



Sector: Energy

April 2016

Prepared by the Danish Embassy in Sofia

Keywords: Bulgaria, Sofia, Energy sector , Renewable energy, Nuclear power, Wind energy, Solar energy, Biomass, Natural gas, Oil and Coal, Shale gas, Hydropower, Geothermal energy

Abstract:

Bulgaria has a well-established energy sector. It is one of the main exporters of electricity in Southeast Europe and has the prospect to export even more. Due to Bulgaria's almost unexploited natural resources the hydro, solar, 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 energy sector - both for consultancy companies and suppliers of equipment. Bulgaria is currently ranked as number 44 on the Energy Architecture Performance Index Report 2016 with a benchmark of 126 countries, which indicates that Bulgaria is improving its energy efficiency compared to previous years.

Introduction

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

In June 2011 the Bulgarian Energy Strategy: *For Reliable, Efficient and Cleaner Energy* was developed (valid until 2020). Just as the other EU member states Bulgaria is also committed to meet the estimated 2020 targets within their own reach. The Bulgarian Energy 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 reduction of gas emissions, a 50% decrease of energy intensity of GDP i.e. the specific energy consumption for a unit of GDP and a 16% share of Renewable Energy Sources (RES) in total energy consumption which is bound by obligation. Bulgaria already reached the latter in 2012.

Main challenges in front of the energy sector is less dependency on imports of gross demand of energy resources (approximately 70% is imported from the Russian Federation), the high energy intensiveness of GDP and reducing the volume of greenhouse gas emissions. Consistent work is going on to overcome these weaknesses and achieve transparent and effective results.

A new Renewable Energy Sources act was adopted in May, 2011 and was lastly amended in April 2014.

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, coal and natural gas, in combination with electricity generated from a combination of domestic nuclear, coal and hydroelectric plants. The electricity prices (per kWh) for industries have been falling since 2013, while the prices have been going up and down for the Bulgarian households.

There is a serious growth of the import of energy and fuel which makes the Bulgarian economy dependent on external factors.

The Bulgarian government has adopted legislative measures in order to reach the 2020 targets. The measures will preferably promote the deployment of RES and encourage investments within RES through e.g. long-term contracts, a quota and a feed-in tariff system.

Bulgaria is pursuing Renewable Energy Sources in three different directions:

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

Bulgaria is trying to reach their 2020 renewable energy targets by increasing the RES heating and cooling consumption up to 24%, generating 21% of the electricity demand from RES and 8% of the energy demand within transportation.

Bulgaria mainly has three Renewable Energy Sources:

1. Solid biomass, 2. Hydropower and 3. Wind power. The latest data illustrate that Bulgaria contributed with 1.7% solid biomass of the total contribution of RES to EU-27, which also includes liquid biomass. Furthermore Bulgaria contributed with respectively 1.3% hydropower and 0.5% wind power to the EU-27 countries.

Nuclear power

In 2006 the nuclear power plant in Kozloduy supplied 44% of the country's electricity, however four of the total six reactors were shut down in an agreement with the EU. Currently Bulgaria has two working nuclear power plants in Kozloduy (Kozloduy 5 and 6), which are generating one third of the total electricity in Bulgaria. Bulgaria is therefore heavily dependent on the electricity from the remaining and functioning reactors. The units have been licensed to function for 30 years; until 2017 and 2019, but both reactors have been extended to operate for additional 20 years.



Coal and oil

Bulgaria produces most of the coal that it uses. The coal mine Maritsa Iztok produced 88% of Bulgaria's total coal output in 2014 for generating heat and electricity. Bulgaria's only significant coal resource is low-quality lignite, mainly from the Maritsa-Iztok and Bobovdol complexes which is used in local thermoelectric power plants.

Bulgaria has the biggest oil refinery in the Balkans; Lukoil (Lukoil Neftochim Burgas), which was purchased by the Russian oil giant Lukoil in 1999. Oil is mainly imported from Russia. 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.

Natural gas

The consumption of natural gas has fallen since 2013. However, the natural gas distribution grid is and has been undergoing enlargements and development the last couple of years. A large amount of the produced fuel is used for energy consumption in some district-heating firms, although direct gas supplies to households are underdeveloped. The second largest share of natural gas consumption is an important feedstock for synthetic chemistry in the heavy industry.

Overgas Inc, AD is the biggest gas distributing company in Bulgaria. It distributes 59% of the total amount of natural gas in Bulgaria.

Bulgaria is highly dependent on imports of natural gas, also mainly from Russia. 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.

However Bulgaria is becoming less dependent on Russian gas supplies due to pipeline connections to Turkey, Greece and Macedonia. Currently Bulgaria has the biggest transition of natural gas with Turkey.

In December 2015 Bulgaria and Greece signed an investment agreement to build a joint 180 km liquefied gas pipeline between the two countries near Alexandroupolis.

On the 6th of April 2016 Bulgaria signed an agreement with Romania of an underwater section of gas interconnector. This interconnection will bring Bulgaria one step closer to implementing the European Energy Union's principles of a more secure and stable energy delivery for Bulgaria and its neighboring countries. Furthermore this construction will contribute to a more competitive and accessible gas supply for the consumers in the Southeast Europe. The length of the section is 2.1 km and the maximum capacity of the interconnector is 1.5 billion cu m annually. Future connection with Serbia is expected to be ready by 2018.

Shale gas

In January 2012 the Bulgarian government adopted 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 was not 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 Bulgarian government have announced that they will not use shale gas extraction until there has been invented an eco-friendly method for doing so.

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.



In 2011 9.60% of the generated electricity in Bulgaria came from hydropower. Bulgaria is aiming at having installed 200 small hydropower plans before 2020 with a total capacity of 380 MW.

Chaira PSHPP is the largest pump-storage hydropower plant in Bulgaria, but also the biggest in the Southeast Europe. It can generate up to 864 MW.

Biomass

Biomass is a somewhat unexploited renewable energy source that has a big technical potential of installation. Biomass, in the form of firewood, accounts for a small part of Bulgaria's renewable energy production. The high share of firewood in the renewable energy balance reflects the relative underdevelopment 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 the biomass energy production will reach 9.7 TW/h in 2020.

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.

In recent years more and more Bulgarian farmers and manufacturers invest in environmental treatment of biowaste. The Foundation for Environment and Agriculture has announced that there have been installed 12 biogas plants in Bulgaria in the past three years. Ten of them are used for feedstock crops and animal waste and the rest are fumes from sludge. The Bulgarian National Renewable Energy Action Plan has estimated that 351 GWh of biogas energy will be used for the production of electricity until 2020 and that 20 ktoe will be used for the production of heat energy.

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/m² per day or 1450 kWh/m² 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/m² per day or 1450 – 1500 kWh/m² 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/m² per day or 1550 kWh/m² 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 m² 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.

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

Approximately 1000 thermal springs and aquifers exist in Bulgaria. There is a difference between the thermal springs in the north and south. The springs in the north are deep while the ones in the south are shallow hot springs. Although Bulgaria is not currently exploiting the advantages of geothermal power it has been estimated that the overall potential of power generation from geothermal sources is at 200 MWe. In 2014 60.5% of the thermal water was used for balneology while 27.3% is used as a direct water supply and only 1.8 is used for space heating. The government has lowered the fees for thermal water use with the aim of boosting the geothermal application in Bulgaria.

The highest capacity of geothermal water is concentrated in the southern part of Bulgaria due to the high water temperatures and low water salinity. As for the chemical composition, Bulgarian geothermal waters are weak in minerals with contents of soluble mineral substances under 1g/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, CO₂, 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. Wind power is currently the third biggest renewable energy source in Bulgaria.

According to the Ministry of Economy and Energy the conditions are especially advantageous along the peninsulas of 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.



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 legislation. Renewable Energy Sources are primarily financed by commercial banks and private investors. An increasing amount of the heating plants, electricity producers, gas companies, coal mines and hydropower plants are fully or partly privatized. Other companies are undergoing changes in order to eventually being privatized as well. RES is promoted through the implementation of Bulgarian Energy Efficiency and Renewable Energy Credit Line (BEERECL) which is supporting small renewable energy projects in the private sector and industrial energy efficiency.

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.

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 RES 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.

Conclusions and recommendations

Bulgaria is the main exporter of electricity in Southeast Europe and has the potential to export even more. Due to the almost unexploited natural resources in Bulgaria, 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. Bulgaria 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 and EU directives.

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.

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.

Ministry of Foreign Affairs of Denmark

Embassy of Denmark
The Trade Council
Dondukov Blvd. 54
Sofia

Phone no: (+359) 2 917 01 00
Fax: (+359) 2 980 99 01
E-mail: sofamb@um.dk
www.bulgarien.um.dk

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