

# RES based Energetics in Bulgaria: Current situation and Future alternatives

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## ABSTRACT

*Bulgarian energy sector is quite controversial and diverse. This article is dedicated to the current situation in the energy sector in Bulgaria and pay attention to the Renewable energy sources and especially to the possibilities for its development in accordance to the EU policy in the sector. One of the basic statements is that in the country is functioning the doubtful system of the SEWRC. This state authority have to protect at the same time the public interests and the corporative interests fixing the “proper” price rates of all the types of energy sources, by companies and by regions. The second objective is that the Hydro Power Plants are the only real RES energy source and the possibilities of the other RES types are more or less hypothetic for the Bulgarian economy. In the final part we propose some conclusions about the future development alternatives of the RES in Bulgaria.*

*Keywords: Energetics, Renewable energy sources (RES), Hydro Power Plants (HPP);*

## General statements

Our world is faced with some very struggle problems that are shaping step by step the world of tomorrow. In this world there will be a huge change causing one of the most important elements in the current mode of production – the energy system. The change will be so dramatically significant that it won't be wrong if we call it – new energy paradigm. In a period of two or three decades we must overcome our dependence of fossil fuels and to establish more self sustainable way of exchange of energy between the human society and the planet resources. For a long time in all the geographical studies concerning the natural potential, natural hazards, economic landscapes, economic transitions and etc., there are the so called “global scale” of exploration and researches. Just in one single century the human society and the human needs /despite of the huge regional differentiations/ reached the point where we all need to calculate the Planet Earth Potential in any aspects and in relevance to our needs.

Bulgaria is a small European country but facing economic and social difficulty in many aspects. The country has proved its inability to pass effectively the transition period and probably for a long time will remain the poorest EU member state. The basic objective is that the problems related to the energy systems will be one of the most powerful “engines” of its competitiveness and in accordance to the national specialization shaped by the priority economic sectors. In this manner of thinking the possibilities for research and exploitation of the Renewable Energy Sources (RES) will be a key element into the nearest future. These economic possibilities are the basic research objective of that article.

One thing is certain the needs for energy sources will always increase and move up, the reasons are many – the growing up world population, the constant increasing foods and goods consumption and etc. So, the logic economic conclusion is that the investments in the energy system are reasonable and quite well protected. Is that really true?

In the last decade some things has been changed about Bulgaria. From 1997 the country has started significant public reforms that made possible the NATO and after that the EU integration process. The Bulgarian case is quite specific in geopolitical and economic point of view. For about 50 years the country was the “closest” Soviet satellite with predominantly heavy industry using old technologies and consuming huge amount of energy resources. Furthermore, the economy was military oriented importing raw materials and predominantly exporting machineries and equipment including special ones.

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These technologies were especially low efficient in accordance to the electricity power. In fact, after the privatization process in Bulgaria that basically happened in the period 1997 – 2007 one of the most important tasks that faced the new owners was the replacement of the machineries and equipment with ones that uses less electricity and have more productivity. On the other side were standing the heritage of the socialistic economic system based on highly concentrated companies (state monopolies) which after the privatization turned into private monopolies. This characteristic is very typical to the whole Energy sector.

### The Electricity sector in Bulgaria - current situation

The electricity sector in Bulgaria could be described as shaped of slow process of market liberalization with predominantly state property and in the last year's private monopolies. The overall energy system was divided into two sections "Producers of electricity" and "Electricity distributors". The first group of companies takes all the electricity producers in Bulgaria including the Nuclear Power Plant (NPP), the Thermo Power Plants (TPP), the Hydro Power Plants (HPP) and etc. They are presented as well as by state property companies as well as private companies. In our days the second groups of companies are presented mostly by private companies, redistributing the electricity in regional principle. In any case if any citizen or any entrepreneur invests money in property (residential, office, factory) the electricity to this property must be provided by only one electricity provider. The new owners have to agree with the price rates, the quality of the services and all the market conditions presented by only one possible electricity distributor. The basic companies that privatized the Bulgarian electricity system are E.ON, CEZ and EVN. There are few more companies but their market share is insignificant. For example the company CEZ is having the whole market in South-west Bulgaria, North-west Bulgaria and Varna. (See Fig. 1) The company EVN controls all the customers in South-East Bulgaria and E.ON in North-East Bulgaria.

Fig.1  
Regional structure of CEZ



This regional monopoly structure is supported by the state through the SEWRC (State Energy and Water Regulator Commission) which is the public authority that "fix" the properly price rates of the electricity by regions, companies and type of electricity consumers. Actually this commission is regulating all the communications between the customers and the electricity distributing companies in accordance to the price rates. We could say that the energy system in Bulgaria has cross the transition

period with following stages: State monopoly – Semi State monopoly – State-Private monopoly. The stakeholders in Bulgaria have to be very trustful and to believe that the SEWRC is capable in any moment to evaluate and benchmark the energy market and to set the properly price rates for the distributing companies. In this case the commission has to secure the real economic sector interests, the state interests and the social justice in accordance to the home customers. That must be an organization with huge administrative and scientific capacity, because this "regulation" holds on the key factors to the competitiveness, social fear and finally the key to the economic stability.

The country energy needs has increased after the deep crises of the 90<sup>th</sup> years. At the same period of time the electricity sector in Bulgaria has lost huge power capacity (1760 MW) with the closure of four reactors of Kozlodui NPP. The economy system came into a stable stage of development with 5.5 % GDP average annual growth of the last 5 years. This mostly political decision that has been taken as a "tax" for the EU integration made possible some political factors in Bulgaria to distribute a message. That message was propaganda and its direct sense was: *"In Bulgaria there will be again electricity regime, just like in the soviet times"*. That "message" has done its job scaring the society and creating the comfortable media environment. That was the "appropriate" time for starting the privatization procedures in the whole energy sector. In a very short period of time were made the contracts for Maritza-Iztok TPPlants and the contracts for the electricity distributing companies. At same time the state has preserved for itself greater part of the HPP's basically covered by the National Electricity Company.

### From state to ...state and private monopoly

In our days Bulgaria is approaching its RES-E target for 2010. The Large-scale Hydro power plants are currently the main source of RES-E, but its technical and economic potential is already fully exploited. Good opportunities exist for biomass, since 60% of land is agricultural, and about 30% is covered by forest. Other sources could be the public wastes which in Bulgaria are simple depository fields.

The Main supporting policies in the sector is the new act on RES which was adopted in June 2007 for diversifying energy supply, environmental protection and to set the terms for sustainable local and regional development. One of the Act's objectives is to increase the capacity of SMEs and RES producers etc. The electricity distributing companies are obligated to purchase all renewable electricity that has a certificate of origin. The public utility company and the end suppliers, respectively, shall purchase the entire quantity of energy generated from renewable and alternative energy sources, except for the power generated by hydroelectric power plants with installed capacity of over 10 MW, at preferential prices. A bill is foreseen for 2011 on the market mechanisms for encouraging production of electricity and heating power from renewable energy sources. In order to promote RES, Bulgaria is currently implementing the Bulgarian Energy Efficiency and Renewable Energy Credit Line (BEERECL). RES projects are eligible for a 20% grant. In accordance to this policy the SEWRC has fixed preferential price rates for electricity created by RES.

Table 1

Preferential price rates for Electric power made by RES  
(with exception of HPP over 10 MW)

<i>Types of HPP</i>	<i>Preferential price rates, leva./MWh</i>
<b><i>HPP installed up to 10 MW</i></b>	<i>97,12</i>
<b><i>Wind power plants</i></b>	
<i>Working hours up to 2 250 and installed power 800 kW and more</i>	<i>185,95</i>
<i>Working hours over 2 250 and installed power 800 kW and more</i>	<i>167,90</i>
<i>Installed power up to 800 kW and inductive generator</i>	<i>139,96</i>
<b><i>Photovoltaic instalations:</i></b>	
<i>Installed power up to 5 KW</i>	<i>782,00</i>
<i>Installed power over 5 KW</i>	<i>718,00</i>
<b><i>Biomass installed power up to 5 MW:</i></b>	
<i>Wooden</i>	<i>215,00</i>
<i>Agricultural biomass</i>	<i>162,00</i>
<i>Energetic crops</i>	<i>184,00</i>

Source: SEWRC

On the market are operating several kinds of Power Plants distributed as follow One Nuclear Power Station – 3760 installed MW – 1760 turned off; Seven companies owning – Thermo Power Plants – 4458.8 MW installed power; Six companies in the HPP sector one of which is having 2430.55 installed MW and the rest 5 are having 219,4 MW. Actually NEC owns and operates 29 Hydropower plants and Pumped-Storage power plants with total capacity of 2563 MW which is the greater share of RES electricity sources. The largest 14 of these HPP are operating in four major cascades and cover peak loads, regulate the power system supply, and produce electricity. The company operate 50,1 % of the controlled capacity of all water reservoirs in Bulgaria.

Fig. 2

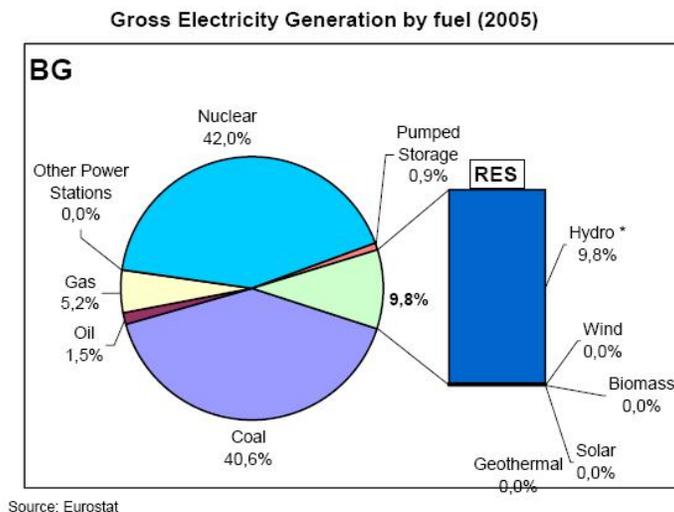


Figure 2 shows that the whole electricity generation by fuel the only one real RES source is the Hydropower plants with 9.8 %. The share of the wind, solar, biomass and geothermal energy power plants is insignificant below the decimal sign in the overall statistics.

Table 2

*Installed Electricity power using RES*

Type HPP	UNIT	2005	2006	2007
HPP	MW	2 743,40	2 747,40	2 740,30
SHHP	MW	164,30	175,70	197,70
Wind PP	MW	7,50	25,50	40,70
PVPP	MW	0,00	0,00	0,03
<b>Total</b>	<b>MW</b>	<b>2 915,20</b>	<b>2 948,60</b>	<b>2 978,73</b>

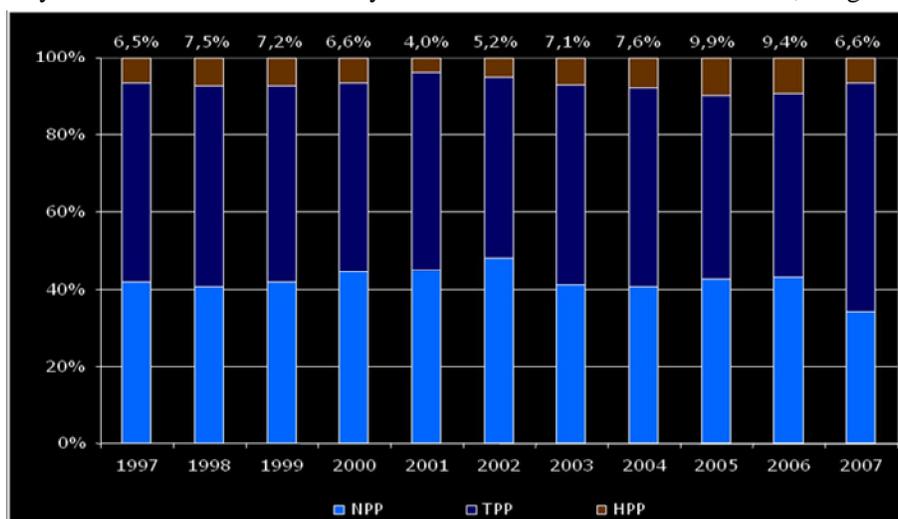
*Source: NEC, 2008*

On the other side are the already installed powers using RES which development we expect to become more and more reasonable in the nearest future. The data shows that the Wind PP are developing faster than the other RES which could be explained with the investors' expectations about the high profit rates caused by the preferential price of the electricity produced by Wind PP. (See table 4) In addition the preferential price rates are highest for the PVPP with is actually more feasible, stable and predictive RES. In the nearest future the expectations of economy are that the PVPP will become more effective as a result of the advance in the nanotechnologies. This will make possible the installation investment's to drop down and the PVPP to become widespread electricity alternative. Actually this RES could be very attractive for distant regions or settlements developing alternative form of tourism were the preservation of the environment is a part of the competitive advantage.

Despite of the NPP reactors closure process the share of the NPP in the Gross Electricity Production does not fall dramatically (see Figure 3). Actually it is totally compensated by the TPP and the share of the only one significant RES in Bulgaria the HPP remain the same. In fact, instead of the economy to become more environmentally sustainable, controversially Bulgarian energy sector become too dependent by the Thermo PP, especially those in the Maritza-Iztok basin. These plants are using lowest quality coals in the whole Europe and pollute the atmosphere (SO, SO<sub>2</sub>, heavy fractions and etc.) in the South-East Bulgaria, and the northern parts of Turkey and Greece. Is addition are destroyed fertile soils and the surface waters. In 2004 the complex was upgraded and was reached record rates in the lignite coals extraction (over 24 million tons).

Figure 3

Dynamics in the Gross Electricity Production for the Period 1997-2007, Bulgaria



Source: NEC, 2008

In 2005 and 2006 the country has succeeded to produce 9.9 and 9.4 % of the total electricity by HPP. The reasons for this were not new installations or better water management but the high precipitation rates. These precipitations caused devastating floods in some regions of Bulgaria and put on the table many other problems related to the water sector management – overgrown river valleys, lack of communication system in the Dam’s management, bad infrastructure and absence of early warning system.

This fact this could be proved by the results of the RES electricity production were the HPP takes major part especially in 2005 and 2006. The specific positive trend is the constant interest to Wind PP and Photovoltaic PP. The Wind PP takes specific locations near Kavarna in the North-East of Bulgaria and close to Sliven South-East of Bulgaria.

Table 3

Electricity Produced by RES in 2005, 2006 and 2007

Type RES	Unit	2005	2006	2007
HPP	GWh	3 788,3	3 718,1	2 275,7
SHPP	GWh	548,2	520,1	504,5
WindPP	GWh	4,5	19,8	46,8
PVPP	GWh	0,0	0,0	0,1
<b>Total</b>	<b>GWh</b>	<b>4 341,0</b>	<b>4 258,0</b>	<b>2 827,1</b>

Source: Ministry of Economy

### European Policies for Development of Renewable Energy Sources /RES/ Regulation 2001/77/EC - Climate change and Energy Report

In the beginning of 2008 the EU presented the package “Climate change and Energy” which concerns the RES policy in the community. The European council confirmed the long-term objective for the RES development after 2010 and promoted the following aims:

1. *Obligatory objective for increasing up to 20% of the RES share in the overall energy consumption in the EU by the end of 2020”;*
2. *Renewing renewable forms of energy: Renewable energy currently accounts for 8.5% of final EU energy consumption. That means an increase of 11.5% to meet the 20% target”;*
3. *Biofuels: the aim is to have 10% of Europe’s transport sector powered by bio-fuels by 2020;*

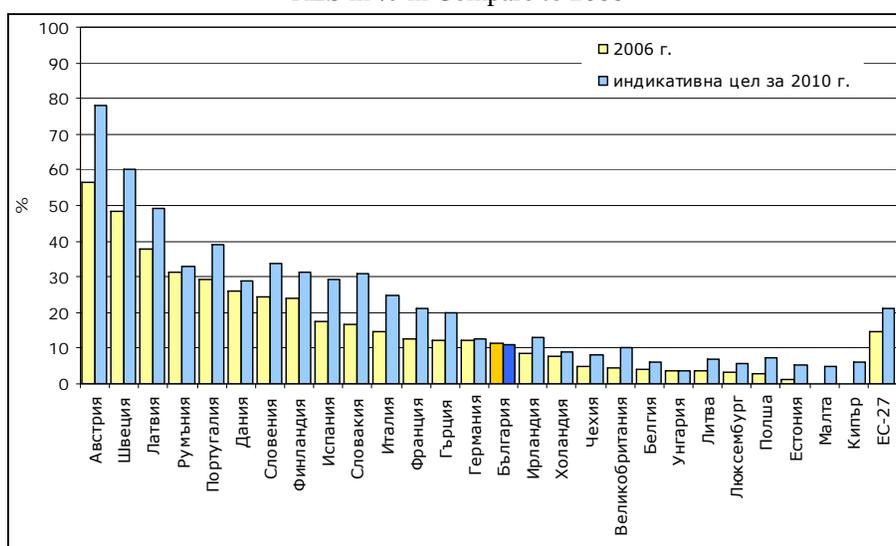
According to this document the Bulgarian final objective is 16% (2005 – 9.9%) of the Energy powered by RES in 2020 and at least 10% of transport to be powered by Biofuels.

The most important document affecting the electricity power gained by RES is the Regulation 2001/77/EU and its basic objective is to increase the percentage of electricity produced by RES and used in the economic system. The Regulation foresees the member states to undertake measures that will ensure the usage and the production of electricity made by RES in accordance to the Indicative Objective of every Member state. The Global indicative objective is up to 2010 - 13.2% of the total energy and 21 % of the electricity to be produced by RES. The Regulation requires the Member states to be able to issue certificates underlying the electricity origin. These certificates must be recognized by all the Member states.

The national power operators must secure the distribution of the electricity made by RES in the power networks. In addition they must secure priority to the electricity made by RES in accordance to the technical possibilities.

Figure 4

Indicative Objectives up to 2010 for the EU Member States in Accordance to Electricity Created by RES in % in Compare to 2006



Source: <http://www.mi.government.bg/eng/geoterm.html>

In accordance to these objectives the Ministry of Economy and Energy has made the following forecast for the RES share in the Gross Electricity Consumption in Bulgaria.

Table 3

Forecast for the RES share in the Gross Electricity Consumption in Bulgaria

	UNIT	2007	2008	2009	2010
NPP	GWh	14 643	12 450	12 450	12 350
TPP	GWh	25 211	23 310	25 610	29 740
HPP	GWh	2 827	3 630	4 060	4 800
Gross production of Electricity	GWh	42 681	39 390	42 300	46 890
Gross consumption of Electricity	GWh	38 663	38 900	40 070	41 390
RES share in the gross consumption of Electricity	%	7,3	9,3	10,1	11,6

Source: <http://www.mi.government.bg/eng/geoterm.html>

The table shows that the electricity production rate will anticipate the electricity consumption rate. The NPP rate will be stable. The TPP will remain the basic electricity producer in the country and its share will exceed 63% in 2010. The production of electricity by HPP will increase with about 25 % and the share of the HPP will be over 10, 2%. So if the overall RES will be about 11.6% that mean that only 1.4 % will be for the other RES. Probably this is the “maximum program” which means that the significance of the HPP and respectively of the TPP for the economy will be greater.

## Conclusions

The above analysis reveals a economic subsector which development is in design at the current moments. According to us the indicative objectives directed by the EU could be achieved. The reason for this will be the already started Hydro system “Tzankov kamak” with the power of 80 MW and annual production of 158 GWh electricity. In accordance to the projects the system must start in 2010. These projects will strength the HPP system on the position of basic RES electricity producer in Bulgaria. In addition there are many projects for Small HPP which came into construction process. One of them is the Middle Iskar cascade with the total installed power of 25 MW distributed by nine small HPP and annual productivity of 142 GWh. The rest eight will be constructed in series up to 2011, if the Environmental impact assessment is positive. As a result we may say that for the near future the huge HPP in Bulgaria are the only one real RES electricity producer.

NEC Ltd. is the owner and the manager of 29 HPP and PSHPP with total power of 2 563 MW. Fourteen of these HPP are working in four basic cascades: Belmeken-Sestrimo-Chaira, Batak, Vucha and Downstream Arda. This highly concentrated territorial structure means that the current power capacity for HPP is already included into the energy system. Secondly, the energy objectives could be reached not only by active enlargement of the installed capacity but the measures increasing the energy efficiency could be much more reasonable. Finally, into the nearest future the PVPP and Wind PP technologies are capable to cover just small needs and as a country non producer of advanced technologies Bulgaria will remain country basically using conventional energy sources.

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