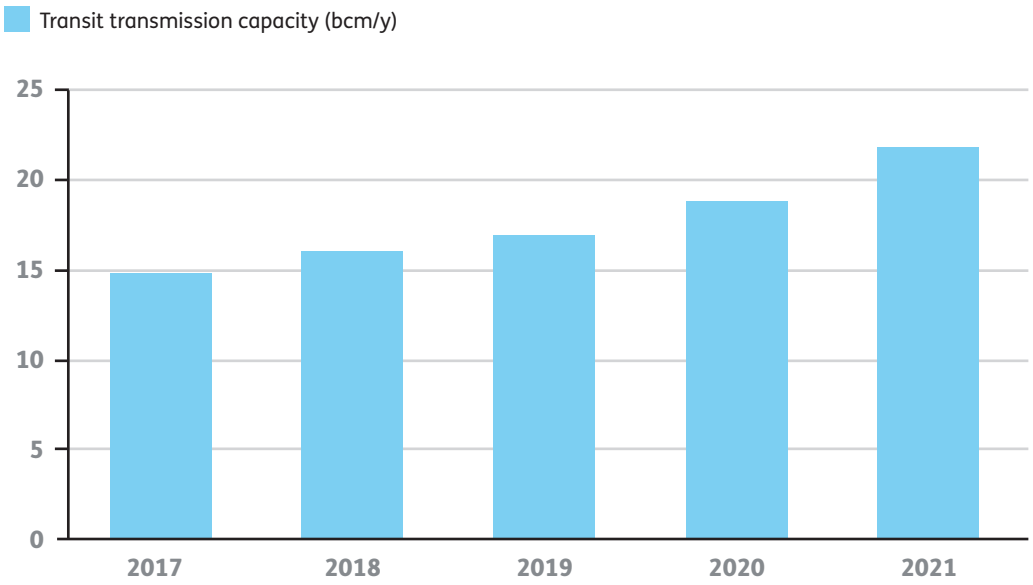
2) BTG and Romanian Transgaz AD for the Negru Voda 1 / Kardam interconnection point on BTG network for national transmission.

These enable the implementation of "non-physical reverse natural gas transport" through Kulata-Sidirokastro in the direction Greece – Bulgaria and through Negru Voda 1 / Kardam in the direction Bulgaria – Romania, thus creating the opportunity for virtual natural gas trade. The first real deals are already in place and natural gas quantities are delivered to customers in Bulgaria from Greece.[57]

BTG's network development programme provides for modernization of the transit pipeline to Turkey with completion expected by mid-2018. This will result in a capacity upgrade to 15 bcm/year from 14 bcm/year.

BTG's forecast for the use of cross-border transmission capacity, based on the existing long-term contracts for transit transmission and the expected new booking of capacity resulting from making new capacities available and cross-border entry and exit points, including from the projects ITB, IGB, IBS and IBR is shown below:[58]

Figure 18 – Forecast transit transmission capacity (bcm/y)



Source: Bulgartransgaz, 2017

Management of Transmission Capacity

Access to the transmission system and storage is open for third parties under an entry-exit tariff system (which, in 2017, replaced an old postage stamp system) [59]. Capacity nomination and allocation at the interconnection points of the gas transmission network of BTG and the gas transmission networks of Greece and Romania, as well as at all exit points of the national gas transmission network, are executed on the regional booking platform. Capacity can be booked on an annual (up to 5 years), quarterly, monthly, daily and intra-day basis. Balancing is done via a commercial dispatching platform, operated by BTG with daily imbalance charges applied, approved by the Regulator and use of the VTP for exchange of non-material goods as part of interim measures applied by the Operator by April 2019, with effects on gas market liquidity pending.[60]

Two balancing zones have been defined: national gas transmission network and gas transmission network for transit transmission (we note that this may inhibit efficiency of the market liquidity). The balancing zones are connected at GMS Ihtiman and GMS Lozenets, defined as entry-exit connection point between BTG national gas transmission network and BTG gas transmission network for transit transmission.

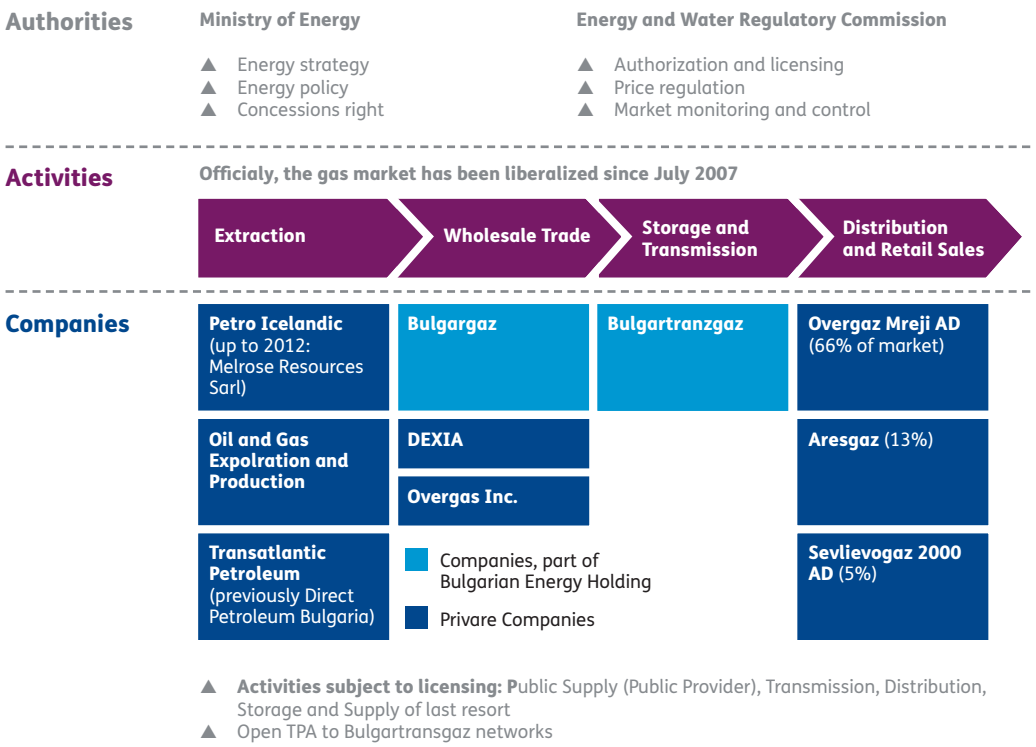
Network capacity has thus far proved ample, with no physical overloads registered for the network. The utilization rate of the national transmission network is typically at 40% of the maximum technical capacity. Gas pressures, used in system operation, currently are relatively low at 54 bar. The system pipelines are relatively mature in some cases.

The interconnection (physically and commercially) at GMS Ihtiman of the two networks – for national and for transit transmission – allows transfer of gas between the two networks, providing technical and commercial combination of entry and exit points on the two networks. Coupled with the possibility for virtual reverse flows on existing pipelines represents a significant step towards market liquidity and increased competition.

A.3. Energy market structure

A.3.1. Key market participants

Figure 19 – Governmental institutions and key market players in Bulgarian gas market



The Ministry of Energy is responsible for the development and implementation of energy sector policy. The Energy and Water Regulatory Commission (EWRC) is the Regulator for both the electricity and gas sectors. Further key participants are:

- Bulgartransgaz EAD – combined gas operator (licenced activities for natural gas transmission and storage and operation of networks) responsible for performing natural gas transmission and storage activities. The company is 100% owned by Bulgarian Energy Holding and in 2015 was certified as an ITO;
- Bulgargaz EAD – natural gas public supplier in Bulgaria, prices for gas supplies are approved by the Regulator quarterly. It is 100% owned by Bulgarian Energy Holding;
- Gas distribution companies – licenced activity for natural gas supply and distribution activities to end users connected to gas distribution networks on licenced territories; these companies are obliged to build and develop the gas distribution networks in compliance with the long-term business plans and terms and conditions as approved by Regulator;
- Natural gas traders – transact for natural gas supply with the public supplier, end suppliers, users, other natural gas traders, production companies, natural gas storage companies and the combined operator;
- Industrial natural gas consumers connected to the gas transmission networks. Around 80% of industrial gas demand is in the hands of 10% of the consumers.

A.3.2. Role of Regulator

EWRC, in compliance with EU acquis, has a central role in licencing activities for natural gas transmission and distribution, storage, LNG import facilities and in the provision of gas supply to consumers. EWRC supervises the performance compliance of licensing activities with the issued licenses' terms by performing preventive control and continuous monitoring.

The Regulator approves the rules for access to gas transmission and distribution networks as well natural gas storage facilities and respective technical rules.

EWRC is also responsible for the pricing methodology for access and transmission of gas on transmission networks owned by BTG and regulates the price formation of access and storage of natural gas storage facilities.

On the gas distribution side, prices of "natural gas distribution" and "natural gas supply by an end supplier" are regulated under the "price cap" method and EWRC approves tariff structures by customers' groups, reflecting the allocated annual revenue requirements for the service for each consumer group, based on a submitted cost service study. The existing tariff structures and prices for end customers of the gas distribution companies are differentiated depending on scale of consumption (household and non-household) as well as relative evenness of consumption.

EWRC adopted Rules on natural gas market balancing and daily imbalance charge calculation methodology as part of interim measure proposed by BTG to apply interim measures under Regulation (EC) 312/2014. EWRC is involved in cross-border issues as per the applicable framework.

A.3.3. Network access

Network access is open to third parties and there is a regional capacity-booking platform in operation. However, under Case COMP/B1/AT 39849 BEH gas, in 2013 the EC opened formal proceedings to investigate whether Bulgarian Energy Holding (BEH), its gas supply subsidiary Bulgargaz and its gas infrastructure subsidiary Bulgartransgaz might be hindering competitors from accessing key gas infrastructures in Bulgaria, in breach of EU antitrust rules. EC and Bulgarian stakeholders failed so far to achieve understanding on definite commitments[61] and in November 2017 the Parliament mandated the Bulgarian Government not to accept commitments and not to "plead guilty" in the case.

Capacity on the network for transit transmission is booked under long-term contracts (up to 2030), however devepostlopments for reverse flow and new infrastructures / modernization and expansion of existing infrastructure, provide for available capacity and trading options.

From October 2017, an entry-exit tariff model to network access replaced an old postage stamp model. Daily imbalance charge and specific balancing rules apply as part of interim measures proposed by the BTG under Regulation (EC) 312/2014.

Access to UGS Chiren is open for TPA under approved by EWRC price for storage of 2.49 BulgariaN/1000 cm/month.

A.3.4. Gas sales – wholesale

Bulgargaz EAD sells natural gas at prices regulated by EWRC and its share of the natural gas wholesale market in 2016 was 98%. The remaining 2% was realised by traders.

Bulgargaz offers a standard 3-year contract to its customers (large industrial consumers connected to BTG network).

In gas distribution, Overgaz Mrezhi AD serves most of the customers – 66% of all distribution network natural gas consumers in the country, followed by Aresgas AD with 13% and Sevlievogaz - 2000 AD with 5%.

According to data of distribution companies, 92% of their natural gas customers in 2016 were households and 8% non-household (i.e.

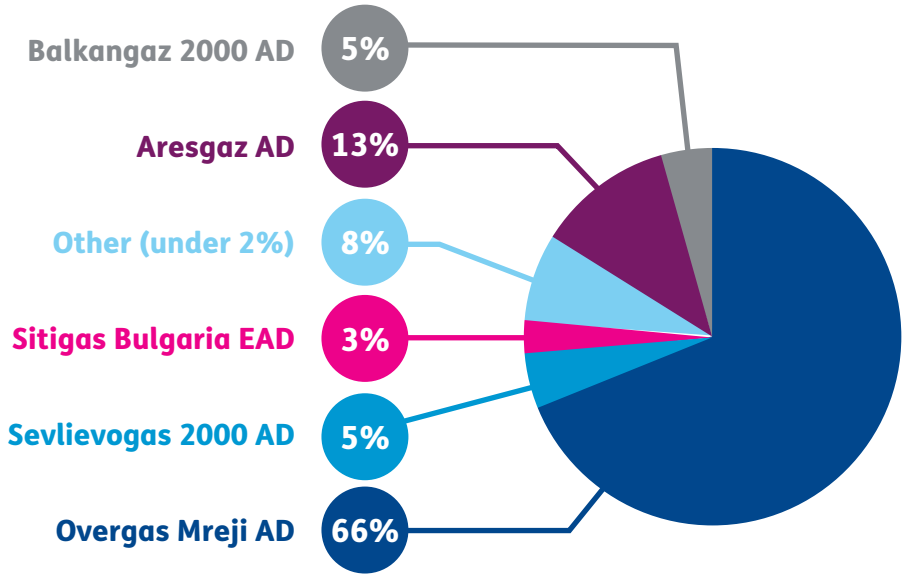
small commercial). Much of Bulgaria does not have gas distribution infrastructure in place and household consumers connected to the natural gas distribution network are few. Household consumption is very low – 2.28 % of the total consumption in the country.

The Independent Bulgarian Exchange plans to add a gas trading module and some of the distribution companies are proposing a trading platform whereby they can manage their seasonal supply/demand variation through trade amongst themselves. For now however all are supplied by Bulgargaz.

A.3.5. Retail

There is a number of licenced distributors to consumers, however distribution is highly concentrated with few players. Largest company, Overgas – 66%, second largest – 13% market share. See figure below.

Figure 20 – Market shares (CEER, NRA report 2017)



According to Security of Supply emergency action plan (updated in 2017[62]) there is a 261 million m3 under contract between "Gazpromexport" and Overgas Inc.

The share of household gas supply in the country is low compared to other European gas markets. Stakeholders did describe important efforts on household gasification including the development of 'Virtual pipelines' via truck deliveries of CNG (small volumes) for mountainous areas, including planned regional involvement for Macedonia and North Greece.

Natural gas has a very minor role in heating, with electricity, coal, district heating dominating the heating market.[63] Bulgarian heating association calculations show that using night electricity tariffs will deliver more competitive heat over natural gas.[64] This market sentiment was confirmed in discussions with stakeholders in February 2018.

The retail market is not (yet) liberalised with regulated prices are in place for domestic and non-domestic customers, with maximum prices approved by the NRA (NRA, 2017[65]).

A.3.6. Progress toward EU energy market directives

Bulgaria has been transposing of EU energy acquis in its legislation. However, the EC has recently (25 January 2018) requested Bulgaria to correctly implement the Electricity Directive (Directive 2009/72/EC) and the Gas Directive (Directive 2009/73/EC). According to the Commission's assessment,[66] Bulgaria has incorrectly transposed several requirements concerning the ownership unbundling model, the independent transmission operator unbundling model and the distribution system operator. Bulgaria has not correctly transposed the rules on connection to the network by allowing the gas transmission system operator to refuse connection based on lack of system capacity.

Following the formal notice from the EC, the Ministry of Energy proposed, for public consultation, amendments to the Energy Act[67] for full compliance and transposition of the requirements of Directive 2009/72/EC and Directive 2009/73/EC as well as the provisions of the Regulation 1227/2011 (REMIT).

A.4. Domestic supply options

Domestic extraction of natural gas is declining and there are small proven reserves. Exploration activities are ongoing and there are currently 15 exploration oil and gas blocks, onshore and offshore. About 10 more blocks have been identified by the government and could be tendered in the future, including some deep and shallow water offshore blocks.

Any increase in domestic production is not expected before 2020 and production will remain in the range of max 75-80 MMcm/year until such a time a new reserve are discovered and developed.

Particular focus in the Government Programme 2017-2021 is to support domestic gas extraction including:

1) Continuation of deep Black Sea exploration and implementation of procedure for exploration block Teres[68]; and

2) Support for the exploration activities in block Khan Asparuh[69] and block Khan Kubrat[70] to guarantee competitive prices of energy sources and significant income from concession rights.

The field with the highest potential appears to be Khan Asparuh. It is in deep water Black Sea, close to the Romanian offshore fields and controlled by Total, OMV and Repsol. Lovech A (Direct Petroleum) is another with potential – reserves are estimated at 13.7 bcm, potentially growing to 22 bcm if tied in with neighbouring resources.[71]

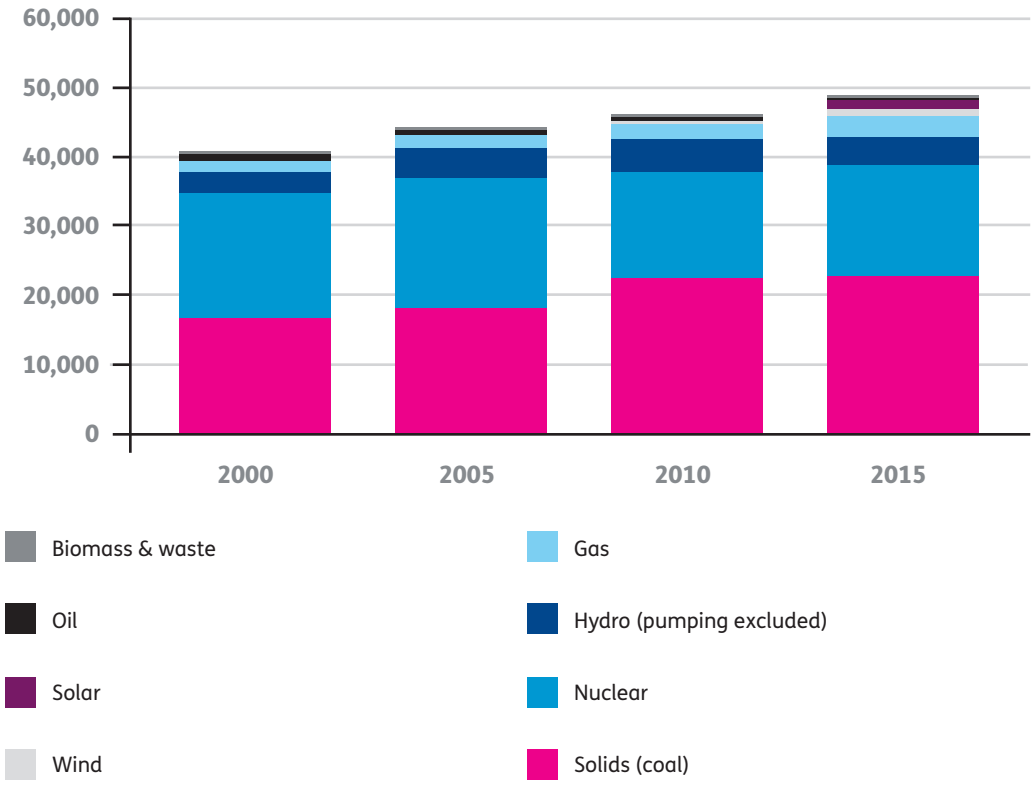
Despite the strategic imperative of encouraging domestic gas production to reduce import-dependence, one avenue for increased gas production has been blocked. There is an indefinite suspension [2012] of shale gas exploration due to environmental concerns.

Appendix B: Power markets, and renewables policy support

B.1. Key players in the power market, and status

- The state owned Bulgarian Energy Holding EAD (BEH) and its subsidiary NEK (National Electricity Company) hold together generation assets representing 50% of the installed capacity, and 60% of generated electricity. BEH has a diversified generation mix with hydro, nuclear (the Kozloduy power station, with a licence to 2027) and thermal generation. NEK acts as a single buyer from the power generators on the high voltage grid and remains the sole electricity supplier at regulated prices for end suppliers. Moreover, NEK is obliged to purchase electricity produced by CHP plant, renewables and industrial producers at regulated prices
- BEH also owns the Maritsa Iztok 2 which operates one of the three power stations that constitute the Maritsa Iztok coal power plant complex, the main coal-fired power plant in Bulgaria. The other two power stations (1 and 3) are owned by AES and Contour Global respectively
- The now idle 1.3 GW Varna power station, formally a coal plant and major provider of balancing energy for the north-east region, where most wind plants are located, is being considered for conversion to gas. On December 12th 2017, Bulgaria's Commission for Protection of Competition announced it has allowed Bulgarian logistics company SIGDA to acquire the Varna power station for an undisclosed price. Sigda plans to rebuild three of the plant's six 210 MW units so they can operate on natural gas.
- Bulgaria has approximately 11 GW of installed capacity of which the majority is based on nuclear, coal/ lignite and gas. Solar experienced strong deployment rates in 2011 and 2012, exceeding 1 GW of installed capacity, but has not developed much further since. Onshore wind capacity is also at comparable levels (approximately 0.9 GW), and developed strongly in same period as solar. There is also significant hydro (2 GW) and hydro Pumped Storage capacity (1.4 GW), with some upside potential (see figure below).

Figure 21 – Gross electricity generation capacity by source (GWh)



Source: Baringa-analysis

The power market faces some issues, particularly as a result of NEK running at a deficit. A range of legislative and regulatory changes were implemented in 2015 and 2016 aimed at stabilising the sector by reducing NEK's costs and increasing its revenues on the regulated segment. In detail, the background to this is as follows[72]:

Formation of the tariff deficit

Three key factors led to the accumulation of a tariff deficit in NEK in past regulatory periods

- Boom in renewables combined with mandatory purchase by NEK of renewables generation at preferential prices for the quantity fed into the grid
- Mandatory purchase of efficient cogeneration power at preferential prices without a mechanism for measuring compliance with efficiency criteria
- Existing PPAs between NEK and AES and ContourGlobal, based on "take or pay" principles with NEK commiting to pay for almost the entire capacity of the plant, independent of whether this capacity is dispatched or not

Measures implemented to address tariff deficit

- A range of legislative and regulatory changes were implemented in 2015 and 2016 to reduce NEK's costs on the regulated segment by limiting NEK's obligation to purchase electricity from renewables and cogeneration plant in order to eliminate the formation of new tariff deficits
- Moreover, in July 2015 the Bulgarian Parliament established an Electricity System Security Fund to increase NEK's revenues from the regulated segment by increasing existing and creating new revenue streams. Since 2017, both electricity and gas TSOs have also been subject to contributions to the Fund. The fund raises 5 per cent contributions on the monthly revenues of all energy producers, as well as revenues from the sale of CO2 quotas. Additionally, there has also been an increase in the amount and scope of the "Obligation to Society" fee, with the fee almost doubling (from 19 BulgariaN LEV/MWh to 37 BulgariaN LEV/MWh) and now applying also for quantities of electricity purchased for technological losses
- Note that for 2016 it has been reported that over BulgariaN LEV 355 million (approximately EUR 180 million) has been collected as part of the Electricity System Security Fund. It was also reported that the costs of the fund's maintenance in 2016 amounted to BulgariaN LEV 131,900. The document was adopted by the Managing Board of the Fund in March this year and audited by the National Audit Office

Renewable support schemes

- Electricity from renewables has historically been promoted in Bulgaria through feed-in tariffs (FiTs) under long-term contracts, paid out by NEK or by one of the three end-suppliers and affiliates of the electricity distribution companies. The regulator (EWRC) has regulated the electricity selling price at the wholesale market and the tariff at which the renewables producers sell electricity to suppliers, with tariffs set every year on 30th June. In August 2016 the European Commission approved that Bulgarian state aid supporting the generation of energy from renewables from 2011 is compatible with the internal market
- The principal energy laws that govern renewable energy projects are the Energy Act and the Energy from Renewable Sources Act (ERSA). The Energy Act serves as the general law regulating the electricity, gas and thermal power sectors, while the ERSA regulates the renewables sector
- FiTs are compensated through end user bills and taxes (the 'Social Responsibility Tax') covering renewables power purchased by the regulated market supplier, NEK

Reforms in the renewable sector

- The renewable energy sector has undergone extensive reforms in recent years to the detriment of investors in the sector. FiT support for new renewables was withdrawn for new wind and PV capacities in 2015, with annual hourly limit on mandatory purchases of all generated power from renewables also introduced in 2015. Allowed rates of return for renewable projects have also been limited to the Weighted Average Cost of Capital (WACC) – 9% in 2011 down to 7% in 2014. Following these changes, investments in new wind and PV installations have declined dramatically since 2015

- Additional measures adopted in the past few years included:
  - Introduction of grid access fees, which were only imposed on electricity produced by wind and PV installations
  - Introduction of a 20% revenue tax (repealed by the Constitutional court)
  - Introduction of balancing responsibility in the day-ahead market without considering the ability of renewable producers to predict their production
  - Retroactive reduction of renewables FiT based on reevaluation of the additional EU financing the projects had received
- On 23rd December 2015 Bulgaria's Supreme Court of Cassation (VKS) ruled that the regional electricity distribution grid operators as well as the state operator of the transmission grid ESO must repay grid access fees that they had charged developers of renewable energy sources
- Despite the fact that the Supreme Court repealed the initial decision for introduction of the grid access fees, the regulator issued a new decision that increased the amount of the fees by more than 200% compared with 2014. The Government also imposed a limit on the annual amount of electricity permitted to be purchased by the off-takers under the preferential tariffs for renewable producers
- Going forward, Bulgaria has not yet introduced an auctioning system for new renewables support with the 2030 renewables share expected to be pursued using the European Commission's 2014 State Aid Guidelines on RES-E support

Future market operation

- Full market liberalisation within the electricity sector is a strategic objective for the government in order to achieve full compliance with the 3rd energy package of EU Directives, and to contribute to financial health improvement of the energy sector. It is therefore intended that the current single buyer model under regulated prices and generation quotas will be replaced with a fully competitive wholesale market
- The World Bank presented its suggested approach with respect to the Electricity System Security Fund in January 2017. The model proposed by the World Bank largely follows the actions taken in Spain with a transfer of the system deficit to a special purpose Government-owned and guaranteed fund (in Spain this is called FADE – Fondo de Amortizacion del Deficit Electrico)

The Bulgarian government is yet to announce their proposed course of action regarding the enduring financial stabilisation of the electricity sector.[73] The proposals will then be open to public discussion and legislative changes may also be required.

Appendix C: EC cases – Bulgaria, overview

Recently, Bulgaria has been part to several EC cases for breach of competition on electricity and gas markets. We describe briefly the cases below for background using press sources.

C.1. Case COMP/B1/AT 39849 BEH gas[74]

In 2013, the EC opened formal proceedings to investigate whether Bulgarian Energy Holding (BEH), its gas supply subsidiary Bulgargaz and its gas infrastructure subsidiary Bulgartransgaz might be hindering competitors from accessing key gas infrastructures in Bulgaria, in breach of EU antitrust rules. EC and Bulgarian stakeholders failed so far to achieve understanding on definite commitments[75] and November last year (2017) the Parliament mandated Bulgaria Government not to accept commitments and not to "state guilty" in the case.

C.2. Case 39816 Upstream gas supplies in Central and Eastern Europe[76]

Under this case, EC main concerns are that Gazprom isolated the Bulgarian gas market and may have been charging excessively high prices in Bulgaria compared to Western European benchmarks, especially liquid gas hubs. Certain commitments from Gazprom were opened for public consultation [2017] and they provide for gas from other parts of Central and Eastern Europe to be brought to Bulgaria under swap-like operations, commitment Gazprom not to seek damages from its Bulgarian partners following the termination of the South Stream project, option for price revision under Gazprom supply contract benchmarked to Western European price, including prices at competitive gas hubs and free flow across Bulgarian borders [that so far has been hindered by certain provisions under Gazprom supply contracts].

C.3. Case 39767 BEH Electricity[77]

The case has been closed [end 2015] with EC decision that renders legally binding the commitments offered by Bulgarian Energy Holding (BEH) to end competition restrictions on Bulgaria's wholesale electricity market. BEH has committed to offer certain volumes of electricity on an independently-operated day-ahead market on a newly-created power exchange[78] in Bulgaria for a period of five years. These volumes will be put for sale in the day-ahead market, with a maximum price based on the marginal costs of BEH's production subsidiaries. Further BEH committed to set up a power exchange with the assistance of an independent third party with expertise in the area, and transfer control of the ownership of the new power exchange to the Bulgarian Ministry of Finance.[79] Monitoring Trustee has been appointed to follow the implementation of BEH Commitments.

Appendix D: What if gas did not play a role

Introduction

There are different pathways for proceeding towards the 2030 goals, given the current Bulgarian energy mix build up including particularly coal focus. In the report we extensively focused on the opportunity for growing role for gas in decarbonisation in Bulgaria.

Arriving at a sustained 2030 mix, and full 2050 decarbonisation will require a concerted push across the Bulgaria' energy mix, including a key role for gas to support decarbonisation. Renewables alone won't be able to deliver the further decarbonisation. Gas, with its characteristics as a fuel, is a key enabler to support further renewables deployment. Energy efficiency – though potentially costly – will also contribute to meeting the 2030 targets.

It is important to note that there are factors, which could make such key enabling role for gas less likely, these factors are:

Residential

In the Residential sector, continuation of relatively low power prices could make switching to gas in the domestic sector relatively rare – increased reliability of power supply would support this.

Power generation

Part of growing energy demand, may be met by other sources:

- Gas's opportunity to replace existing power generation capacity may be replaced by continued role for coal and lignite in particular. Both would be used as key fuel in Bulgaria energy mix through winning of continued derogation from the European regulations, and/or e.g. if and when carbon capture storage (CCS) would become a commercially viable technology. This is not seen as likely by stakeholder sentiment. Though, lignite is the only substantial local energy source so far, and thus viewed as key to security of supply and socially (jobs).
- Requirement for new generation could be alternatively satisfied by growth of:
  - Renewables (including PV, Wind, Hydro), through stabilisation of support schemes bringing back international investor confidence, and finding of scale through regional electricity market integration and/or rising power prices, which both may attract investors (again)
  - Nuclear through finding financial and commercial support for continued build-out
  - Technological solutions for large scale storage being available, removing the need for flexible power generation, and the need for expanding large scale hydro storage.
  - Technological solutions for hydrogen.
  - Progress in other technologies (e.g. improvements in affordability and efficiency of electric heat pumps)

Conclusion

All the above inhibitors to role for gas, were not seen as likely by stakeholder sentiment, or at least not likely in the timeframe for the 2020-2030 strategy. However, it does apply for all (residential, power and Industry) market segments, that failure or delay of further active policy support for role of gas in the future energy mix, will deter role of gas.

Appendix E: An overview of Baringa

Baringa Partners is an award-winning management consultancy specialising in energy, financial services, telecoms and technology sectors. It partners with organisations when they are developing and delivering key elements of their business strategy, as well as working extensively with government and regulators providing policy and advisory services.

Figure 22 – Overview Baringa

Our people join from industry, tier 1 consultancies and SIs. We engage with our clients in a range of models, from taking accountability for deliverables and outcomes to client side advisory and assurance.

We help clients using our deep industry insight to:

- Run more effective businesses
- Launch new businesses and reach new markets
- Understand and navigate industry change

Energy+Environmental Economics

We are international, working jointly with US-based Energy and Environmental Economics

- Founded in 1989 and based in San Francisco
- E3 has 45 professionals focusing on electricity sector economics, regulation, planning and analysis

We bring Valuable, deep industry experience

We have an award-winning culture that attracts the brightest people

Our independence means we give you the best advice for your business

Collaboration runs through everything we do

We roll up our sleeves and deliver value from Day 1

Baringa was founded in 2000 and now has:

592 Employees

62 Partners

7 Offices worldwide

UK, Germany, Ireland, UAE, USA (New York, San Francisco) and Australia

Our reputation is hard won and we're determined to keep it growing.

Ranked #1 Advisory firm in the UK&I for Energy, Utilities and Environment sector

in-house RECRUITMENT awards WINNER 2016

No.1 Category Large GREAT PLACE TO WORK 2017

Best Workplaces Mester 2007-2016 United Kingdom

Commodity Business Awards 2016

Energy Risk AWARDS WINNER 2016

NATIONAL BUSINESS AWARDS UK 2012

FT FINANCIAL TIMES statista UK's Leading Management Consultants 2018

Notes

1 Please see the draft TYNDP 2018-2027, as released in March 2018, for consultation, available at: http://www.eso.bg/fileObj.php?oid=1088. The document assumes continued role for coal-fired generation, some limited RES-growth, and the use and build-out of hydro capacities (see sections 3, 5.3 and conclusions of the draft TYNDP). In section 3, a role of gas-fired power plant TPP Varna is dismissed given 'uncertainty'. In section 5.3 the document suggests that gas-fired generation could be considered to support the growth of RES by 2027, subject to economic evaluation and affordability of natural gas. The document suggests two other alternatives as well: demand side response and investment in hydro, subject to cost benefits analysis of national and regional energy market situation. In current draft conclusions, the document does not mention role for gas.

2 The First Interim Report on the energy strategy with focus on nuclear electricity, dated 31 October 2017, was published by the Bulgarian Academy of Science in January 2018, following public pressure for transparency. The focus of the report is according to stakeholders Baringa spoke to, primarily role of nuclear. It is mostly silent on role of gas or other fuels versus nuclear.

3 This qualitative case study is a Baringa contribution to the debate across Europe, as initiated by 'role of gas'-event co-organised in November 2017, with Eurogas, National Grid, and support of ENTSOG. This case study – made in part possible by commercial funding by Shell – can be a helpful input to the preparation of national energy and climate plans in course of 2018. As a strong believer in the critical role that natural gas will play in addressing the energy transition, Shell is highly motivated to lead the dialogue and support others, such as Baringa, who contribute to it with analyses and recommendations.

The study is targeted at EU-wide energy expert audience, as well as offered to Bulgarian stakeholders. Key added value – in addition to other studies (e.g. Worldbank, Academy of Science report) – is the integrated view of power and gas sectoral issues. This study assumes that integrated state-ownership by BEH of mining, key power and gas participants will continue, and offers opportunity to address the role of gas question, in synchronicity with the power sector issues in Bulgaria.

We also note that the Gas hub feasibility study, discussed in section 5.4 of the report, launched in March 2018, will raise the role of gas going forward in Bulgaria.

4 See http://futureofgas.uk/wp-content/uploads/2017/12/Baringa-Future-of-Gas-Postcard-A4-v3.pdf

5 See BEH 2016 detailed presentation on the ownership of key market players in Bulgaria, their respective market shares and BEH recognition of the advantage of working closely with the public sector in Bulgaria, available here: http://bgenh.com/OBIAVI/2017/BEH%202016%20Financial%20Results.pdf

6 In 2014 a final agreement was reached to have a single binding greenhouse gas (GHG) target of 40% by 2030 compared to 1990. The governance system for the 2030 targets is seen by energy industry to focus on the single binding GHG target and a strong EU ETS (Emissions Trading System). This approach can enable a more cost effective approach to decarbonisation allowing technologies to compete on an equal footing on the basis of a robust carbon market.

7 Bulgaria's coal-fired power supply is under some pressure via the recently adopted (17 August 2017) Best Available Techniques (BAT) Reference Document for Large Combustion Plants (LCP). The so-called LCP BREF sets, for the first time at the EU level, limits emissions of mercury, hydrogen chloride and hydrogen fluoride from the combustion of solid fuels in LCPs. In addition, the existing emission limits for pollutants including sulphur dioxide (SO2) and nitrogen oxides (NOx) have been tightened. Existing LCPs have four years to become compliant with the new requirements. Bulgaria has joined Poland in its appeal against the rules, see https://uk.reuters.com/article/uk-bulgaria-coal/bulgaria-joins-poland-in-appeal-against-eu-pollution-crackdown-idUKKBN1EZ20T

8 EC, November 2017, https://ec.europa.eu/commission/sites/beta-political/files/annex-3-progress-national-energy-climate-plans_en.pdf

9 Baringa notes that the still to be released strategy report may consider the wider scale of energy sources and not focus on nuclear only.

10 ESO TYNDP 2017-2026, http://www.eso.bg/fileObj.php?oid=703

11 According to 2015 study, particularly the SME sector contributes significantly to the formation of the profile of the Bulgarian economy as the highest resource-and-energy-intensive economy per unit of GDP-output among the economies of the EU. The high energy intensity of the industry is quoted to be due to physically outdated and obsolete technologies, limited access to new best practices, systems and models for energy and efficiency production. The need for replacement of large production facilities and systems is indispensable, but it lags behind because of the insufficient financial resources, and the relatively slow return of investment in such, with the price of electricity in the country being relatively low. See http://www.opcompetitiveness.bg/images/filerepository/3733_OPIC_2014_2020_adopted_by_EC_16.03.2015_EN.pdf

12 For further information, please consider Appendix A, and the WB summary report: https://www.me.government.bg/files/useruploads/files/wb_ras_i__summary_report_en.pdf

13 In 2014 a final agreement was reached to have a single binding greenhouse gas (GHG) target of 40% by 2030 compared to 1990.

14 http://www.eso.bg/fileObj.php?oid=703

15 Please see the draft TYNDP 2018-2027, as released in March 2018, for consultation, available at: http://www.eso.bg/fileObj.php?oid=1088. The document assumes continued role for coal-fired generation, some (more versus previous plan) limited RES-growth, and the use and build-out of hydro capacities (see sections 3, 5.3 and conclusions of the draft TYNDP).

16 The latest draft Ten Year Network Development Plan 2018-2027 states in section 3 that "As regards the [LCP Bref] based on investment intentions expressed by generation companies using coal as a primary energy source, it was declared that they intend to remain online within the forecast period [to 2027]. In the event of a future change of investment intentions, it will be reflected in the next ten year plan". Please see the draft TYNDP 2018-2027, as released in March 2018, for consultation, available at: http://www.eso.bg/fileObj.php?oid=1088.

17 IMF Country Report

18 Source: EU Reference Scenario 2016 based on PRIMES, GAINS

19 Expert estimation

20 EWRC Annual Report to EC, 2017, http://www.dker.bg/PDOCS/EWRC-Report-EC-ACER-2017-%D0%B5n.pdf

21 In stakeholder discussions, Baringa noted that this may have been driven inter alia by households currently relying on more carbon-polluting fuels, with air quality being a factor.

22 Some financially minor grants, co-funded by EU, have been provided for example to the gas TSO for "high pressure"-network to municipalities.

23 Source: https://www.euroheat.org/knowledge-centre/country-profiles/district-energy-bulgaria/

24 Source: http://atdb.bg/bg/pages/read/централизираното-топлоснабдяване/основни-ползи

25 In July 2015 the Bulgarian Parliament established an Electricity System Security Fund to increase NEK's revenues from the regulated segment by increasing existing and creating new revenue streams. The fund raises 5 per cent contributions on the monthly revenues of all (thermal and renewables) energy producers, as well as revenues from the sale of CO2 quotas. Source further information: the official webpage of the Fund, including the list of all obliged to Fund contributions parties: https://www.fses.bg/

dependancies The annual reports on the Fund functioning can be found under: https://www.fses.bg/news

26 Another driver for gas demand growth in the residential sector could be the modernisation and stabilisation of the district heating sector, leading to CHPs using gas for centralised heat production, according to stakeholders sentiment.

27 Source: https://www.investor.bg/energetika/472/a/britanskata-amec-foster-wheeler-konsultira-vyglishtnite-ni-centrali-za-derogaciiata-248789/

28 According to industry literature there may be a minor loss of efficiency. See https://www.power-eng.com/articles/print/volume-119/issue-11/features/de-bunking-the-myths-of-coal-to-gas-conversions.html

29 As discussed in section 3.2 SME-sector is seen to suffer from highest energy-intensity in Europe.

30 http://www.ebrd.com/work-with-us/procurement/p-pn-20180205a.html. These are also for example grant

31 For conversion to other units, please use https://www.iea.org/statistics/resources/unitconverter/ or please use https://www.bp.com/content/dam/bp/en/corporate/pdf/energy-economics/statistical-review-2017/bp-statistical-review-of%20world%20energy-2017-approximate-conversion-factors.pdf. Illustrative conversion factors to convert toe to m3: 1 toe = 11.63 MWh; 1 m3 = 10.64 kWh (Bulgarian NRA EWRC decision 2017; Decision NNG-1 of 01.08.2017 of the EWRC - http://www.dker.bg/uploads/documents/res-ngp1-2017.pdf; calorific value of 10.64 kWh per 1 m3, metered at 20C, pressure 0.101325 MPa and reference burning temperature 25C). co-funded under KIDSF.

32 See Appendix A for more detailed overview of the Bulgarian gas market, and its structure.

33 See slide 19 of BEH 2016 detailed presentation, available here: http://bgenh.com/OBIAVI/2017/BEH%202016%20Financial%20Results.pdf

34 Case 39816, Upstream Gas Supplies in Central and Eastern Europe. See Appendix B.

35 Hubs can range from the simple to the complex; fundamentally, a "hub" is a wholesale gas trading point at which gas can be delivered to and taken from, either virtual (EU) or physical. A well-functioning, liquid wholesale gas market trading point will enable competition. Liquidity is the functioning of a market that provides participants with the ability to contract with confidence to buy or sell gas for a future delivery period for the volume they require, at a fair market price, without causing undue change in the market pricing level, and at a reasonable cost for transacting. Source: The benefits of TTF liquidity, Baringa report for ACM, 2015.

36 Further we note, that with ongoing implementation of the newly introduced in 2017 Security of Supply Regulation, there is an increasing EU-support to develop gas deliveries from multiple sources. This could be a forceful influence on the Bulgarian status quo of strong reliance on a single source of supply. See https://ec.europa.eu/energy/en/topics/imports-and-secure-supplies/secure-gas-supplies

37 For the Security of Supply plans including import, supply and demand data, please consult https://www.me.government.bg/bg/themes/me-podgotvi-aktualizirani-proekti-na-prevantiven-plan-i-plan-za-deistvie-pri-izvanredni-situacii-1779-0.htm

38 See http://new.transgaz.ro/sites/default/files/tgn_release_on_the_statements_of_the_bulgarian_minister_of_energy-13.12.2016.eng_.pdf

In February 2018, EBRD announced to support further BRUA development. See http://www.ebrd.com/news/2018/ebrd-finances-romanias-section-of-regional-gas-pipeline-.html Hence we assume the resolution is being worked on.

39 See https://ec.europa.eu/energy/en/topics/infrastructure/central-and-south-eastern-europe-energy-connectivity

40 A "hub" is a wholesale gas trading point at which gas can be delivered to and taken from, either virtual or physical. See footnote 35 for further discussion on liquidity.

41 We note that the media reported in March 2018 that study commenced, and will be concluded by summer 2018. See https://uk.reuters.com/article/bulgaria-gas-hub/bulgaria-launches-gas-hub-feasibility-study-idUKL8N1QW5VE

42 See http://epicenter.bg/upfiles/docs/Presentation%20Borchardt.pdf

43 Source: Gazprom.

44 Source: Bulgarian stakeholder discussions. See http://new.transgaz.ro/sites/default/files/tgn_release_on_the_statements_of_the_bulgarian_minister_of_energy-13.12.2016.eng_.pdf

In February 2018, EBRD announced to support further BRUA development. See http://www.ebrd.com/news/2018/ebrd-finances-romanias-section-of-regional-gas-pipeline-.html Hence we assume the resolution is being worked on.

45 See further the TOR document at https://www.entsog.eu/publications/network-code-implementation-monitoring-group#REFERENCE-PAPER-FOR-THE-NC-IMG

46 The performance of wholesale markets is assessed by ACER via the ACER Gas Target Model (AGTM1) metrics: (i) the market health metrics look at whether markets are structurally competitive, resilient and exhibit a high degree of diversity of supply and (ii) the market participants needs metrics measure to what extent the state of gas hubs allow for effective market functioning. For more details see ACER report 2017, at https://acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER%20Market%20Monitoring%20Report%202016%20-%20GAS.pdf

47 See https://ec.europa.eu/energy/en/topics/infrastructure/central-and-south-eastern-europe-energy-connectivity

48 Stakeholder sentiment showed that no demand materialised for current products offered at Chiren.

49 Whilst ACER notes this, Baringa notes that the industry practice in liquid gas markets, is generally is to come to a transparent, market based, price discovery mechanism that enables buyers and sellers to supply/take gas at competitive conditions. The (partial) oil-linked price can be acceptable, if negotiated at competitive conditions.

50 The example to be investigated could concern merger of the two balancing zones to increase relative size of the markets, and attractiveness for gas trading (see Appendix A for detailed gas market description). Another example could concern more detailed implementation of strict congestion management procedures on the main gas transit routes, to assure market access to any undertutilised capacities.

51 See http://www.icgb.eu/about/igb_project

52 See http://new.transgaz.ro/sites/default/files/tgn_release_on_the_statements_of_the_bulgarian_minister_of_energy-13.12.2016.eng_.pdf

53 2017 Energy and Water Regulatory Commission Report to EC, http://www.dker.bg/PDOCS/EWRC-Report-EC-ACER-2017-%D0%B5n.pdf

54 2017 Energy and Water Regulatory Commission Report to EC, http://www.dker.bg/PDOCS/EWRC-Report-EC-ACER-2017-%D0%B5n.pdf

55 https://www.bulgartransgaz.bg/en/pages/about-us-1.html

56 IBS has been developed so far by the Ministry of Energy with financial support under EU Cohesion Funds. IGB is developed by special project company established with 50/50 shareholding of Bulgarian Energy Holding and IGI Poseidon (in turn 50/50% shareholding of DEPA, Greece and EDISON, Italy).

57 2017 EWRC report to EC http://www.dker.bg/PDOCS/EWRC-Report-EC-ACER-2017-%D0%B5n.pdf

58 BTG draft TYNDP 2017 -2016, https://www.bulgartransgaz.bg/en/news/publichna_konsultaciya_na_desetgodishen_plan_za_razvitie_na_mrejite_na_bulgartransgaz_ead_za_perioda_-284-c15.html

59 With large part of storage reserved for Security of Supply, and access to parts of transmission system contracted long-term.

60 This includes implementation of an alternative to a balancing platform (to be applied up to Oct 2018) which comprises provision of balancing services by the TSO and a VTP. It has also implemented an interim imbalance charge (to be applied not later than 15 April 2019) and a tolerance of +/- 5% from the reserved daily capacity at network user exit point portfolios (to be reduced to 3% Oct 2018 and removed by April 2019)

BTG report on interim measures: https://www.bulgartransgaz.bg/en/news/publichna_konsultaciya_na_proekt_na_vtori_doklad_za_prilagane_na_vremenni_merki_po_reglament_na_es_za_-343-c15.html

61 From media publications seems the disagreement was on the views of ownership and sale of stakes in TSO.

62 See https://www.me.government.bg/bg/themes/me-podgotvi-aktualizirani-proekti-na-prevantiven-plan-i-plan-za-deistvie-pri-izvanredni-situacii-1779-0.html

63 Source: https://www.euroheat.org/knowledge-centre/country-profiles/district-energy-bulgaria/

64 Source: http://atdb.bg/bg/pages/read/централизираното-топлоснабдяване/основни-ползи

65 Quote NRA report rationale for not having liberalised retail gas prices: "Household consumers connected to the natural gas distribution network are few. Household consumption is very low - 2.28 % of the total consumption in the country. EWRC (NRA) applies a regulatory mechanism, which ensures incentives for the natural gas distribution enterprises to continue the development of the networks and the connection of new consumers aiming the increase of consumption. One of the incentives enhancing market competition is that EWRC approves marginal prices for the gas sale and the gas distribution companies have the right to sell to consumers at prices lower than the approved, which promotes market competition."

66 http://europa.eu/rapid/press-release_MEMO-18-349_en.htm, accessed 3 Feb 2018

67 https://me.government.bg/bg/discussion-news/s-promeni-v-ze-se-transponirat-iziskvaniya-na-es-otnosno-obshtite-pravila-za-vatreshniya-pazar-na-energiya-2538-m0-a0-1.html, accessed 3 Feb 2018

68 Procedures 2013 and 2017 – cancelled due to lack of interest

69 Total, OMV, Repsol

70 Before Silistar; 2017 rights transferred to Shell International Exploration and Development Italy

71 TYNDP BTG 2017-2026 quote: "A number of natural gas exploration licenses have also been issued in the country, whereas the best studied and with possibility for real production in the coming years is the gas condensate field Koynare of Direct Petroleum (acquired by the company Trans-Atlantic), block - Lovech."

72 Sources used: stakeholder discussions, World Bank and BEH reports and presentations.

73 Some new proposals are being discussed (status March 2018). See http://www.wec-bulgaria.org/download_file/view/130/

74 http://ec.europa.eu/competition/elojade/isef/case_details.cfm?proc_code=1_39849, accessed 3 Feb 2018

75 From media publications seems the disagreement was on the views of ownership and sale of stakes in TSO.

76 http://ec.europa.eu/competition/elojade/isef/case_details.cfm?proc_code=1_39816, accessed 3 Feb 2018

77 http://ec.europa.eu/competition/elojade/isef/case_details.cfm?proc_code=1_39767, accessed 3 Feb 2018

78 Independent Bulgarian Energy Exchange was established as BEH subsidiary in January 2014. IBEX is a full member of the MRC and an associated member of the PCR. Since January 2016, IBEX EAD has been a full member of the association of EUROPEX. Currently are functional bilateral contracts and DAM modules for electricity. ID module is to be functional Feb 2018. Bulgaria is stream country in XBID project. IBEX plans to add natural gas trading to its portfolio.

79 On 1 Feb 2018 EC cleared a deal of transfer (purchase) of the Independent Bulgarian Energy Exchange by Bulgarian Stock Exchange

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Baringa. Brighter Together.

United Kingdom
Dominican Court,
17 Hatfields,
London SE1 8DJ

+44 (0)203 327 4220

info@baringa.com

USA
Floor 9,
261 Madison Avenue,
New York 10016

+1 747 227 4642

Germany
Königsallee
2a / 4th floor,
Düsseldorf 40212

+49 211 5403 9950

baringa.com

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