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## **Sector: Energy**

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### **Abstract:**

Bulgaria is the main exporter of electricity in Southeast Europe and has the potential to export even more, and because of almost unexploited natural resources in the country the hydro, solar and biomass, geothermal and wind energy potential is considered high.

The market for energy in Bulgaria is still under development and there is great potential in the sector - both for consultancy companies and suppliers of equipment. However, recent amendments in the Renewable energy sources act show that the Bulgarian government does not encourage new investments in renewable energy except for biomass.

## Introduction

The Bulgarian energy sector is of crucial importance to the present and future economic development of Bulgaria.

A highlight theme has been the updated Bulgarian Energy Strategy (valid until 2020). It is revised according to two EU documents, quite important to energy policy, that are being implemented by EU institutions – Energy/Environment and the Third Energy Liberalisation Package. The Strategy follows strictly targets and priorities embedded in the European energy policy, and it relies on energy efficiency, developed energy and gas market, embedding new technologies and the development of alternative energy sources.

In accordance with the common European aim Bulgaria should achieve a decrease in harmful carbon emissions, a 16% share of RES in total energy consumption which is bound by obligation, and a 50% decrease of energy intensity of GDP i.e. the specific energy consumption for a unit of GDP.

Main challenges in front of the energy sector are the need for transparency, corruption risk, strong local and foreign lobbies preventing diversification, a need for accounting mechanisms, and a need for systematic data collection. Consistent work is going on to overcome all these weaknesses and achieve transparent and effective results.

A new Renewable energy sources act was adopted in May, 2011 and amended in March 2012, but it turned out to be rather contradictory, pushing back new investors in green energy.

## Market overview

As a legacy from the communist era and its industrial structure, the economy is still very energy-intensive. Bulgaria's energy provision is based partly on imported oil and gas, in combination with electricity generated from a combination of domestic nuclear, coal and hydroelectric plants. In the last number of years, energy prices have risen rapidly and the prices continue to increase.

There is a serious growth of the import of energy products which makes the Bulgarian economy dependent on external factors. The import of solid fuels in January 2011 grew by 12.1%, of natural gas by 5% and of energy by 1.7% in comparison to January 2010.

Bulgaria is pursuing renewable energy sources in three different directions:

- Electricity - wind, small hydro, solar PV, biomass
- Heating/Cooling - solar thermal, biomass, geothermal
- Transportation - biomass

In order to promote diversifying their energy sources, Bulgaria implemented the Bulgarian Energy Efficiency and Renewable Energy Credit Line. Renewable energy projects are eligible for a 20% grant. Loans over EUR 12.8 billion have already been granted.

In 2010 the biggest quantity of renewable energy ever was produced in Bulgaria (5509 GWh) which is around 15% of the gross national consumption (while the indicative aim was 11%). The situation is different in the industry where only around 3.5% of the final energy consumption was of renewable sources.

## ***Nuclear power***

In 2006, the nuclear power plant in Kozloduy supplied 44% of the country's electricity; however on agreement with the EU, four of the six reactors have been shut down, cutting the Kozloduy plant's share of electricity drastically. As replacement for the four reactors at Kozloduy, the Bulgarian government approved an overall energy strategy with the construction of a new nuclear plant in the city of Belene. This nuclear plant would cost an estimated EUR 3.9 billion, and the reactors of 1000 MW each were expected



ready between 2013 and 2014. However, there were some problems with finding investors for the project because Bulgaria is not very willing to have Russian investments. State investments in the project were considered. A lot of elements of the project were still under discussion especially after the tragedy in Japan. In March 2012 the government decided that the power plant in Belene will not be built. The reactor and other equipment, which have already been ordered from Russia, will be either sold out or put as a seventh reactor in the power plant in Kozloduy.

## ***Oil and coal***

Bulgaria produces most of the coal that it uses. The industry has seen many difficulties, however, there is an ongoing restructuring and rehabilitation program that includes some closures as well. Bulgaria's only significant coal resource is low-quality lignite, mainly from the Maritsa-Iztok and Bobov Dol complexes which is used in local thermoelectric power plants.

Oil, mainly imported from Russia, is largely used for the Neftochim refinery, which was purchased by Russian oil giant Lukoil in 1999 and has since undergone serious modernization (2005). Oil exploration is ongoing offshore in the Black Sea (the Shabla block) and on the Romanian border, but Bulgaria's chief oil income is likely to come as a transfer point on the east-west and north-south transit lines.

Burgas is Bulgaria's main oil port on the Black Sea. The Burgas refinery, with a capacity of 300,000 barrels per day, is undergoing an expansion program that aims to take production figures even higher.

A turnkey project-implementation contract was signed in Sofia in January 2012 for a heavy residue hydrocracking complex to be built at the Lukoil Neftochim Burgas refinery. Implementation will allow it to increase the output of Euro-5 diesel fuel by 1.2mn tonnes per annum (tpa) and also to end production of high-sulphur fuel oil. Commissioning of the new complex is expected in January 2015. Lukoil was to have invested US\$240mn in the plant in 2011, but has been battling with local authorities over its operator license.

Bulgaria's Iliantsi oil storage depot was previously owned by Petrol AD. However, in 2008, Petrol AD sold the depot to Lukoil Neftochim for EUR80mn (US\$107mn). Development of more oil storage facilities remains a key development aim for Bulgaria's energy infrastructure, as the country pursues greater flexibility.

Bulgaria has dissolved its 2007 agreement for the construction of the Burgas-Alexandroupolis pipeline, effectively abandoning the project, which will likely be officially scrapped soon.

## ***Natural gas***

Natural gas, also mainly imported from Russia, is the fuel for much of the heavy industry and is an important feedstock for synthetic chemicals. It also fuels some district-heating firms, although direct gas supplies to households are underdeveloped. Following an agreement in 1998, the conditions attached to

Russian gas supplies have become a much less sensitive issue, although gas prices remain too high for many large plants to be profitable. Regional licenses for the development of low-pressure distribution to households and smaller industrial users are gradually being issued to private firms.

In February 2010, Bulgaria and Turkey signed a memorandum of understanding (MoU) to improve the gas infrastructure between the two countries. Sofia and Ankara agreed to make existing gas pipeline flows reversible, to build a new gas pipeline and for Bulgaria to cooperate on Turkey's liquefied natural gas (LNG) projects. Furthermore, the two countries have also reportedly agreed to push for the development of the EU-backed Nabucco gas pipeline project. These measures would allow Bulgaria to reduce its dependence on Russian gas imports and make it less vulnerable to future gas supply disruptions.

In line with the country's pragmatic approach, and in recognition of the potentially insurmountable challenges the Nabucco project faces before coming online, the country is also leaving its options open with regard to the Russia-led South Stream pipeline. In November 2010, Sofia signed an agreement with Russian gas export monopoly Gazprom to create a 50:50 partnership to design, build and operate the Bulgarian section of the proposed pipeline. In the end of March 2012 the Bulgarian Minister of Economy agreed with Russia that Bulgaria will make everything possible to take the final investment decision until November 15, 2012, so that the construction of the sea part by Gazprom could start. At the moment in Bulgaria there are on-going procedures for selection of designer of the technical project, as well as for preparation of environmental impact assessment / EIA / and detailed development plan.

### *Shale gas*

The Bulgarian government adopted in January 2012 a moratorium for the ban on shale oil and gas exploration through hydraulic fracturing or fracking due to environmental concerns following widespread protests against the unconventional procedure. The government reviewed a shale gas exploration permit it granted to US-based oil major Chevron, in spite of the country's speculated 1,000bn cubic metres of shale gas potential. Ministers across the political spectrum said there wasn't enough proof the drilling method was environmentally safe. Critics worry it may poison underground waters, trigger earthquakes and pose serious hazards to public health. The centre-right government, initially a staunch supporter of shale gas on hopes it may reduce the country's almost total dependence on gas imports from Russia's Gazprom, has changed its position after growing opposition to fracking. However, now in April 2012 the new Minister of Economy, Energy and Tourism suggested that the limitation of pressure when drilling for oil and gas should be dropped off. This limitation is written in the text of the moratorium on the production of shale gas. Because of it virtually any drilling up to 20 atmospheres is limited, and this completely blocks the exploration and extraction of oil and gas in the country.

### *Hydropower*

The total capacity of the current hydroelectric power plants of variable size, most of them in the Southern part of Bulgaria, amounts to 1980 MW. Still, opportunities for construction of additional plants along the Iskur River, the Maritza River and the Struma River are good, with small-scale units considered more attractive. There are 20 reservoirs in Bulgaria, which can also be used for utilization of hydropower.



## ***Biomass***

Biomass, in the form of firewood, accounts for a large part of Bulgaria's renewable energy production. The high share of firewood in the renewable energy balance reflects the relative under-development of the sector.

Biomass could cover about 9% of the end energy consumption in Bulgaria – this was stated in the National Long-term Program to promote the use of biomass for the period of 2008-2020. The strategy foresees that in 2020 biomass energy production will reach 9.7 TW/h.

Furthermore, the biomass energy production is somewhere between 0.5 to three times cheaper compared to the widely used diesel fuel. Production of energy from biomass is a business with great potential in Bulgaria.

However, there is an imposed excise on the biofuels in Bulgaria which drives the entrepreneurs away from the sector.

In 2010 Bulgaria produced 30 000 tons of biodiesel which ranked the country 20th in the EU. The country is before Ireland (28 000 tons), Slovenia (22 000 tons), Cypress (6 000 tons), Estonia (3 000 tons) and Malta and Luxemburg where there was no production. In comparison to 2009 Bulgaria produced 5 000 tons more in 2010. In 2011 the production capacity of Bulgaria is 348 000 tons which is a drop in comparison to 2010 when the capacity was 425 000 tons.

After discussions during the visit of the Brazilian Prime Minister in October 2011 the import of biofuels from Brazil has been considered because it would be cheaper than its production in Bulgaria despite using the efficient Brazilian technologies.

In the European Biodiesel Board there is only one associated Bulgarian company- Rapid Oil Industry EOOD.

## ***Solar Energy***

The geographical layout of Bulgaria makes the country suitable for solar energy utilization. Currently 80% of the territory of Bulgaria is suitable for utilization of solar energy. However, there is considerable difference in sunlight intensity in the different regions. Data analysis shows that Bulgaria's territory can be divided into three solar zones; the average annual sunshine duration is roughly 2150h which is about 49% of the maximum.

Central-east region: Occupies 40% of the country's territory with 30% of its population. That zone covers mountainous regions and is characterized by inconsistency of micro-climatic conditions. Average annual sunshine duration is as follows 31 March – 31 October: up to 1640h, and 31 October – 31 March: up to 400h. Solar energy resource accounts for 4kWh/m<sup>2</sup> per day or 1450 kWh/m<sup>2</sup> per year.

North-east region: Occupies 50% of the country's territory with 60% of its population. That zone covers agricultural regions, the industrial region and part of the central north riverside strip. Average annual sunshine duration is as follows 31 March – 31 October: Up to 1750h, and 31 October – 31 March: 400 - 500h. Solar energy resource accounts for 4.25 kWh/m<sup>2</sup> per day or 1450 – 1500 kWh/m<sup>2</sup> per year.

Southeast and South-west region: Occupies 10% of the country's territory with 10% of its population. That zone includes the south coast. Average annual sunshine duration is as follows 31 March – 31 October: Over 1750h, and 31 October – 31 March: Over 500h. Solar energy resource accounts for 4.25 kWh/m<sup>2</sup> per day or 1550 kWh/m<sup>2</sup> per year.



The potential for solar energy is greatest for low temperature thermal applications, rather than electric power generation. Warm air solar heating may be utilized in a broad range of agricultural and forestry applications such as for crop dryers and wood dryers. There are some private sector companies interested in solar energy that has done preliminary research and/or pilot project implementation.

Solar thermal energy has been utilized in Bulgaria in several applications. From 1977 to 1990, the Bulgarian government developed an energy efficiency program for the utilization of solar collectors, which amounted to the installation of 50,000 m<sup>2</sup> of collectors or about 17 MWh. Additional pilot and educational projects for domestic hot water heating under the PHARE program have yielded successful results, although there has not been a large increase in such projects.

The installed capacity for the production of solar energy at the end of 2011 could reach 100 MW while in 2010 the solar panels were only 20 MW.

The source of the above mentioned information about solar energy is the Ministry of Economy, Energy and Tourism

For residents the main obstacle is the relatively high initial investment in solar energy utilization equipment. There seems to be a potential for the use of conventional thermal solar panels. Currently traditional solar panels are sold mainly to hotels and office buildings for hot-water supply.

### ***(Geo) thermal Energy***

Research shows that Bulgaria has more than 137 geothermal sources. More than 50 geothermal sources have been registered and the total thermal capacity freely flowing geothermal waters is estimated to about 488 MW.

The highest capacity of geothermal water is found in a source near Varna and the lowest capacity in Kumaritza (Sofia area). As for the chemical composition, Bulgarian geothermal waters are weak in minerals with contents of soluble mineral substances under 1 g/l. Bulgarian geothermal water contains most hydro carbonates, sulfates, chlorides, sodium, potassium, calcium, and magnesium. Besides this, some water contains gas- nitrogen and noble gases, fluorine, CO<sub>2</sub>, sulphur hydrate and methane.

### ***Wind Energy***

Bulgaria has the wind potential needed for construction of larger wind farms, with a midterm potential of 3,400 megawatts (MW), making it one of the top countries for investments in the sector. According to the Ministry of Economy and Energy the conditions are especially advantageous along the Black Sea coast line and in areas with an altitude above 1000 meters, particularly to the south of Sofia. 90% of the wind farms are in the area of Kavarna. The largest wind farm in Bulgaria is also in the area of Kavarna and its installed capacity is 156 MW.

The capacity for the construction of wind parks in Bulgaria at the moment is totally exhausted. The reason is the condition of the electric grid which could take maximum 1800 MW new capacity. Currently, there are paid guarantees under preliminary contracts for the construction of 1700 MW wind parks while those which are installed or in a process of construction are around 1100 MW. Until the end of the year 200 MW of those which are under construction will be put into operation while the rest will be constructed within the next two years. However, in order for Bulgaria to meet the European objectives 3600 MW wind farms must be installed.



## *Energy Efficiency*



Energy consumption in Bulgaria is higher than the average in the rest of the European countries. Bulgaria is one of the many Eastern European countries waking up to the financial importance of energy efficiency. There is a huge economic potential in energy saving.

Currently there is an ongoing investment in and completion of energy efficient projects, plus imposing of solid measures regarding the economics of energy efficiency in the construction and retrofitting of buildings.

## **Market trends**

Privatization of the energy sector has begun and is a statement of both commitment and progress to maintain the position of Bulgaria as a regional net exporter of electricity as well as the country adapting to the Western standards.

The privatisation processes for energy producers and distributors were initiated in 2002 with the passing of new strategies and some pieces of legislation, and several district heating plants and electricity producers are now fully or partly privatized. Hydropower production companies have also been privatized, so have coal mines and the Bulgargaz gas company, and other companies are undergoing changes in order to eventually being privatized as well. The foreign direct investments in the production and distribution of energy and heat, gaseous fuels and water were 278.9 million Euro in 2010.

It is a slow process however, and the sector continues to be somewhat inefficient and in need of a lot more investment. The industry suffers from obsolete equipment and most of Bulgaria's conventional power plants will require large-scale modernization in the near future.

In order to improve the corporate management and supervision of the energy sector, the government has set up a state-owned energy holding company in February, 2008. This company is composed of several of the big actors within the sector: gas company Bulgargaz, power company NEK EAD, Kozloduy nuclear power plant, Maritza-Iztok II thermal power plant, and the Mini Maritza Iztok (Maritza Iztok mines), ECO EAD, Bulgartransgas EAD and Bulgartel EAD. The state holds a 100% stake in the holding company.

Major energy transportation routes are planned to pass through Bulgaria. When major pipeline projects come on line, it will significantly increase the amount of energy carried through the country to other parts of Europe. The Nabucco and South Stream pipelines are planned to carry natural gas from Russia and the Middle East via the Black Sea to the rest of Europe.

The major trends for development of the energy sector in Bulgaria are related to a drop in electricity consumption and an increase in natural gas and renewable energy sources consumption. Energy efficient technologies and clear pricing policy are to be introduced. The ownership in the sector will be fully restructured and energy system, in line with the EU requirements and environmental regulations, will be created. High investment activity in the sector is a key condition for the creation of a competitive energy market.

# Law for Energy from Renewable Sources

The Bulgarian Parliament adopted a new Law for Energy from Renewable Sources on May 3, 2011 which replaced the former Law for Renewable and Alternative Energy Sources and Biofuels. The Act was amended in March 2012.

Unfortunately, instead of promoting renewable energy development in Bulgaria, the current law practically sets conditions for a complete stop of the industry and threatens the fulfillment of the binding EU 2020 climate targets by Bulgaria. The law introduces more restrictions and state control in the renewable energy sector; it increases the development risk, leads to more speculation and higher costs in the sector and ultimately less investment.

## Conclusions and recommendations

Bulgaria is the main exporter of electricity in Southeast Europe and has the potential to export even more, and because of almost unexploited natural resources in the country, the hydro, solar and biomass, geothermal and wind energy potential is considered high. Within other energy sources Bulgaria is still heavily dependent on import from other countries, especially Russia, and imports more than 70 % of its primary energy sources. The country faces challenges in terms of the efficiency of energy production, and still has some work to do in order to bring the sector in line with European standards.

Environmental issues are pressing and Bulgaria is taking its EU membership commitment of generating a portion of its electricity through renewable sources, looking in particular at developing hydropower, which currently accounts for about 10% of the country's production. However, as renewable energy sources are still considered too costly, Bulgaria's primary energy sources will still be oil and natural gas in the foreseeable future, experts predict. According to the EU Accession Treaty for Bulgaria, by 2010 at least 11 % of gross national energy consumption should be produced from renewable energy sources, a figure that should rise to 16 % by 2020.

The market for energy in Bulgaria is still under development and there is great potential in the sector - both for consultancy companies and suppliers of equipment. The country has to increase its energy efficiency which could be achieved by importing modern technologies and installing them in the enterprises. However, in regard to renewable energy the latest adopted legislation imposes threats to further development of the renewable energy sector and the investments in it.

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