Bulgarian Electricity Market Restructuring

by

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Abstract: The electric power system of the Republic of Bulgaria is part of the united system of mainland Europe (UCTE) composed of the electric power systems of 23 countries as well as parts of Denmark and Ukraine. Their annual electricity consumption reached 2,530 TWh at 2.5% average annual demand growth in the period 2003–2006 (following the accession of Bulgaria and Romania to UCTE).

Bulgaria and Romania are the largest electricity producers among the South East European countries. Bulgaria produced 45 billion kilowatt hours (Bkwh) of electricity in 2005. Bulgaria's nuclear facility, Kozloduy NPP, has allowed the country to become one of the major energy exporters in Europe, with the Bulgarian national electric company, Natsionalna Elektricheska Kompania EAD (NEK), exporting 7.5 billion kilowatts (Bkw) of electricity in 2005. Kozlodoy produced more than 40% of Bulgaria's electricity in 2005. Reactors No. 1 and No. 2 were decommissioned in December 2002, and Bulgaria's electricity export potential shrank after it shut down reactors No.3 and No.4 in the beginning of 2007 due to EU safety concerns. After the closure of those units, only reactors No.5 and No.6 remained operational, generating an electricity shortage for the country and forcing it to significantly reduce electricity exports. In April 2006, the Bulgarian economy and energy minister announced that the cost of direct losses to Bulgaria is estimated to reach over $2 billion with the closure of the two units (No. 3 and No. 4). Bulgaria received $688 million from the EU as compensation for the closures.

In January 2005, Bulgaria officially announced plans to have its second nuclear plant, Belene, operational by 2011 to offset the loss of the two reactors at the Kozloduy facility. In November 2006 the preliminary agreement was signed with the Russian company Atomstroyexport for engineering, procurement, and commissioning of Belene Nuclear Power Plants, Units 1 and 2 – two 1,000MW light water reactors. Design and construction will be supervised by Parsons Europe Ltd, while Italian energy utility Enel plans to hold a majority stake in the 2,000MW nuclear power station. It is estimated to cost between $3-5 billion and will be built along the Danube.

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Bulgaria fully liberalised its electricity market in July 2007, adhering to EU standards. The Government had already privatised seven power distribution companies, selling them to the Czech Republic's CEZ, Germany's E.ON, and Austria's EVN in 2005 for a total of $827 million. In 2006, Bulgaria's Privatisation Agency (PA) signed a draft contract to sell the 1,260MW Varna power plant to Czech utility CEZ for $250 million, after Russian utility company UES withdrew its $689 million offer earlier in the year over regulatory and environmental issues. CEZ has also pledged to invest another $140 million in the power plant.

Bulgaria has the lowest electricity prices (in absolute terms) in EU-27. Household electricity prices have risen 13.6% over the last three years and are about 49% below the European averages. Similarly, industrial user prices have risen by 12.5% over the last three years and remain about 39% lower than the European averages. Prices for industrial users are lower in absolute terms than for households.

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1.1 Glossary of terms

Term	Definition/Explanation
MEE	Ministry of Economy and Energy;
NEK EAD	National Electric Company;
SEWRC	State Energy and Water Regulatory Commission;
EPS	Electric Power System;
TSO/EPSO	Transmission System Operator/Operator of the Electric Power System;
Balancing Market	Organised trade in balancing energy to maintain the balance between production and consumption within the Electric Power System;
Balancing Energy	The energy used by the TSO to match system-wide imbalances between electricity production and consumption;
Balancing	The making up for the difference between the quantities of energy consumed/produced by Plants of a Trading Participant and its contractual quantities under delivery schedules;
Plant	A generation plant or demand plant of a Trading Participant and the associated metering equipment. For generation, a Plant is typically a single generating unit, power plant or cascade. For demand, a Plant is typically a factory, works or installation operated by an eligible customer;
Eligible Consumer	Any person or legal entity that has the right to choose its supplier.

1. Institutional Structure

1.1 Ministry of Economy and Energy (MEE)

The main institution responsible for the development of the policies related to the energy sector is the Ministry of Economy and Energy (MEE) which was created in 2005 after the merger of the Ministry of Economy and the Ministry of Energy and Energy Resources (MEER). With the establishment of the new Ministry a separate Directorate has been designated to deal with the issues of energy efficiency and environmental protection.

Other relevant ministries are: **the Ministry of Environment and Waters (MOEW), the Ministry of Agriculture and Forestry (MAF), and the Ministry of Regional Development.** The Ministry of Environment and Waters has two important functions related to distributed generation: (i) its regional branches make decisions on the screening of whether projects require Environmental Impact Assessment and the Minister of MOEW is the one who has the final word on whether the Environmental Impact Assessment (EIA) will be accepted or not; (ii) it has functions to issue permits for water usage. The Ministry of Regional Development has functions related to issuing of land-use permits.

1.2 State Energy and Water Regulatory Commission (SEWRC)

The functions of an independent regulator of the energy and water markets are served by the SEWRC. It was established in 1999 as the energy regulator but from the beginning of 2005 the water regulation was included in its functions. In relation to Distributed Generation (DG) some of the main responsibilities of the Commission are: (i) issuing and controlling of various licensing related to electricity, heat and natural gas; (ii) regulation of the prices of electricity, heat and natural gas (including for RES and CHP); (iii) developing the rules for connection to the electricity and gas distribution and transmission networks; (iv) issuing certificates of origin and green certificates for the electricity produced from renewable energy sources and from co-generation.

1.3 Energy Efficiency Agency

Another state body, which is directly responsible for the implementation of the energy efficiency policy, is the Energy Efficiency Agency (EEA). EEA is a separate legal entity on budgetary financing and serves the functions of an Executive Agency to the Minister of Economy and Energy. It is a successor of a unit within MEER which was created back in 1992 and has been a separate legal body since 1999. Its main responsibilities are in the field of energy efficiency. However, if the Minister delegates his/her responsibilities to the Executive Director of the EEA, he/she can perform functions related to renewable energy generation too. The Agency has participated in several EU funded projects and in the preparation of several energy efficiency programmes and action plans and is currently preparing such for the promotion of RES. Among its numerous responsibilities are the collection of information on energy efficiency and renewable energy generation in the country, and the monitoring of implementation of energy audits.

2. The Energy Policy of Bulgaria

The Energy Strategy of Bulgaria, approved by the National Assembly in 2002, has outlined the country's energy policy and the principal reforms envisaged for the sector, the leading priority being the establishment of a competitive energy market. The main Strategy guidelines are expected to provide for security of supply, a competitive energy sector for a competitive economy, and environmental protection. The three major steps, pointed out in the Strategy were modernisation, market liberalisation and energy efficiency.

2.1 Security of Energy Supply and the Development of a Competitive Energy Market

The primary energy balance of the country is well structured in terms of diversity of primary energy sources, but at the same time the import dependence of the latter is about 70%, the main supplier being the Russian Federation.

Security of energy supply does not necessarily mean minimising the import, but rather reducing the risks of failing to provide the necessary supplies through a diversification of the energy resources in terms of the latter's type, source and supplier, given the regional and global energy market trends. This aspect of the security of supply has a positive impact on the establishment of a competitive energy market. The diversification of energy supply will foster competition among the major energy suppliers and consequently a reduction of primary energy prices. The accumulated experience and the importance of the Bulgarian energy sector for the region – *as it covers a considerable part of the power balance deficit of the net importers in the South East European region and plays an important role in the gas transit towards the countries in the Region* – and the positive impact resulting from the energy supply diversification should result in an auspicious climate for attraction of investments into the energy sector.

The strategic location of Bulgaria – *between Russia and South East Europe and close to the Caspian Region and the Middle East* – creates significant advantages for diversification of the type and source of energy supplies and the establishment of a competitive energy sector. Bulgaria is located in the area between the main producers and consumers of energy resources in Eurasia. The possibility for transit of Russian and Asian energy resources (natural gas and oil) to Southern, Central and Western Europe, as well as the utilisation of these resources and the development of nuclear energy, will help create a competitive energy sector which will not only export a considerable amount of electricity to the regional South East Europe electricity market and the common EU electricity market, but also transit considerable energy flows (oil and gas) to countries within the region and to Central European ones.

2.2 Measures for Environmental Protection in a Liberalised Electricity Market Environment

The Republic of Bulgaria has ratified the United Nations Framework Convention on Climate Change. According to the Kyoto Protocol signed in 1997 Bulgaria has committed itself to reducing greenhouse gas emissions

within the period 2008–2012 by 8% compared to the emission level in 1988. During the negotiation process with the EU on Chapter 22 "Environment" Bulgaria committed itself to fulfilling the requirements of EU Directive 2001/80/EC with regard to reducing the emissions of nitrogen oxides, sulfur dioxide and dust from large combustion facilities. The investment necessary to meet the environmental goals is estimated at more than 3 billion leva. In order to ensure that the Bulgarian side will be able to actively participate in the emission trade process it seems absolutely necessary to maintain and even increase the share of electricity produced by NPPs through the construction of replacement nuclear capacities. The development of nuclear energy, in line with the commonly adopted nuclear safety standards, is an important instrument conducive to fulfillment of the international commitments as well as for the fulfillment of the environmental standards, set by EU legislation in the energy sector.

It is also necessary to adequately draw upon the existing potential with a view to improving energy efficiency, energy savings and the utilisation of renewable energy sources (RES) on a larger scale, as all these activities should be highly beneficial with regard to environmental protection. There is a considerable market potential for the improvement of energy efficiency, as, according to different assessments, the amount of energy consumed per unit of GDP in Bulgaria is from three to five times higher than the average for the OECD countries.

To the end of securing the relevant and accessible financial resources for the implementation of energy efficiency oriented projects, the Energy Efficiency Act, adopted in February 2004, envisaged the establishment of an Energy Efficient Fund, the function of which was to cover two main areas:

- Direct allocation of low interest rate credit lines;
- Guaranteeing credit lines for energy efficiency projects allocated by other financial institutions – this also results in lower interest rates.

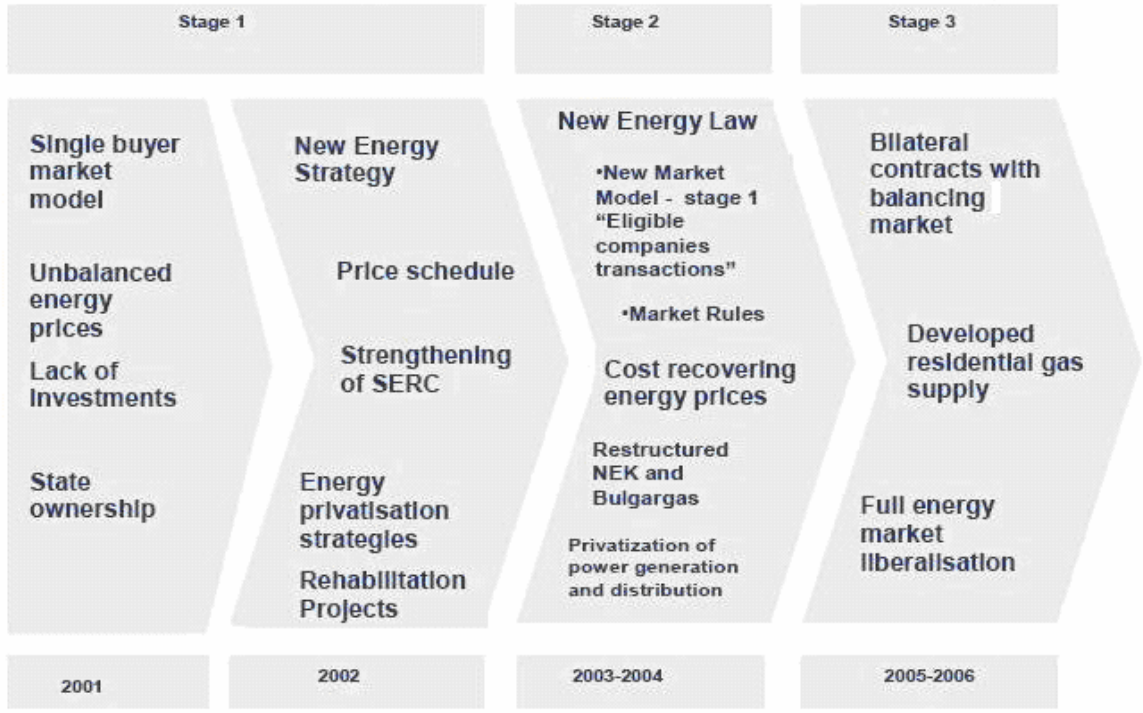
The Energy Law and Energy Efficiency Act envisage additional incentives targeting the implementation of energy efficiency measures and utilisation of RES. Those incentives come in terms of tax alleviations and reduced concession taxes for the utilisation of geothermal energy.

3. Electricity Reform in Bulgaria

In the period after 1989 the state energy authorities were represented by the Energy Committee, then by the Ministry of Energy, the State Agency of Energy and Energy Resources, the Ministry of Energy and Energy Resources and, since August 2005, by the Ministry of Economy and Energy. The economic functions are performed by the National Electric Company, NEK EAD, established on 1 January 1992 as a single-owner trade company with state property, a two-tier management system and a supervisory board. A year later the supervisory board was abolished and a single-tier scheme of management was established in NEK EAD.

The reforms continued further with the abolishment of the NEK monopoly and the establishment of new players in the electricity market.
The real restructuring of the Bulgarian electricity market started in the beginning of the 21st century. The next figure shows the exact stages of the reform and the liberalisation of the electricity market through the last six years.

Figure 1: Stages of Reform, 2001–2006

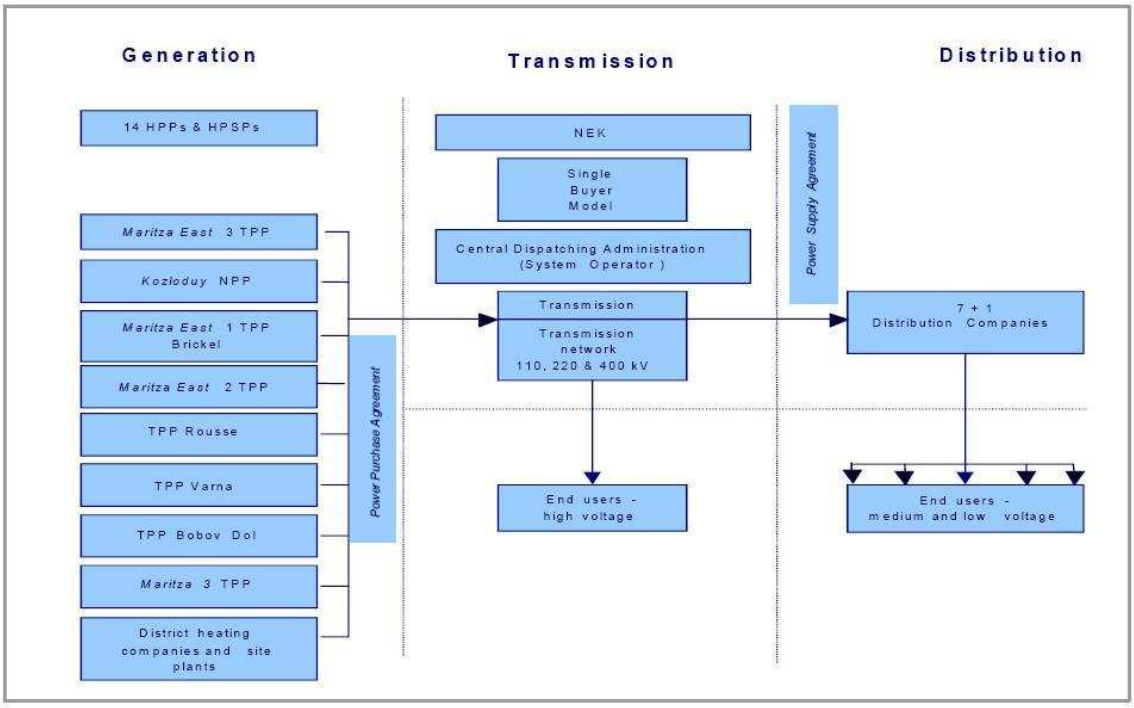


Source: "Bulgarian Energy Sector", Ministry of Energy and Energy Resources; October 2004

In the middle of 2000 the National Electric Company was restructured, and seven electricity distribution companies and three electricity producers were separated from it and became independent legal entities. Kozloduy NPP, Rousse East TPP and Maritsa East 1 TPP were set up as independent electricity producers. NEK EAD began functioning as a separate unit within the framework of the Single Buyer Model. The National Electric Company is the owner of the 110kV and higher voltage transmission network and acts as a Transmission System Operator (TSO) through its National Dispatch Center (NDC).

In 2001 the National Electric Company functioned as a "single buyer" of electric power from the independent power producers and as a single supplier to the distribution companies and clients.

Figure 2: The Restructuring of the Bulgarian Electricity Sector



Source: "Bulgarian Energy Sector", Ministry of Energy and Energy Resources; October 2004

The restructuring of the Bulgarian electricity sector has had a significant impact on increasing the investment opportunities in the sector. One of the key advantages of the Single Buyer Model is that funds from the private sector can be attracted through the installation of additional capacities or through complete privatisation. The existence of a single transmission company facilitated Bulgaria joining UCTE after the execution of a list of measures for improvement of the technical parameters of the Bulgarian EPS and its alignment with the UCTE requirements. In 2002 NEK EAD became a full member of SUDEL and in May 2003 it became a full member of UCTE as well.

The relations between the participants in the domestic electricity market were regulated on the basis of annual contracts in compliance with rules approved by the Government for setting tariffs and prices, concerning both the wholesale and retail prices in the electricity market. NEK was the only authorised legal entity in Bulgaria for import and export of electric power regardless of the transaction type and volume.

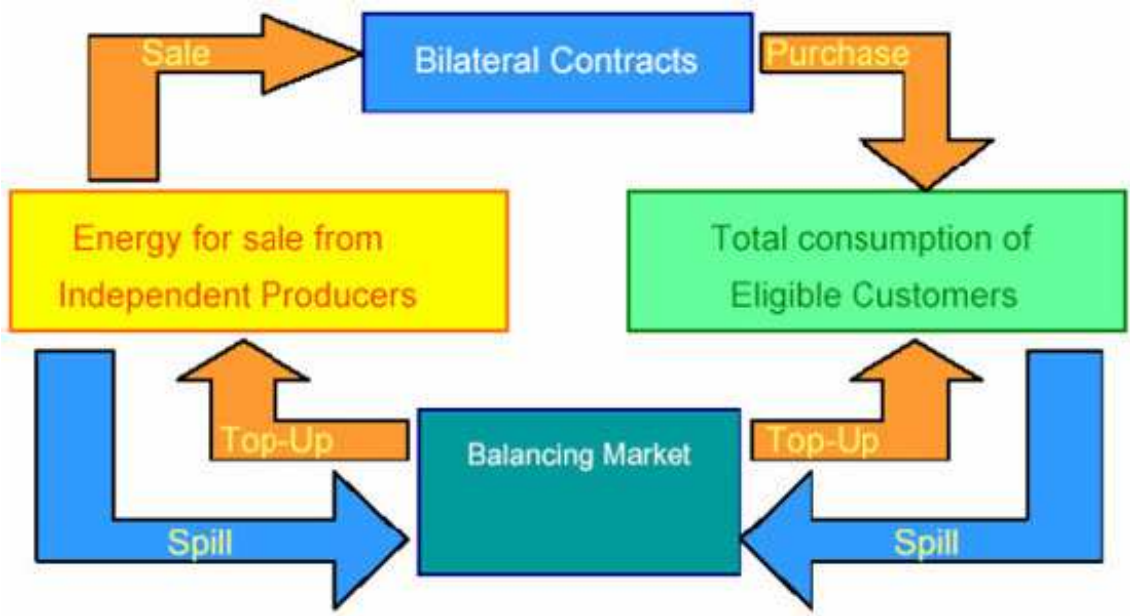
On 26 November 2003 the Parliament adopted a new Energy Act. This law is in full compliance with the existing and the new EU Electricity and Gas Directives in terms of electricity generation, operation of the transmission and distribution networks, separation and transparency of the accounting balances and access to the transmission and distribution grids.

The new Energy Act introduces a new Market Model of regulated Third Party Access to the network, which replaces the Single Buyer Model. The liberalised share of the electricity market is gradually expanding, following the model of bilateral contracts and a balancing market. A legal separation of the operators

of the transmission and distribution networks from the generation and supply activities is being performed.

The electricity market is organised on the basis of Power Supply Contracts and a Balancing Market.

Figure 3: Electricity Market Organisation



Source: "Brief Guide to market Rules", Electricity System Operator (ESO)

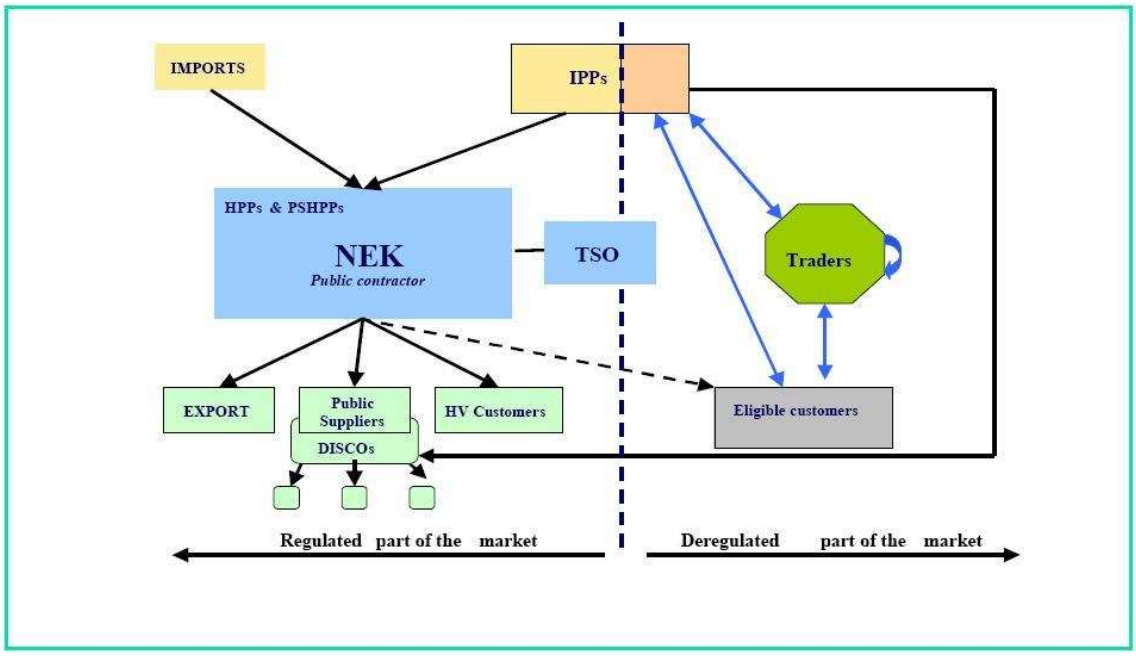
A central feature of this market model is the fact that producers are dispatched according to their contractual quantities of electricity. Energy imbalances resulting from failure on the part of a producer or a consumer to meet contractual delivery schedules are redressed by providing balancing energy that is purchased from or sold to the TSO. Producers who over a certain settlement period have generated less energy than the contract amount and demand-takers who have consumed more energy than the contract amount will be in negative energy imbalance and buy energy from the TSO at a top-up price. Generators who over a certain settlement period have generated more energy than the contract amount and demand-takers who have consumed less energy than the contract amount will be in positive net imbalance and sell energy to the TSO at a spill price. Since usually the top-up price is higher than the contract price and the spill price is lower than the contract price, trading participants have incentives to meet as closely as possible their contractual delivery schedules that result in lower levels of imbalances between generation and demand in the system.

The electricity market consists of two segments – market based on regulated prices and market based on freely negotiated prices. The regulated market is administered on the basis of firm contracts with the Public Supplier and/or public providers at prices regulated by SEWRC and the participants are not subject to balancing, i.e. they do not enter into deals for balancing energy with the TSO. The non-regulated market is based on free price negotiating between the participants (within the quotas of the independent producers

determined by SEWRC every year). The market model, as mentioned above, is based on bilateral contracts and a balancing market.

Though the two market segments function under different conditions, they operate jointly and the connection between them is carried out by NEK EAD as shown in the figure below:

Figure 4: Operation of Market Segments



Source: "Bulgarian Energy Sector", Ministry of Energy and Energy Resources; October 2004

The parties in the electricity market (mentioned above: Transmission System Operator (TSO), owners of the transmission and the distribution networks and market participants) take part in the electricity market in different ways. The TSO provides reliable and secure operation of the EPS and administrates the balancing market by carrying out activities related to registration of the participants and the bilateral contracts signed between them, as well as receiving bids and offers for balancing energy, preparation of merit orders, calculation and invoicing of the imbalances. The TSO is not a market participant. It buys and sells electric power only for the needs of the balancing market, for covering the imbalances of the market participants, and it remains financially neutral in these transactions.

The owner/owners of the transmission/distribution networks provide the technical conditions for electric power transmission. The access to their networks was regulated by the Access Rules published in State Gazette (issue 39/16.04.2002), which since the middle of 2004 has been replaced by Rules on the terms and procedures regulating the access to the electricity transmission and distribution networks, published in State Gazette (issue 67/02.08.2004). The electricity market participants are parties in bilateral contracts for electricity transmission with the transmission and/or distribution companies; they are also parties in contracts with the TSO in connection with

the balancing market. They buy and sell electric power as trade entities for electricity use or re-sale purposes.

Market Opening – Eligible Consumers

- In July 2003, commercial consumers with annual consumption **over 100GWh** became eligible (**10** eligible customers), resulting in **over 18.9%** official market opening by the end of 2003 – potential market **USD 100 million**;
- In July 2004, commercial consumers with annual consumption **over 40GWh** became eligible (**25** eligible customers), resulting in **over 22%** official market opening – potential market **USD 150 million**;
- In July 2005, commercial consumers with annual consumption **over 20GWh** became eligible (**60** eligible customers), resulting in **over 25%** official market opening – potential market **USD 250 million**;
- In July 2006, commercial consumers with annual consumption **over 9GWh** became eligible (**130** eligible customers), resulting in **over 28%** official market opening – potential market **USD 350 million**;
- In 2007, **all non-household** consumers became eligible (**1,200** eligible customers), resulting in **over 60%** official market opening – potential market **USD 500 million**;
- Since 1 July 2007, all consumers became eligible (over **1,000,000** eligible customers), resulting in **full market liberalisation –** potential market **USD 1.1 billion.**

- The first contract agreement on freely negotiated prices in the Bulgarian electricity market was signed on **16 September 2004** – between Kozloduy NPP and The Umicore Group;
- Measurements of the impact of derivatives' market development in the electricity sector show that the potential market can reach **USD 3 billion** at the end of 2007.

4. NEK EAD and the Power Transmission Network

Natsionalna Elektricheska Kompania EAD (NEK EAD) is a single-owner joint-stock company, 100% held by the State. Its seat of business is in Sofia. The single-owner rights are exercised by the Minister of Economy and Energy. The management body of the joint-stock company is a five-member Board of Directors. The Company has 6,293 employees. NEK EAD is the owner of the high-voltage power transmission network in the country. Its total length is 14,610km.

In the beginning of 2006, NEK EAD was the owner of 31 hydro power plants (HPP) with 2,563MW total installed capacity. During the same year, two small hydro plants of total capacity 0.25MW were privatised. Thus, at the end of 2006, NEK EAD was running 29 hydro power plants and their total capacity in

fact remained unchanged. The hydro power capacities of NEK EAD represent the most considerable renewable source of energy for the power balance of the country.

With the accession of the Republic of Bulgaria to the European Union NEK EAD has restructured its business and operations so as to satisfy the provisions of EU Directive 2003/54. To ensure equal access to the grid system of all participants in the free power market, the EU Directive 2003/54 provides for the legal, functional and accounts separation of the transmission system operator where it is part of a vertically integrated enterprise from non-transmission-related activities that could compete in the market, in particular, trading and generation.

In line with the provisions of the Energy Law and Directive 2003/54, in the beginning of 2007 NEK EAD effected its restructuring through establishment of a new company, electricity system operator JSC (ESO EAD), 100% owned by NEK EAD, which performs the functions of an electricity system operator, balancing market administrator, and operation and maintenance of the transmission system that remains property of NEK EAD.

The new company is independent in terms of:

- **legal status** – i.e. a separate legal entity as per the Commerce Act;
- **organisational form** – it has a structure of its own and produces a balance sheet and income statement consolidated by NEK EAD;
- **decision making capability** – independent Board of Directors as per the Commerce Act.

Following its restructuring, NEK EAD performs the functions of public provider, hydro generator and electricity trader. Pursuant to the Energy Law, NEK EAD continues to purchase the electricity under the existing long-term power purchase agreements with TPP Maritsa East 2 and TPP Maritsa East 3 and, in the future under, the PPA with TPP Maritsa East 1 when commissioned, as well as the electric energy produced by renewable energy sources and CHP plants at preferential prices.

5. Privatisation

Bulgarian electricity is still mostly generated by state owned enterprises, mainly because of the state owned Kozloduy NPP, which generates more than 40% of the electricity in the country. Kozloduy NPP (3,760MW; 2,000MW after the closure of the four units), Maritsa East 2 TPP (1,450MW), and Bobov Dol TPP (630MW; should be totally shut down in 2014) are still state owned enterprises.
Varna TPP (1,260MW), Maritsa East 3 TPP (840MW), and Maritsa 3 TPP (120MW) are already privately owned companies.

The privatisation method preferred until 2001 – “negotiations with potential buyers” – has been replaced by a public tender procedure since 2002–2003.

Maritsa East 3 TPP was privatised in 2003. That was the first major privatisation deal in the energy sector – 100MEUR monetary installment of the investor (ENEL/Entergy) + 600MEUR secured investments. Maritsa East 2 TPP is not going to be privatised soon, since it has been included by the Government in the Sales Ban List of the Privatisation Act. The reason for this decision is that a large scale programmeme for rehabilitation and noxious emissions reduction has been going on in this power plant to the amount of 300 million EUR. The funds are provided by the Japanese Bank for International Cooperation JBIC (100% state institution), the ISPA preaccession programmeme (for flue gas desulphurisation installations (FGD) of units 5 and 6) and EBRD. Eighty-five per cent of the investments for rehabilitation of the old units 1-4 which have been in operation for more than 35 years are provided by an export credit given by JBIC with a state guarantee and the remaining 15% are the power plant's own funds. The ISPA condition for giving a grant is that the power plant must remain a state property for at least the next five years.

Following the unbundling of the vertically integrated power utility, initiated in 2000, small hydro power plants are gradually put up for privatisation in the form of assets sale deals. Till the end of 2003, 32 small power plants (the largest one with a capacity of 35MW), with an overall installed capacity of 243MW have been sold to private investors. Maximum price per MW installed capacity reached, at some, BGN 2.4m.

At the end of October 2003 the Privatisation Agency announced the start of the privatisation of the seven electricity distribution companies. The method applied was a public, two-stage tender with submission of preliminary and final bids in compliance with the Regulation on Tenders and Competitions and the PPCA. The sale was carried out through three separate tender procedures executed simultaneously. The seven electricity distribution companies were grouped in three packages:

- ***Western Bulgaria*** - Sofia City EDC EAD, Sofia; Sofia Region EDC EAD, Sofia; Pleven EDC EAD, Pleven;
- ***South Eastern Bulgaria*** - Plovdiv EDC EAD, Plovdiv; Stara Zagora EDC EAD, Stara Zagora;
- ***North Eastern Bulgaria*** - Varna EDC EAD, Varna; Gorna Oriahovitsa EDC EAD, Gorna Oriahovitsa.

The strategic investors who met the qualification criteria stated in the tender documentation were admitted to participate in the tender procedures. The preliminary qualification criteria for the potential investors were the same in the three tender procedures:

- ***Volume of electric power sold*** – the volume of electric power sold, on the basis of operational data for 2002, of the strategic investors had to amount to a minimum of 7,000GWh.
- ***Own capital*** – the own capital of the strategic investor according to the accounting balance, except for minority participations, had to be equal to or higher than 700m EUR as of 31 December 2002.

- ***Credit rating*** – the investor should have a long-term credit rating higher or equal to “BBB Minus” (Standard & Poor’s); “Baa3” (Moody’s Investors Service); and “BBB Minus” (Thomson Bank Watch).
- ***Proven experience in a liberalised electricity market*** – an electricity market is considered to be liberalised when at least 26.5% of the market has been officially opened to competition as of April 2003 or a later date. This requirement corresponds to the first stage of the market opening according to the EU Directive. The investor should have at least a 5% share in such a liberalised market, measured according to the volume of sold electric power in 2002 compared to the annual volume of the end consumption for the same period.

Preliminary offers were submitted by the Austrian company EVN AG, the Greek Public Power Corporation A.E., the Italian Enel s.p.A, the Czech CEZ a.s. and the German E.ON Energie AG. The only criterion for evaluation of the bids was the price proposed for each of the three packages in which the distribution companies were grouped.

As a result of a number of serious measures undertaken during the past two years the electricity distribution companies significantly increased their attractiveness for privatisation. While in 2002 they reported losses and the electricity prices in the country were considerably low, at the beginning of 2004 the situation was considerably different. The distribution companies closed 2003 with positive financial results: the electricity thefts were reduced, and investments were made for electric meter replacement and installation of the meter panels at the property border.

The owners of the seven electricity distribution companies have been defined. In the middle of July the Government announced the selected buyers of 67% of the capital of the seven electricity distribution companies. The Czech State Electricity Company CEZ was selected as buyer of the West Bulgaria Pool (Sofia, Sofia District and Pleven) with an offer of 281.5m EUR. The companies in South East Bulgaria (Plovdiv and Stara Zagora) were won by the Austrian company EVN AG with an offer of 271m EUR. The third package, North East Bulgaria (Varna and Gorna Oryahovitsa), was won by the German company E.ON Energie AG, which offered the price of 140.7m EUR. The total value of the deals amounts to 693.2m EUR and it is the highest value in the history of the Bulgarian privatisation. The seven electricity distribution companies grouped in three packages have over 4.5 million clients and their revenues in the year of privatisation amounted to over 1.6billion EUR.

According to the tender conditions the companies could apply for all packages but buy only one of them. At the future sale of the minority state share in every electricity distribution company the price of a share will be equal to or higher than the agreed ones in the sale of 67% of the companies, approved by the Government. This is stipulated in the privatisation procedure for the sector. Thus, the price of the minority state share cannot be lower than 439.8m EUR. With this deal the state actually guarantees future revenues of 1.033billion EUR for itself.

Privatisation of the distribution companies was a huge success in contrast to the ongoing privatisation of the generation ones, mainly because of the transparency and clarity of the overall privatisation procedure and the rules of conducting it. The results achieved place Bulgaria at the front line in Eastern Europe according to the "price for a customer in privatisation" index. In Bulgaria it is 230 EUR per consumer, while in the Czech Republic it is 200 EUR, in Romania, 100-150 EUR, and in Ukraine, 80 EUR.

Bad Experience in Privatisation

The privatisation of TPP Varna (total installed capacity of 1,260MW), TPP Bobov Dol (total installed capacity of 630MW) and DHC Rousse (total installed capacity of 400MW + full heating capacity of 41MW): the process started in autumn 2004 and on 27 April 2005 the binding offers of the bidders were opened – RAO EES, CEZ, PPC and Enel.
The highest bid prices were as follows:
1) **TPP Varna** – BGN 762m + BGN 370m raise of capital (RAO UES) – *twice as much as the second ranked candidate (CEZ);*
2) **DHC Rousse** – BGN 235m + BGN 114m raise of capital (RAO UES) – *four times as much as the second ranked candidate (CEZ);*
3) **TPP Bobov Dol** – BGN 139m + BGN 67m raise of capital (PPC).
In May 2005 the Privatisation Agency selected RAO UES, from Russia, as a winner in the competition for the sale of TPP "Varna" EAD. With a decision from 8 July 2005, the Commission for Protection of Competition permitted the concentration of the business activities concerning RAO UES, Russia, and District Heating Company Rousse EAD with a constraining requirement, namely: *RAO UES must under no circumstances acquire a share in the capital of District Heating Company Varna EAD*. The Bulgarian CPC barred the Russian company from buying both power stations, forcing it to pursue only the acquisition of the plant in Varna. The TPPs have contested the ruling of the antitrust watchdog but no hearings have been held. In the end the Russian state owned company abandoned plans to buy the thermal power plant (TPP) based in Varna.
Privatisation failed because of the misunderstanding of the idea of competition.
The publicly announced tender for the sale of 100% of District Heating Company Bobov Dol EAD has been discontinued on the grounds of unsatisfactory bids. Binding offers were submitted by Public Power Corporation A.E., Greece and Enel S.p. A, Italy.

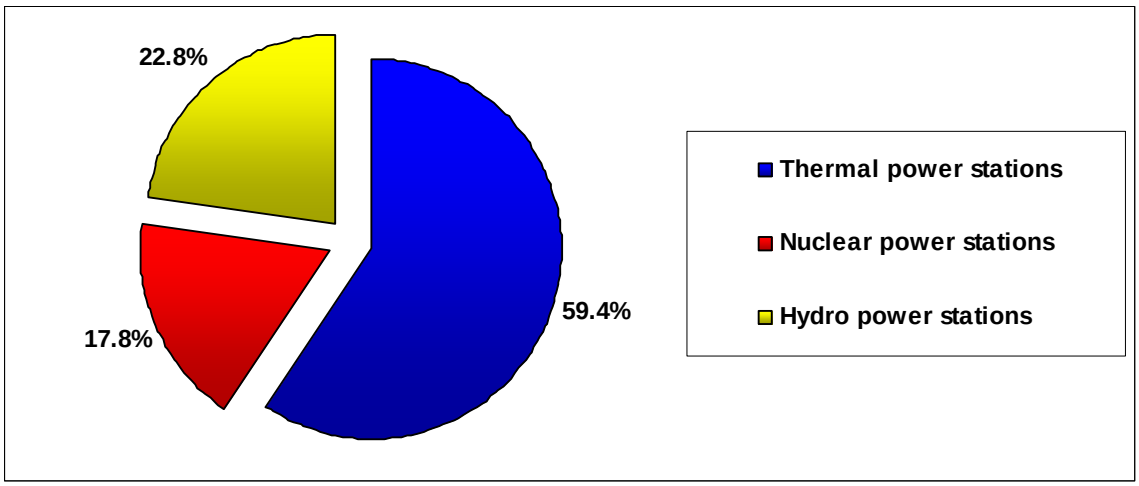
6. Performance of the Bulgarian Power Sector

6.1 Installed Capacity and Generation

In 2007, Bulgaria had a total installed generation capacity of 11,263MW, consisting of thermal power stations (6,700MW), nuclear power stations (2,000MW), and hydro power stations (2,563MW). Most of the generation capacities were commissioned in the 1970s and the 1980s. The total installed

capacity dropped since last year, because of the closure of the two units (3 and 4) of Kozloduy NPP.

Figure 5: Share of total installed capacity – Bulgaria, 2007



Source: Eurostat

At present, Kozloduy NPP has only 2,000MW installed capacity, 1,000MW for each unit (units 5 and 6), which is less than 20% of the total installed capacity of the country. Hydro power stations' installed capacity is around 20% of total capacity and they are almost fully owned by NEK EAD, who are running 29 hydro power plants. Thermal power stations' installed capacity is more than half of the total capacity of the country and it is mostly concentrated in Maritza East Power Complex.

Table 1: Installed Capacity of Bulgarian Plants

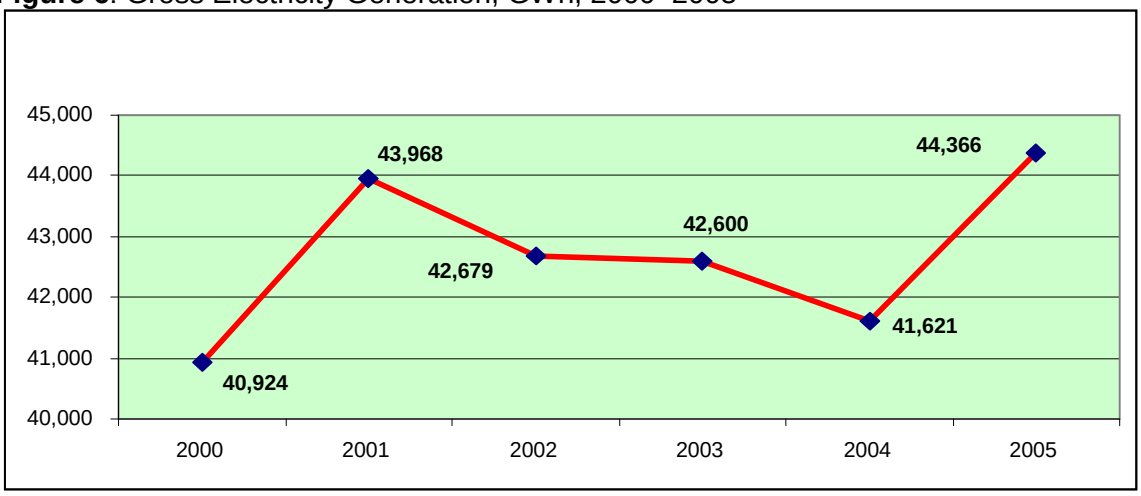
Thermal Power Plants	Capacity, MW	Energy source
TPP Maritza East I	200	Local lignite
TPP Maritza East II	1,450	Local lignite
TPP Maritza East III	840	Local lignite
TPP Maritza-3	120	Local lignite
TPP Bobov Dol	630	Local brown coal
TPP Varna	1,260	Imported black coal
TPP Russe	400	Imported black coal
Cogen & autoproducers	1,800	Natural gas, fuel oil, coal
Total	**6,700**	**-**

Source: "Bulgarian Energy Sector", Ministry of Energy and Energy Resources; October 2004

Bulgaria has significant reserves of coal, with annual extraction in recent years at around 25m tonnes, down from 34m tonnes in the late communist period. Almost 90% of output is lignite and most of the rest is brown coal. About 90% of extraction is opencast. Most locally mined coal is used for power generation, with around one-fifth of the coal used in the electricity sector imported for the Varna and Russe thermal power plants (TPPs), mostly from Russia and Ukraine. Imports accounted for around one-third of Bulgarian coal consumption.

In 2005, gross electricity generation in Bulgaria was 44,366GWh, which is the best performance in recent years. Still, the available capacity of the existing power generating sources is considerably lower than the installed capacity. Distribution losses in Bulgaria are at least 12.5% of total generation. Consumption of the electricity generation sector is around 10% of total generation.

Figure 6: Gross Electricity Generation, GWh, 2000–2005



Source: Eurostat

Nuclear power accounted for about 42% of electricity generation in 2005. Bulgaria used to mine uranium but the mines were closed. At present, nuclear fuel is imported from the Russian Federation. Bulgaria has one nuclear power plant in operation with four WWER-440/V-230 units and two WWER-1000/V-320. As part of the EU accession agreement, first two blocks were closed at the end of 2002 and then the other two were closed in 2007. In November 2006 the preliminary agreement with the Russian company Atomstroyexport was signed for engineering, procurement and commissioning of Belene Nuclear Power Plants, Units 1 and 2 – two 1000-MW light water reactors.

Coal represents a significant share of the fuel mix and is widely used for electricity generation (or 40% of total electricity generation in 2005), for space heating, and in industrial processes (IEA 2004a). While the county has significant reserves of lignite, estimated to be 2.3Gt that might be sufficient for about 80 years, its quality is very poor. Typical calorific value of Bulgarian lignite coal is about 1,600kcal/kg compared to about 4,300kcal/kg for the anthracite coal used in Bulgaria (NSI 2003) and it also has high ash and sulphur content (of about 2%). Increasing the share of coal is seen as one of the means for achieving the country's independence from fuel imports.

Hydro energy is the only renewable source that has been utilised to a considerable extent for electricity generation in Bulgaria. In 2005, the output of all hydro power plants was 4,730GWh or 10.7% of total electricity generation. The 14 largest HPPs and PSHPPs operate within four cascades: Belmeken-Sestrimo-Chaira, Batak, Vacha and Dolna Arda; all are used to generate

electricity, cover peak loads and regulate the parameters of the electric power system.

The contribution of wind energy to the electricity fuel mix of Bulgaria is very limited. However, 100 years ago, windmills were in operation in Northeast Bulgaria and on the Black Sea Coast. Evaluation of the potential for wind development in Bulgaria shows that theoretically there is a possibility for the installation of 484MW (ESD and Ecotherm - Engineering Ltd. 1997). The most promising regions are the northern Black Sea Coast, the central mountain range, and the Rhodopi mountains in the southwest.

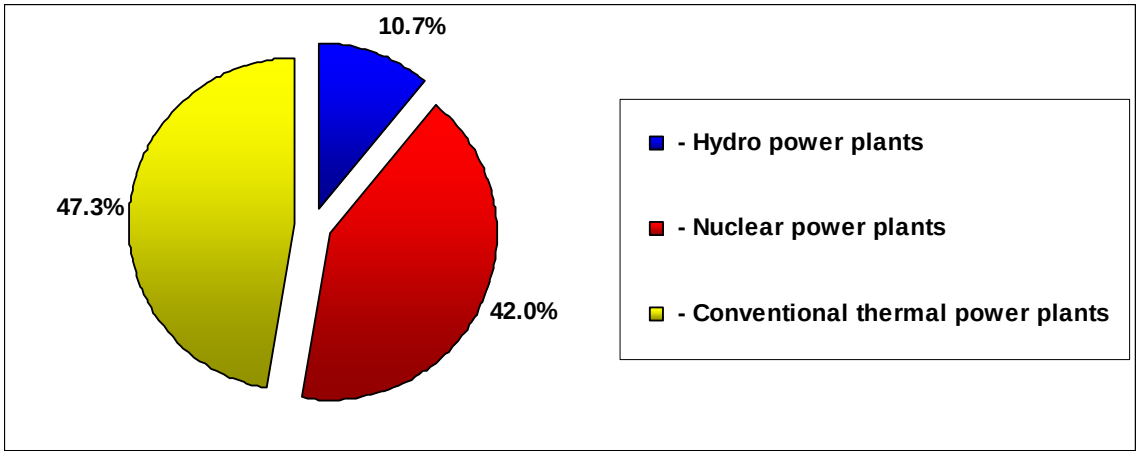
Biomass is considered to be the main potential source of renewable energy (heat and electricity) in Bulgaria. At present it is largely used as a heating source, mainly firewood, representing 4% of the TPES in 2005, but its applications in electricity generation are insignificant, limited only to several CHP installations that utilide the waste by-products in the pulp and paper industry. With 35% of Bulgaria covered with forests there is theoretically significant potential for wood utilisation which, however, is limited by the possibility of concurrent uses of timber and nature conservation objectives.

Table 2: Gross Electricity Generation by Plant, GWh, 2000–2005

	2000	2001	2002	2003	2004	2005
- Hydro power plants	2,951	2,171	2,704	3,301	3,363	4,730
- Geothermal power plants	-	-	-	-	-	-
- Nuclear power plants	18,178	19,553	20,222	17,280	16,815	18,653
- Conventional thermal power plants	19,795	22,244	19,753	22,019	21,442	20,981
- Wind turbines	0	0	0	0	1	2
Total gross electricity generation	**40,924**	**43,968**	**42,679**	**42,600**	**41,621**	**44,366**

Source: Eurostat

Figure 7: Gross Electricity Generation in Bulgaria, GWh, 2005



Source: Eurostat

While there is still only one (state owned) nuclear power plant, and hydro power plants are mostly owned by NEK EAD (also state owned), conventional thermal power plants seem to be the most interesting from the market's point of view, as they generate nearly half of the electricity in the country and there

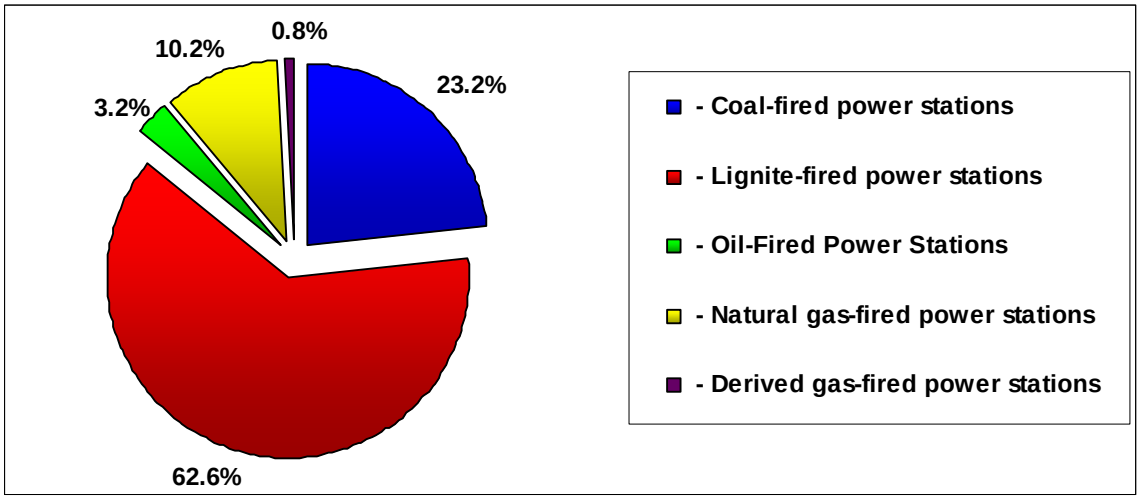
is real place for competition between them. Despite this, the privatisation of these plants should continue in order to encourage future competition. Most of the electricity generation from conventional thermal power plants comes from lignite-fired power stations (around 60%) concentrated in Maritza East Power Complex. Another 23% of electricity generated form conventional thermal power plants comes from coal-fired power stations and around 10% comes from natural gas-fired power stations.

Table 3: Gross Electricity Generation in Bulgaria by Conventional Thermal Power Plant, GWh**,** 2000–2005

	2000	2001	2002	2003	2004	2005
- Coal-fired power stations	2,972	4,446	3,863	4,525	3,950	4,866
- Lignite-fired power stations	13,969	15,051	13,319	14,712	14,952	13,129
- Oil-Fired Power stations	661	579	830	789	822	671
- Natural gas-fired power stations	1,912	1,908	1,539	1,762	1,494	2,130
- Derived gas-fired power stations	266	260	191	225	205	168
- Biomass-fired power stations	15	0	0	0	0	0
- Other power stations	0	0	11	6	19	17
Conventional thermal power plants	**19,795**	**22,244**	**19,753**	**22,019**	**21,442**	**20,981**

Source: Eurostat

Figure 8: Gross Electricity Generation in Bulgaria by Conventional Thermal Power Plant, GWh, 2005



Source: Eurostat

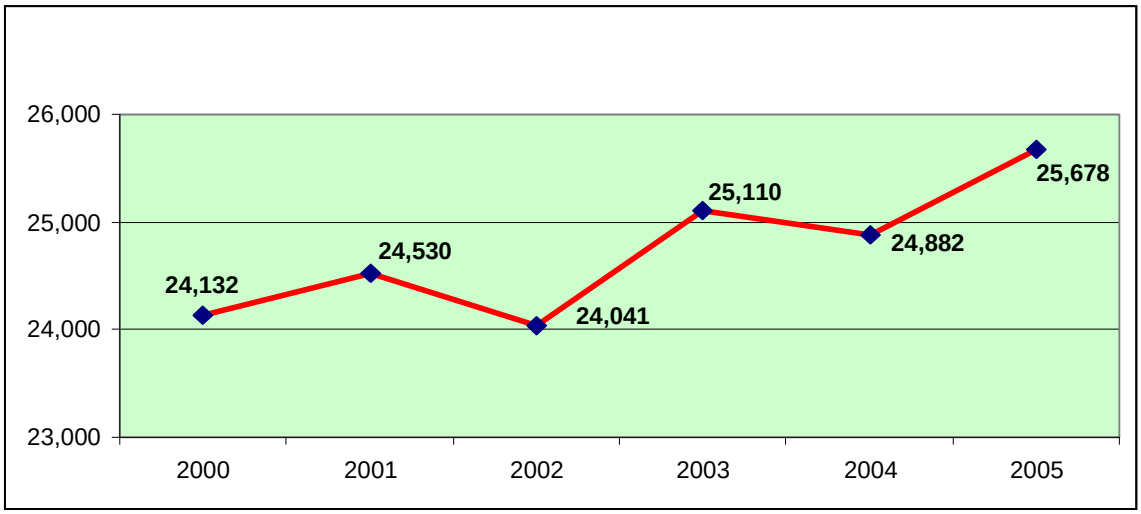
Most of the equipment for power generation in Bulgaria was produced in Russia, other parts of the former Soviet Union and by Soviet trading partners in Central and Eastern Europe. The physical condition of the thermo and hydro power plants, as well as the district heating utilities, has deteriorated to an extent that makes it difficult to maintain reliable operation and develop a responsive regional wholesale power market without significant investment to rehabilitate the infrastructure. The current technical state is inadequate for modern metering and measuring, telecommunications, instrumentation and frequency control, information systems and management, and supervisory control and data acquisition.

The facilities require rehabilitation with more efficient and environment-friendly equipment, so that they can operate at their design capacities. There are currently no manufacturing facilities in the country for the production of equipment used in power generation and transmission.

6.2 Consumption and Prices

Final electricity consumption in Bulgaria has varied with an upward trend for the last ten years reaching 24,678GWh in 2005. Household consumption is slightly above 35% of total consumption in the country, while industry is still the main consumer with a relative share of 40% in 2005.

Figure 9: Final Electricity Consumption, GWh, 2000–2005



Source: Eurostat

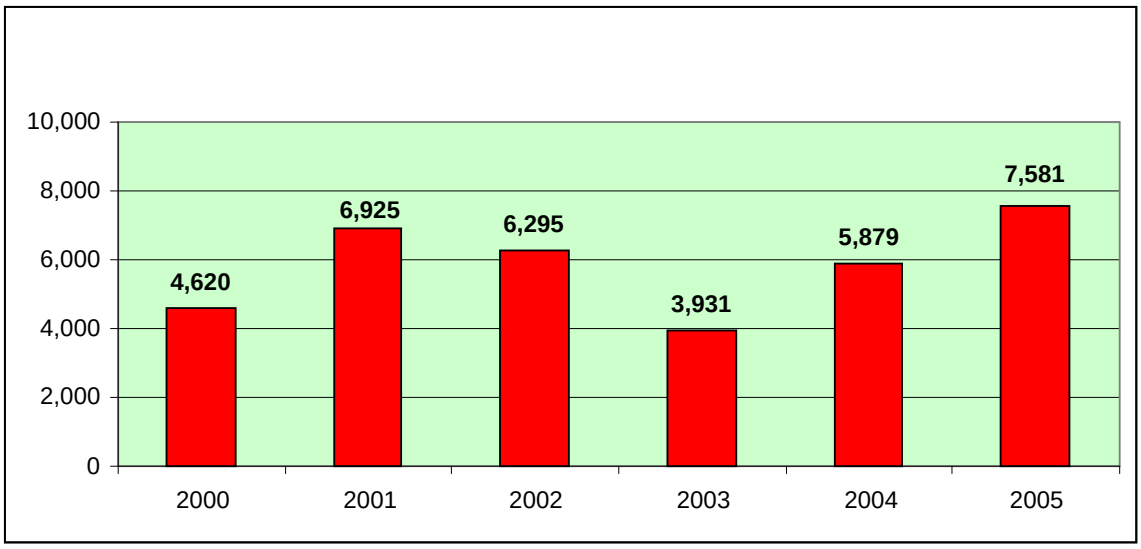
Primary energy intensity, represented in terms of an amount of primary energy consumption per unit of GDP, is one of the basic energy efficiency measurements and a key element of national competitiveness. The Bulgarian economy could not be competitive given the considerably higher rate of energy consumption involved in the production of a GDP unit against the EU countries. The Bulgarian economy is currently consuming between two and eight times more primary energy for the production of a GDP unit.

Bulgaria has the lowest electricity prices (in absolute terms) in EU-27. Household electricity prices have risen 13.6% over the last three years and are about 49% below the European averages. Similarly, industrial user prices have risen by 12.5% over the last three years and remain about 39% lower than the European averages. Prices for industrial users are lower in absolute terms than for households.

6.3 Net Export

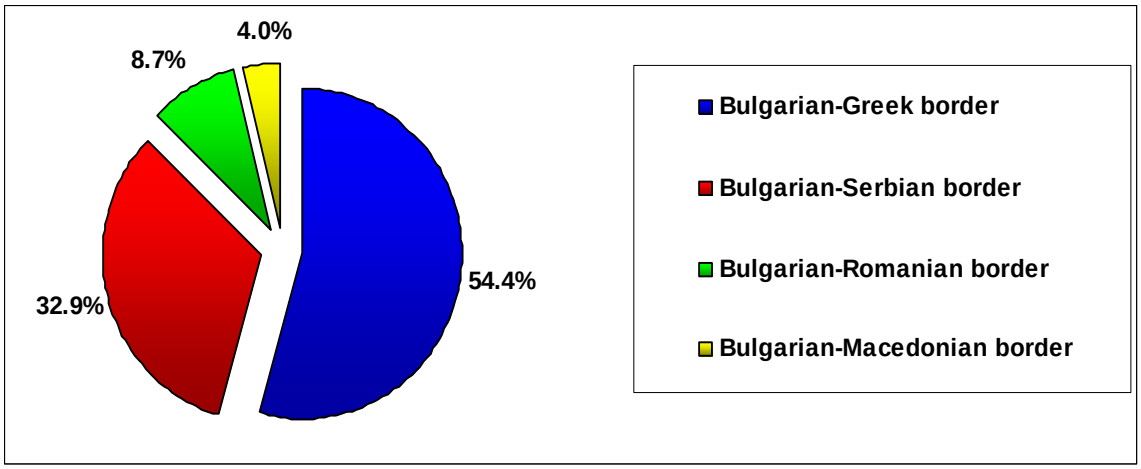
Bulgaria is the main electricity exporter in the region, selling electricity to Greece, Serbia, Romania, Macedonia and Turkey. In 2005, Bulgarian net electricity export was 7,581GWh. Since the beginning of 2007 Bulgarian electricity export is put on hold, because of the closure of units 3 and 4 of Kozloduy NPP. Still, the country has the potential to recover in the near future.

Figure 10: Net Electricity Export, GWh, 2000–2005



Source: Eurostat

Figure 11: Bulgarian Electricity Export Structure (2005)



Source: Eurostat

6.4 Interconnections

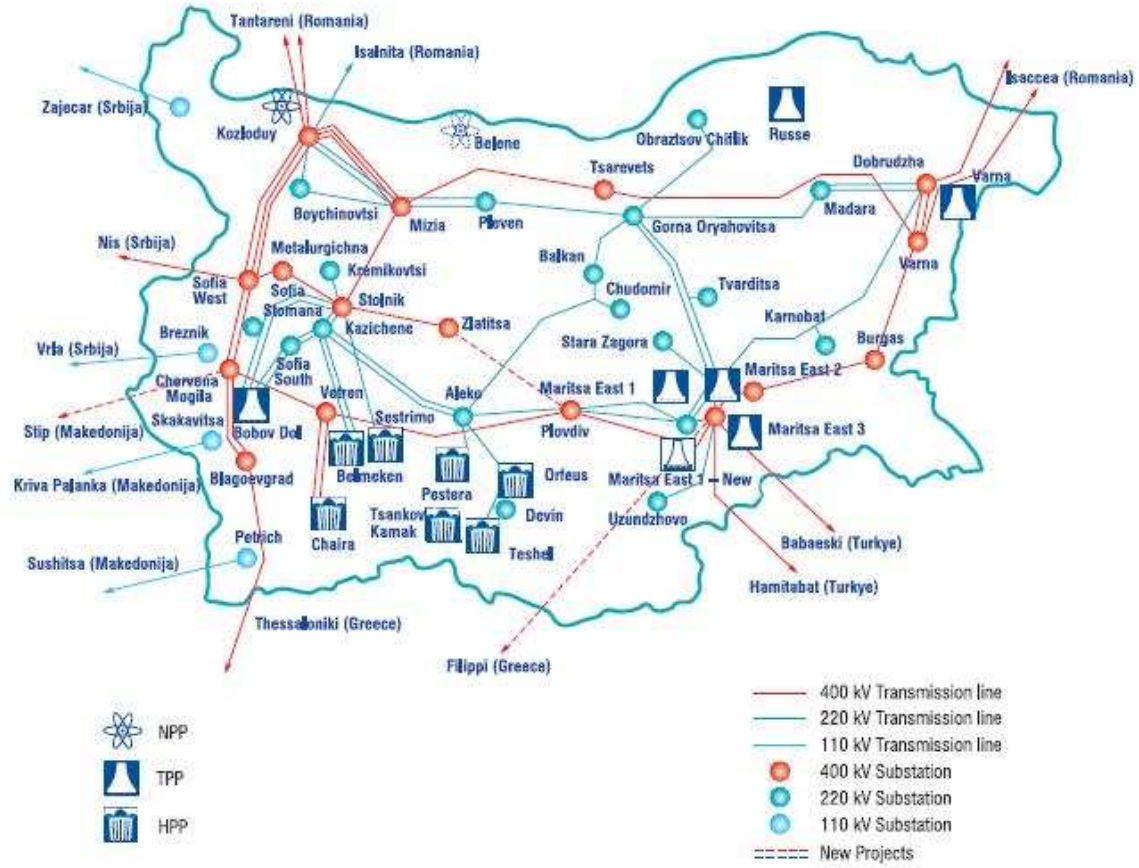
The Bulgarian power grid is well interconnected to neighbouring countries through the following transmission lines, as shown in Table 4 and Figure 12.

Table 4: Transmission Lines between Bulgaria and Other Countries

Country	Substation	Voltage, kV	Length, km Full length of line (length of line in Bulgarian territory)
Romania	NPP Kozloduy (BG) - Tantareni (RO)	400	115,7 (14)
Romania	NPP Kozloduy (BG) - Isalnita (RO)	220	98,1 (18,6)
Romania	Varna (BG) - Isaccea (RO)	400	235,4 (85)
Romania	Dobrudja (BG) - Isaccea (RO)	400	230,6 (80,3)
Turkey	TPP Maritza East 3 (BG) - Babaeski (TR)	400	136,6 (59,5)
Turkey	TPP Maritza East 3 (BG) - GPP Hamitabat (TR)	400	150 (59)
Greece	Blagoevgrad (BG) - Thessaloniki (GR)	400	174,7 (72,7)
Macedonia	Petrich (BG) - Sushitsa (MK)	110	49,3 (21,5)
Macedonia	Skakavitsa (BG) - Kriva Palanka (MK)	110	12,7 (5,3)
Serbia	Sofia West (BG) - Nis (SER)	400	122,6 (37)
Serbia	Breznik (BG) - Vurla (SER)	110	64,1 (41,1)
Serbia	Kula (BG) - Zajecar (SER)	110	21 (11,8)
Macedonia	Chervena Mogila (BG) - Stip (MK)	under construction	
Greece	TPP Maritza East 3 (BG) - Filippi (GR)	under construction	

Source: National Electric Company

Figure 12: Bulgarian Transmission Lines



Source: National Electric Company

7. Focus on Nuclear Energy: Kozloduy NPP and Belene NPP

In the next five to ten years, Bulgaria is expected to show a significant increase in its electric power demands. The rising prices of coal, oil and gas, the problems related to the reliability of their supply, the generation of harmful gases as a result of fuels' burn-up, as well as the current requirements for environmental protection – all these add to the crucial importance of the nuclear power industry satisfying the energy demands of Bulgaria and the region.

Nuclear power has a major contribution in satisfying the needs for electricity of the economy and population on the national and regional level. It guarantees a minimum risk in terms of the supply of energy sources and maximum economic effect in the long run. Its reliability is very high and is not affected by meteorological conditions.

In this sense, with Decision No.260 dated 8 April 2005, the Council of Ministers approved the construction of two 1,000MW units with pressurised water reactors at a site located near the town of Belene. These capacities guarantee not only the country's electricity supplies, but also the development of the Bulgarian nuclear power industry. The Government claims that the project will create significant social and economic benefits, thus providing new employment opportunities and securing the long-term supply of cost-effective electric power. Nevertheless, the **Belene project** is still **highly controversial**.

7.1 Kozloduy NPP

The Bulgarian Nuclear Power Plant "Kozloduy" has a total capacity of 3,760MW, built in three stages. In the first stage, two 440MW units were constructed – units 1 and 2, commissioned in 1974 and 1975 respectively. Kozloduy 1 and 2 have long been called the "timebomb of Europe". In the second stage another two 440MW units were built – units 3 and 4, commissioned in 1980 and 1982 respectively. Each unit has two turbines with 220MW single capacity, and the reactors are light water-pressurised reactors (PWR), type WWER-440, model B-230.

The second stage is characterised by a lot of improvements in comparison to the units of the first stage. The reactors are slow-breeder types and generate energy from uranium dioxide, enriched with 3.5% of uranium 235. In the 70s and 80s Bulgaria was one of the major uranium producers. All of the ore was exported to the Soviet Union from where, according to the respective agreements, the fuel assemblies for the reactors were imported and the spent fuel was returned back to the USSR.

The construction in the third stage of Kozloduy NPP was subject to a totally different concept. It consists of two units – units5 and 6, with WWER-1000 reactors, model B-320. They have 3000 MW thermal capacity and 1000 MW electric capacity. Each of the units has one turbine with a capacity of 1000 MW and four steam generators. Unit 5 was commissioned on 5 November 1987 and was put into commercial operation on 28 September 1988. Unit 6 was

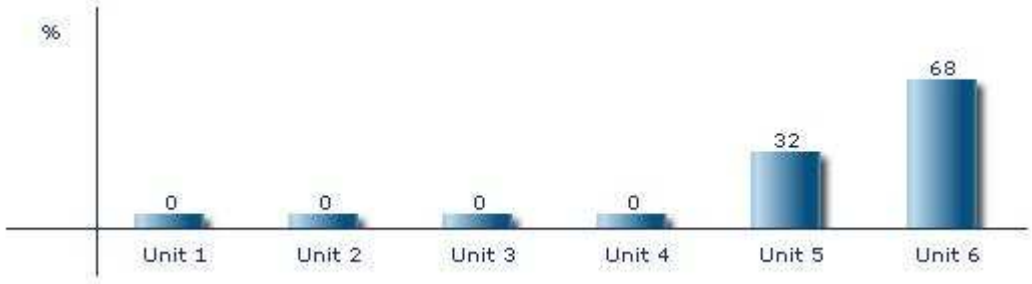
commissioned on 29 May 1991 and was put into commercial operation on 29 December 1993.

In compliance with the arrangements between the Republic of Bulgaria and the European Union the first two units were shut down in 2002 and units 3 and 4 were shut down in January 2007.

In 2004 Kozloduy NPP celebrated 30 years from the commissioning of the first unit and the start of the power plant. Currently, after the closure of units 1 and 2 the installed capacity is 2,880MW. For thirty years (till the end of April 2004) the largest Bulgarian power plant has generated over 378,549GWh of electric power. The annual gross generation of Kozloduy NPP in recent years is around 40% of the electric power generation in the country. The price of the electricity generated by the NPP is the lowest in the country – about 0.04 BGN per KWh. Only the price of Maritsa East 2 TPP is comparable to it.

According to a survey of the Energy Institute, for 25 years the nuclear units have efficiently reduced the CO2 emissions by 300 million tons, which is more than 3.5 times the emissions of the country for 1988 – the base year for Bulgaria under the Climate Change Convention.

Figure 13: Share of the Units in the Overall Gross Electricity Production of Kozloduy NPP, August 2007



Source: http://kznpp.org/main_en.php

7.2 Belene NPP

The discussions on constructing a second nuclear power plant started in the early 1970s. After performing the necessary investigations, studies and analyses, the Belene site was approved by the Bulgarian Government in 1981 for the construction of a second nuclear power plant on the Danube River. The technical design for the Belene Nuclear Power Plant construction was completed in 1987, thus initiating the large-scale construction of the first two units.

In 1990, the Bulgarian Government decided to suspend the project's execution due to financial difficulties. Since then, measures have been continuously undertaken to preserve the supplied equipment, the construction site and the buildings.

Various investigations and assessments have been carried out with respect to the site suitability and the equipment status, all of which yielded positive

conclusions. New investigations have been performed in relation to site safety and its compliance with international requirements. There has been particularly extensive research on the seismic safety of the chosen site. The International Atomic Energy Agency (IAEA) and other bodies of authority carried out a number of missions. All these came up with positive conclusions and confirmations that the Belene site is suitable for the construction of a nuclear power plant.

Fulfillment of all legislative requirements allowed the Government to enact Decision No.260 of the Council of Ministers dated 8 April 2005, thus approving the construction of a nuclear power plant on the Belene site with total rated capacity of 2,000MW.

Pursuant to the abovementioned decision, on 10 May 2005, the National Electric Company launched a procedure for selection of a Contractor for the engineering, procurement, and commissioning of Belene Nuclear Power Plant, Units 1 and 2.
Based on the above decision and in compliance with the Public Procurement Act, NEK started a procedure for selection of a contractor for the engineering, construction and commissioning of Belene NPP Units 1 and 2.

Two companies submitted proposals by the announced deadline – the Russian company Atomstroyexport and the Czech Skoda Alliance. Nine months later the Board of Directors of NEK officially announced that the Russian Atomstroyexport is the company, which had been rated first with their A92 option for the construction of two 1,000MW light water reactors at the site of Belene NPP.

The preliminary agreement with the selected contractor was signed on 29 November 2006. This agreement is the first part of the Main Contract, which will specify all details of the plant construction works, and will determine the conditions for successful project completion, the overall construction schedule and the main parameters of the equipment.

The future of Belene NPP is highly doubtful as the project has many pitfalls and has not proven economically feasible for Bulgaria:

- There is **no detailed economic and social impact assessment** of the project. All questions concerning economic feasibility of the project remain unanswered as the only backing used so far is based either on populist grounds (Bulgaria to become center of energy on the Balkans) or on unproved expectations for electricity shortages around 2010-2011.
- There is **no calculation about the net present value of the project**. For instance, the costs for the secondary infrastructure may turn out to be considerable higher than all existing expectations. The same issue exists with waste disposal. Electricity price per kWh will most probably turn out to be much higher than existing promises of 3.5-3.6 eurocents per kWh. If comparing with similar plants in other countries and most recent studies it would be more reasonable to expect prices above 5-6 eurocents per kWh.

- The project **may significantly hamper energy market liberalisation**. The majority share of the nuclear plant will be owned by the Government, which closes the door for true market liberalisation and emerging of competition among energy producers. If the Government promotes nuclear power, a large part of the energy market will be subject to Government intervention. Suppliers of gas and coal, on grounds of consistency, may well want to receive some kind of favoured treatment. A return to a protectionist energy policy would restrict competition in product markets, adversely affect efficiency, raise prices, probably reduce security of supply and disadvantage all energy consumers.
- The Bulgarian Government plans to retain more than 50% ownership of the plant and to provide loan guarantee for 50% of the cost of the project. Thus, the nuclear power plant will be constructed with money, collected from the present and future taxpayers. It is imperative that politicians justify their decisions to spend taxpayers' money before the general public and explicitly prove that the benefits of the project are more than the costs. Instead, there **is lack of public debate** and a clearer reasoning behind the state backed financial guarantees.
- At present, Bulgaria is mainly reliant on energy resources from Russia: oil, natural gas, high-quality coal and nuclear fuel. **The project will further increase the dependence of Bulgaria on Russian resources** and thus, the Bulgarian economy will become even more vulnerable to Russian energy policy. Bulgaria has awarded a contract to "Atomstroyexport", in which the Russian gas company "Gazprom" owns an 84% stake, to build the plant and install two 1,000MW water-pressurised reactors. The design of the plant will be based on Russian technology. Russia will also provide all the nuclear fuel for the power plant, and recycle its spent fuel.

The market solution of the "Belene" case would be if the existing infrastructure is sold at an open tender and is used according to decision of new owner. If there is private interest to build additional nuclear facilities without any government support then all related risks will be taken by private investors.

8. The Future of the Bulgarian Electricity Sector

The development of the power system until 2012 is predetermined. It covers completion of the 80MW HPP Tsankov Kamak project, commencement and completion of a new capacity at Maritsa East 1 TPP, extension of CHP Sofia with two units rated at 65MW each and refurbishment of Russe TPP unit 3 of 100MW capacity. The total capacity of the new facilities at TPP is 900MW and they will make up for the early decommissioning of Kozloduy units 3 and 4, unit 1 of Bobov Dol TPP and units 4 and 5 of Sofia TPP. In addition, over the period 2006–2012, 1,640 MW will be refurbished.

Generation development in the period 2013-2020 is characterised by two types of capacity – nuclear rated at 1,000MW and CCGT plants (unit capacity 150MW and 300MW).

Bulgaria will develop renewables-based power generation. Pursuant to the provisions of Directive 2001/77/EC, 11% of the gross power output in the country after 2010 should come from renewables. This programmeme will be implemented with the construction of HPP Tsankov Kamak, Cascade Gorna Arda and small hydro and wind power plants. It is envisaged that the total capacity of renewables-based new power plants will reach about 1,000MW by 2020.

The very need for additional power in Bulgaria has not been proved. The Bulgarian economy exhibits a very high energy intensity. The energy intensity of the Bulgarian economy, defined as the amount of energy needed to produce one unit of economic output, is seven times higher than the EU average according to 2005 Eurostat figures. Therefore **potential savings and energy efficiency activities are a serious alternative to building new power facilities**.

Electricity transportation losses in Bulgaria are from two to three times higher compared to Germany or Italy. Thus, **it is not clear why efforts are not focused on transportation saving technologies instead of building additional powers.**

Even if needed in the long run, it has not been proven that any additional electricity production should be nuclear. Rehabilitation of existing thermal plants, building additional hydro plants, and utilising local renewable energy resources appear to represent a serious alternative to nuclear projects. Up to now **there is no cost and benefit analysis of different alternatives**.

Electricity imports may turn out to be more cost-efficient than local production. In this respect the biggest problem appears to be stereotypes from the past as imports are considered lost *per se*. This way of thinking is wrong especially as we know that Bulgaria is importing around 80%–85% of all energy resources.

References

Law of the Energy Sector – *Prom. SG. 107/9 Dec 2003, amend. SG. 18/5 Mar 2004, amend. SG. 18/25 Feb 2005, amend. SG. 95/29 Nov 2005, amend. SG. 30/11 Apr 2006, amend. SG. 65/11 Aug 2006, amend. SG. 74/8 Sep 2006, amend. SG. 49/19 Jun 2007, amend. SG. 55/6 Jul 2007*

Energy Strategy of Bulgaria – 2002; Ministry of Energy and Energy Resources

Bulgarian Grid Code, State Energy and Water Regulatory Commission

Brief Guide to the Market Rules, Electricity System Operator

NEK EAD Annual Report 2006

Bulgarian Energy Profile 2005; Bulgarian National Committee to the World Energy Forum

Bulgarian Energy Sector 2004, Ministry of Energy and Energy Resources

Bulgarian Energy Sector – The Transition, Bulgarian National Committee to the World Energy Forum

Energy Information Administration – South Eastern Europe 2006

Bulgaria and the Energy Community, Bulgarian National Committee to the World Energy Forum

Electric Power Infrastructure in Bulgaria and Prospects for its Development, 10th CEI Summit Economic Forum

http://www.nek.bg/cgi-bin/index.cgi?l=2

http://www.dker.bg/index_en.htm

http://www.tso.bg/

http://www.mi.government.bg/eng/index.html

http://www.belene-npp.com/index.php?lang=2&pid=&sid=&gid

http://www.kznpp.org/main_en.php