Final Draft

ALLIANCE TO SAVE ENERGY

Municipal Network for Energy Efficiency

Urban Heating in Bulgaria:

Experience from the Transition and Future Directions

Acknowledgements

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Abbreviations

BGN	Bulgarian Leva (Currency)
CEE	Central and Eastern €ope
CHP	Combined Heat and Power
CO_2 eq.	GHG as Carbon Dioxide Equivalents
DH	District Heating
DHC	District Heating Company
DHW	Domestic Hot Water
EBRD	European Bank for Reconstruction and Development
EDC	Electricity Distribution Company
EEA	Energy Efficiency Agency
EEF	Energy Efficiency Fund
EU	European Union
GDP	Gross Domestic Product
GHG	Greenhouse Gas
HFO	Heavy Fuel Oil
HP	Heating Plant
HPP	Hydro Power Plant
HSN	Heating Supply Network
HV	High voltage
IPP	Independent Power Producer
IRR	Internal Rate of Return
JsC	Joint Stock Company
KIDSF	Kozloduy International Decommissioning Support Fund
LV	Low Voltage
MEER	Ministry of Energy and Energy Resources
MIE	Ministry of Economy and Energy
MLSP	Ministry of Labor and Social Policy
MoEW	Ministry of Environment and Water
MoF	Ministry of Finances
MV	Medium voltage
NEK or NEC	Natsionalna Elektricheska Kompania EAD (National Electricity Company)
NGOs	Non-Governmental Organizations
NPV	Net Present Value
NSI	National Statistical Institute
PEC	Primary Energy Consumption

PA	Privatisation Agency
PSHPP	Pump Storage Hydro Power Plant
SG	State Gazette
SERC	State Energy Regulatory Commission
SEWRC	State Energy and Water Regulatory Commission
SPJsC	Sole Proper Joint Stock Company
TPP	Thermal Power Plant
UNDP	United Nations Development Program
USAID	US Agency for International Development
ViK	Water Supply and Sewerage Company
WB	World Bank

Units of Measure

bcm	billion cubic meters
Gg	giga gram = tonne
GJ	giga joule = 10^{12} joules
GW	gigawatt
GWh	gigawatt hour
kg	kilogram
km	kilometer
kt	kilo tonne
ktoe	kilo tonnes of oil equivalent = 10^3 tonnes of oil equivalent
kW	kilowatt
kWh	kilowatt hour
m	meter
MW	megawatt = 10^6 watts
MWh	megawatt hour
MW_{el}	electric megawatt
MW_{th}	thermal megawatt
Nm^3	normal cubic meter
tce	tonnes of coal equivalent
toe	tonnes of oil equivalent
tCO_2	tonnes of carbon dioxide
tCO2eq	tonnes of carbon dioxide equivalent
TJ	tera joule = 10^9 joules
TWh	terawatt hours

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1 Technical Structure and Physical Condition of District Heating, Gas, Electric and Water Systems and Projects for their Improvement

1.1 DISTRICT HEATING SECTOR IN BULGARIA

Structure of the District Heating Sector

Almost all of the district heating systems in Bulgaria were built between 1970 and 1990. Heat production is based mainly on the combustion of natural gas and imported coal and district heating is the major modality of space heating in densely populated urban areas with high-rise built-up. There are 21 cities and towns in Bulgaria that have district heating. These include Sofia, Plovdiv, Pleven, Shumen, Pravets, Pernik, Sliven, Gabrovo, Ruse, Kazanlak, Burgas, Varna, Vratsa, Razgrad, Lovech, Veliko Tarnovo, Yambol, Loznitsa, Iskrets, Samokov and Tryavna. Heat power consumers are divided in two groups: industrial and non-industrial users. The non-industrial users comprise heat power consumers for domestic application (households) and non-domestic applications. These systems provide 22% of the total public and residential heating. The largest DH company is that in Sofia, accounting for 60% of the total DH industry. In 1997, 45% of heat was produced in combined heat and power boilers, and 55% in heat only boilers. Of the combined heat and power plants, 30% are coal-fired.

In the early 1990s centralized heat supply was reorganized to 20 shareholding companies with 100% state ownership and one district heating company ('Toploficatsiya Sofia') with 100% municipal ownership. Under the provisions of the Law on Financial Rehabilitation of State-owned Enterprises, approved in August 1996, the district heating companies are in the process of implementation of rehabilitation programmes.

In all the years of transition district heating systems suffered from both technical and financial problems. There was lack of metering, the capacity in both heat production and distribution is oversized compared to present demand. Financial problems (which are inter-linked with technical problems) are caused both by subsidised prices, which do not cover cost, and by late or non-payment of bills by consumers as well as disconnecting of customers.

A new licensing regime in district heating sector, as well as in power and natural gas sectors, was introduced in 1999 Energy and Energy Efficiency Act and it is continued in new Energy Act from 2003. In 2000, the State Energy Regulation Commission (SERC) was created according to this Act. One of its activities was to control and regulate the activities of the companies in the DH sector and to provide and terminate licenses for permission of activities related to the production, transfer and storage heat. In 2005 SERC was renamed to State Energy and Water Regulation Commission SEWRC as it became a regultor also in the water sector.

Figure 1. District heating companies in Bulgaria
Source: Bulgarian Energy Sector

As of end of 2005 there were 24 licenses issued for district heat supply. This number includes all the previously existing DHCs excluding "Toplofikatsiya Samokov", one new private DHC and three private factory plants. The license of the DHC in Samokov was terminated in 2005 due to decision of the Ministry of Energy and Energy Resources to close the company, which was not in operation since 2002. The first private with a minoritary share holding of the municipality DHC was commissioned in 2003 in the town of Stamboliyski. Due to some local political problem, it was forced to stop for the season 2005/2006. All DHC operates only with approved regulated prices by the SEWRC. Neither of three factory plants has an approved price for the last two heating season. There are also some DHC from the list of previously existing ones which have not survived in the condition with terminated subsidies and didn't have approved prices since 2002 – DHC Iskrets and Tryavna. For the 2005-2006 heating season the prices of only 15 DHCs has been approved by SEWRC, as DHC Pravets, Lovech and Loznitsa as out of the price list on 1st November 2005. On 22 December 2005, prices for DHC of Pravets, and TEGE-21 were approved to be in force since 1 January 2006. In 2004 the process of privatization in DHC started and by 30 November 2005 totally 10 DHCs were 100 % privatized.

Installed Capacity

Aside from regular residential households – family houses and multi-apartment buildings, the non-domestic consumers, are businesses and budgetary entities. By the end of 1994 the connected heat load was 1 782 MW for industrial consumers and 7 439 MW for non-industrial consumers – households. The heat power produced in 1994 amounted to 13 163 MWh.

Table 1. Nominal installed capacity and pick heat load of the DH systems in 1997

	Nominal installed capacity	Pick load	Share of Installed Capacity Utilized
	MW	**MW**	**%**
Sofia	5 314	2 705	50.9%
Pernik	384	219	57.0%
Sliven	291	167	57.4%
Kazanluk	81	47	58.0%
Pleven	471	263	55.8%
Gabrovo	105	57	54.3%
Plovdiv – North	390	224	57.4%
Shoumen	419	233	55.6%
Plovdiv – South	477	281	58.9%
Burgas	477	286	60.0%
Varna	128	77	60.2%
Ruse	273	148	54.2%
Vratsa	235	140	59.6%
Veliko Tarnovo	138	80	58.0%
Razgrad	19	11	57.9%
Yambol	36	19	52.8%
Loznitsa	3	2	66.7%
Pravets	33	20	60.6%
Samokov	16	10	62.5%
Lovetch	8	5	62.5%
Triavna	19	10	52.6%
Iskrets	2	1	50.0%
TOTAL	**9 317**	**5 004**	53.7%

Source: Technical Assistance for Development of the Strategy, Harmonization of the Legislation and District Heating Sector Regulation in compliance with Requirements of the European Union. Bulgaria Final Report Draft

Data about installed thermal capacities in all DHC collected together in one literature source is available for year 1997. According this data presented in Table 1, many of the DH systems had oversized installed capacity compared to the real heat demand, in some cases even more than 100 % higher. Total Nominal installed capacity for all DHCs in Bulgaria was 9,317 MW but the total pick heat load in 1997 was 5,004 MW which equals to just 53.7% of installed capacity. This results in higher number of operating hours on a low capacity in many of DH systems and lower heat generation efficiency.

In recent years, especially after 2000, there is lack of detailed summary reports or analysis for the complete DH sector in Bulgaria. For that reason newer data about installed capacities in most of the DHCs is not available. Information about the status of the biggest DHCs – "Toplofikacija" Sofia, which comprises roughly 57% of the total installed DH capacity in Bulgaria, is presented in Table 2. Of the installed capacity for hot water production of Sofia, 70 MW is not in operation (this capacity is in reserve).

Table 2. Installed capacity in DHC Sofia, March 2002

Type	Units	Installed Capacity
Steam generators, MW_{th}	15	2118.0
Steam boilers, MW_{th}	6	52.2
Hot water boilers, MW_{th}	33	3135.4
Turbo generators, MW_{el}	9	311.0

Source: Web page "Toplofikatsiya-Sofia" – www.toplo.bg

Current information about DHC in Ruse, one of the largest in the country, is presented in Table 3. The company consists of DH CHP part and TPP part for electricity production only. In the Table 1 is presented the thermal capacity related only to the DH part. DH system in Gabrovo is an average as a size one compared to all DHCs in the country. Data about installed capacities in DHC of Gabrovo dated 2003 is presented in Table 4. Data about personnel of the DHC in Bulgaria for 1997 is presented in Table 5. Updated data is presented only for Sofia and Varna, dated by 2003 and Sliven and Gabrobo, dated by 2001.

Table 3. Nominal installed capacity in DHC Ruse, November 2005

Type	East - CHP			West - CHP			Total
	Units	Fuel	MW	Units	Fuel	MW	Units
Steam boilers	7	Coal/ HFO	1302.2	4	gas	76	11
Hot water boilers, MW	1		116.3		gas		1
Turbo generators, MW_{el}	6		400	1		4	7

Source: Web page "Toplofikatsiya-Ruse – www.toplo-ruse.com

Table 4. Installed capacity for hot water and steam production of DH Gabrovo, 2003.

Type	Units	Capacity	Fuel
Steam generators, MW_{th}	7	219.7	2 units – black coal; HFO
Turbo generators, MW_e	3	18	

Source: Study on Opportunities for Renovation of the District Heating System in the city of Gabrovo

Table 5. Employees in DHC in Bulgaria in 1997

	Personnel 1997	Updated Personnel	Personnel '97 vs. heat production
	People	People/year	People/GWh
Sofia	2 537	2500	0.3
Pernik	1 080	N/A	1.9
Sliven	295	250	0.9
Kazanluk	177	N/A	1.0
Pleven	275	N/A	0.4
Gabrovo	168	115	1.0
Plovdiv – North	377	N/A	0.6
Shoumen	194	N/A	0.6
Plovdiv – South	208	N/A	0.5
Burgas	162	N/A	0.3
Varna	90	82	0.6
Ruse	197	N/A	0.5
Vratsa	166	N/A	0.5
Veliko Tarnovo	113	N/A	1.1
Razgrad	72	N/A	1.3
Yambol	69	N/A	4.2
Loznitsa	16	N/A	2.8
Pravets	26	N/A	0.8
Samokov	20	N/A	1.4
Lovetch	20	N/A	1.9
Triavna	35	N/A	1.4
Iskrets	36	N/A	3.4
TOTAL	**6 333**	N/A	**0.5**

Source: Technical Assistance for Development of the Strategy, Harmonization of the Legislation and District Heating Sector Regulation in compliance with Requirements of the European Union. Bulgaria Final Report Draft

Supply Network

In 1994 connected to the district heating networks in the country were 781 510 dwellings and the so-called 'adjusted flats', equal to a number of average sized apartment (73.5 m^2) representing the build up area of the DH-connected public buildings. The total length of the supply pipe work (industrial and domestic applications) was 2 247 km.

Based on data on 1 May 2005 DH in Sofia provide heat foe space heating and domestic hot water to a total number of 384 000 'adjusted flats', residential and public or business and heat for technological purposes to 11 industrial facilities into the industrial zones of Sofia. According to data from the web page of the company presented in Figure 2, the trend of connection of customers to the system shows slow increase for the years after 1999 after a period of standstill in the first years of the transition period in the country. Currently 87% of people in Sofia are DH customers. The rest of the people in the city use mainly electricity or wood and coal for heating purposes. The last few years started the process of natural gas supply to households in some parts of the city but still the number of gas customers between the households is negligible.

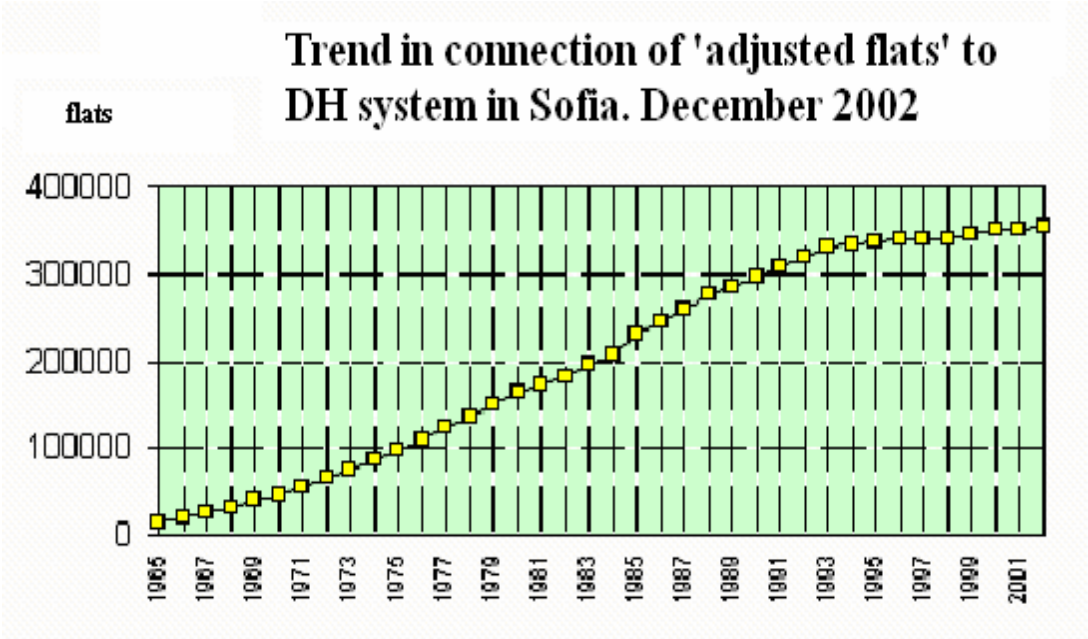


Figure 2. Trend in connection of 'adjusted flats' to DH system in Sofia
Source: Web page "Toplofikatsiya-Sofia"

Total length of the heat supply network in Sofia is 930 km. In the 90's an annual average of 9 to 10 km of network has been renovated (~1%). In 1998 16.3 km of pipework was replaced and in 1999 approximately 21 km (1.7% and 2.2% respectivel). with diameters between 50 and 900 mm. All this repairs were done with own funds following general repair schedule. Thanks to international loans received from the World Bank and EBRD since 2003, the DHC of Sofia started implementing widespread a program for modernization, reconstruction and replacement of old and inefficient heat supply network and substations. In the last years almost all 70 km above-ground placed pipelines were replaced only in 2003 and 2004 (7.5%). On 1 May 2005, more than 6,000 substations were replaced. Plans for the next two years envisage full replacement of all 15,000 substations in the city. Table 6 summarizes more updated main technical data about supply networks of three DHCs.

Heat Production and Consumption

Heat consumption in the 1990s was characterized by significant ebb of consumers because of industry restructuring and decline in income of the population. This leads to a decrease of heat loads and an increase of heat losses, the negative consequences of which are for the

expense of the connected end-users and tax-payers and are further aggravated by the insolvency of the subscribers, mainly from the residential sector and the organisations financed by the state and local budgets.

Table 6. Supply network data about DHC in Sofia, Ruse and Gabrovo, 2002

Network length	**Sofia[1]**	**Ruse [2]**	**Gabrovo[3]**
Hot water network in km	871.9	26.4	39.5
Steam network in km	58.1	13.3	11.7
Max. pipeline diameter in mm	N/A	920	N/A
Hot water network in km	1200	133	N/A
Number of substations	15 142	N/A	212
Buildings connected	378 869*	N/A	6177
Industrial customers	11*	26.4	3**

**Data from 2004; **Data from 2003*
Source: 1. Web page "Toplofikatsiya-Sofia";
2. Web page "Toplofikatsiya-Ruse";
3. Study on Opportunities for Renovation of the District Heating System in the city of Gabrovo

The trend of heat production by DHC of Sofia, which represents more than 60 % of total heat production in Bulgaria, is shown in Figure 3. The drop in the levels of heat production is continuous after year 1996. Compared to the beginning of transition period in the country in 1989 the heat production in 2002 was approximately on the level of 60 %.

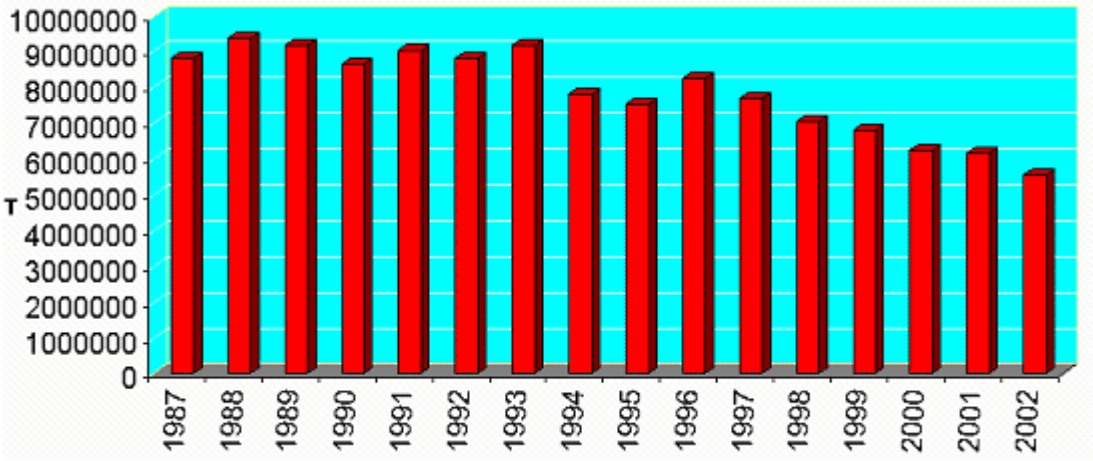


Figure 3. Trend in heat production by DHC Sofia 1987-2002, MWh
Source: Web page "Toplofikatsiya-Sofia"

Over the last four years the heat generation and consumption has been stabilized. The heat market stabilization in the last years was achieved by pursuing a policy for extension of the operation period of district heating companies, directed towards re-attracting the consumers through investments designed to decrease the generation costs, and

consequently the heat cost, while phasing out subsidies. Figure 4 shows heat generation and distribution in Bulgaria for the period of 2000-2005. Figure 5 shows the structure of final consumption of heat from district heating companies per consumers, for the period 2000-2005. The trend shows stable consumption in households and public sectors, increase in commercial sector and continuing drop in industry where own heat production is more proffered alternative.

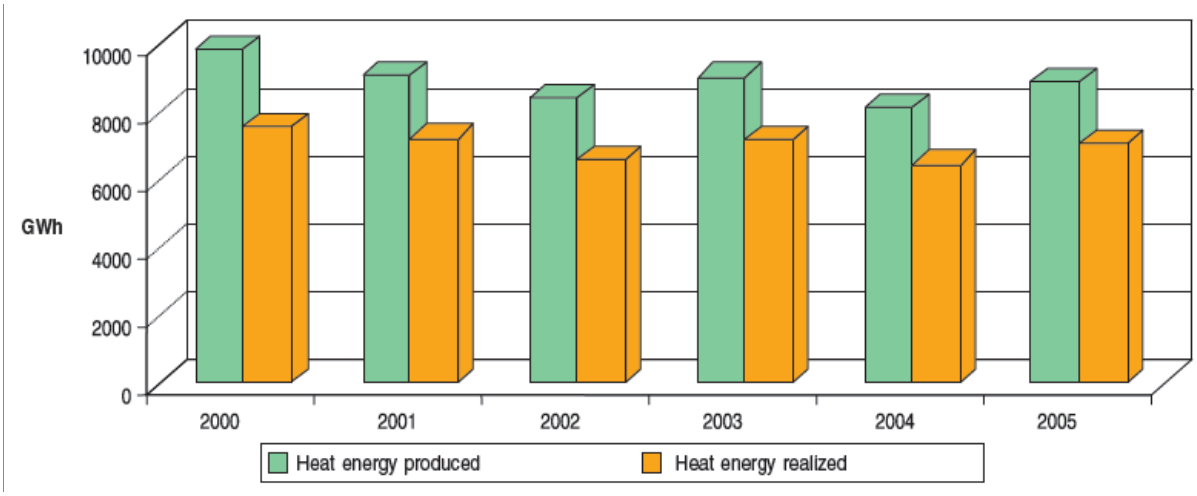


Figure 4. Heat generation and distribution in Bulgaria for the period 2000-2005
Source: Energy sector in Bulgaria 2001-2004

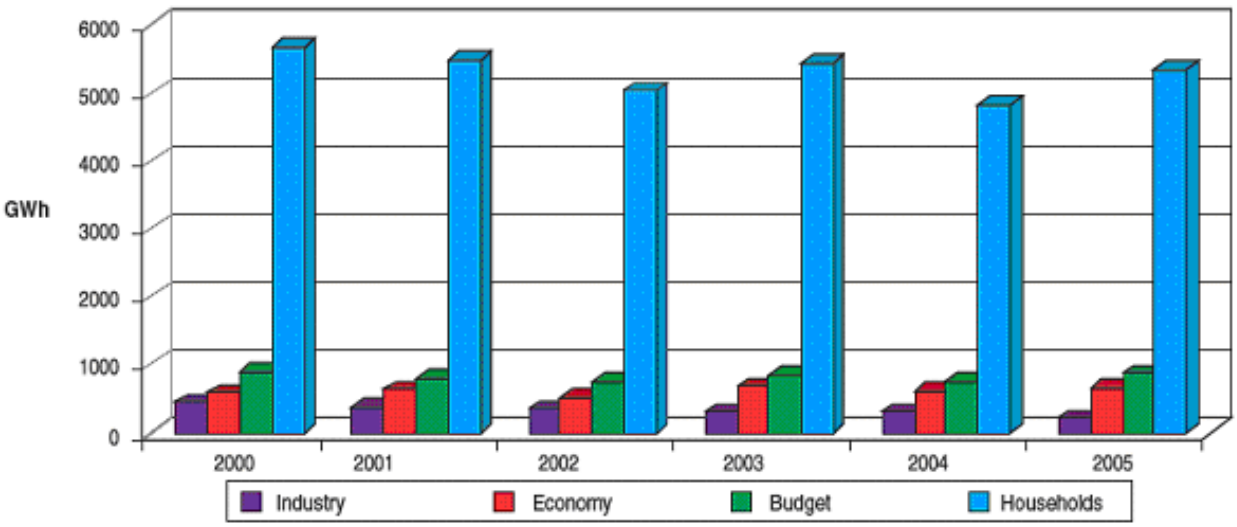


Figure 5. Final heat consumption by consumers for 2000 - 2005 period
Source: Energy sector in Bulgaria 2001-2004

Table 7 presents the electricity versus heat production in DHCs where CHP is available. Current data about year 2004 could be compared to data form 1996 and 1997. The evident tendency is that most of the DHCs currently produce much higher percentage of electricity, which is most obvious in Pernik, Sliven and Ruse, which now operate more like thermal

power plants instead of district heating. As different from Sofia, were the percentage of disconnections is not high and new connection compensate disconnection (See Figure 3), in the rest of the cities the situation, especially in the 90's was the opposite. Because of the decreased incomes from heat sells this DHCs gave priority to electricity production.

Table 7. Electricity versus heat production in DHC

	1996[1]	1997[1]	2004[2]
	MW_{el}/MW_{th}	MW_{el}/MW_{th}	MW_{el}/MW_{th}
Sofia	0.128	0.143	0.156
Pernik	0.596	0.558	1.378
Sliven	0.224	0.424	1.510
Kazanluk	0.080	0.075	0.030
Pleven	0.069	0.081	0.151
Gabrovo	0.060	0.078	0.140
Plovdiv – North	0.261	0.196	0.240
Shoumen	0.093	0.099	0.116
Ruse	0.005	0.005	0.707
TOTAL	**0.131**	**0.142**	**0.281**

Sources: 1) Technical Assistance for Development of the Strategy, Harmonization of the Legislation and District Heating Sector Regulation in compliance with Requirements of the European Union. Bulgaria Final Report; 2) *Regulatory Review of the Companies in the Thermal Engineering Sector.*

Results from Sector Reform

- By end 2001 the measurement of consumed energy on building level in the substations was fully implemented;
- At the end of the 2002/2003 heating season the introduction of heat cost allocation systems has completed, as an instrument for individual regulation (by thermostatic valves) and individual reading of heat consumed (by individual heat cost allocators and heat-meters);
- The heat price increase was compensated through state gurantee loans investments for rehabilitation of heat transmission network and substations, and introduction of consumption regulation for each building depending on the oudoors temperatures;
- Adequate pricing of electricity produced by cogeneration taking into account the real costs for production and encouraging high-efficiently production has been adopted;
- Gradual reduction of subsidies to their final phase-out at the end of 2004, which helped provide budget funds for other use;
- The relevant regulatory framework was ensured - regulations, rules etc. *(See the section: Regulatory and market policies for setting tariffs, managing debts and billing consumers)*

As a result of measures aimed at rehabilitation of local heating substations, introduction of heat cost allocation systems, improvement of district heating companies operation quality, reduction of generation and transmission losses, implemented in parallel with the energy efficiency improvements the following positive trends are observed:

- Reduction of average specific heat consumption;
  - Relative increase in average heat energy production efficiency at the district heating companies;
  - Reduction of heat and hot water expenditures, as a result of energy efficiency measures implemented to the end consumer.

(See data on results in the section Cost effectiveness of investments in District Heating sector of the document)

District Heating Rehabilitation Project in Sofia

The District Heating Rehabilitation Project aimed at modernization of some 8,000 district heating substations, rehabilitation of the network (replacement of about 70 km pipelines, compensators, thermal insulation of over-ground pipelines, conversion to variable flow of the Sofia district heating network).

The estimated project cost was approximately € 114 million funded by the EBRD (€ 30 million), the World Bank (€ 26 million), local contributions (€ 26 million), grant from the Kozloduy International Decommissioning Support Fund – KIDSF (€ 30 million) and EU financing for consultancy (€ 1.6 million). This is a multi-phase project and some elements of it are still in process.

At the end of 2004 as a result of implementation of the Project for Rehabilitation of Heat transmission network of Sofia DHC the following results were achieved:
The replacement of 5 580 local substationsled to the following savings for the beriod since the beginning of the project in 2002 till the end of 2004:

- 91,000 m^3 water;
- 163,000 MWh heat, of which around 100 000 MWh are reflected in the consumers bills and the rest are for the company own needs;
- 7-8 times lower technical losses of the new local heating substations in comparison with the old ones;
- 15 to 20 times lower water use costs due to replacement of direct local substations;
- More than 20% reduction of heat energy consumption in buildings with automated local substations and share distribution;

The results of replacing 150 km of pipes are:

- 144 000 m^3 water or 50-60 times less water for system addition;
- 54 000 MWh heat saved.

The activities carried out within the project were planned for completion in 2005. The first project for modern co-generation has been implemented in Varna DHC in 2004. For the consumers this meant lower energy price and opportunity for heat energy for hot water supply during the summer season. For the company this meant higher incomes and more attractiveness for privatization.

Other future projects envisaged by the government include €335 million investment for construction of co-generation capacities in 10 large: Varna, Sliven, Kazanluk, Veliko Tarnovo, Gabrovo, Pleven, Vratsa, Plovdiv and rehabilitation of the transmission network in Burgas CHP/DHC, cities currently in implementation. Financing is expected from credits, own funds, grants, Kozloduy Internetional Decomissioning Support Fund (KIDSF), emission trading.

1.2 POWER SECTOR IN BULGARIA

Structure of the Power Sector

The real restructuring of the Power sector in Bulgaria practically started in 1998 when the Bulgarian Parliament began to liberalize the country's power sector by unbundling the generation, transmission, and distribution activities of the National Electricity Company (NEK). Before 1998 the state owned NEK was the owner of all power generation capacities, transmission and distribution networks. In the summer of 2000, the largest power plants and distribution networks, including the country's Kozloduy nuclear power plant, were separated from NEK, creating seven generation and seven distribution companies. Six of the seven independent power generators registered profit in 2000, and some of them (except NPP "Kozloduy") were foreseen for privatisation. The so-called "single buyer" model was introduced. NEK retains responsibility for central power trading (as the single buyer and seller of electricity), system operation, transmission network management, and system planning, as well as control over the country's biggest hydropower plants. An organisational scheme of the "single buyer" model is presented on Figure 6.

The new market model of bilateral contracts and a balancing market was introduced under the Energy Act in December 2003, which envisages and represents the framework legislation for liberalization of the electricity and gas market and introduction of competition. It substantially facilitates the investments in energy machinery and equipment. The model of the electricity and natural gas trade gradually shifts from the model of "single buyer" to the model of third parties' (foreign suppliers) regulated access to the market. The regulation regimes for the construction of new power supply facilities were alleviated and new market players introduced. There are also completely new legislative regulations, which govern the free trade with electricity and natural gas, cancelling the licenses for construction or upgrading of power plants. The new establishments are only subject to a registration regime. Licenses are issued only for activities related to the production, transfer and storage of electricity, natural gas and heat. Therefore, there will be no more tenders for construction, reconstruction or upgrading of power plants. An organisational scheme of the new market model is presented in Figure 7.

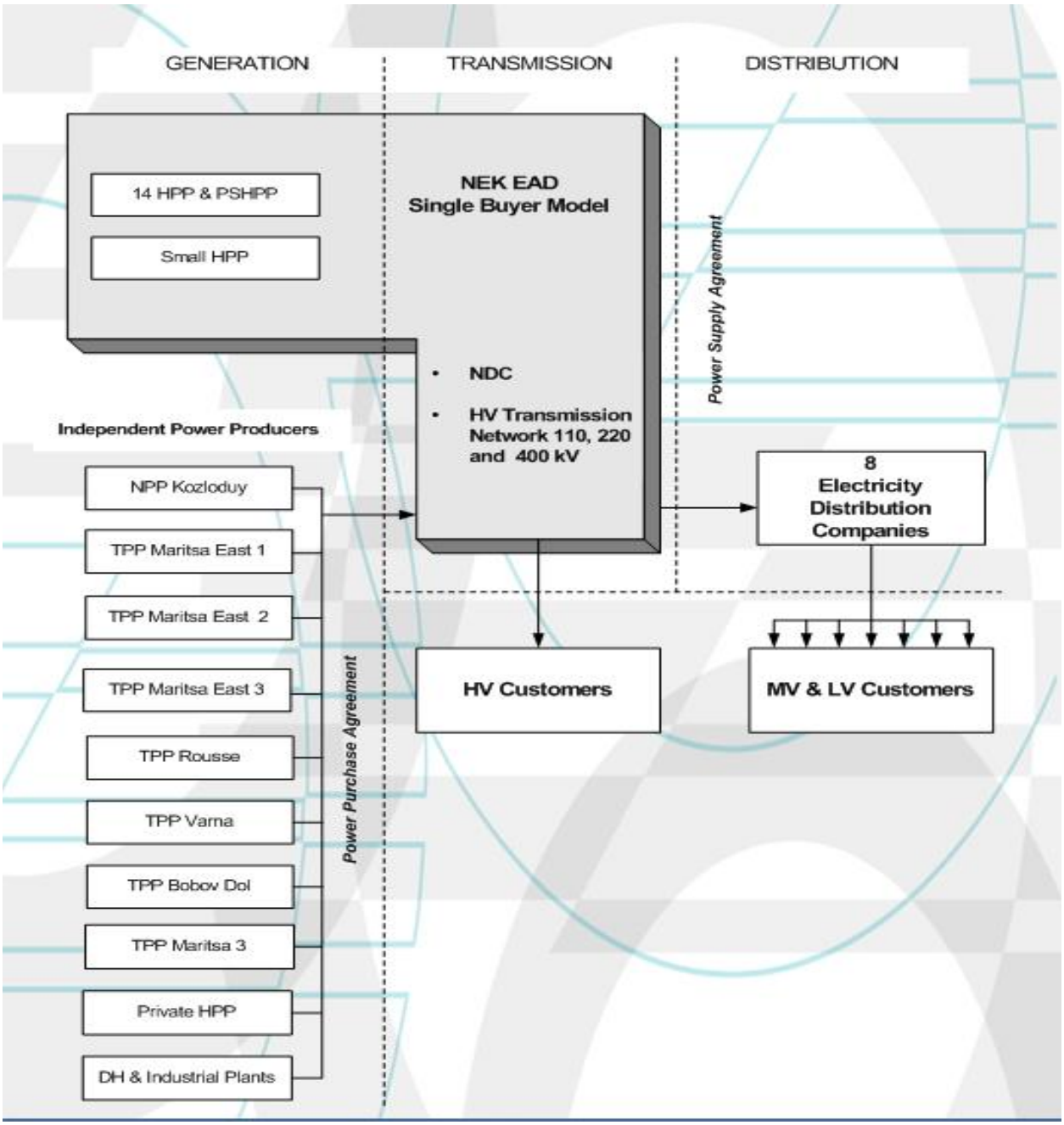


Figure 6. "Single buyer" electricity market model in Bulgaria

PSHPP: Pump Storage Hydro Power Plant

NEK EAD: Natsionalna Elektricheska Kompania EAD (National Electricity Company)

NDC: National Dispatching Centre

Source: Feasibility Study on District Heating Extension Project in Ruse, Bulgaria

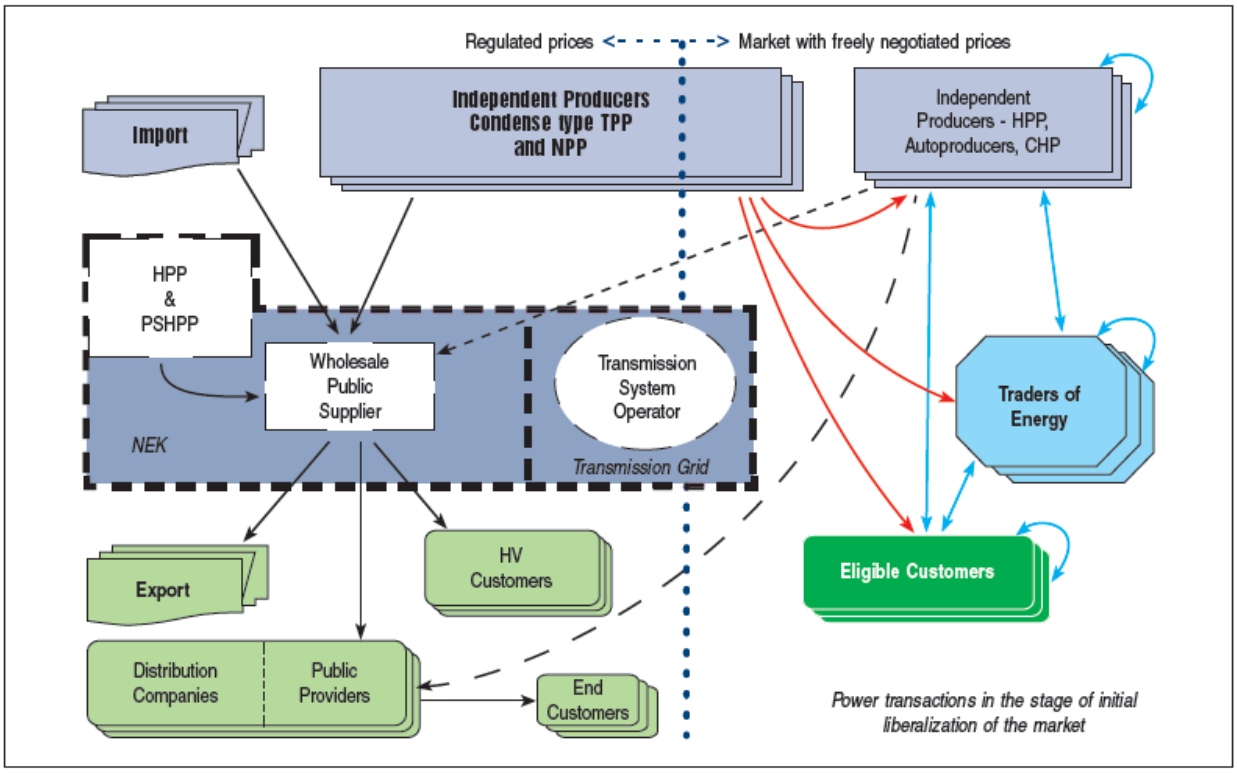


Figure 7. New electricity market model
Source: Energy sector in Bulgaria 2001-2004

According to the provisions of the Energy Act, the SERC determined the availability and the technical parameters for power generation, in compliance with which every power producer may negotiate transactions with privileged customers, electricity traders and other manufacturers under the terms of the rules for electricity sales. By virtue of decision No. TE-001 of 17 December 2002, the SERC defined the capacity and quantities of electricity, which every independent power producer may negotiate with privileged customers by the end of 2003. Since July 2003 the statute of privileged (eligible) customer may be assigned to an individual/entity, whose annual electricity consumption during the preceding calendar year has amounted to not less than 100 GWh and who has no unsettled liabilities to the electricity transmission or electricity distribution company under contracts for supply of electricity. In order to meet the demand for electricity by the privileged customers, as well as to create conditions for competition among the producers, Maritsa-Istok 2 TPP, Varna TPP, Bobov Dol TPP, Toploficatsia Ruse SPJsC, condensation Unit 4 and Maritsa-3 TPP have been assigned the right to sell on the competitive market about 9% of their declared annual available capacity.

In July 2004 commercial customers with annual consumption over 40 GWh became eligible, resulting in over 22% official market opening and first transactions for electricity sales at freely negotiated prices was contracted.

The indicative timetable, adopted by SERC, for electricity market liberalization is as follows:

1. In 2005: commercial customers with annual consumption over 20 GWh – 25 % official market opening
2. In 2006: commercial customers with annual consumption over 9 GWh – 28 % official market opening
3. In 2007: all non households – 60 % official market opening

Full liberalization is expected in July 2007 concurrent with EU accession. Direct contracting will be allowed between all generators – traders – eligible customers (non households) under bilateral contracts at freely negotiated prices and duration (non-regulated market). Major power generation companies are allowed direct contracting with eligible customers up to certain monthly limits, sufficient to meet the annual electricity consumption of customers with eligibility status. All other power generation companies can freely negotiate their entire capacity and output on the non-regulated market.

Until mid 2005, 12 trade participants were registered at the electricity market, 7 out of them being with the status of eligible customers. The first registered transactions at freely negotiated prices are of September 2004, which is the start of electricity market opening.

The Energy Act envisages the incorporation of the electricity distribution companies in the category of privileged (eligible) customers, which will help create a wholesale market for electricity. The ultimate goal of the domestic market development is the creation of retail market for electricity, which will allow mass end-users the right and opportunity to select their supplier.

Power Generation

Power capacity

Most of the power generation capacities in Bulgaria were commissioned in the 1970-1980s. The installed capacity allows the country to cover its power demand and to be the main exporter of electricity in the region. The electricity produced by CHPs practically belongs to District heating plants.

Table 8. Aging profile of Bulgarian conventional thermal facilities (percent of facilities of a given age)

Type facility	>35	31-35	26-30	21-25	16-20	<15	Total
TPPs	6.3 %	27.1%	17.4%	25.5%	15.2%	8.7%	100%
CHPs	36.0%	23.0%	2.7%	19.2%	8.2%	11.0%	100%
Autoproducers	11.6%	29.0%	31.4%	6.7%	8.1%	13.1%	100%

Source: Development and opportunities in the field of energy sector Energy Sector

Except for Kozloduy NPP, most of the baseload capacity is located in South-Eastern Bulgaria (Maritza-East), a region interconnected to Turkey. North-Eastern Bulgaria is the entry point for the black coal and natural gas imports from Russia and Ukraine, giving access to cheap and high calorific value fuel. (Every three months the SWERC improves or rejects the new gas selling prices proposed by the Gas supply companies. The recent fuel price increase on the world market affected also Bulgaria.) Most of the Bulgarian

hydroelectric capacity is located in southwest Bulgaria, close to large consumption centres (Sofia, Plovdiv). The location of the Power generation capacities in Bulgaria is presented on Figure 8.

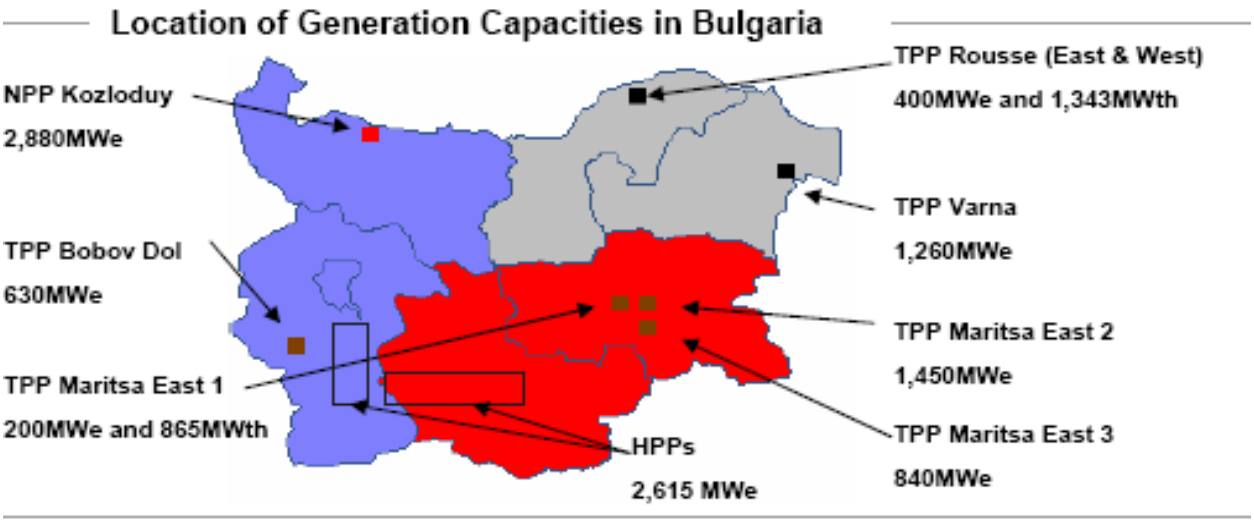


Figure 8. Power generation capacities in Bulgaria
Source: Bulgarian Energy Sector. Presentation

In 1997, The National Electric Company (NEC) owned prior to the reform 11,062 MW or 87,9% of the total installed capacity. Outside the system of NEC there was some 1,606 MW electricity generating capacity, co-generation (heat and power) thermal power plants (TPP), owned by district heating companies that supply heat for the human settlements and large industrial enterprises. The available power capacity in the country was 11 132 MW. In 2004 the total installed capacity in the country was 12,331 MW. The available power capacity in the country was 9,515 MW.

Thermal power

In 2004 out of all thermal plants 4,740 MW are conventional TPPs, 880 MW are CHPs for district heating, and 993 MW are CHPs at large industrial enterprises. Seven TPPs running on local/imported coal accounted for 4,900 MW (73 % of total), balance is covered by CHP and auto-producers.

Table 9. Installed capacities and electricity generation output in Bulgaria

	Installed capacities, 1997		**Installed capacities, 2004**	
	MW	%	GWh	%
Thermal	6 556	51.7	6 613	53.6
Nuclear	3 760	29.7	2 880	23.4
Hydro	1 920	15.2	1 974	16.0
Pump Storage Hydro Plant	432	3.4	864	7.0
Total	**12,668**	**100.0**	**12,331**	**100.0**

Sources: 1997 data – Bulgarian energy sector overview

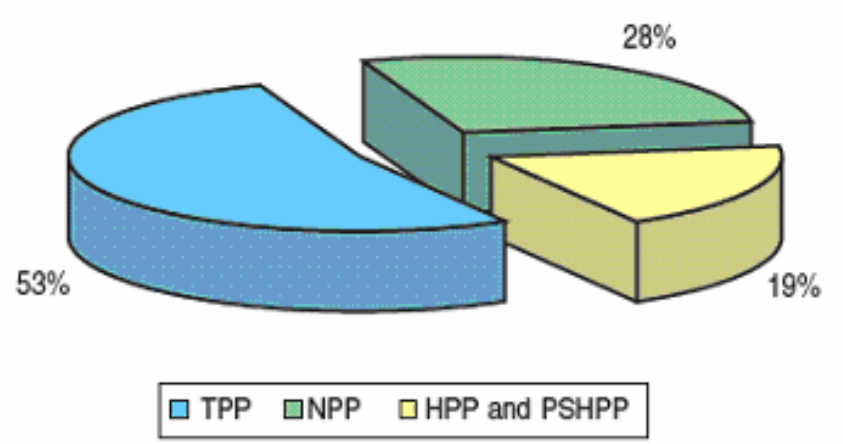


Figure 9. Capacity structure of Bulgarian energy sector, 2001-2004
Source: Bulgarian Energy Sector 2001-2004

The main thermal power producers are:

1) **Maritza-East Power complex** located in South-Eastern Bulgaria in close proximity to the Maritza-East Mines running on indigenous lignite consists of three base load TPPs – Maritza-East I (Brikel), Maritza-East II and Maritza-East III (total capacity 2,490 MW).
2) **TPP Varna and TPP Ruse** (Part of District heating company of Ruse – "Toplofikatsiya Ruse" SJSC), both using imported black coal and covering intermediate load, located in Noth-East Bulgaria to take advantage of Port Varna location.
3) **TPP Bobov Dol** is positioned in proximately to domestic brown coal reserves in Southwest and Western Bulgaria and operates as an intermediate load plant.
4) **TPP Maritza-3 Dimitrovgrad** was privatized in 2003 through the stock exchange. Located in South-Eastern Bulgaria, it burns domestic lignite and covers the intermediate load.

Table 10. Thermal power plants in Bulgaria

Thermal Power Plant	Capacity, MW	Energy Source
TPP Maritza East I	200	Local lignite
TPP Maritza East II	1450	Local lignite
TPP Maritza East III	840	Local lignite
TPP Maritza –3	120	Local lignite
TPP Bobov Dol	630	Local brown coal
TPP Varna	1260	Imported black coal
TPP Ruse	400	Imported black coal
Cogen & autoproducers	1800	Natural gas, fuel oil, coal
Total	6700	

Source: Bulgarian Energy Sector Presentation. Note: Black coal is better quality than lignite and brown coal.

Hydropower

By the end of 2003, the total designed hydropower capacity was 2.730 MW. NEC generation facilities are connected in 14 large HPPs/PSHPPs operating in 4 cascades, located in the Rila, Rhodopi, Pirin mountainous region (I) Belmeken Sestrimo Chaira, (II) Batak, (III) Valcha and (IV) Arda. In 2003, power generation from hydro facilities run by NEC amounted to 3.294 GWh, representing 85 % of domestic hydro electricity output. Totally 5 private companies have licenses for hydro power production as total installed capacity of this companies is 220.4 MW. HPPs/PSHPPs energy is used to cover the peak load and to provide system regulation. Hydro energy potential is a function of water quantity and plant's pressure head. HPPs and NPP average water use totals 9.3 bcm per year. Usual annual runoff from surface water streams averages 20.4 bcm, with values of 9 bcm to 24 bcm in dry and wet years.

Nuclear Power

Bulgaria has one nuclear power plant, Kozloduy is located 200 km to the north of Sofia on the Danube River. Kozloduy is the largest plant in the Balkan Peninsula, consisted of six units using the Russian-designed VVER reactors. Units 1, 2, 3, and 4 (rated at 440 MWe each) were commissioned in the 1970s and early 1980s, while units 5 and 6 (rated at 1,000 MWe each) were commissioned in 1987 and 1991, respectively. The total capacity of Kozloduy was 3,8 MWe.

Total capacity	3 760 MW/28 %
Electricity generation	20.2 TWh/47.3%
Operational experience	131 reactor-years
WSFSF Kozloduy Site	
Total capacity	850 tHM
RAW Treatment and Storage Facility Kozloduy Site	
Total capacity	21 420 m^3

Until the end of 1990, the oldest four units at Kozloduy had one of the best load factors in the world. International concern about the station's safety record, however, has led to calls for its complete closure. In support of continued operation, government observers have noted a marked improvement in safety at Kozloduy due to training, new investment, and a marked increase in employee morale. Two of the six units at Kozloduy (Units 1 & 2) were shut down in 2002. On 31st December 2006 Units 3 & 4 will be shut down.

For the planned 600 MWe Belene nuclear power plant, the Bulgarian government will be assessing the condition of the equipment supplied and the construction already completed, and will determine what would be necessary to license the plant in conformity with current international standards. The final design would provide for safety, security, and load-following capability to meet international standards.

Belene NPP

WWER type reactors – Russia	1 unit
Total capacity	1 000 MW
Status:	frozen in 1991; project recovered in 2002

RAW storage facility Novi Han site

Total capacity	600 m^3
Status:	Licensed by NRA

Electricity generation

Figure 10 gives an overview of the trend of production and consumption in the electricity sector during the 1990s. Difference between generation and consumption in the period after 1992 is due to export. The energy sources for electricity generation for the period 2000-2004 are shown in the Table 11. The structure of electricity generation at the end of 2004 is shown in Figure 11. TPPs are maintaining their capacity share in the energy balance since their annual usage coincides with the average usage of the electricity system. The increased utilization of NPP results in the increased share of the latter in the energy balance, which is to the detriment of HPPs share.

Table 11. Power output, million kWh

Plant type/Year	2000	2001	2002	2003	2004
NPP	19,791	19,553	20,222	17,278	16,815
TPP	18,179	22,368	19,738	21,991	21,399
HPP and PSHPP	2,958	2,047	2,741	3,285	3,386
Total	**40,927**	**43,969**	**42,701**	**42,554**	**41,515**

Source: Bulgarian energy Sector 2001-2004

Power Distribution

The Bulgarian power grid is well interconnected to neighbouring countries through the transmission lines described in Table 12. The high-voltage transmission network is owned and operated by NEK and consists of:

750 kV lines – 85 km
400 kV lines – 2 266 km
220 kV lines – 2 650 km
110 kV lines – 9 167 km

The distribution networks are operated by the 8 Distribution Companies privatized 2004 and consists of:

- 41 747 middle-voltage/low-voltage transformers
- 49 720 km of middle-voltage lines
- More than 55 000 km of low-voltage lines

A schematic of the power distribution in Bulgaria is presented in Figure 12.

2002 data before privatization of Distribution Companies presents that network technical losses are about 10 to 12 percent. The Sofia electricity distribution company reported technological losses of about 19 percent (19.54 percent in 2002). The loss due to electricity theft (“trade loss”) is about ten percent. The nonpayment rate can run as high as 43 percent during winter months due to high heating bills.

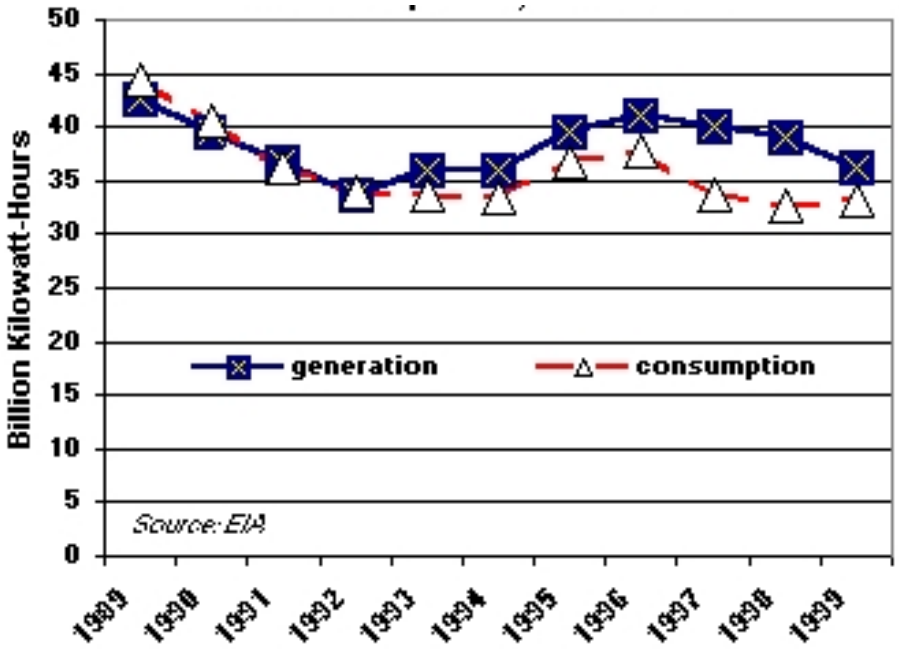


Figure 10. Bulgarian electricity generation and consumption, 1989-1999
Source: Bio-energy in Bulgaria: market study

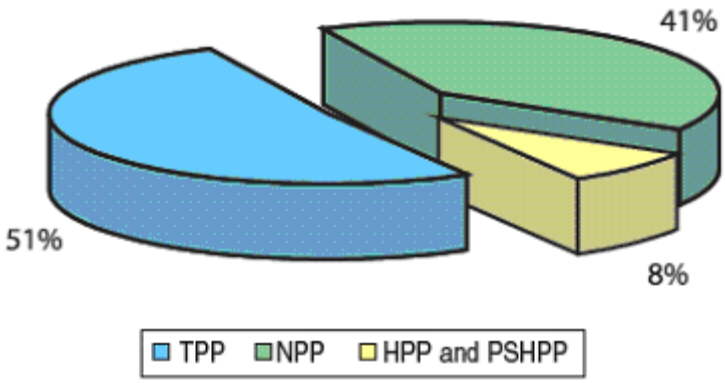


Figure 11. Structure of electricity generation in Bulgaria, 2004
Source: Energy sector in Bulgaria 2001-2004

Since 2001 the electricity distribution companies have been implementing annual programs for replacing electric meters and installing meter panels at property border-line of. In the table below the results from implementation of measures (replacing of electric meters, installing at the property borders of meter panels, including the newbought) during the last three years are shown. At the end of 2004, 49% from total amount of electric meters in exploitation have been replaced - 35.66% have been replaced with new ones and 13.4% with working ones.

The installation of electric meters on property borderlines, as well as the introduction of new equipment (static electric meters, remote electric meter reading, etc.), are important factors for reduction of technical losses. Therefore a decrease of energy losses and accuracy of measuring has been achieved. If a comparison of end and gross consumption in the

country for the last years is made, it is evident that there is a tendency for decreasing of technological costs for transmission and distribution of electricity. This means that the implemented measures are taking effect.

Table 12. Transmission lines

Kozloduy NPP – Tintareni (Romania)	400 KV	2 600 MW
Kozloduy NPP – Isalnita (Romania)	220 kV	360 MW
Sofia West s/s – Nish (Serbia and Montenegro)	400 kV	1 300 MW
Blagoevgrad s/s – Thessaloniki (Greece)	400 kV	1 300 MW
Dobrudja s/s – TPP Moldova (Moldavia)	400 kV	1 700 kW
Varna s/s – Isaccea (Romania)	750 kV	3 500 MW
Maritza East III s/s – Babaeski (Turkey)	400 kV	1 300 MW
Maritza East III s/s – Alibeykoy (Turkey)	400 kV	800 MW

Source: Bulgarian Energy Sector. Presentation

Figure 12. Power distribution in Bulgaria

Source: Feasibility Study on District Heating Extension Project in Ruse, Bulgaria

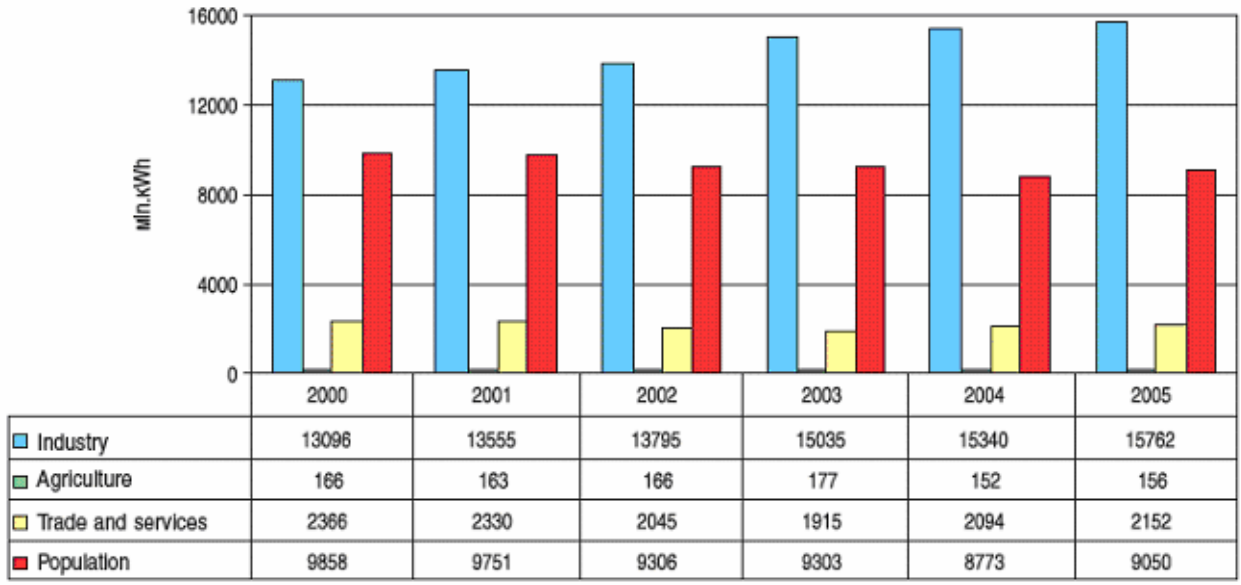
Table 13. Technological costs for electricity transmission and distribution, million kWh

Year	2000	2001	2002	2003	2004
Technological costs	6290	6126	6151	5948	5082

Source: Energy sector in Bulgaria 2001-2004

Power Consumption

Realization of electric power consumption in economic sector for the period 2000-2004 and the prognosis for 2005 are presented in the Figure 13.



	2000	2001	2002	2003	2004	2005
Industry	13096	13555	13795	15035	15340	15762
Agriculture	166	163	166	177	152	156
Trade and services	2366	2330	2045	1915	2094	2152
Population	9858	9751	9306	9303	8773	9050

Figure 13. Electric power consumption for the period 2000-2004
Source: Energy sector in Bulgaria 2001-2004

The consumption of electricity in the industrial sector for the period 2003-2004 increased and this is an indicator of accelerating economic growth of the country. The relative share of electricity in household consumption is higher compared with other EU countries - 40% as in many EU countries it is between 10 and 20%. This indicates the significant importance of electricity within the household activities - cooking, hot water supply and heating. Another reason for its large share in household consumption is the low quality of hard fuels and small quantities of propane- butane and liquid fuels consumed by population and still not widely developed natural gas supply to households.

Table 14. Electric power consumption in economic sector, million kWh

Sector	2000	2001	2002	2003	2004
Industry	13 096	13 555	13 795	15 035	15 340
Agriculture	166	163	166	177	152
Commercial	2 366	2 330	2 045	1 915	2 094
Households	9 858	9 751	9 306	9 303	8 773

Source: Bulgarian energy sector 2001-2004

Currently Bulgaria is the biggest net exporter of electric power in the Balkan region. The exported amount of electric power for the period 2001-2004 and prognosis for 2005 are indicated in Table 15. In the future after the shut down of Units 3 & 4 of NPP Kozloduy theexprt of electricity from Bulgaria will decrease sufficiently.

Table 15. Electric power export, million kWh

Year	2000	2001	2002	2003	2004
Balance import-export	4620	6926	6295	5489	5879

Source: Energy sector in Bulgaria 2001-2004

Future Projects in Power Sector

Electricity Transmission and Interconnection Lines

1) 400 kV Interconnection line between Bulgaria and FYR Macedonia

- Contractor: NEC and the Electricity company of Macedonia
- Total length: 150 km of which 80 km in Bulgaria.
- Implementation status: Development stage
- Implementation schedule: 2006
- Estimated project cost: € 40.5 M –EBRD loan facility
- Bulgarian portion: € 20 M (€ 4.5 M as investment by NEC and € 15.5 M as debt financing from EBRD.
- Purpose: Strengthening the interconnection among the EPS's operating in parallel in the region and facilitation of a regional electricity market.

2) 400 kV Interconnection line between Bulgaria and Greece

- Total length: 257 km of which 142 km in Bulgaria.
- Implementation status: Feasibility study
- Implementation schedule: 2007
- Estimated project cost: € 25 M for the Bulgarian portion
- EBRD and the World Bank have expressed interest in financing.
- Purpose: Enhancement of the system transmission capacity in the condition of regional electricity market.

3) Energy 2

- Contractor: NEK
- Implementation status: Ongoing tenders
- Implementation schedule: 2002-2007
- Project cost: € 153 M
- Financing: NEK, EBRD, EIB.
- Purpose: Rehabilitation and modernization of the power transmission system; Development of the telecommunication system of NEK.

HPP projects

1) Construction of Yadenitsa DM

- Status: to be implemented
- Project price: USD 72 M

2) Rehabilitation of Hydro Cascade Arda

- Status: to be implemented

- Project price: USD 12.5 M

3) Tsankov Kamak Hydropower Project

- Status: ongoing
- Project price: € 220 M
- Financing: Emission trading, credits, own funds

4) Rehabilitation of HPP Orpheus and HPP Krichim

- Status: ongoing
- Project price: € 17.4 M

5) Rehabilitation of HPP Teshel

- Status: ongoing
- Project price: € 3.42 M
- Financing: credits, own funds, emission trading

1.3 NATURAL GAS SECTOR IN BULGARIA

Structure of Natural gas sector

Low endowment with indigenous reserves of natural gas in Bulgaria predetermines high import dependence. Gas supply in Bulgaria is characterized by strong dependence on the foreign supplier 'Gazprom' (Russia). Imports made from Russia under a long term "take or pay" fixed supply quantity (Bulgaria would have to pay this fixed supply quantity even if it is not consumed) contract with Gazprom expiring in 2008. The quantities fixed in the contract are significantly higher than those actually needed to meet domestic demand, which results in higher gas price for the end-users but on the other hand the price of the natural gas fixed in the contract ensured lower price for the country in the last few years when the international price of natural gas was rapidly increasing. In the 2006 the contract was cancelled and a completely new long term contract for gas supply were signed between the Bulgarian government and 'Gazprom'.

The state-owned Shareholding Company 'Bulgargas' is the operator of gas transmission pipeline and the underground gas storage facility in Chiren. The company carries out the import, transmission and sales to large end-users – mainly chemical plants and district heating companies. Private distribution companies are licensed by the SERC for distribution of natural gas on the territories of the municipalities to all types of customers. The process of licensing started in year 2000 according to the Energy Efficiency Act.

Main players at the natural gas market:

- The vertically integrated national gas company – Bulgargas SJSC, which carries out the activities relevant to supplies, transportation, including transit and natural gas storage.
- As of the end of 2003, 36 licenses for low-pressure distribution were granted in 32 municipalities, 3 towns and 1 municipality region
- Two production companies;
- Natural gas consumers – about 1800.

Sale/purchase price between Bulgargas and distribution companies are set on a quarterly basis by the SEWRC taking into account of required revenues (RoR of 8%). Regional

distribution prices are also updated on a quarterly basis under same approach (RoR of 15%), differentiated by consumer groups. Natural gas price is a boarder that reflects crude oil price fluctuations and BGN/USD exchange rate movement.

Eight distinct regions have been defined under government's strategy for construction of new gas distribution networks and distribution of gas within this new networks. The tenders for selection of investors in the eight gas distribution regions in Bulgaria, according to the List of Regions of the MEER, have already started following competitive procedures organized by SEWRC. Four tenders have been successfully closed: regions Misia and Dobrudja were licensed to "Chernomorska technologic company", Bulgaria, region Trakia to "Gruppo Societa Gas Rimini" SpA, Italy and region Dunav "Overgas Inc." JsC, Bulgaria. Three tenders are open: regions Zapad, Primorski (Burgas) and Struma (Dupnitsa). A map of gas distribution regions in Bulgaria is presented on Figure 14.

Figure 14. Gas distribution regions in Bulgaria
Source: Bulgarian Energy Sector Presentation,
Ministry of Energy and Energy Resources, 2005

The medium-term development of the natural gas supply sector is in the following directions:

1. In compliance with the European Directive, the market will be opened to allow access to third parties to the gas transportation network on a non-discriminatory basis and permitting large consumers to negotiate directly with suppliers, including those from abroad. In the event of one sole supplier and a delivery contract of the "take or pay" type and the restriction for re-export of excess quantities, the opening of the natural gas market will be seriously limited. Opening the market will initially be important as a

statement proclaiming an open energy policy. In medium- and long-term, its influence will be greater in connection with the active involvement of the European countries in the framework of the Inogate Programme—to which Bulgaria is a party—for transportation of natural gas from the Caspian area and Central Asia to the West.

2. Establishment of a market for low-pressure natural gas for space heating by means of local plants and introduction of natural gas for direct use in households as a competitive and highly efficient alternative to electricity. The use of natural gas in households has been a declared priority of the energy policy since many years, however a certain progress in this respect has been noted only after 2002. The reasons for that were the changing general investment conditions in Bulgaria and the elimination of certain shortcomings inherent to the energy sector. For example, subsidies to the competing energy sources (electricity and heat), the delay in the approval of a specific law and other regulatory acts on that subject; and the recent introduction of differentiated regional tariffs for natural gas by consumer groups.

3. Increase in the transit of Russian gas towards neighbouring states, improvement of the transportation capacities of the existing gas pipelines and construction of a new transit gas pipeline towards Serbia and Montenegro. The increase in the volume of transit flows via Bulgaria will enhance the importance of our gas transportation system and together with the above mentioned long-term prospects will create conditions for negotiations under the contract with Gasprom in the search for more acceptable solutions.

Rapid development of a low pressure gas distribution network is expected due to the new strategy.

The transmission and transit network features a ring structure ensuring security and continuity in gas supplies (see Figure 15). The total length of the 2 570 km gas transmission and transit network includes: (a) main gas pipeline of 870 km, (b) High pressure branch gas pipeline of 900 km, (c) 6 compression stations with total installed capacity of 205 MW, and (d) 70 pressure reduction stations.

Table 16. Natural gas consumption (million Nm³)

Consumer groups	1996	1997	1998	1999	2000	2001	2002
Consumers of Bulgargas	5 669	4 522	3 744	3 355	4 502	3 047	2 741
Gas distribution companies	62	72	47	74	82	93	219
Total	5 737	4 594	3 791	3 429	4 584	3 140	2 960

Source: Feasibility Study on District Heating Extension Project in Ruse, Bulgaria

Natural Gas Consumption

The predominant use of natural gas consumption is for energy applications, mainly in district heating plants and for CHP generation, and in industry – as a raw material. Gas supply for the residential sector is in its initial stage of development. In the recent years consumption has dropped almost two-fold. The main reason for the drop in natural gas

consumption is the ever-aggravating financial state of the major end-users – district heating companies and the chemical industry. The biggest group of customers of Bulgargas SPJSC – the district heating companies – cannot settle their overdue liabilities for the delivered natural gas because of their grave financial state. Demand for natural gas on the part of industry is also decreasing because of the lost positions for their output on the international markets. Gas supply for the residential sector is in the early stage of its development. Table 16 illustrates the changes in consumption since 1996, when the process of drop in natural gas consumption in the domestic market was first noted. Domestic consumption contracted nearly twofold in 2002 (2.7 bcm) compared to 1996 level, following industry reconstruction and rationalisation. In 2003, 6% increase was recorded to reach 2.9 bcm. In 2003 the energy sector share in the total consumption accounted for 39%.

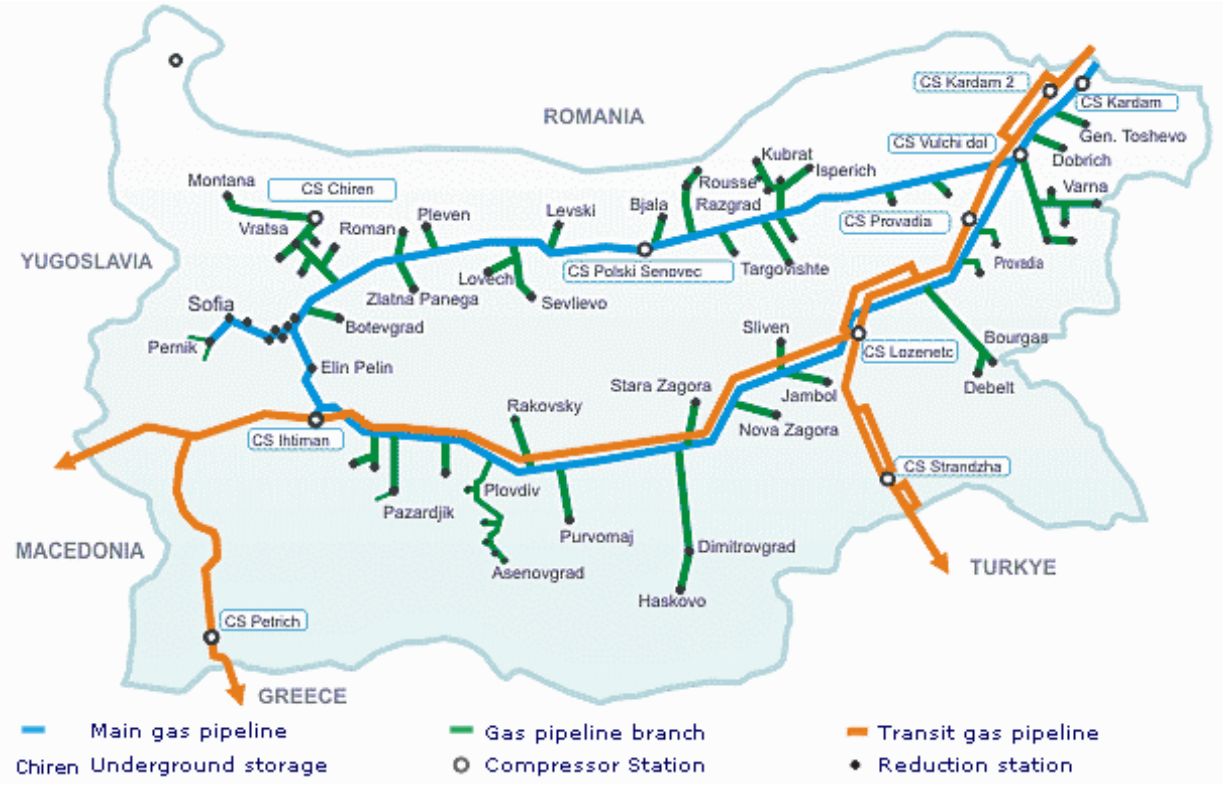


Figure 15. Bulgarian Gas Transportation Network
Source: Feasibility Study on District Heating Extension Project in Ruse, Bulgaria

Future Projects in the Gas Sector

1. *Gasification to more households*
   Investment needs in the sector were estimated at €325 million (transmission network branches not included) to carry out gasification of 525,000 households in 42 cities currently outside the granted municipality based licenses.

2. *Gas infrastructure development projects include*
   a. Expansion of transit capacity to Greece and Macedonia (€95 million)
   b. Expansion of transit gas network to Serbia (€37 million)

Table 17. Annual consumption of natural gas by users directly connected to Bulgargas transmission network by regions (2003)

Region	1000'Nm³
Mizya	158 186
Dobrudja	351 545
Dunav	2 592
Primorski	350 100
Struma	3 401
Trakia	517 763
West	112 086

Source: Bulgarian Energy Sector. Presentation. Ministry of Energy and Energy Resources, 2005

Table 18. Consumption of natural gas by distribution regions (thousands of Nm³)

		Potential gas consumption			
		Industry	Public	Households	
Mizya	128 669	41 250	21 250	69 300	260 469
Dobrudja	282 744	50 100	23 970	65 450	422 264
Dunav	12 631	16 000	5 900	41 207	75 738
Primorski	360 100	65 150	46 450	121 100	582 800
Struma		53 450	17 850	60 700	132 000
Trakia	422 200	309 650	67 560	179 600	979 010
West	112 088	21 360	18 350	62 064	213 860

Source: Bulgarian Energy Sector. Presentation. Ministry of Energy and Energy Resources, 2005

c. Possible pipeline from Italy via Greece in the investigation phase (USD 900 million for Bulgaria portion)

3. *Nabuco project*

The preliminary schedule of Nabuco Project is as follows:

- A Protocol signed between the gas companies of Turkey, Bulgaria and Austria on feasibility study on transit gas pipeline: Caspian Region/Iran – Central/Western €ope, including the clarification of the financing structure: 2003 - spring 2005
- Construction phase, including pre-works, regarding environmental issues and technical specifications: 2005 –2010

Preliminary parameters:

Tentative length: 3600 km (DN 1200-1400 mm)

Max. volumes including build-up period 25-31 bcm/year

- in transit countries 14-17 Bcm/year
- in the countries of Central and Western €ope 11-14 bcm/year.

Preliminary assessment of the investments: €4.5 billion.

Preliminary parameters – Bulgarian part:

Tentative length: 400 km (DN 1200-1400 mm)
Compressor stations: 2
Preliminary assessment of the investments: €0.35-0.4 billion.

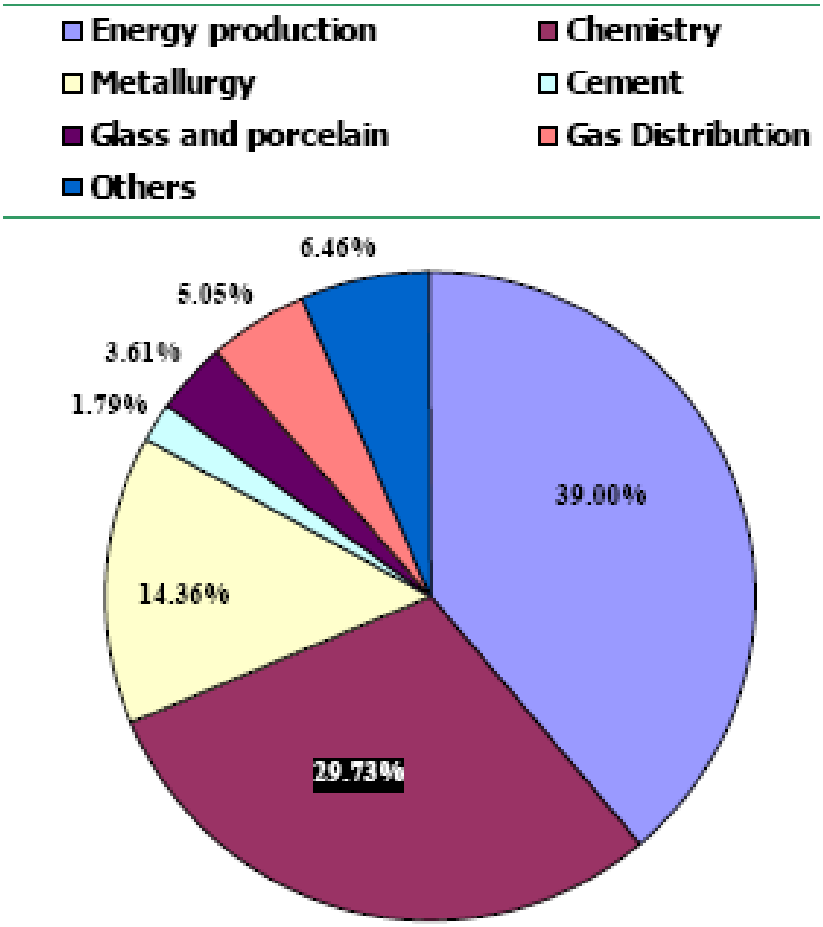


Figure 16. Natural gas consumption structure for 2003
Source: Bulgarian Energy Sector. Presentation. Ministry of Energy and Energy Resources, 2005

Figure 17. Nabuco project gas network (schematic)
Source: Bulgarian Energy Sector. Presentation

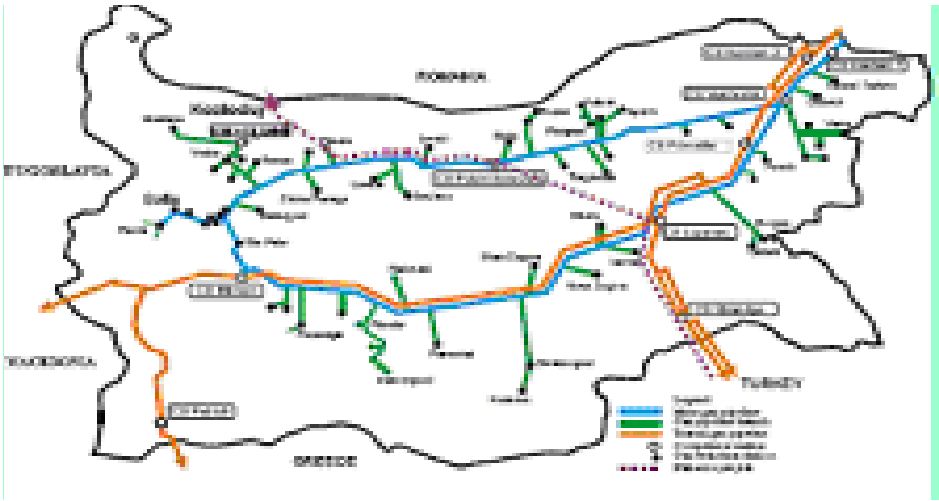


Figure 18. Nabuco project Bulgarian part gas network (schematic)
Source: Bulgarian Energy Sector. Presentation

1.4 WATER AND SEWERAGE IN BULGARIA

Water

The available water resources in the country are adequate for ensuring normal water supply of the settlements in the event of good management and efficient use. Surface

waters account for 70% of the total water resource vs. 30% ground waters. The average annual water consumption in the country is about 10-12 billion m^3/year. The distribution of the total consumption by economic sectors is as follows:

1	Water supply	8 - 10 %
2	Irrigation	5 - 35 %
3	Industrial water consumption	20 - 26 %
4	Hydro power generation	15 - 35 %

The total number of water-supplied settlements in the country is 5,031, which accounts for 98.6% of the population living in water-supplied settlements. The total length of the water supply network is 70,620 km. There are 42 drinking water treatment plants *in situ*, 3,560 pumping stations, 6,087 water reservoirs and a great number of other facilities.

There are 11 dams with a total volume of 1,158.4 million m^3, which have been specifically constructed for the purposes of water supply to human settlements. Data about the dams are presented in a summarized format in Table 19. A map of the country illustrating the location of dams for water supply purposes is shown on Figure 19. A map of the country illustrating the location of drinking water treatment plants is shown on Figure 20.

Table 19. Dams for water supply purposes in Bulgaria

No	Artificial lake	Main settlement supplied with water	Total volume, million m^3
1.	Hristo Smirnenski	Gabrovo	18.7
2.	Yovkovtsi	Veliko Tarnovo	92.2
3.	Borovitsa	Kurdjali	27.3
4.	Asenovets	Sliven	28.2
5.	Kamchia	Burgas and Varna	228.5
6.	Srechenska bara	Montana and Vratsa	16.5
7.	Yasna Polyana	Southern Black Sea region	34.7
8.	Novo Panicherovo	Southern Black Sea region	1.8
9.	Studena	Pernik	25.2
10.	Iskar	Sofia	670.0
11.	Beli iskar	Sofia	15.3

Source: Strategy for Management and Development of the Water and Sewerage Sector in the Republic of Bulgaria. Ministry of Regional Development and Public Works, February 2004

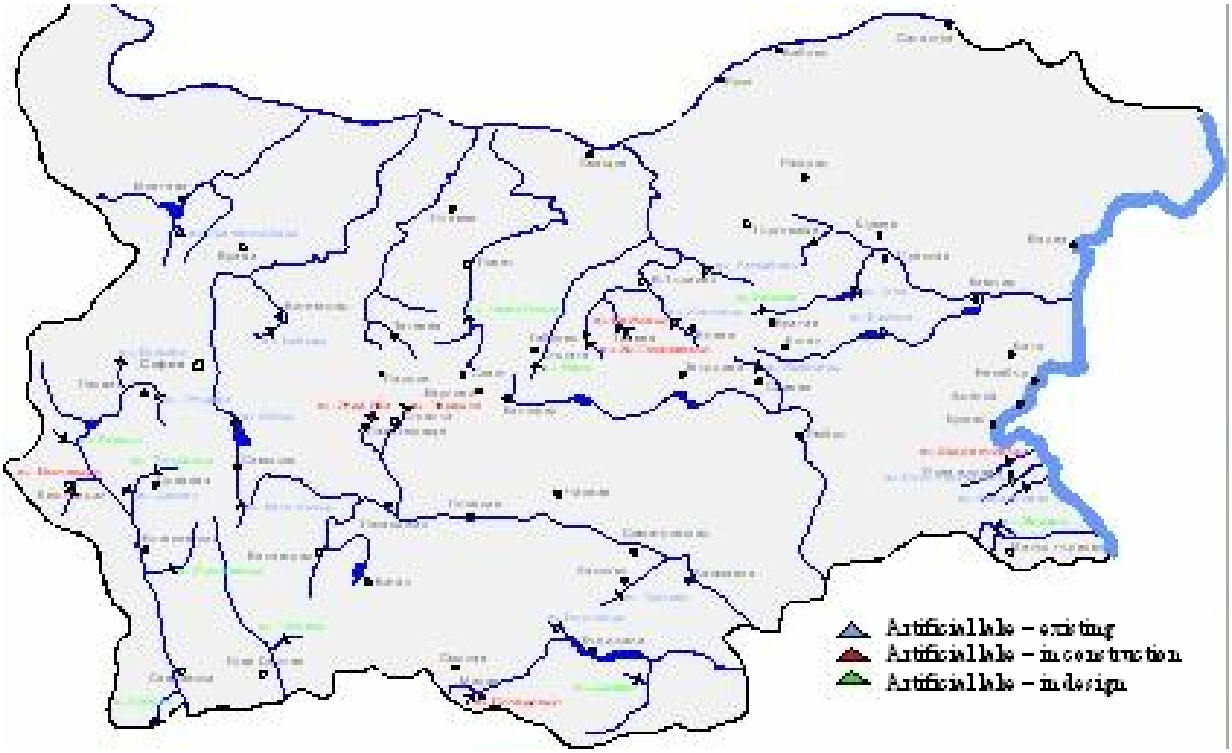


Figure 19. Dams for water supply purposes in Bulgaria

Source: Strategy for Management and Development of the Water and Sewerage Sector in the Republic of Bulgaria. Ministry of Regional Development and Public Works, February 2004

Figure 20. Location of drinking water treatment plants in Bulgaria

Source: Strategy for Management and Development of the Water and Sewerage Sector in the Republic of Bulgaria. Ministry of Regional Development and Public Works, February 2004

The total length of the sewerage network and sewer facilities is 9,013 km. The share of urban settlements possessing sewerage networks is 70.2% and that of villages – 2.1%. The available sewerage network covers a total of 46% of the population. By the end of 2001, there were 53 wastewater treatment plants in operation in the country. Of these, 39 apply biological treatment and the other 13 apply only mechanical treatment. These wastewater treatment plants serve 63 settlements, inhabited by 35.7% of the population in this country.

Three types of regulation are performed:

1 Economic regulation. It is related to monitoring of the level and standards of the services and regulation of the price of services. Since 2005 this is the responsibility of SEWRC.

2 Drinking water quality. The monitoring and control are the responsibility of the chemical and epidemiologic control inspectorates with the Ministry of Health Care.

3 Quality of surface and ground waters. The monitoring function is the responsibility of the regional inspectorates on environmental protection and waters.

The water supply systems are obsolete and gravely depreciated, characterized by high water losses. The number of existing annual and multi-annual equalizing facilities is far from being adequate. Approximately 20% of the sewerage systems are in bad need of profound rehabilitation and upgrading. Construction of a large number of new sewerage systems and wastewater treatment plants is needed. The water supply and sewerage companies (ViK) operate under conditions of absence of a national strategy for development and management of the sector.

Ownership and Management of Water and Sewerage Systems

In Bulgaria there is a total of 50 water supply and sewerage companies. Among these there are 16 companies, which are municipal property, servicing a total of 253 settlements with a population total of more than 1 616 925 people. The largest municipal water supply and sewerage company is that of the city of Sofia ("Sofiyska Voda" plc), servicing 1 150 000 people.

Reforms and modernization in the water sector are lagging significantly behind as compared to those in the energy sector. Methods for managing and developing water supply and sewerage companies, as outlined in the "*Strategy for Management and Development of the Water Supply and Sewerage Sector in the Republic of Bulgaria",* consist of the following: service contracts, management contracts, concession contracts and build-operate-transfer (BOT) contracts, and joint ventures for management with application of the quoted modalities.

Table 20. Ownership of Water and Sewerage companies in Bulgaria

	100% State property	51% State property 49% Municipal property	100% Municipal property
1	Blagoevgrad	Varna	Batak
2	Burgas	Vratsa	Belovo
3	Vidin	Gabrovo	Berkovitsa
4	Dobrich	Dimitrovgrad	Botevgrad
5	Pazardjik	Isperih	Bratsigovo
6	Pleven	Kurdjali	Breznik
7	Plovdiv	Kyustendil	Velingrad
8	Razgrad	Lovech	Dupnitsa
9	Smolyan	Montana	Kresna
10	Sofia-region	Pernik	Kovachevtsi
11	Stara Zagora	Ruse	Kubrat
12	Haskovo	Silistra	Panagyuriste
13	Yambol	Sliven	Petrich
14		Turgoviste	Pestera
15		Shumen	Rakitovo
16		Veliko Tarnovo	Sanadnski
17			Svistov
18			Sevlievo
19			Sofia-city
20			Strelcha
21			Troyan

2 Efficiencies of Energy Generation, Transmission and Distribution in District Heating Systems

General assessment of efficiency for all DHCs in Bulgaria was presented in a report prepared under a project in 1999 in the framework of European Union programe "Poland and Hungary: Assistance for Reconstruction of the Economy (PHARE)" after Bulgaria was also included as an eligible country. It consists of data from year 1997, which is compared to year 1993 (see Table 21). The report on the regulatory review of district heating companies, performed by the District Heating Division and Economic Analyses and Contacts with Consumers Division of SEWRC (September 2005), contains data about the individual district heating companies for the year 2004. Areas covered are: heat and power output, specific fuel consumption in coal equivalent for heat and power production, energy consumption for company's own needs, and production costs. On the basis of this data a summary and analysis of the efficiency of the heat generation and transportation in the district heating sector was performed. The available data for 2004 are presented in Tables 22 and 23.

Bulgaria currently has low efficiency in energy consumption and generation, giving it good potential for energy efficiency. The energy efficiency potential is estimated at 40% for existing buildings, 30% for the district heating sector, and 30% for industry.[1]

Figure 21 shows the efficiency of heat and power generation and the total efficiency of the production output of a total of 14 district heating companies in Bulgaria for 2004. Ten of the companies under review produce both power and heat, while the companies in Burgas, Razgrad, Veliko Turnovo and Yambol generate only heat. It is evident from the diagram that the efficiency of individual district heating companies varies within broad limits both with respect to electricity production and heat production. This is above all the consequence of the state-of-repair and the load of the available generating capacities.

[1] *Source: Bulgarian Energy Sector 2001 – 2004*

Table 21. Efficiency of the DH systems, 1997

	Total efficiency in 1997 (%)	Total efficiency 1997 vs 1993 (%)
Sofia	47	94
Pernik	32	105
Sliven	31	88
Kazanluk	51	98
Pleven	45	98
Gabrovo	37	82
Plovdiv – North	49	106
Shoumen	40	87
Plovdiv – South	57	109
Burgas	57	111
Varna	60	112
Ruse	36	83
Vratsa	52	104
Veliko Tarnovo	49	92
Razgrad	58	124
Yambol	17	45
Loznitsa	33	62
Pravets	43	82
Samokov	46	72
Lovetch	51	95
Triavna	43	80
Iskrets	39	77
TOTAL	**47**	**96**

Source: Technical Assistance for Development of the Strategy, Harmonization of the Legislation and District Heating Sector Regulation in compliance with Requirements of the European Union. Bulgaria Final Report Draft

Table 22. Production and efficiency in production of District heating companies in different cities Bulgaria for 2004 (given in coal equivalents since the heating plants use coal)

Parameter	Unit	Sofia	Plov-div	Ple-ven	Shu-men	Varna	Vrat-sa	Per-nik	Sliven	Gab-rovo	Kazan-lak	Bur-gas	Raz-grad	Veliko Tar-novo	Yam-bol
Total energy production	10^6 kWh	6,472	704	548	118	106	1,111	890	293	70.4	110	290	39.5	85.4	3.3
Input of coal equivalent for energy production	000 ton	929	104	86.8	17.2	14.2	275	321	97.3	14.6	17.7	37.0	5.1	13.2	0.62
Input of coal equivalent for energy production	10^6 kWh	7,565	850	706	140	115	2,242	2,613	792	120	144	301	41.9	107	5.1
Efficiency of energy production	%	85.5	82.7	77.7	84.4	91.9	49.6	34.1	37.0	58.7	76.7	96.4	94.3	79.6%	65.1%
Specific coal equivalent consumption for electricity production	kgce/ MWh	223.8	191.0	255.1	240.0	409.0	387.7	504.4	434.4	309.3	264.8				
Input of coal equivalent for electricity production	000 ton	196	26.0	18.3	3.0	1.3	178	260	76.5	2.7	0.84				
Input of coal equivalent for electricity production	10^6 kWh	1,595	212	149	24.0	10.5	1,453	2,117	623	21.8	6.8				

Efficiency of electricity production	%	54.9	64.3	48.2	51.0	30.0	31.7	24.4	28.3	39.7	46.4			
Specific coal equivalent consumption for electricity production	kgce/ MWh	131.1	138.3	143.6	134.5	125.2	149.1	162.8	178.4	195.5	157.2	127.5	130.	154.3	188.7
Input of coal equivalent for heat production	000 ton	734	78.5	68.4	14.2	12.9	97.0	60.9	20.8	12.1	16.9	37.0	5.1	13.2	0.62
Input of coal equivalent for heat production	10^6 kWh	5,970	639	557	116	105	790	496	169	98	137	301	41.9	107	5.1
Efficiency of heat production	%	93.7	88.8	85.6	91.4	98.2	82.4	75.5	68.9	62.9	78.2	96.4	94.3	79.6	65.1
Total production of electricity	10^6 kWh	876	136	71.9	12.2	3.16	460	516	176	8.65	3.17				
Consumption of electricity - own needs	10^6 kWh	222	17.8	15.8	4.34	0.45	71.5	127	28.5	2.90	0.74				
Consumption of electricity - own needs	%	25.3	13.1	21.9	35.4	14.2	15.5	24.6	16.2	33.5	23.4				
Total production of heat	10^6 kWh	5,596	568	476	106	103	651	374	117	61.7	107	290	39.5	85.4	3.31

Table 23. District heat production and efficiency in supply of companies in different cities Bulgaria for 2004

Parameter	Unit	Sofia	Plov-div	Pleven	Shum en	Varna	Vrat-sa	Per-nik	Sliven	Gab-rovo	Kaza n-lak	Bur-gas	Raz-grad	Veliko Tar-novo	Yam-bol
Total production of heat	MWh	5 595 869	567 514	476 473	105 699	103 025	650 932	374 182	116 661	61 725	107 327	289 933	39 493	85 386	3 309
Production of heat - steam	MWh	97 429	62 175	106 084			207 379		21 063	4 211	37 345	3 848	3 155		434
Production of heat - hot water	MWh	5 349 651	461 401	337 818	99 074	99 215	263 682	328 695	86 976	50 064	58 020	281 410	34 447	81 442	2 846
Consumption of heat - own needs	MWh	148 789	43 938	32 570	6 625	3 810	179 871	41 871	8 622	7 450	11 962	4 675	1 891	3 944	29
Consumption of heat - own needs	%	2.7	7.7	6.8	6.3	3.7	27.6	11.2	7.4	12.1	11.1	1.6	4.8	4.6	0.9
Sales of heat – steam	MWh	36 510	18 720	64 337			154 254		9 676	3 394	37 345	3 848	3 052		434
Sales of heat – steam	%	0.7%	3.3%	13.5%	0.0%	0.0%	23.7%	0.0%	8.3%	5.5%	34.8%	1.3%	7.7%		13.1%
Sales of heat - hot water	MWh	4 481 930	355 032	263 224	61 784	68 174	195 739	219 404	58 872	38 179	43 356	220 010	27 837	60 137	2 673
Sales of heat - hot water	%	80.1	62.6	55.2	58.5	66.2	30.1	58.6	50.5	61.9	40.4	75.9	70.5	70.4	80.8
Sales of heat – total	MWh	4 518 440	373 752	327 562	61 784	68 174	349 993	219 404	68 548	41 573	80 701	223 858	30 889	60 137	3 107
Sales of heat – total	%	80.7	65.9	68.7	58.5	66.2	53.8	58.6	58.8	67.4	75.2	77.2	78.2	70.4	93.9
Heat losses in supply - hot water	MWh	867 721	106 369	74 594	37 290	31 041	67 943	109 291	28 104	11 885	14 664		6 610	21 305	
Heat losses in supply - hot water	%	15.5	18.7	15.7	35.3	30.1	10.4	29.2	24.1	19.3	13.7		16.7	25.0	

Heat losses in supply - steam	MWh	60 919	43 455	41 747			53 125		11 387	817			103		
Heat losses in supply - steam	%	1.1	7.7	8.8	0.0	0.0	8.2	0.0	9.8	1.3	0.0	0.0	0.3		
Total heat losses in supply	MWh	928 640	149 824	116 341	37 290	31 041	121 068	109 291	39 491	12 702	14 664	61 400	6 713	21 305	173
Total heat losses in supply	%	16.6%	26.4%	24.4%	35.3%	30.1%	18.6%	29.2%	33.9%	20.6%	13.7%	21.2%	17.0%	25.0%	5.2%

Notes:
1. In Kazanlik steam is sold at the outlet of the district heating company and for that reason the steam losses in transportation are zero.
2. For Burgas and Yambol there exist data only about heat losses total, without breakdown for hot water and steam separately.

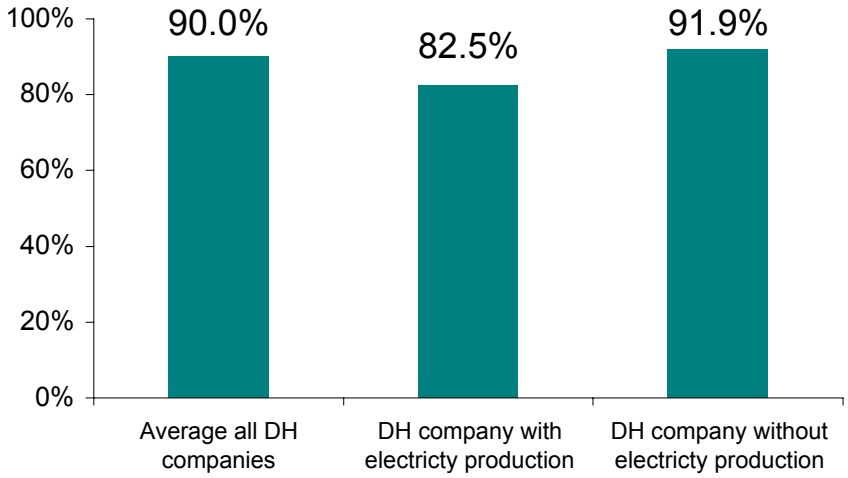


Figure 22. Efficiency of heat production in district heating companies in Bulgaria for 2004

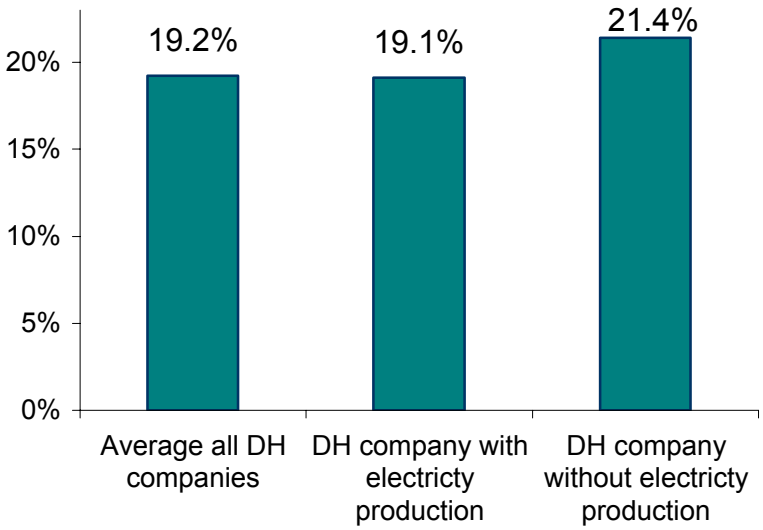


Figure 23. Heat losses in supply of district heating companies in Bulgaria for 2004

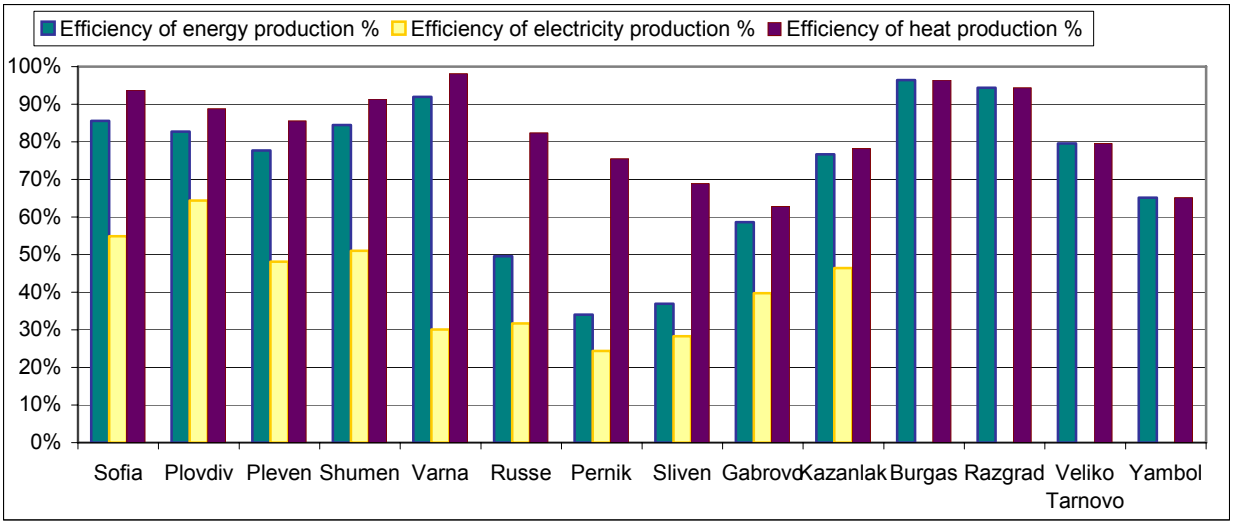


Figure 21. Efficiency in production of district heating companies in Bulgarian cities for 2004

Figure 22 shows separately the efficiency of heat generation for all the 14 district heating companies under review, respectively for the 10 companies for combined heat and power production and for the heat-only companies. The average heat generation efficiency for all the companies is 90%; that of CHP plants is 82.5%; and for heat-only plants it is nearly 92%.

Figure 23 presents the aggregate heat losses in transportation for hot water and steam as heat carriers. In terms of this indicator, a significantly lower efficiency has been registered for the DH companies without electricity production, with average heat losses in transportation amounting to 21.4%. In the case of the companies with combined heat and power generation this percentage is slightly above 19%. One explanation could be the fact that in Sofia as a result of implementing the rehabilitation project for the company—the losses in transportation have been reduced substantially as compared to other DH companies. Losses were reduced to 16.6% in 2004, while the share of the Sofia DH company in the total heat production of the 14 companies under review is about 65%.

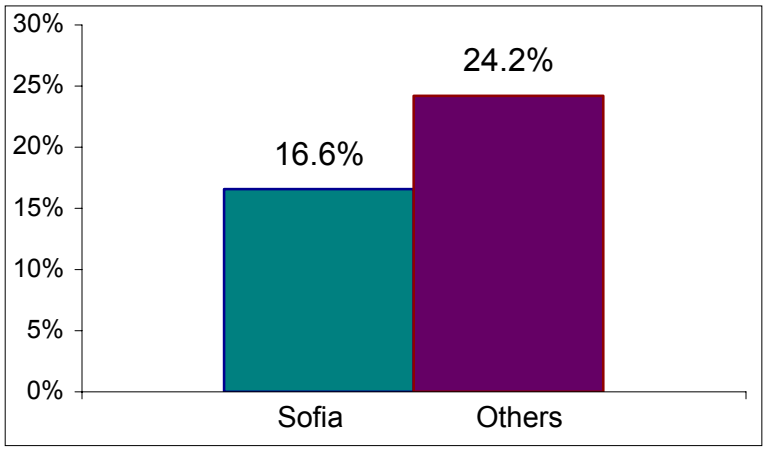


Figure 24. Total heat losses in supply of Sofia and other District heating companies in Bulgaria for 2004

Figure 24 offers a juxtaposition of the losses in heat transportation of Toplofikatsiya Sofia SPJsC and the average figure for the rest of the DH companies under review, from which the positive result from the currently implemented project for rehabilitation of the company becomes clearly evident. Illustrated on Figure 25 is the share of losses in transportation, the energy consumption for

plant's own needs and total supplied heat as a percentage of the total heat output of the district heating companies under review. One can clearly see the small heat losses in transportation for *Toplofikatsiya-Yambol* SPJsC and the big heat consumption for plant's own needs of *Toplofikatsiya-Ruse* SPJsC, the latter being due to the fact that the company's assets comprise also the condensing plant "Ruse" TPP.

Figure 26 illustrates the share of transportation losses and the supplied heat in the form of total hot water as a percentage of the total hot water output available for transportation via district heating networks under review in 2004. Figure 27 presents detailed data concerning steam transportation and sales. One gets the impression that heat losses in the transportation of steam are significantly higher as compared to those of transportation of hot water as heat carrier, except in the case of the DH companies in Razgrad and Gabrovo. The efficiency of steam transportation is particularly low in Sofia and Plovdiv, where heat losses exceed 60%. This situation might be explained by the big drop in steam consumption because of the collapse of the country's economy during the 1990's, along with the shortage of investments for rehabilitation and replacement of the steam transportation network.

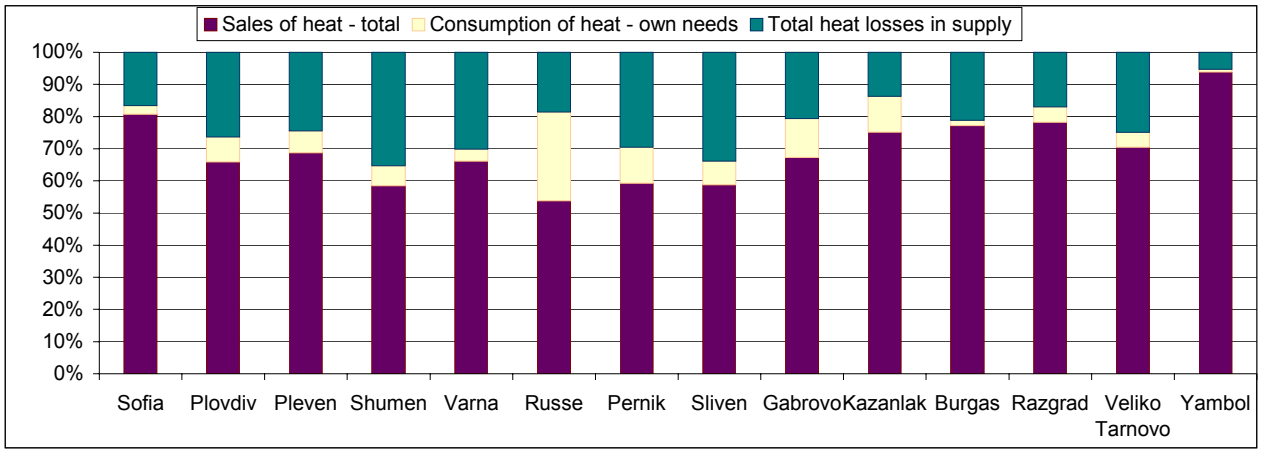


Figure 25. Shares supply losses, own use and sales in total heat production of Bulgarian district heating companies for 2004

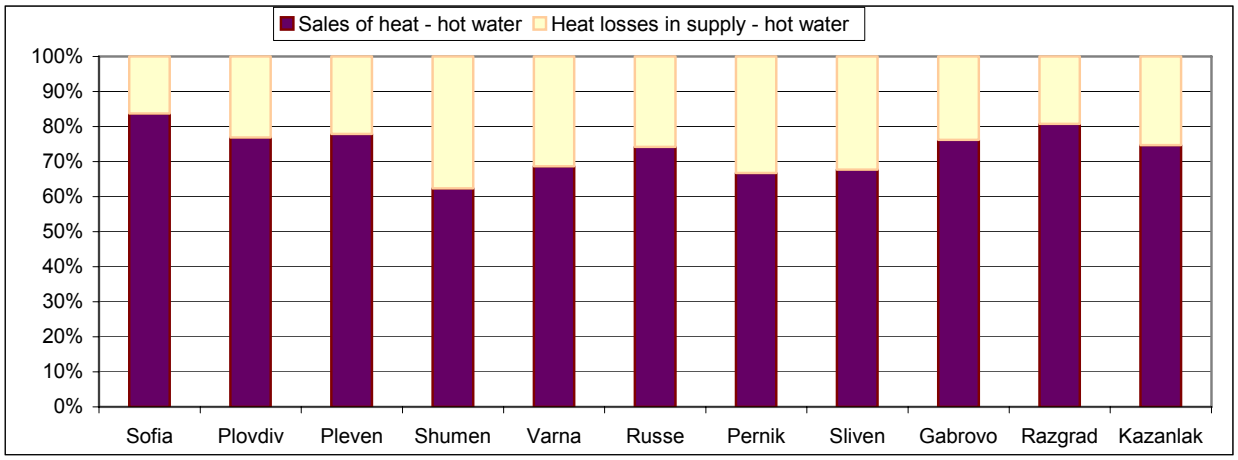


Figure 26. Shares of losses in supply and sales of hot water available for transportation of District heating companies in Bulgaria for 2004

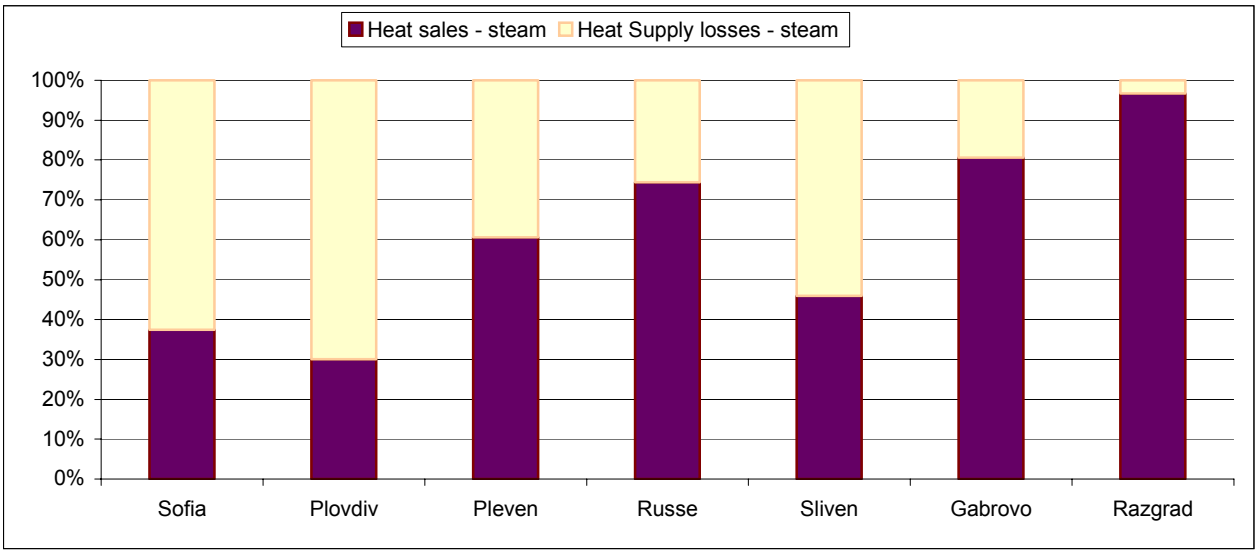


Figure 27. Shares of losses in supply and sales of steam available for transportation of district heating companies in Bulgaria for 2004

3 Restructuring and Prospects for Privatizing Urban Heat Supply

The authority to implement privatization of DH companies in Bulgaria is vested with the Privatization Agency (PA). The privatization process started in 2004 with as certain delays in the schedule envisaged in the governmental strategy for restructuring of the energy sector, which at that time was planned for the period 2003-2004.

By virtue of PA Decision No. 2713-П/30 March 2004 nine DH companies were offered for privatization through public sale of their shares at the Bulgarian Stock Exchange: in Veliko Tarnovo, Lovech, Gabrovo, Pleven, Burgas, Varna, Pernik, Pleven, Razgrad and Shumen. Additionally, by virtue of PA Decision No. 2714-П/30 March 2004, the PA has ruled on the sale of the state-owned shares (actually 100 % of shares) *(see Table 24)* from the capital stock of DHCs of Pravetz, Loznitza, Plovdiv and Samokov through public offer of these shares at the Bulgarian Stock Exchange Sofia plc.

By 30 November 2005, a total of 7 deals for privatization of DH companies from the above list have been realized. Some major data about the privatization deals is presented in Table 24. According to the privatization agreements there are several basic requirements, which are applicable to all buyers.

- No change of the basic sphere of activity of the company shall be permitted for the term of validity of the licenses of the company, issued by the SEWRC;
- The buyer shall do its best to prevent withdrawal of the licenses of the company by SEWRC or any other authorized in conformity with the enforced legislation state

body for reasons such as failure to implement the terms, restrictions and obligations specified in the licenses related to the company and the activity implemented by it;

- The buyer shall not transfer onto a third party the ownership on the shares, nor the rights and responsibilities ensuing from the agreement for a period of 3 year, except with a prior written permission of the Agency for Post-Privatization Control (APPC);
- The buyer is obliged to realize a specifies minimum amount of investments in the company for a period of 3 year; and
- The buyer shall not diminish the amount of its share below 51%, including in the event of increase of the capital stock of the company, for a period of 3 years, except with the prior written consent of APPC.

Table 24. Realized privatization deals in the district heating sector as of 30 November 2005 through public sale of shares at the Bulgarian Stock Exchange Sofia

DHC in city of:	Date of privati-zation	New owner	% of shares	Price (000 BGN)	Required investment for next 3 years, BGN
Razgrad	10.09.2004	"Overgas Holding" SJsC	100 %	722	n.a.
Loznitsa	11.10.2004	"Arma" SJsC	100 %	55	n.a.
Veliko Tarnovo	29.12.2004	"Eko Energiya Holding" Ltd	98 %	696	1,200,000
Gabrovo	30.12.2004	"Topgrup" Ltd	100 %	958	850,000
Pleven	04.05.2005	"Metroni" Ltd	100 %	26,588	52,000,000
Burgas	15.06.2005	"Novas 2004" Ltd	100 %	15,126	42,000,000
Pravetz	10.08.2005	"Energo I kompyutarni sistemi" Ltd	100 %	250	n.a.

Four more DH companies listed under the above two decisions by 30 November 2005 are in a list of preparatory work for possible privatization. The major details concerning these transactions are shown in Table 25. The Samokov DHC has entered a liquidation procedure and since 3 June 2005 its activity license has been suspended by the SEWRC. DHCs of Shumen, Varna, Pernik, Plovdiv are pending similar privatization of full shares through the stock exchange. DHCs of Kazanluk, DHC Yambol, DHC Vratsa were also privatized through public sale of their shares on the stock exchange in 2004 but detailed data about privatisation deals is not available.

The procedure for the privatisation of DHC Ruse was passed and the new buyer the Russian company RAO was approved. The same company was approved to privatise TPP Varna. For that reason the Competition Protection Commission decided that the Russian company should choose one of the two sites. The PA claimed this decision in court and so the process of privatisation of DHC was stopped for months. The new Minister of Economy and Energy announced that the privatisation procedure will be cancelled and DHC Ruse

will be offered for privatisation together with the remaining four DHCs presented in Table 16.

Table 25. Privatization deals in the district heating sector as of 30 November 2005 for realization through public offer at the Bulgarian Stock Exchange Sofia

DHC in city of:	% of shares for sale	Legally registered capital stock, BGN	Status of privatisation process
Shumen	100 %	9,697,000	Pending coordination of the preliminary agreed eligibility requirements and terms of the contract
Varna	n.a.	3,964,800	Pending review of the privatisation of the company with experts from the MEE
Pernik	100 %	5,245,502	Pending review of the privatisation of the company with experts from the MEE
Plovdiv	100 %	25,850,307	Pending coordination of the preliminary agreed eligibility requirements and terms of the contract

4 Financing and Investments to Modernize District Heating Companies

4.1 Overview

Within the period 2001-2004, two favourable changes took place in the investment environment:

1 Transition from subsidized and administrated prices in the sector to financial stabilization, by subsidy phase-out, and the creation of a clear legal and regulatory environment;

2 Improvement of the macroeconomic environment and creation of a favourable investment climate, expressed by a gradual increase of the country's credit rating (BBB) to investment and sustainable growth of GDP

This allowed a flexible usage of suitable combinations of financial mechanisms for providing the necessary funds to implement investment projects in energy sector:

1. State guaranteed credits from international financial institutions for financing of significant and socially important infrastructure projects, which due to legal, regulatory and other barriers could not be financed with standard bank credits. – Projects for rehabilitation of DHC Sofia and DHC Pernik.
2. Standard bank credits are used for co-financing of big projects and for full financing of relatively smaller projects
3. Contemporary mechanisms for financing of investment projects including financial leasing – Project for Construction of a cogeneration facility at DHC Varna.

4. Joint Implementation Projects Mechanism according to the Kyoto Protocol – Projects for rehabilitation of DHC Sofia and Pernik. The Joint Implementation mechanism is the best option for economically profitable greenhouse gases emission reduction and for attracting foreign investments.
5. Equity. Successfully carried out price reform and implementation of modern methods for price regulation and created opportunities for financing of investment projects with equity. During 2004 the investments in the energy sector are about 960 million leva, from which 43% (416 million leva) are equity.
6. Pre-accession funds of EU are another source for financing energy projects - KIDSF and ISPA. They have been used for: a) rehabilitation of district heating network of DHC Sofia (30 million €o), and b) a financial memorandum for project for rehabilitation of DHC Pernik for the amount of €4.95 million was signed at the end of 2004.
7. Privatisation is another approach by which funds are provided for the implementation of investment projects: through the establishment of joint ventures and providing funds from the new private shareholder, and by attracting strategic investors who meet the preliminary requirements that guarantee their financial potential (e.g. equity). The certified bidders for DHC Ruse meet the preliminary qualification requirement for equity amounting to at least €500 million, which provides a financial guarantee for investments in environmental protection and rehabilitation amounting to 1350 million leva (preliminary estimation).
8. Through investment agreements of the purchasers, included in the privatisation contracts for sell of energy companies. The investment agreements of purchasers of DHC Burgas, DHC Gabrovo and DHC Veliko Turnovo amounted to 23.55 million leva, necessary for modernization of processes for production and transmission of heat energy.

The investments of the companies in the energy sector for 2001-2005 period, planned and accounted amounted to 4 billion leva, as shown in Table 26. The percentage distribution of the investments in the period 2001-2005 by sub-sectors in the energy sector is shown in Table 27. Figure 28 presents the investments distributed by sub-sectors in million BGN. For the 2001 to 2005 period the planned and accounted investments in the district heating companies were 232 million BGN, from which 87 million BGN during 2004, which is more than the total amount of the investments made for the three year period 2001-2003.

Table 26. Investments in the companies in the energy sector

Year	2001	2002	2003	2004	2005
Amount of the investments, million BGN	550	504	629	960	1339

Source: Bulgarian Energy Sector 2001-2004

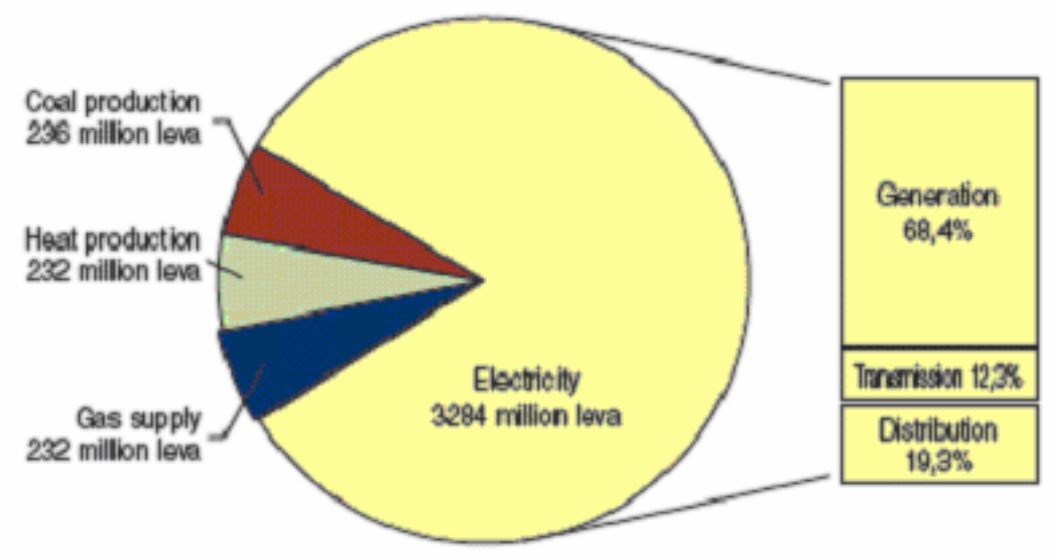


Figure 28. Investments in energy sector (2001-2005)
Source: Bulgarian Energy Sector 2001-2004

Table 27. Investments by sub-sectors

Sub-sector	Electricity generation	Heat production	Gas supply	Coal production
Investments, %	82,5	5,8	5,8	5,9

Source: Bulgarian Energy Sector 2001-2004

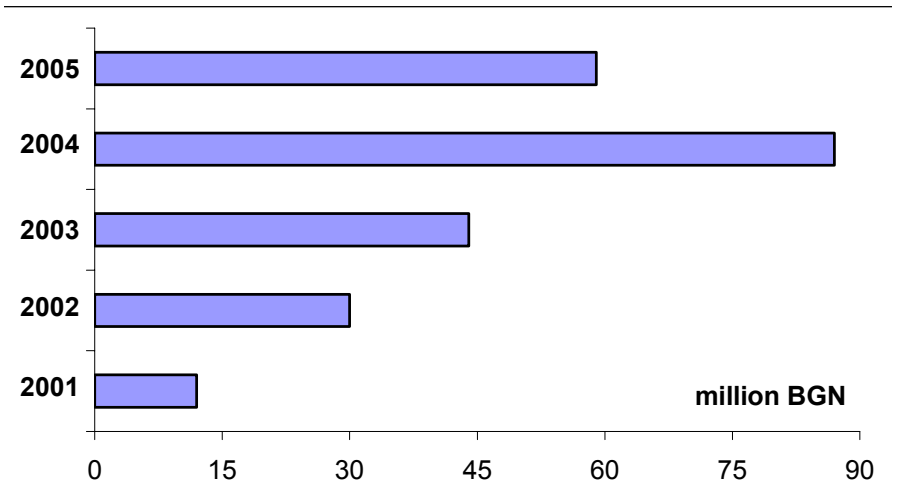


Figure 29. Investments in the district heating companies for the 2001-2005 period
Source: Bulgarian Energy Sector 2001-2004

The considerable growth of investment activity in the sector—more than a six-fold increase in 2004 compared to 2001—is due to improved macroeconomics in the country, better financial opportunities, and changes in the financial and economic state of companies. This

includes an improved pricing and regulatory environment, which allows companies to carry out the necessary investment activities, financed with equity and debt capital.

The investments in the district heating companies were mainly for:

1 Optimization of the parameters of the heat source technological regimes;
2 Rehabilitation of the heat transmission network;
3 Modernization and replacement of local heating stations. A considerable part of the investments for 2004 in the district heating sector - 79%, were utilized by Sofia and Pernik DHCs under the state-guaranteed credits project "Rehabilitation of heat transmission network of DHC Sofia and Rehabilitation of DHC Pernik".

4.2 Cost Effectiveness of District Heating Investments

The MEER reports in 2005 reduction of the technological losses in the district heating sector and reduction of the production costs. Figure 35 shows the investment activity profile in the district heating sector and the consequent efficiency improvement.

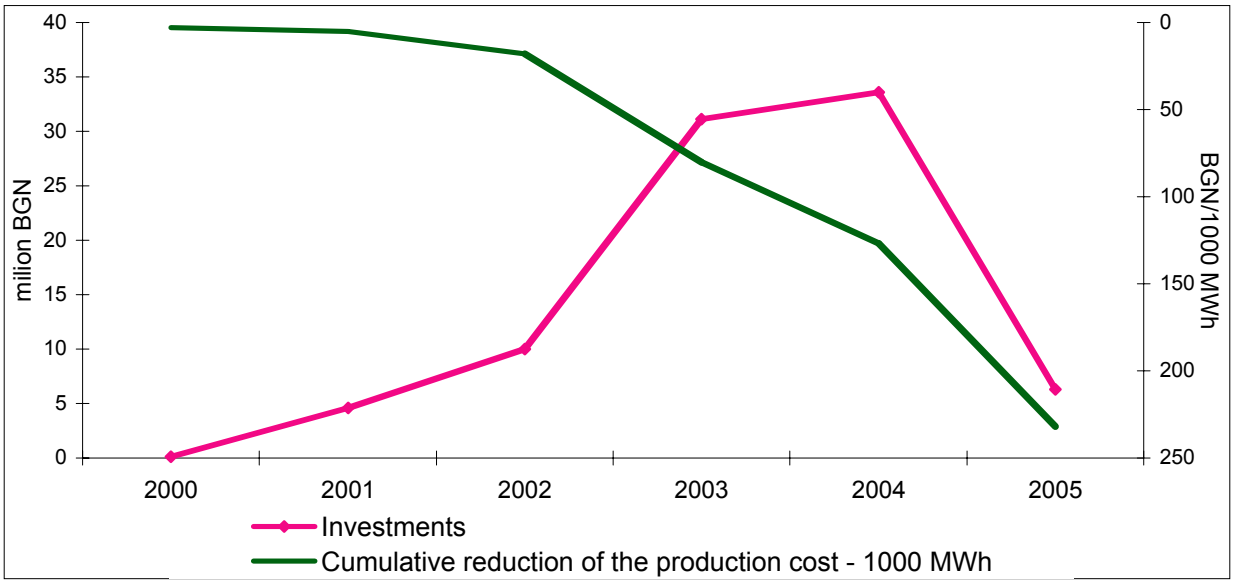


Figure 35. Investments and results in the District heating sector 2000-2005*
Source: Bulgarian Energy Sector 2001-2004

Investments in heat supply result in:

1. Improvement of financial stability of the district heating companies;
2. Increasing reliability and efficiency of the heating system;
3. Reduction of operation and production costs;
4. Reduction of heat energy quantity used from the households and respectively reduction of the households heating expenditures.

The largest projects in the district heating sector are described below.

Project for Rehabilitation of the Heat transmission network of DHC Sofia

The project budget was 114 million BGN and included supply and installation of local heating substations, replacement of heat transmission network, etc. but not any DSM measures. By the end of 2004, 55% of project activities had been carried out. The execution of 37 contracts for total amount of €38.3 million was completed, as follows:

- Supply and installation of 4 029 local heating substations;
- Supply of 150 km insulated pipes etc.

Now 11 contracts for €8.2 million are being executed, connected with supplying and installing 834 local heating substations. The expenditures from the beginning of the project are €41.9 million, from which:

- Equity – €10.1 million;
- Credits – €23.5 million, including from EBRD - €11.2 million and WB – €12.3 million;
- €8.3 million grant fund from KIDSF.

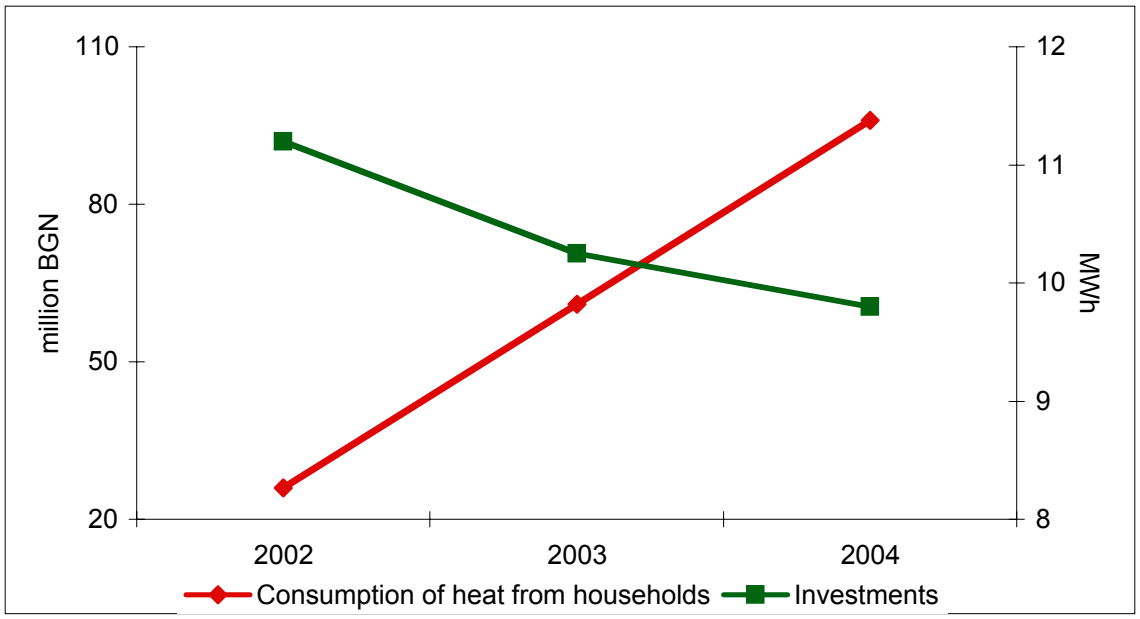


Figure 36. Investments in substations and regulation equipment (2002-2004)

Source: Bulgarian Energy Sector 2001-2004

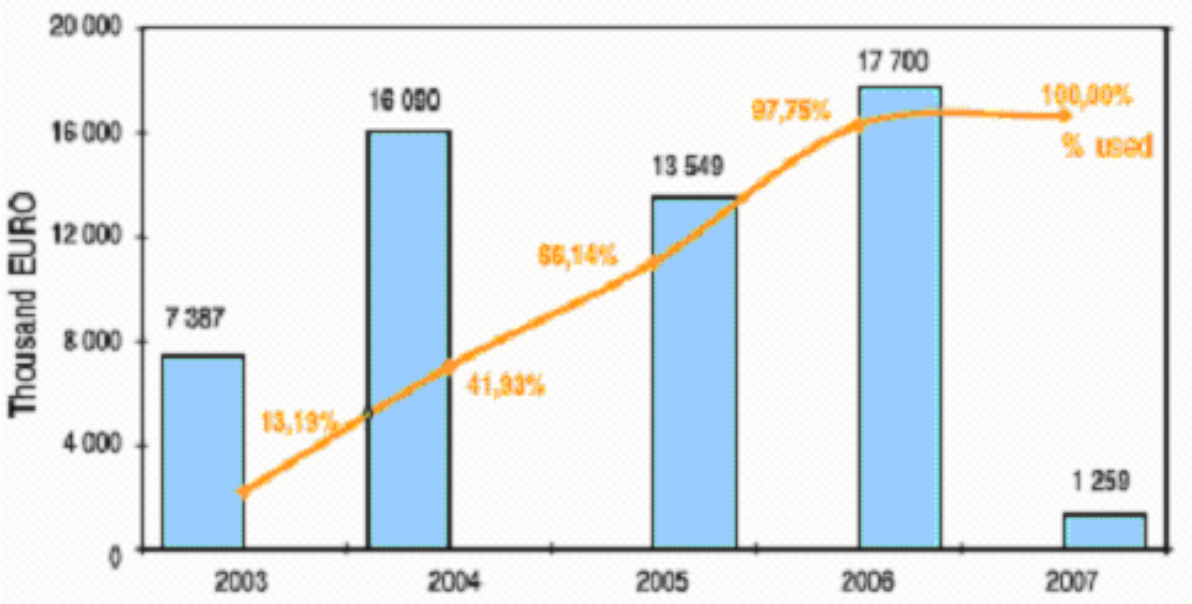


Figure 37. Rehabilitation of the heat distribution network of DHC Sofia
Source: Bulgarian Energy Sector 2001-2004. MEER, 2005

Project for rehabilitation of DHP Pernik

The project includes rehabilitation of the heat transmission network and heat source. The project is for 13.7 million USD, financed as follows:

- State guaranteed credit from WB - 7 million USD;
- Equity and grant from KIDSF - 6.7 million USD.

At the end of 2004, 35.1% of the activities were carried out in line with the initial plan, including rehabilitation of 686 local heating substations. The project expenditures were 5.3 million USD; including 2.8 million USD credit from WB and 2.5 million USD own funds.

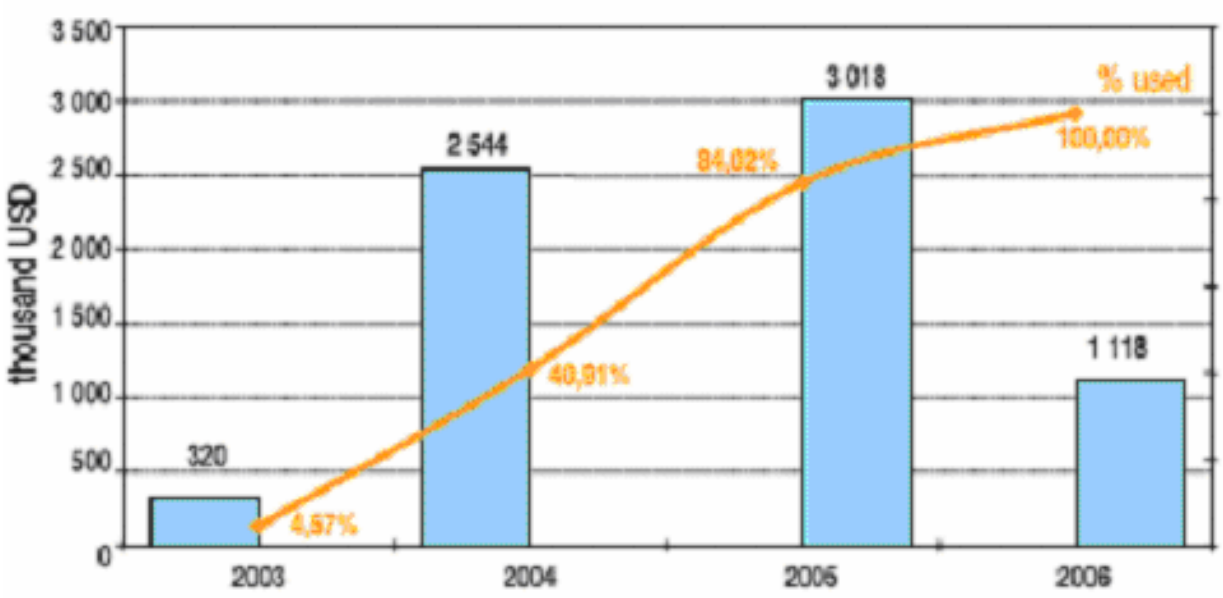


Figure 38. Rehabilitation of DHC Pernik
Source: Bulgarian Energy Sector 2001-2004

Project for Construction of a Cogeneration module in DHC Varna
A project for construction of a cogeneration module in Varna DHC for 4.9 million BGN (3.12 million USD calculated at average exchange rate for 2004 1USD=1.57 BGN) was structured and implemented in 2004. The implementation of the project started in April with the signing of the contract for supply of the cogeneration installation on leasing - provided by Biochim Bank to the amount of 3.845 million leva and a credit contract of the Economic and Investment bank amounting to 960 thousand leva. In October 2004 the equipment was supplied and installed by Jenbacher, Austria.

5 Environmental Performance of Urban Heating Systems

There is a variation (Figure 39) in energy generation quantity in the period 2000-2005 as well as in CO_2 emissions as a result of this generation. It is expected in 2005 the CO_2 emissions to be stabilized.

In spite of the increasing heat generation in 2003, the emissions from this generation are decreasing. Part of this decrease in the District Heating sector is achieved through:

- Rehabilitations of the substations;
- Introduction of a heat billing system, which system allows real regulation and registration of used heat energy;
- Implementation of activities for optimization of the production process in the district heating sector.

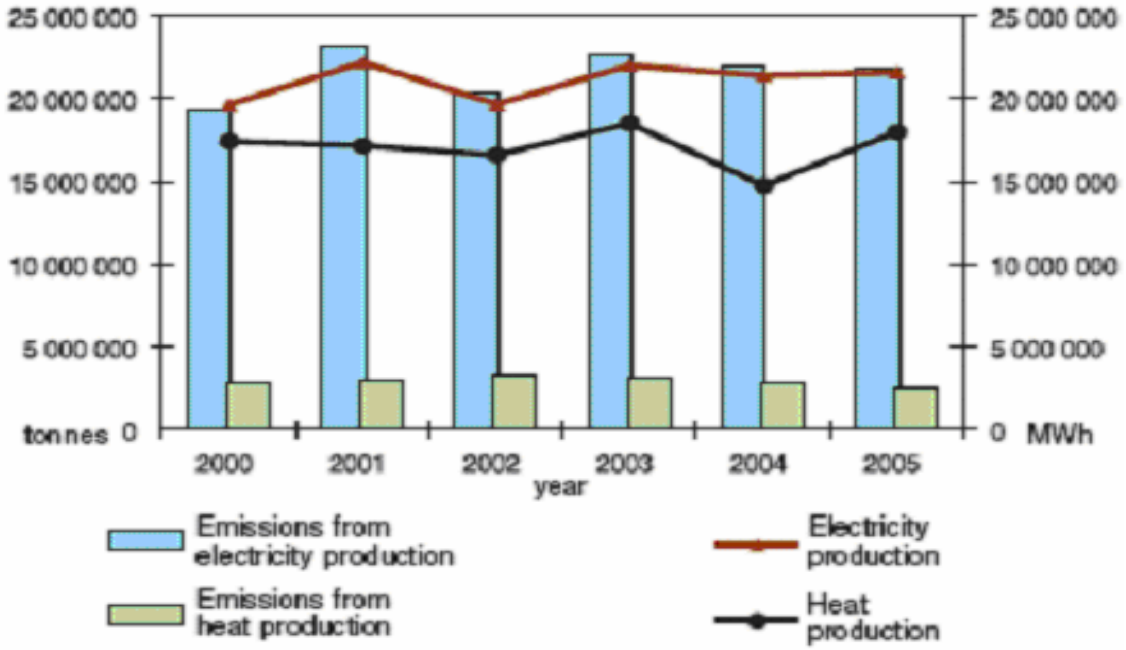


Figure 39. CO_2 emissions in energy sector in Bulgaria for the period 2000-2005
Source: Bulgarian Energy Sector 2001-2004

6 Regulatory and Market Policies for Setting Tariffs, Managing Debt and Billing Consumers

6.1 OVERVIEW

During the 1990s, the financial performance of all DHCs was negative, mainly because of the low fixed heat power prices for the population. Despite the fact that the DH tariff has always been subsided from the state budget, the number of consumers of district heating from the residential sector has been constantly diminishing. There was a unified tariff for all DH companies, which was not sufficient to cover the real production and transportation costs. Tariff increases were introduced periodically, however they did not at all lead to diminishing of the level of subsidies since the enterprises continued to make losses for a number of factors, such as lack of investments for improvement of the efficiency of the systems, poor accounting and collection practices, disconnection of growing number of subscribers because of the price increases.

Generally, the environment within which the district heating companies operated before the reform in the last four years can be summarized in the following way:

- The heat price for households did not cover the production, transmission and distribution costs;
- The district heating companies were centrally subsidized from the state budget[2];
- There was no investment equity;
- The potential of the district heating companies to attract investments was limited;
- There were no incentives and resources with regard to improving the efficiency; and
- There was no equipment allowing the regulation of consumption by the households.

It is only since 2002, i.e. 12 years after the country embarked on the process of transition, that a start was given to the real reform in the formation of prices in the district heating sector. The pricing reform in the district heating sector focuses on the phase-out of subsidies (which practically happened in 2005)[3] to the producers by balancing prices for households, bringing those prices down to levels that allow production costs to be covered and ensuring the return on investment for the development of district heating companies.

[2] The subsidies and heat price cover the heat cost if the customer pays the heat price. However, for some people the price is still too high even when subsidised, and they are not able to pay for the heat. The price-setting mechanism is not the problem. The problem is that the State is not able to subsidise the DHCs any more, yet people were not prepared to pay higher prices.

[3] Tarifs are described in Trend in heat pricing sub-section 3 pages below. Data about the share of the subsidies is not available. Subsidies are discussed in the section: Volume of Subsidies

6.2 TARIFF-SETTING MECHANISM

The State Energy Regulation Commission (SERC) is responsible for electricity, natural gas and district heating tariff setting since 2002. According to the latest amendment of the Energy Act of March 2004 SERC has been renamed to State Energy Regulation Commission (SEWRC) and has been assigned the responsibility of regulation of the prices in the water sector as well.

The method currently applied by the SEWRC for regulation of the prices in the district heating sector is called "Rate of Return on Assets" ("costs plus"). This method is described in detail in the formulas below. The Commission endorses the prices and monitors on a current basis the actual values concerning the necessary revenue of the energy enterprise and the components of the price. The regulatory period shall be not less than a year; the next regulatory review may be performed at the initiative of either the Commission or the DH enterprise in the event of significant disparities between the approved prices and the real costs and/or return of capital. In the course of the regulatory period the prices may be changed in the event of circumstances, which could not have been envisaged at the point of endorsement.

In addition to this method, the Commission applies certain indicators based on performance (energy quality, service quality, etc.), allowing for linkage of the required revenue of the energy enterprise with the achievement of the objectives set by the Commission. The revenue, respectively prices, endorsed in this manner, is based on compliance with set indicators beyond those related to the cost of the service provided by the energy enterprise.

The required annual revenue from activities of the DH companies comprise the costs subject to endorsement by the Commission and the return on investments under the following formula:

$$НП = Р + (РБА \times НВ),$$

where:

НП	-	the required annual revenue
Р	-	recognized annual costs for the activity
РБА	-	the regulatory basis of the assets *(described in the next paragraph)*
НВ	-	the Rate of Return of the capital for the regulatory period

The regulatory basis of the assets directly related to the licensed activity is the recognized value of the assets on which the energy enterprises accounts return on investments and is calculated under the following formula:

РБА = А - Ф - Ам + ОК + И, where :

РБА	-	the regulatory basis of the assets *(The most important is that this is the recognized value of the assets of the DHCs by the SWERC.)*
А	-	the recognized value of the assets, which are in use and which have an outstanding balance of service life
Ф	-	the value of assets acquired as grants
Ам	-	the accounted depreciation for the use of the assets for the primary activity
ОК	-	the required turnover capital

И - the forecast average amount of investments approved by the Commission

The Rate of Return of investments for the regulatory period is equal to the forecast average weighted price of the capital (СПЦК). The average weighted price of the capital is then approved by the Commission Internal Rate of Return for the attracted capital and the equity capital of the energy company, weighted according to the share of each of these sources of financing in the approved target structure of the capital.

The Rate of Return of investments is determined as a real rate prior to taxation according to the following formula:

$$НВ = ДСК \times \frac{НВСК}{1 - ДС/100} + ДПК \times НВПК$$

where:

НВ	-	Rate of Return prior to taxation
ДСК	-	share of equity capital in the total capital
НВСК	-	Rate of Return of equity capital prior to taxation
ДС	-	corporate profit tax
ДПК	-	share of attracted capital in the total capital
НВПК	-	Rate of Return of attracted capital

The price consists of the following components: capacity charge and energy price. The capacity charge is formed as the sum of permanent costs and the return from heat generation *activity* divided to the sum of the producer's hot water and steam generation capacities recognized by the Commission.

When steam comprises not more than 25% of the total heat produced (steam + hot water), setting a common price is permitted for heat produced with both steam and hot water as heat carrier.

The Commission determines preferential sales prices for electricity produced by CHP plants. The preferential prices are set at a level not lower than 80% of the average retail electricity price for the preceding calendar year for residential consumers. In the case of combined heat and power generation the required revenue from heat generation is equal to the difference between the required revenue of the producer and the forecast revenue from electricity sales.

District heating companies are obliged to submit to the SEWRC the following documents:

1. Annual financial report endorsed by an Auditor;
2. Financial accounting information, as well as information evidencing compliance with all the provisions of the Ordinance, as well as the performance indicators related to the quality of services;
3. Technical and economic data, including monthly reports about the sales during the baseline year;
4. Information by groups of consumers for the baseline year, including number of consumers, energy sales, negotiated capacity, revenue and information related to billing;

5. Other data, considered by the energy enterprise to be appropriate in support of the submitted declaration or requested by the Commission;

The enterprises have the right to apply for recognition and reimbursement of costs incurred as a consequence of obligations to the society imposed in the process of endorsement of the prices. A typical example to that effect is the practice of granting subsides. The final price of the producer is reduced by the amount of the subsidies allocated by the state for the purposes of implementation of its social policy.

The energy enterprise may correct certain measurable components of the costs and revenue for the baseline year and submit them separately with justification concerning their feasibility, including financial data and activity data. Information proving the necessity of the correction shall be submitted for every correction the baseline data. It shall comprise the following:

1. New assets, which will be necessary and commissioned in regular operation during the next pricing period;
2. Increase of the forecast number of consumers, which will lead to additional costs for provision of the service;
3. Increases of certain production costs, which have not been taken into account for the baseline year;
4. Changes in the level of certain liabilities to the state (charges, taxes, etc.), which lead to changes in the levels of costs or the rate of return;
5. Alignment of sales during the baseline year, which has been marked by unusual meteorological conditions, to the normal level of sales, in the event that these conditions have had some impact on energy sales.

6.3 TRENDS IN HEAT PRICING

Since 1 September 1998 the prices for industrial consumers are no longer subsidized and are determined on the basis of production costs plus a certain percentage of profit. In this period there were two levels of district heating tariffs: for residential consumers, which are uniformly set throughout the country, and for industrial consumers, which are established by the different district heating companies through supply contracts. Tariffs for residential users were approved by the Council of Ministers, as proposed by the SERC. The fixed price for the population has been increased by 30% to 27.09 BGN/MWh or approximately USD 14.6/MWh. Residential heat prices covered 60% of costs, the remainder was being subsidized. Industrial heat prices were based on costs plus a 7% profit margin.

The action plan adopted by the government in 1998 foresaw annual increase in the district heating tariff for the residential sector and complete phasing out of the subsidies of the heat price by 2001. Due to different reasons this has not been accomplished. The average tariffs for the population have increased as follows: 1999 – by 22%, 2000 – by 6.8%, 2001 – by 2.7%, and the level reached was 37.40 BGN/MWh. At the same time, by December 31, 2001 heat production costs amounted to 69.49 BGN/MWh.

During the process of introduction of heat accounting in the residential sector, at the beginning of 2002 the government set a new tariff of 40.05 BGN/MWh. The Council of Ministers adopted Regulation No. 53 of March 6, 2002 and introduced a two-tier tariff for district heating that includes a separate price for heat and a separate capacity charge. The following Regulation No. 67 of March 29, 2002 sets up the upper rate limit for the two-block tariff for the residential sector:

- Heating capacity charge: 0.045 BGN/m^3/month = 0.022 USD/m^3/month
- Heat Energy: 34.05 BGN/MWh = 16.37 USD/MWh.

Note: Average exchange rate for 2002: 1 USD = 2.08 BGN

The total price of district heating, calculated on the basis of mean indices, is 40.05 BGN/MWh (19.25 USD/MWh). The development and following debates of the 2002 budget revealed that the district heating production costs are 67.70 BGN/MWh (32.55 USD/MWh). The planned subsidy from the state budget was BGN 37 million. Thus the average annual retail price should have therefore been in the range of BGN 58.18/MWh (27.97 USD/MWh), based on the average projected annual consumption. However, the Council of Ministers recognized that this price is unbearable for a large portion of the population and might lead to a new wave of disconnections from district heating services and destruction of the district heating market. So they kept the price at the level of BGN 40.05/MWh and decided to proceed with further increase after the introduction of protective social measures.

The capacity charge is paid by all the owners of flats in district-heated buildings, regardless of whether they use the district heating service or not. Although it has nowhere been explicitly mentioned, this development may be interpreted to be part of the measures for financial rehabilitation of the DH companies. Capacity charge is paid at equal monthly instalments for all consumers of the service, thus ensuring higher revenue for the DH companies during the summer months, when the sales of heat energy are insignificant – for DHW supply only. It is difficult to say if energy bills are reduced due to the capacity charge. Theoretically, it is possible for the bills of heat customers, because the capacity charge is paid also from former customers who do not use heat but live in the same building. If the total amount that should be paid by a single building is the same, but if this is the case in practice probably only the bosses of DHCs and the SWERC can say, but such information is never published or announced. Some diminishing of the bills of "customers – users" is happening because of the way of allocation of the bills of the heat inside the building but it is explained in the fifth paragraph of the next section of the report). The fairness this approach provides grounds for reasonable doubt. This text of the law has caused serious controversy and legal claims on the part of the Federation of Consumers in Bulgaria, numerous disputes, which are still going on.

On July 7, 2002, the Council of Ministers approved a two-block tariff for the heat component of the two-tier tariff as a measure for social protection of the small quantity consumers. The introduction of a two-block tariff for heat secured:

- up to 250 kWh/month - at the price of April 2002 and according to the Energy Strategy that price was to remain unchanged till putting end to the subsidies in 2005, as it happened;
- above 250 kWh/month - that portion of the price to be increased annually on July 1st, the increase being in compliance with the rate set down in the Energy Strategy.

The tariff set by SERC for district heating above monthly consumption of 250 kWh/month is 37.94 BGN/MWh (18.24 USD/MWh), an increase of 11.1%. The annual heating capacity charge is 0.05 BGN/m^3 (0.024 USD/m^3/month) (an increase of 11.1 %). The application of these tariffs, together with retention of the other terms and conditions of district heating supply, leads to an increase in the average district heating tariff by 9%.

With the next changes in the district heating prices, defined by the SERC and introduced on 1 November 2002, application of separate tariffs for the different district heating companies was launched.

All the subsequent amendments after that date are summarized in Table 28. The capacity charge is currently set according to two tariffs: either or on the basis of the heated volume of the flats or on the basis of the design heated volume, and since 1 November 2003 – only on the basis of the design heated volume.

6.4 HEAT BILLING

Historically, Bulgarian households have not had their heat usage metered. The old billing system charged households solely on the basis of the number of cubic meters of apartment space. There was no metering on building level.

As a result of the government program initiated in 1996, block meters were installed in basements of all district heated residential. The master meters record total heat consumed by the building. The basement meters are a (technical) prerequisite to installing the HCAs on each radiator in order to bill consumers on an apartment level; this was initiated by the Energy and Energy Efficiency Act of 1999. The government introduced the concept of household-level metering by creating a legal requirement for households to install HCAs (for heat metering) by September 2002.

HCAs meter the relative heat consumption at each radiator in a building so that households can be charged according to their heat consumption. TRVs allow households to adjust the amount of heat generated by each radiator (including turning them completely off when no one is home), allowing the households to conserve energy and, thus, lower their heating bills. All customers of DH were obliged by Law to invest in HCA devices for every single radiator in their living areas. The SEWRC issues licences to specialized private companies (independent from the DHC) to perform the heat accounting service. The general assembly of all the residents of every multifamily building had to agree on one selected by them licensed company, with which all the owners of flats in the building had to sign a contract for the performance of the service. According to the provisions of the law, a given building may be serviced by only one company. In smaller district heating systems the DHC collects the data by HCA's and private billing companies are not involved.

Table 28. Prices in district heating sector

№		Energy price (BGN/MWh)				Capacity charge (annual, BGN)					
		01.11.02	01.7.03	01.7.04	01.11.05	01.11.02[1)]	01.11.02*	01.7.03*	01.7.03*	01.7.04	01.11.05
						m3	/kW	m3	/kW	/kW	/kW
1	Sofia	47.38	42.32	50.45	55.85	0.92	15.96	0.76	12.38	12.02	10.53
2	Plovdiv	47.22	45.41	57.79	61.18	0.95	19.80	1.52	23.18	9.97	8.31
3	Pleven	54.12	48.55	50.62	58.27	0.89	14.28	0.98	15.55	10.85	10.84
4	Shumen	55.56	62.78	58.34	63.71	1.22	33.60	1.96	28.22	15.92	12.97
5	Pravetz	43.19	45.38	40.18	52.13[2)]	1.94	34.44	1.88	31.25	32.24	32.23[2)]
6	Pernik	37.64	43.50	40.52	49.82	1.30	36.00	1.02	21.31	13.85	10.69
7	Sliven	38.65	54.59	71.02	62.46	0.89	17.16	1.85	30.38	10.46	8.99
8	Gabrovo	47.35	54.84	80.65	78.10	1.43	28.20	1.69	19.01	5.89	9.85
9	Kazanlak	83.75	86.82	89.80	97.80[3)]	1.08	30.00	1.65	29.95	12.66	10.55
10	Ruse	34.06	34.07	36.31	41.27	2.08	34.44	1.48	24.62	15.00	12.38
11	Burgas	47.02	45.02	50.88	57.17	1.21	32.40	1.07	27.07	15.47	12.89
12	Varna	49.69	49.16	49.60	56.86	1.12	29.40	1.19	29.66	17.52	13.94
13	Vratsa	52.15	48.49	49.74	63.32	0.86	12.12	1.36	19.01	11.81	9.04
14	Razgrad	50.65	47.68	58.16	57.20	1.02	24.36	1.35	26.50	13.49	11.24
15	Lovech	68.76	73.20	76.42	-	2.95	36.48	5.12	118.51	43.28	-
16	Veliko Tarnovo	77.18	92.80	110.26	86.47	1.12	29.40	1.11	29.23	6.23	9.78
17	Yambol	-	48.14	63.79	70.56	-	-	1.27	25.49	12.79	11.21
18	Loznitsa	-	70.31	76.18	-	-	-	2.81	51.41	41.23	-
19	Samokov	56.38	-	-	-	1.04	16.56	-	-	-	-
20	"NPP Kozloduy"	21.85	22.92	25.00	29.16	-	-	-	-		-
21	TEGE 21 Stamboliyski	75.3	-	91.32	120.83[2)]	-	-	-	-	-	-

1) The officially announced prices are defined on a monthly basis and have been recalculated in annual cross-section

2) Prices dated 1 January 2006; 3). Since 1 January 2006 energy price was changed to 133.64 BGN/MWh

The licensed companies used to approach the residents directly and submit quotations about the HCAs and TRVs and the owners of flats in the buildings then could chose among these offers at a specially organized general assembly. All the radiators in a given building should be equipped with HCAs of one and the same type. The majority of the companies offered these devices under delayed payment terms. Generally, two types of HCAs were offered: electronic type and evaporation type. The former are characterized by higher accuracy, however they are more expansive and have a limited life cycle of the battery (about 10 years). The evaporation type HCAs are simpler and cheaper devices and were the type preferred by the majority of households, however there is no published data as to how many units of each of the two types of HCAs have been installed. Although full compliance with the law did not meet the deadline for installation of HCAs, compliance in mid-2003 stood at 90 percent. Noncompliance penalties foreseen in the law have not been enforced.

It is again at general assemblies of the residents of district heated multifamily building that people used to decide in compliance with the provisions of the Energy Act what percentage of the heat consumption read on the heat meter in the substation to be allocated for covering energy losses in the building and its common parts. This percentage may vary between 10 and 30% and is payable by all the owners of flats pro rata depending on their apartment floor space, irrespective of whether they use the district heating service or not. According to data from Ministry of Economy and Energy about 80% of district-heated buildings have chosen the 15%. The remaining quantity to the total of 100% from the quantity of heat energy consumed in the building as per the readings of the heat meter in the substation is then distributed among the households depending on the readings of the HCAs. This mechanism of distribution/allocation of heat energy consumption is one of the methods applied for reduction of the bills of customers using the DH service for the expense of those, who have resigned from the service, however still live in the same district heated building. An objective that might be suspected to be at the root of this approach might be to prevent the formation of excessively high bills that lead to customers' resigning from the service. At the same time, however, prerequisites are created that make unreasonable the practice of resigning from the service at the background of having TRVs installed, which permit individual regulation of heat consumption. From the point of view of those who have resigned from the service, however, this manner of distribution appears inequitable and it is highly probable the quite a large portion of the accumulated overdue customers' payments to the DHCs to be the result of unpaid bills of such resigned customers. Data about the collection rate of the DHCs is not made public.

The first year after installation of the HCA's each household decided how many cubic meters it will heat in the upcoming heating season. A calculation was made by the district heating company to determine how much heat that would involve at the individual apartment level for the respective month, when the energy consumption for the entire building for the same month as read by the heat meter at the substation is taken into account. It is on this basis that the monthly bills for the individual households used to be prepared. At the end of the heating season, officials of the heat accounting company visit the respective flats to determine how much heat was actually used. At that point, the heat accounting company visit the respective flats to determine and the household sign a document certifying actual heat consumption. The certification is intended to reduce future disputes and corruption. Depending on whether the actual consumption is above or below the predetermined level, an equalizing payment is effected between the customer and the DHC.

During the second year after the installation of HCAs, monthly bills were calculated on the basis of the distribution/allocation of the consumed heat among the individual consumers during the preceding season and the energy consumption during the specific month of the entire building as per the readings of the heat meter in the substation. Since 2004, the DH companies provide their customers the option to pay for their heat consumption at equal monthly instalments instead of the heavy burden of such payments during the winter season. Re-calculation of the monthly instalments for the next heating season is performed by the DH company and is communicated to the customers together with the annual equalizing bill for the preceding year, usually on 1 August of each year.

Grave problems in the formation of the bills emerged in Sofia, especially during the last heating season, to the labour intensiveness of this billing and collection mechanism. They were related above all to the shortage of human capacity in the companies to service such a big quantity of customers, which led to numerous claims, repeated calculation of the bills of some companies. As a result, the bills of many consumers could not be recalculated on time and they could not receive the correction on their annual bills within the announced deadlines.

Individual meters for domestic hot water have been mandatory for two years and are now nearly universal, with every apartment equipped with low-cost household volumetric meters in the bathroom. The water company also meters the building via a meter in the basement. There is, at most, a 10 to 12 percent discrepancy between the master meter and the sum of the individual apartment meters, with the utility's meter taking precedence and the difference being split between the householders. The few households that did not comply with the law now have to pay a fixed rate that is much higher than a typical water bill, so there is a strong economic incentive to comply.

According to a study by EU SAVE II , an average of 14 percent energy savings was recorded over the 1999-2000 heating season in the 1,320 apartments in one Sofia district that had the HCAs and TRVs installed. The financial benefits of investing to install HCAs and TRVs on all radiators in Bulgaria, assuming that installations will generate average savings of 12 percent, are presented below.[4]

Table 29. Financial Returns From Installation of HCAs and TRVs

Investment	Payback Period	Net Present Value	Internal Rate of Return
BGL (000s)	Years	BGL (000s)	%
54,000	2.5	109,610	39.6

Source: Philips, M. A Regional Review of Social Safety Net Approaches In Support of Energy Sector Reform. Appendix 3: Energy Reform and Social Protection in Bulgaria, 2003

[4] In Bulgaria there is no production of HCAs, all HCAs are imported, for example from Brunata (Denmark), Techem (Germany), and Siemens (Germany).

7 Social Safety Net Program

7.1 INTRODUCTION

The Target Energy Social Protection of low-income persons was introduced for the first time in 1995 as a mechanism for redistribution of the social burden of the electricity and district heating tariff rises. In 1997, the target social assistance benefit for heating was included in the Regulation on Social Assistance as a type of monthly benefit. In 1998, Regulation for Implementation of the Social Assistance Act (RISAA) was adopted, including different forms of social assistance to low-income persons and families, including assistance for use of energy.

For 1996-1997 heating season the EU provided €20 million for that season and the following season. Starting in 1998-1999, the Ministry of Labor and Social Policy (MLSP) took over responsibility for funding, management and the implementation of the program. The target assistance financial resources are provided from the State Budget. They have been allocated by the MLSP, and distributed directly to the Municipal Social Assistance Office (MSAO). The municipalities used to partially fund the social assistance. Initially the proportion was 50:50 for the national and the local budget. For 2002 the proportion has been changed to 25% from the municipal budget and 75% from the national budget. Since 2003 all social payments are covered from the national budget.

The other forms of social assistance have been assigned as functions of municipalities and thus they have been allocated through the municipal budget. This refers to **incidental** assistance out of typical social assistance (provided by state budget and institutions) based **on municipal budgets**. Regarding the independence of municipal budgets in Bulgaria there are three cases: municipalities receiving subsidies from the state, municipalities remitting part of their incomes to the state budget, and municipalities not receiving or transferring from/to the state budget.

7.2 BUDGET EXPENDITURES FOR TARGETED ENERGY ASSISTANCE

The targeted social assistance benefits for heating is needed due to the liberalization of energy tariffs as an objective of the state policy, hence the targeted energy social protection has been funded from the national budget. The government takes the responsibility for the social burden of undertaken measures and for provision of financial resources for the functioning of the respective social assistance mechanisms.

To summarize, there are two different forms of support to the heat sector:

- *social heat assistance* – a special support for low income people for heating needs; and
- *subsidies* – support to DHCs to keep the heat price lower, so the beneficiaries are all customers, not only low income.

After 1998 the relative share of target social assistance benefits for heating in the total expenditures of social assistance has decreased, while the absolute amount has been increasing consistently. This trend could be explained by the fact that for 26 months (from

January 1999 to February 2001) the amount of the guaranteed minimal income, as a base for calculation of the social (heat) assistance, was frozen to the level of BGN 37,30. In the same period the number of unemployed and disabled people receiving social (heat) assistance increased (Table 31). The second explanation could be that the access to social assistance for energy initially depended only on the incomes of the beneficiary. In 1997 other criteria for receiving monthly social assistance were introduced: lack of movable and unmovable property, savings and other assets which could be a source of additional income; active job seeking and readiness to enter the labour market.

Table 30. Targeted energy assistance expenditures (1995-2001)

	1995/ 1996	1996/ 1997	1997/ 1998	1998/ 1999	1999/ 2000	2000/ 2001	2001/ 2002	2002/ 2003
Million BGN	0,05	1,2	42,6	59,7	59,9	74,8	92,3	110,6
Exchange rate BGN/USD at end of year	N.A	N.A	1,78	1,68	1,95	2,10	2,22	1,88
Million USD	N.A	N.A	23,98	35,64	30,77	35,59	41,59	58,67
% of total social assistance expenditures	1,3	16,1	42,0	46,4	30,9	27,0	30,8	32,3
% of GDP	0,01	0,16	0,24	0,27	0,25	0,28	0,31	0,35

The share of expenditures for target energy social assistance in the GDP has been increasing in the last three years. In 2001 it was already three times higher than the respective figure for the year 1997. Despite the positive dynamics, the share of targeted social assistance benefits for heating in the GDP remains insignificant - 0,35% for 2003. Even after the planned increase in budget resources and the changes introduced in the mechanism for assistance, the target benefits for the poorest people will remain under 0,5% of GDP, i.e. significantly lower than the expected income from VAT as a result of the increased energy tariffs.

Table 31. Target social assistance benefits for heating expenditures and the number of case

Heating Season	Expenditures (Million BGN)		Number of participating persons and families (Number of cases)	
	Bulgaria	Of which - Sofia	Bulgaria	Of which - Sofia
1998-1999	59.7	2.772	575,858	28,392
1999-2000	59.2	2.330	599,926	25,944
2000-2001	74.8	3.132	614,229	26,832
2001-2002	92.3	4.248	621,983	30,270

Table 32. Main regulatory changes on targeted energy assistance (1995-2001)

Year	Monthly assistance rates	Preferences for groups at risk	Method of assistance
1995	Differentiation by seasons and size of the house. Heating standards for Electricity, DH and Solid fuels consumers – the BGL equivalent of: • For a single-room flat -- 560 kWh of electricity • (390 day time + 170 night time energy) • For a double-room flat -- 840 kWh of electricity 590 day time + 250 night time)	Higher energy consumption standard for pensioners, disabled persons and children	Cash
1996	Differentiation by seasons and type of heating. • Heating standards – the BGL equivalent of: 560 kWh of electricity for electricity consumers (390 day time + 170 night time) – For district heating consumers: 0,7 Gcal of heat • For solid fuels consumers: two tons of locally produced briquettes for six months	None	In-kind
1997	Heating standards – the BGN equivalent of: • For electricity consumers - 400 kWh of electricity (280 day time + 120 night time) • For district heating consumers: 0,7 Gcal of electricity • For solid fuels consumers: 2 tons locally produced briquettes for six months	Higher coefficient of DMI for children	In-kind
1998 and 1999	Heating standards for Electricity, DH and Solid fuels consumers– the BGN equivalent of: Electricity 430 kWh (280 day time + 150 night)	Higher coefficient of DMI for children	Cash
2000	Heating standards for Electricity, DH and Solid fuels consumers – the BGN equivalent of 430 kWh of electricity (280 day time + 150 night time energy)	Higher coefficient of DMI for children	Cash (in-kind for households connected to DH)
2001	Heating standards for Electricity, DH and Solid fuels consumers– the BGN equivalent of 450 kWh of electricity (300 day time + 150 night time energy)	Higher coefficient of DMI for children, elderly (over 70) and persons with over 90% disability	Cash (in-kind for households connected to DH)
2002 to now	Heating standards– the BGN equivalent of: • For electricity and DH consumers: 450 kWh of electricity (300 day time + 150 night time energy) • For solid fuels consumers: 1,2 ton briquettes	Higher coefficient of DMI for children, elderly and disabled, or a family with 2 over 70% disabled	Cash for electricity; in-kind for DH; Vouchers for consumers of solid fuels

7.3 MECHANISMS FOR TARGETED ENERGY ASSISTANCE

This section describes mechanisms in the period from 1995 through 2001. The income threshold that gives the right to assistance depends on the differentiated minimum income (DMI) of the respective family and on the energy consumption standards. Table 32 shows several major changes adopted with the purpose to adjust the line to the level of income of the above listed groups in risk, so that the most vulnerable (children, elderly, disabled) shall be covered to the greatest extent by the assistance. The regulatory changes for the use of energy benefits have also affected the amount of the benefits.

In the first years (1995-1996), the energy consumption standards were differentiated according to the size of household premises. In defining the access of households with children, single pensioners and disabled, the formula used the higher energy consumption standard regardless of the size of premises. After 1996, a new rate was adopted necessary for heating the minimal necessary living area and for other elementary energy needs. In 1997, the target social assistance benefits for heating were granted only for the heating period from 1 November to 30 April. In 1999 the period was cut down till 15 April, and since the year 2000 it has been defined to five months – from 1 November to 31 March. After 1997 the access of households with children was extended by increasing the coefficient of calculation of the differentiated minimum income (in calculating the income line, each child up to 18 year old participates with a coefficient 1,5 instead of the previous 0,9). Since 2001, the preferential ratio has been applied to single elderly over 70 year old and to disabled with over 90% disability.

The effect of the preferential coefficient for extending the access of the respective categories of persons and households is especially favourable on households with three and more children who are entitled to access if both parents work and their income is close to the average for the country – around BGN 290 in 2001. As a result of this regulatory change, the share of children in the total structure of beneficiaries increased from 18% in 1997 to 28% in the last years. This is a positive effect of targeting the program on social assistance for energy.

Throughout most of the eight-year period of application of the target protection system, the amount of the benefits was calculated as a difference between the real income and the protected minimum income line (except for the heating season 1997/1998). This calculation method differentiates the amount of the benefit from 0 to the maximum rate, depending on household income. Thus the sharp confrontation was avoided between households whose income is a bit above the income line and households with income a little below the income line.

Since the year 2000, an exclusion from the principle of differentiation of the social benefits is applied to households connected to district heating. These people receive the maximum amount of the energy consumption standard (if it does not exceed the real costs) and the benefit is transferred directly to the district heating company. This exclusion seems to be justified, first because of the range of problems that the heating supply system faces due to the their poor financial situation, and second, because of the small number of beneficiaries – the DH-connected low income households (some 25-26 thousand households, or around 4% of the total number of assisted people).

In the period 1997-2001, the average amount of the benefit per household was 50-60% of the maximum energy consumption standard for the respective year. Compared to 1997, the real amount of the benefit increased by more than 10% as a result of two consecutive increases of the rate: from 400 kWh to 430 kWh in 1998, and to 450 kWh in 2001. These changes have been undertaken with a dual purpose - to increase the amount of the target social assistance benefits for heating and to increase the level of protected income. Thus, the scope of the system is being adjusted to the increasing social burden of energy tariff, the latter becoming a problem not only for the most poor, but also for an increasing number of persons with regular income sources, including pensioners, working people with low income, etc.

7.4 CHANGES IN 2002 IN THE MECHANISM FOR TARGETED ENERGY ASSISTANCE

The increase in the electricity tariff in force from July 2002 and the amendments of the RISAA adopted by the Council of Ministers at the beginning of August 2001 have introduced the following major changes in the mechanisms for target social assistance benefits for heating for use of electricity, district heating and fuels.

General condition for receiving energy (heat) assistance:
Throughout the heating season of 2002 – 2003 (from November until March), households whose income for the previous month was below the sum of the differentiated minimum income (DMI) and the BGN equivalent of 450 kWh electricity (300 kWh day-time consumption and 150 kWh night-time), were entitled to a monthly benefit for electricity, district heating or solid fuels for heating purposes.

Electricity consumption
The value of the consumption standard for heating with electricity, which determines the amount of the target benefit for households, increased by 21,5%. As for households using electricity for heating purposes, the actual amount of the assistance will increase by 40% compared to the previous season, when the assistance was differentiated pursuant to household income and its average amount equalled about half of the consumption standard.

District heating
For the households connected to district heating, (the heat price increased by 10% from July 2002), the assistance was increased by twice higher percentage. The targeted social assistance benefits for heating contribute to the solvent demand for the services of district heating companies, respectively guarantee of income that will contribute to their financial stabilization.

Differentiation by the income of assisted families has been eliminated in 2002-2003 heating season. Persons and households who use electricity and district heating for heating purposes, and whose income for the previous month was lower than the threshold set in accordance with the coefficients given in RISAA (art.9, para.3 and art.15, para.4), were entitled in 2002-2003 to maximum monthly assistance of BGN 45,38 (24.14 USD at the exchange rate on 31 December 2002 of 1USD = 1.88 BGN), but no higher than the real consumption reported by the meters. The total amount of target energy assistance is transferred to the corresponding District Heating Company. The funds for the social aid are distributed by the Municipal Social Aid Services.

The equal amount of the assistance leads to extremely sharp confrontation between households below and above the protected income line. Many of those who are "not eligible" but their incomes are close to the income line, could also be considered to belong to groups in poverty risk.

Solid fuels for heating

Persons and families using solid fuels for heating are provided with target social assistance benefits for heating for solid fuel whose amount is equal to the BGN equivalent of 1,2 ton briquettes for the overall heating season. For heating season 2002 -2003 equivalent of 1,2 ton briquettes was set at BGN 150. Persons and families using solid fuels for heating (coal or wood) were provided with a voucher on the amount of 150 BGN, which they will use to pay the fuel of the company supplier. For every heating season the amount of the assistance is set in an Order issued by the Minister of Labour and Social Policy and the Minister of Energy and Energy Resources and promulgated in the State Gazette. Data about newer heating seasons is summarized in the Table 35 below.

Until the end of 2002, the Municipal Social Assistance Office transferred to the company supplier only 20% of the money due for the delivered fuel. The remaining 80% of the money were transferred to the end of April 2003. This created some problems since the companies did not like to accept vouchers to supply fuel.

Theoretically, in the cases where distribution network is not well developed or there are difficulties of supplying solid fuels, as an exception, by the decision of the head of the municipal social assistance the solid fuels for heating could be provided in cash.
In-kind assistance and the preliminary supply of briquettes for the whole heating season against vouchers poses some risks of legal breaches of supply and reselling of received fuel. Another possible risk is that households using a combined method of heating (electricity and solid fuel) could prefer to declare only the electricity as a heating method because the amount of this rate is higher.

7.5 SOCIAL SAFETY NET IN THE LAST FOUR HEATING SEASONS

Provision of social protection by means of allocation of special purpose social aid from the budget apart from the application of two-block tariffs for electricity and heat, special purpose aid from the state budget was allocated as an additional measure for energy protection. The size of the aid in the different years during the period 2000-2004 and the forecast for 2005 is presented in Table 33.

Table 33. Special purpose social aid during the period 2000-2004

Year	2000	2001	2002	2003	2004	2005
Special purpose aid - million BGN	61	79	86	111	110	115

These actions are combined with flexible measures ensuring the protection of low-income customers. These actions can be specifically described as follows:

- A two-block increasing electricity and heat tariff systems for households was introduced;

- Annual increase of the second block of the price;
- The first block price was maintained at the level of April 2002;
- A two-tier tariff was introduced - heat energy charge (leva/MWh) and capacity charge (leva/m^3).

Preferential tariffs for the first 125 kWh of the total consumption of electricity

A universal protection has been introduced for all consumers through preferential tariffs for the first 125 kWh of the total consumption of electricity:

- up to 75 kWh/month day-time electricity for all consumers - all the year round at the price of 2001;
- up to 50 kWh/month night-time electricity for not connected to district heating dwellings for the heating period at the price of 2001;
- up to 125 kWh/month day-time electricity for not connected to district heating with one-tariff meters for the heating period at the price of 2001.

Similar preferential tariff were introduced for DH. It is described in the Heat tariff section of this report.

Maintaining the lower tariff for lower consumption is equivalent to the establishment of a social tariff. Consumers who are able to limit their electricity consumption and stay within the social tariff block are paying below-market rates and must, thus, be cross-subsidized by consumers who use more electricity and pay the higher tariff. This measure could be considered as a form of redistribution of the social effect of the increased tariffs between high-income groups, who are expected to consume more energy and will pay more quantity on the new price, but this pricing mechanism gives the cheap first block electricity to both poor and rich people.

The World Bank has reservations about such a tariff because it believes the tariff doesn't target the poor very well, but the Bank did not oppose it. However, the Bank considered the social tariff to be a temporary measure that will be abolished once the overall price adjustments are completed in the 2004-2005 timeframe, which, however, is not a fact as yet and the block-tariffs are still applied. Since 1 November only the block tariff for up to 50 kWh/month night time electricity for not connected to district heating dwellings.

There is disagreement about whether low-income households are hard hit by the tariff increase. The Confederation of Independent Trade Unions (CITU) claims that most low-income households will have difficulty keeping their daytime consumption within the 75 KWh/month and 50 KWh/month limits because just using a standard electric cooker consumes 81 KWh/month. 250 kWh/month is a very low threshold. Some low-income households may be able to keep their consumption below this level, but it is difficult to do for most of them.

The social tariff and the residential tariff in electricity generally were cross-subsidized by the industrial sector tariff during the pricing reform. That is, the tariff charged to industrial users is higher than the cost of supplying electricity to them; the higher price then allows the electricity companies to lower the prices charged to residential users, while still charging enough to cover companies' total costs.

Social assistance for heating in the last for heating seasons
The volume of the total amount of social assistance for heating in the last four heating seasons is presented in Table 34.

Table 34. Social safety net in Bulgaria, number of people assisted, total amount for assistance

Heating season	Number	Thousands BGN	BGN/HH
2002-2003	710 000	119 573	168
2003-2004	550 000	100 265	182
2004-2005	523 000	102 195	195
2005-2006	429 588	83 481	194

Sources:
1. *Ordinance No 5 of the Ministry of Labor and Social Policy on terms and procedure for allocation of social benefits for heating. State Gazette 53/10.07.2003*
2. *Rules on the enforcement of the Social Assistance Act. State Gazette 133/11.11.1998*
3. *Governmental Bulletins*
4. *Ministry of Labour and Social Policy/Social Assistance Agency Press releases*

The number of households, which have taken advantage of the social assistance for heating is decreasing with every subsequent heating season, respectively the total amount of the assistance is diminishing. The ratio of the total amount to the number of people using that assistance reveals the real change in the funds allocated for energy assistance benefits and the trend until the latest heating season shows annual increase. Figure 40 shows the trend in the changes of the number of people using social assistance for space heating and the total amount allocated by the state budget for these needs.

In Table 35 is presented information about the amounts of funds allocated for social assistance for heating in Bulgaria during the four latest heating seasons by types of fuel or energy. The amounts for fuels are paid out as lump sums prior to the beginning of the heating season through granting of vouchers for the purchase of 1.2 t of the respective fuel from local suppliers. The payments for district heat and electricity are remitted on a monthly basis directly to the district heating and electricity distribution companies. The amount of social assistance for heating might cover entirely the annual demand of heating of low-income people, provided they heat only one room or a small two-room flat. Figure 41 illustrates the trend in change of the amount of the assistance benefits by types of fuel.

7.6 VOLUME OF SUBSIDIES

The volume of subsidies and social aid for the period 2000 –2004 and forecast for 2005 ware reported by the MEER in 2005 (Table 36). The average prices values presented in the Table 36 set for 2005 are forecast ones and the subsidies reflect the policies and programs incorporated into the 2005 budget. Since 1 November 2005 subsidies were completely removed from the district heating tariffs.

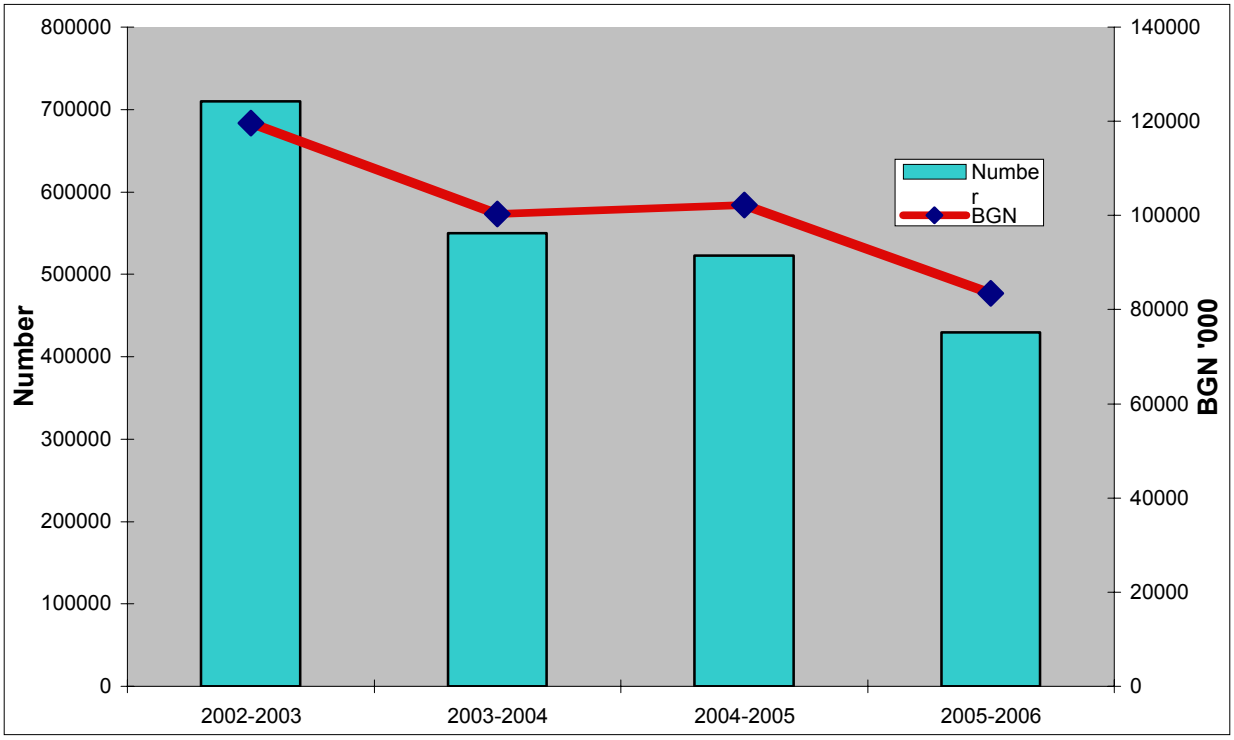


Figure 40. Social assistance for heating in Bulgaria

Table 35. Social assistance for heating in Bulgaria by type of fuel/energy, BGN

Heating season	Wood/coal		Electricity		DH	
	Annual assistance/ person	Annual amount	Monthly assistance /person	Annual amount	Monthly assistance/ person	Annual amount
2002-2003	150	540 000	45.38	135 000	45.38	35 000
2003-2004	150	393 000	52.63	136 000	52.63	21 000
2004-2005	160	383 000	58.45	122 000	58.45	18 000
2005-2006	160	325 918	60.45	89 815	60.45	13 855

Sources:

1. Ordinance No 5 of the Ministry of Labor and Social Policy on terms and procedure for allocation of social benefits for heating. State Gazette 53/10.07.2003

2. Rules on the enforcement of the Social Assistance Act. State Gazette 133/11.11.1998

3. Governmental Bulletins

4. Ministry of Labor and Social Policy / Social Assistance Agency - Press releases

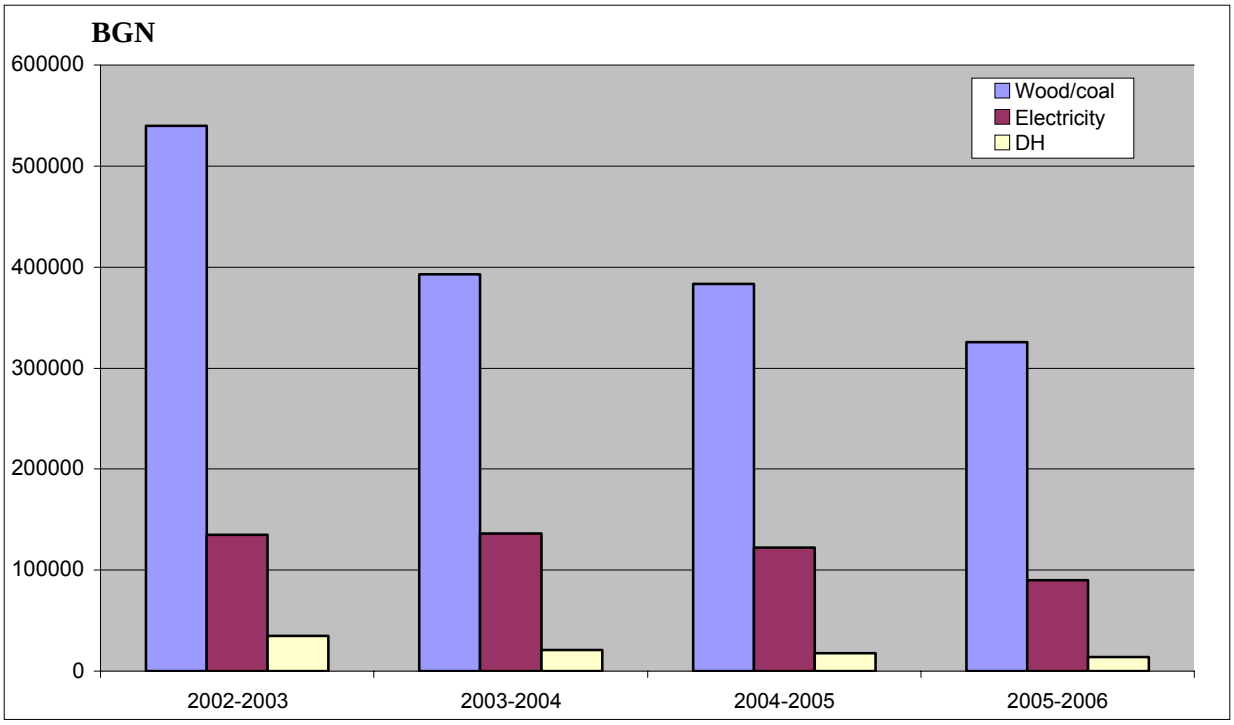


Figure 41. Social assistance for heating in Bulgaria by type of fuel/energy

Table 36. Volume of subsidies and social aid for the period 2000 –2005

Indicators	2000	2001	2002	2003	2004	2005*
Average annual exchange rate, BGN/USD	2.12	2.19	2.08	1.72	1.57	1.6
Subsidies - nominal value	**63.70**	**50.00**	**37.00**	**44.84**	**24.31**	**0**
Subsides adjusted with inflation rate, mil. BGN	57.75	46.55	34.97	43.79	22.90	0
Social aid, mil. BGN	**61.00**	**79.30**	**85.90**	**110.60**	**110.00**	**115.00**
Subsidies adjusted for inflation, million BGN	55.30	73.84	81.19	108.01	103.63	111.00
Average selling price of heat, BGN/MWh	**30.34**	**31.54**	**38.13**	**40.44**	**45.29**	**48.00**
Average selling price of electricity, BGN/MWh	**61.00**	**63.00**	**74.40**	**87.80**	**99.93**	**104.30**
Average annual inflation rate, %/year	**10.30**	**7.40**	**5.80**	**2.40**	**6.15**	**3.60**

**Based on forecast data. Source: Bulgarian Energy Sector 2001-2004*

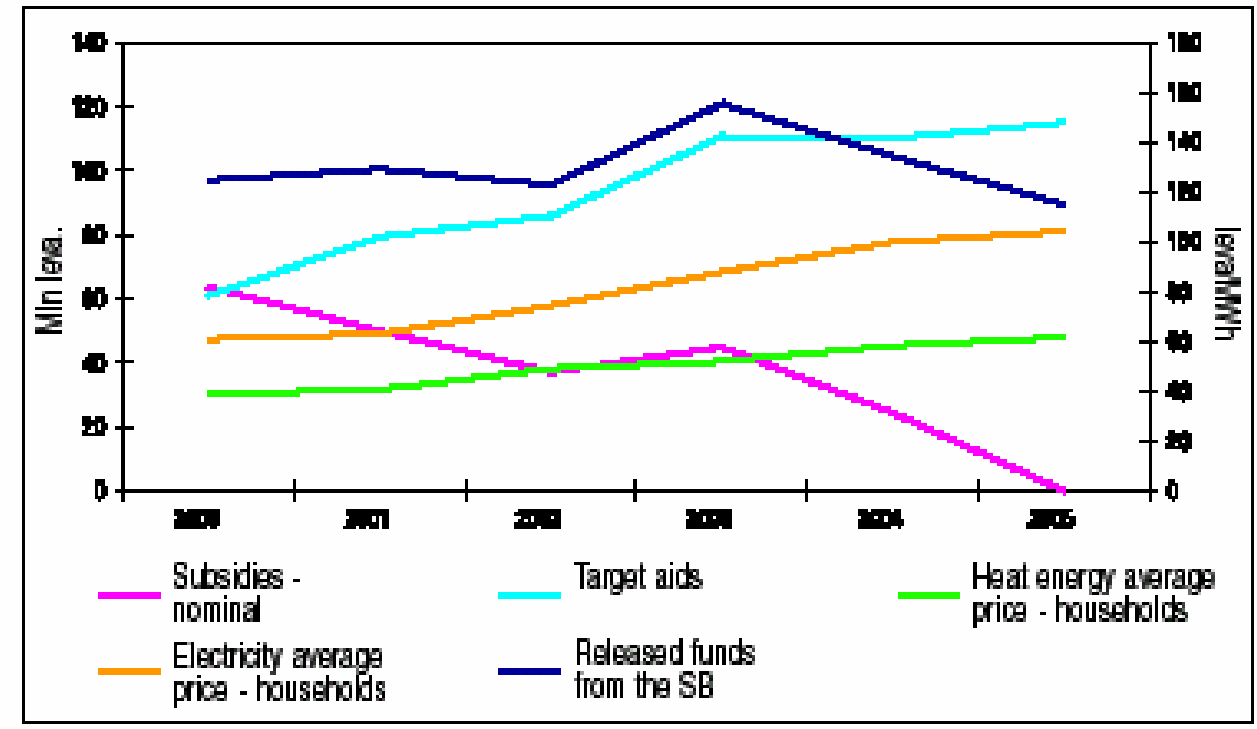


Figure 42. Pricing reform in the energy sector- prices, subsidies, social aid for the period 2000-2004 and forecast for 2005
(Source: Bulgarian Energy Sector 2001-2004)

8 Environmental Requirements and New Technical Standards for District Heating Companies

8.1 Indicators for Quality of Heat Supply

As described above, for the enterprises possessing a license for heat production and transportation SEWRC monitors the compliance specific heat supply quality indicators, with consideration of the costs for primary activity and their impacts on price formation. These indicators are laid down in the SWERC Ordinance concerning the issue of licenses in the energy sector. The indicators for quality of heat supply are divided into three major groups:

Norm requirements for heat quality
The energy enterprise is obliged to supply heat with guaranteed parameters based on the technological specifics of the equipment and the applied regimes of operation of the respective heat transportation network. The values of the guaranteed parameters are determined in the general conditions for sale of heat or in the written contracts with the consumers.

The requirement in the case of steam generation is observation of the regulated steam temperature and pressure. For hot water production the regulated parameters are the maximal winter and summer discharge rates, winter and summer temperature schedules depending on the outdoor temperature, and the negotiated pressures at specific control points of the heat transportation network. At the heat carrier—after the substation in the buildings—the subjects of regulation are: 1) the hot water temperature at the outlet of the heat exchanger for domestic hot water; 2) the maximal deviation of the temperature for all heating loops under rated load in the domestic hot water loop, and in the ventilation loop in the event of instantaneous change in load; and 3) the time span for recovery of the normal temperature deviation. When the substation is the consumer's property, the modernization timeframes are negotiated with him.

Uninterrupted heat supply
To permit for occasional breaks of the heat supply due to a fault of the energy enterprise for a period longer than 1 hour, duly regulated agreed frequency of interruptions per season or per year and the average length of interruptions for one consumer is required. The average annual length of the planned interruptions for one consumer must also be regulated.

Quality of commercial services
These indicators regulate the existence of written rules for implementation of any due work and the deadlines for provision of information, undertaking of measures for repair of errors or omissions, etc. The total number of monitored indices concerning the quality of the service is 17.

On the basis of assessment of all these individual indices the SEWRC calculates under a specific formula the so-called "Summary indicator about the quality of heat supply", which is used for correction of the revenue of the enterprises for the next regulatory period.

8.2 AIR QUALITY PROTECTION

The energy sector faces a major challenge with regard to fulfilling the commitments made following the completed negotiations under the Environmental Chapter No. 22[5]. The main document related to the energy sector is directive 2001/80/EC on the limitation of emissions of certain pollutants from large combustion plants. It is applied for combustion plants with a nominal input thermal power equal to or larger than 50 MW.

The directive implementation will be of significant importance for the improvement of air quality and environmental safety. Thus the country will more than fulfill its commitments under the Goetheborg Protocol with regard to the SO_2 emissions.

In order to comply with the requirements of directive 2001/80/EC it is necessary: to construct desulphurisation plants, replace the current fuel with low-sulphur content fuel, as well as introducing other modern flue-gas desulphurisation technologies. It is necessary

[5] The process of negotiation between EU and Bulgaria for Bulgarian membership in the Union started in year 2000. The EU defined conditions for reforms in different policy sectors described in a document with 31 chapters. Bulgaria is obliged to fulfill the requirements of the EU before accession in the Union. Chapter No.22 is about the environmental policy of the country. More details at: www.evropa.bg

to rehabilitate a number of the plant's electrostatic precipitators in order to limit particles emissions.

To the end of reducing NOx low-nitrogen burners are supposed to be installed. It is expected in 2005 the emissions of nitrogen oxides to rise slightly because of the increasing power generation in TPP Varna and District heating company „Ruse", which are the biggest emitters of nitrogen oxides. Due to the fulfilment of Directive 2001/80/EC requirements, the implementation of different measures for dust emission reduction is expected. A number of projects ensuring the fulfilment of the requirements the directive 2001/80/EC have already been started including a project for installation of a new electrostatic precipitator is in progress in Ruse TPP.

9 Financial Condition and Financing of District Heating Companies

9.1 General Financial State and Profitability of District Heating Companies

In 2004 all the 18 DH companies' financial reports recorded revenue from financing allocated by the government, the amount being some 44% lower than for the previous year. The purpose of these amounts, allocated in the form of subsidies, was to ensure funds for the current activity of the companies to cover the losses caused by the difference between the production cost and the selling prices of heat for consumers from the residential sector.

For the period during which the prices were approved (1 April 2004 to 1 March 2005), the majority of the enterprises reported positive financial results from their activity on their current accounts. Nevertheless, the reported data also contained the amounts of uncovered losses carried over from the activity during preceding years. However, the balance losses for 2004 have gone down by 67% compared to 2003.

The companies, which did not have unsettled losses and could report good rate of return on their equity capital by the end of the calendar year 2004 were as follows: *Toplofikatsiya Sofia* SPJsC, *Toplofikatsiya Plovdiv* SPJsC, *Toplofikatsiya Veliko Tarnovo* SPJsC, *Toplofikatsiya Vratsa* SPJsC, *Toplofikatsiya Pernik* SPJsC, *Toplofikatsiya Gabrovo* SPJsC and *Toplofikatsiya Pravets* SPJsC. The achieved rate of return on equity capital according to the data reported by the companies (with the exception of *Toplofikatsiya Yambol* SPJsC) for the period of implementation of the approved prices (1 April 2004 – 1 March 2005) is summarized in Table 37.

Some basic financial parameters of the DH companies are summarized in Table 36 on the basis of the individual financial reports of each of them, presented in the report on *Regulatory Review of the Companies of the District Heating Sector*, performed jointly by the *District Heating* Division and *Economic Analyses and Contacts with Consumers* Division of SEWRC in September 2005. For 2004 most of the DHCs with the support of the subsidies has a profit. Only for the DHC Sliven and DHC Burgas a loss is reported for 2004. For 11 out of 14 DHCs financial data about 2003 is also presented. The trend for 2003-2004 shows

an incease of the profit of the companies, as only in DHC Sofia a lower prforit is reported in 2004 compared to 2003. According to the above mentioned report only the DHC Yambol is on profit for 2004 without the subsidies but concrete values are not available.

Table 37. Summary data about Rate of Return of equity capital ($RR_{eq.c}$) of DH companies

		Real ($RR_{eq.c}$), % for the period (1 April 2004 – 1 March 2005)	($RR_{eq.c}$), % approved by SEWRC for 2004
1	"Toplofikatsiya Sofia" JsC	2,16	7,0
2	"Toplofikatsiya Plovdiv" SJsC	0,52	6,0
3	"Toplofikatsiya Pleven" SJsC	0,56	8,0
4	"Toplofikatsiya Pernik" SJsC	-6,06	8,0
5	"Toplofikatsiya Sliven" SJsC	-3,36	8,0
6	"Toplofikatsiya Kazanlak" SJsC	-1,17	8,0
7	"Toplofikatsiya Gabrovo" SJsC	1,53	8,0
8	"Toplofikatsiya Vratsa" JsC	9,90	8,0
9	"Toplofikatsiya Veliko Tarnovo" SJsC	18,92	8,0
10	"Toplofikatsiya Burgas" SJsC	3,48	8,0
11	"Toplofikatsiya Loznitsa" SJsC	9,31	8,0
12	"Toplofikatsiya Pravetz" SJsC	-5,08	8,0
13	"TEGE-21" Ltd.	0,00	8,0
14	"Toplofikatsiya Ruse" SJsC	-9,32	8,0
15	"Toplofikatsiya Razgrad" SJsC	4,12	8,0
16	"Toplofikatsiya Varna" SJsC	9,34	8,0
17	"Toplofikatsiya Shumen" SJsC	0,75	7,0[6]

Note: *$RR_{eq.c}$ for the DH companies has been calculated using reported data, the real prices for the period and the subsidy allocated in 2004.*

MEER has reported the following data (Figure 43) concerning the level of investments and the increase of the retail prices in the district sector for the period 2000-2004. According to the below given diagram an increase of investments in the district heating sector is observed parallel with some growth in the revenue level as a result of the increase of the price of the DH service (Value effect, from average price rise).

The introduction of preferential prices for co-generation combined with the annual increase of the heat price also ensured resources and prerequisites for commercialisation and increase of the investment potential of the district heating companies and the final phase-

[6] If the value is under the approved RR it is acceptable for the SWERC. If it is above the approved value, SWERC investigates the reason and could sanction this DHC.

out of the centralized subsidizing. Figure 44 shows the average selling price of electricity from co-generation in DHCs, the average selling price of heat to the households and the subsidies to the district heating companies.

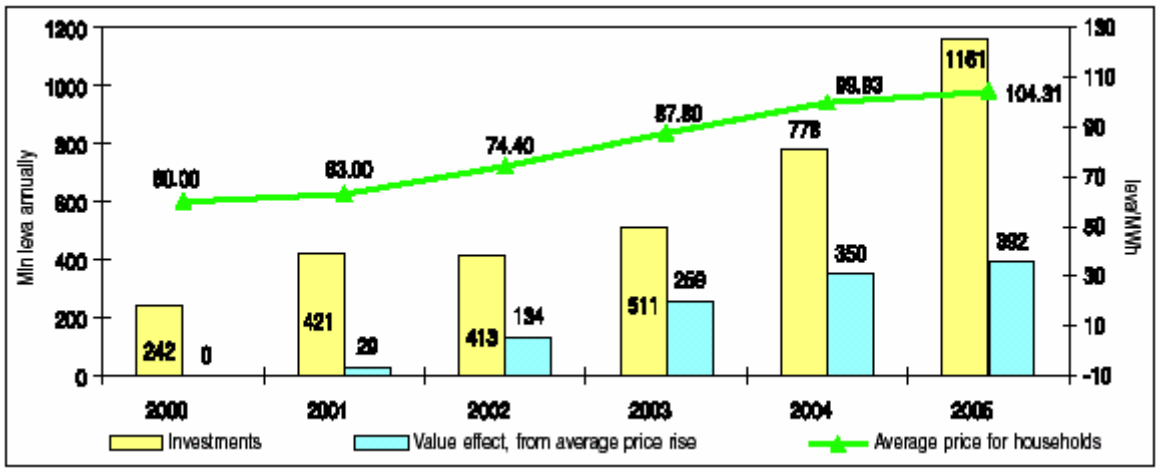


Figure 43. Change of average price by consumers' groups for 2000-2004 and forecast for 2005

(Source: Bulgarian Energy Sector 2001-2004)

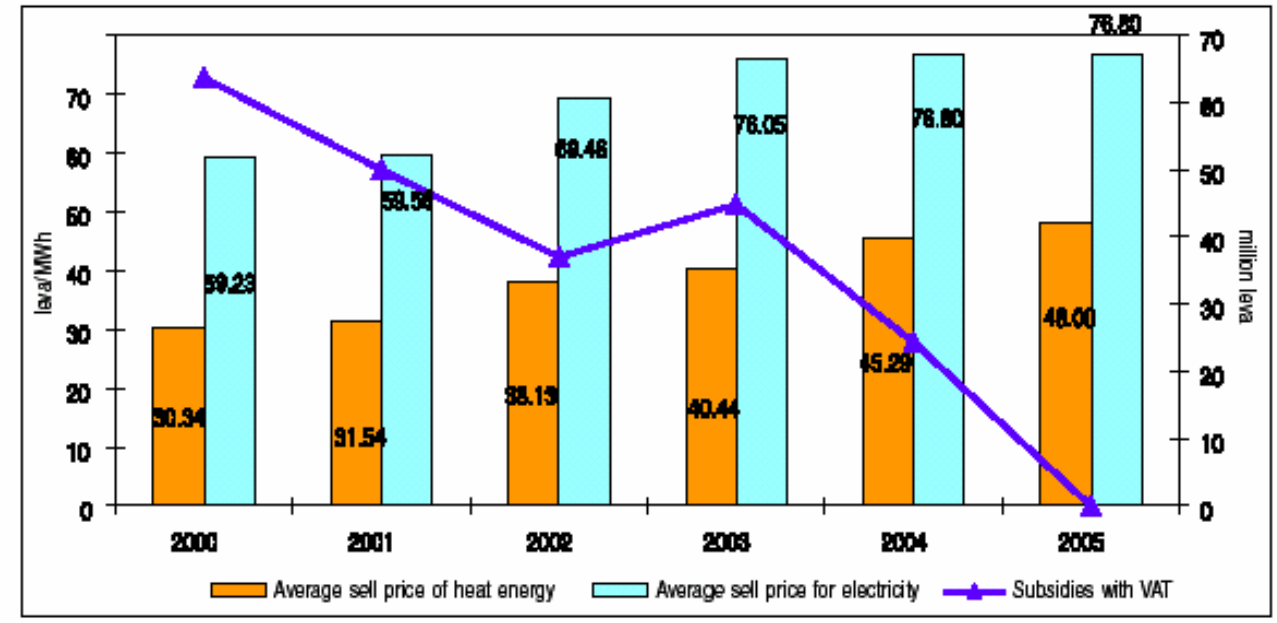


Figure 44. Average sale prices of DHC and trend of subsidies for the period 2000-2005

Source: Bulgarian Energy Sector 2001-2004 (The VAT should be charged to the subsidies. The purpose of subsidies is to keep the heat price lower. The heat price is for the final consumers who pay VAT)

Table 38. Basic financial data about DHC in Bulgaria for 2003 and 2004

Financial parameter	Unit	Year	Financial performance of District Heating Companies of individual cities ("Toplofikatsiya SPJsCs")													
			Sofia	Plov-div	Ple-ven	Shu-men	Varna	Vrat-sa	Per-nik	Sliven	Gab-rovo	Kazan-lak	Bur-gas	Raz-grad	Veliko Tar-novo	Yam-bol
Profit with subsidies and after taxation	1000' *BGN*	2003	3 657	121	488	54	20	238	80	n.a.	36	n.a.	-2384	n.a.	71	66
Profit with subsidies and after taxation	1000' *USD*	2003	2 126	70	284	31	12	138	47	0	21	0	-1 386	0	41	38
Profit with subsidies and after taxation	1000' BGN	2004	2 715	1 515	1 086	255	302	476	280	-847	89	41	-745	101	234	662
Profit with subsidies and after taxation	1000' USD	2004	1 729	965	692	162	192	303	178	-539	57	26	-475	64	149	422
Incomes per 100 BGN expenditures	BGN	2003	n.a.	100,33	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	99,17	85,80	107,38	101,23	109,56
Incomes per 100 BGN expenditures	BGN	2004	n.a.	104,88	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	100,59	95,06	105,33	3,94	2,98
Rate of Return of assets	%	2003	0,76	0,02	n.a.	0,34	0,33	0,52	0,46	n.a.	0,95	n.a.	n.a.	5,52	1,83	24,99
Rate of Return of assets	%	2004	0,52	2,44	4,58	1,61	4,83	3,22	0,47	-3,89	1,48	0,51	n.a.	3,30	4,05	32,21
Rate of Return of incomes form sales	%	2003	2,58	0,43	1,81	0,97	0,51	-1,39	1,00	n.a.	1,48	n.a.	n.a.	7,62	2,48	36,70
Rate of Return of incomes form sales	%	2004	1,01	5,40	5,07	4,91	7,05	7,26	1,27	-6,43	3,01	1,88	n.a.	5,71	5,21	57,97

Average exchange rate BGN/USD for 2003 is 1,72
Average exchange rate BGN/USD for 2004 is 1,57

All DHCs have the opportunity to independently determine the type and size of the necessary investments. The methodology for pricing regulation in district heating sector presented above in details, takes into account the investments planned presented by the DHCs to the SEWRC in the process of price setting. According to the privatization contracts every new owner is obliged to invest a minimum amount for the next three years after privatization

9.2 AVAILABILITY OF AFFORDABLE, ACCESSIBLE FINANCING FOR DISTRICT HEATING SECTOR

Kozloduy International Decommissioning Support Fund

The Kozloduy International Decommissioning Support Fund (KIDSF) is established with the aim to support the Bulgarian government to carry out the necessary reconstruction and modernization activities in the energy sector, to improve the energy efficiency and to overcome the negative consequences from the closure of the first four reactors of the Kozloduy Nuclear Power Plant. For the management of the KIDSF a Framework Agreement was signed in 1999 between the Republic of Bulgaria and the EBRD concerning the KIDSF activities. According to the agreement, the EBRD only administers the KIDSF for and on behalf of the donors of the Fund and this activity is independent of its role as a financial institution supporting investment projects following strict bank rules.

In order to achieve maximum results and to attract more financial resources in addition to the KIDSF, it European Bank for Reconstruction and Development (EBRD) is expected to establish a "financial mechanism" which will support the district heating companies in Bulgaria. Following this mechanism the bank will provide loans to selected priority investment projects, which will improve the financial standing of the district heating companies and their operational stability. To start implementing this mechanism the EBRD will allocate €50 million annually for loans and the KIDSF will allocate € 25 million worth of grants. The required co-funding of the project activities will be between 10% and 20% of the total project cost.

The KIDSF is allocated for particular projects depending on their individual investment characteristics and extend to which they meet the required environmental and health and safety standards. From the end of March 2004, the United Bulgarian Bank (UBB), Bulgarian Post Bank, ProCredit Bank, and UNIONBANK began to launch credits for energy efficiency projects. This is now possible due to the credit line agreements signed with the EBRD on March 16, 2004. The biggest credit line, worth € 15 million, was launched to UBB which has previous experience in financing such projects. Seven years ago, the bank signed an agreement with the USAID for financing companies willing to reduce their electricity expenses. According to the bank's Executive Director Christos Katsanis, credits amounting to USD 9.3 million have been launched under this line for four years. The bank expects that the money provided now by the EBRD and payable in a five-year term will be utilized much faster. A businessman credited for the installation of energy saving technologies in his production may also receive up to 20% of the UBB loan from the European Union free of charge. A five-year credit line, worth € 5 million, will be provided to Bulgarian Post Bank for energy saving credits, a € 10 million one will be launched to ProCredit Bank, and a € 3 million one - to UNIONBANK.

The banks are authorised to take decision which project to finance and what percentage of the project to finance. When a project is completed there is grant for the project-owner. For energy efficiency projects – 7.5% grant over the loan amount. For renewable energy sources projects – 20%.

Loans are provided mainly for SME, but bigger companies can apply as well. The interest rate is set in accordance with the bank crediting policy, the risk of the project and the client. The maturity of the loans is between 3 and 7 years. The general requirement is the loan to be repaid from the savings. The requirements for guarantees/collateral are set by the banks' own policy.

On a later stage similar credit line from KIDSF to 3 new local banks to finance energy efficiency projects in the district heating companies and the public buildings were created. In order to secure investment financing for the projects, apart from the EBRD loans, the heating companies are able to use other funding sources. Additional funding will be sought with regard to the possibilities to sell potential GHG emissions reductions as a result of the project implementation.

In addition to the Bulgarian Energy Strategy, the EBRD will support the financial viability of the companies in the district heating sector through providing funding for the installation of new and the upgrading of old equipment, for the replacement and reconstruction of the supply and distribution networks, etc. Special attention will be given to:

- Enhancing the reliability and safety of the electric and heat production facilities, including rehabilitation of the existing equipment and installation of new highly efficient co-generation modules;
- Extending the operational life of the heat supply networks and reduction of the negative consequences to the environment and the health of the population, including the replacement and construction of new heating pipelines and installation of modern substations.

Bulgarian Energy Efficiency Fund (BgEEF)

The BgEEF was established through the Energy Efficiency Act adopted by the Parliament in February 2004. The initial capitalization of BgEEF is entirely with grant money, its major donors being: the IBRD (the World Bank) with a GEF grant of US$10 million, a grant from the Government of Bulgaria and a grant from the Government of Austria – each one of US$1.8 million.

The main objective of establishing BgEEF is to facilitate energy efficiency investments and promote the development of an EE market in Bulgaria. To this end, BgEEF will support the identification, development, and financing of viable EE projects predominantly implemented by Bulgarian private enterprises and municipalities. These projects shall result in substantial reduction of greenhouse gases (GHGs), which is the main environmental objective of BgEEF as a donor project.

The underlying principle of BgEEF's operations is a public-private partnership. This means that the Fund will pursue an agenda fully supported by the Government of Bulgaria, but it is structured as an independent legal entity, separate from any governmental agency or

institution. The Fund is profit-oriented and will pursue financial sustainability of its own operation. The Fund is managed by a Fund Manager, a consortium of private companies selected through a World Bank tender procedure. The Fund Manager is composed of the Canadian energy efficiency consultancy Econoler, one of the best established experts in Bulgaria in energy efficiency EnEffect and the well-known financial non-banking institution Elana Holding. While the Fund Manager is entirely responsible for the management of the operations and finances of the Fund, the strategic decisions on BgEEF's development are taken by a Management Board, which is composed of representatives of BgEEF's donors.

BgEEF has a combined capacity of a bank, a credit guarantee facility and a consulting company. BgEEF assists technically Bulgarian enterprises and municipalities in developing energy efficiency investment projects and then assists their financing. The Fund will offer the following financial products:

Partial Credit Guarantees: offer financial guarantees of up to USD 500 000 per project to commercial banks conceding credits to EE project developers

Loan Financing: offer credits to EE projects whose cost vary between BGN 30 000 and BGN 3 000 000 (USD 19 000 – USD 1 900 000) at lower-than-market but commercially oriented interest rates.

The financial resources of BgEEF are generally used to finance two types of investments:

A) Investments in improved EE in industrial processes

These include but are not limited to:

1. Purchase of equipment, machines and tools.
2. Technical assistance and advice for proper instalment of the purchased equipment.
3. Training of staff in proper usage of the equipment and new technologies.
4. Improvements to the heat source and distribution system.
5. Rehabilitation of buildings in all sectors, including but not limited to industrial, commercial, multifamily residential, single family residential and municipal buildings at all levels, health care facilities, schools, universities and cultural facilities. The rehabilitation should be directed towards improving EE**,** including but not limited to:
    a) modernizing heat exchanger substations;
    b) heating insulation, including new thermally insulated doors and windows, roof, ceiling and wall insulation;
    c) Solar window treatment and passive solar devices;
    d) Improvements to mechanical heating ventilation and air conditioning such as customized controls and energy management systems, high-efficiency motors, variable-speed drive motor controls;
    e) Improvements to interior and exterior lighting such as retrofitting of existing lamps and ballasts to high efficiency equivalents, addition of automatic lighting controls (i.e. timer or motion sensors); and

***B) New high-efficiency boilers and burners**, including:*

1. Automatic boiler control systems;
2. Separate domestic hot water heaters for summer usage;
3. Substantial efficiency-driven modernization of existing boilers;
4. Boiler heat recovery devices;
5. New heat exchangers or substantial renovation of existing ones;
6. New main valves and steam taps or substantial renovation of existing ones;
7. New distribution piping or radiators;
8. New metering equipment;
9. Thermostatic radiator valves;
10. Pipe insulation in networks;
11. Small cogeneration systems;
12. High efficiency fossil fuel or electric-powered heat pumps;
13. Rehabilitation of municipal facilities (e.g. street lighting);
14. Other energy end-use applications, including but not limited to;
15. Energy management control systems;
16. Power factor correction measures;
17. Air compressors;
18. Fuel switching, excluding to renewable energy resources.

BgEEF doesn't support green-field investments, projects focused on usage of renewable energy resources or expenses not directly related to the achievement of energy efficiency. ;

Principal eligibility criteria:
All EE projects approved and supported by BgEEF should meet the following eligibility criteria:

- At least half of the project's benefits should come from measurable energy savings;
- The project should involve the application of well-proven energy saving technology;
- The project cost should range between BGN 30,000 and BGN 3,000,000;
- The equity contribution of the Project Developer should be at least **10%**;
- The project must have a relatively short payback time **(up to five years).**

Actual financing of projects by the Fund began in January 2006.

Local Banks

Banks in Bulgaria have significantly improved their terms of project financing. Presently, the majority of the banks in the country would be willing to finance cost-effective projects in the DH sector at interest levels of 7-10%.

10 Relative Affordability of District Heat versus Other Heat Sources

The report on *Energy Reform and Social Protection in Bulgaria* contains data about the different types of energy used by the population in Bulgaria in 1997, whereat the population is divided into "poor" and "non poor". This data is shown in Table 39. According to the presented data the majority of the households in Bulgaria used firewood or coal for space heating and even in urban areas that mode of heating used to be very widely spread. Sofia stands out as a major exception, since many households were supplied by district heat. It is worth noting, also, that one-third of the households in urban areas other than Sofia are quoted to have used electricity for space heating.

More recent data of this kind are not available, however we may make the following comments concerning the different alternatives, including the most recent alternative – natural gas.

10.1 DISTRICT HEATING

Despite the absolute increase in the prices in district heating, it still remains among the cheapest and most environmentally sound opportunity in densely populated urban areas. Table 40 offers a comparison between the energy prices under different space heating alternatives. To this end, however, district heating should be provided by modern, flexible and cost-effective systems, which is far from the current state of affairs in the system. The introduction of individual controls of heat consumption at the end-users and shared heat allocation within the individual buildings has resulted in stabilization of consumption because the people have an opportunity to tailor consumption in their dwelling depending to their financial capacity. The results indicate that there is some reduction of DH heat consumption, while at the same time the MEER reports point out a slowing trend towards subscribers' disconnection from DH service for the period 2001-2004.

Table 39. Type of Energy Used For Heating by Poor/Non-Poor Individuals, 1997

	Sofia		Other Urban		Rural		Total	
	Poor	Non Poor	Poor	Non Poor	Poor	Non Poor	Poor	Non Poor
	%	%	%	%	%	%	%	%
District heating	68.29	71.07	10.75	18.53	0.00	0.0	14.47	19.65
Electricity	11.59	12.30	33.02	44.96	2.61	5.23	18.57	28.73
Wood/Coal	20.12	13.74	55.03	34.91	97.39	94.00	66.38	50.10
Oil	0.00	0.72	0.68	0.99	0.00	0.08	0.33	0.68
Other	0.00	2.17	0.51	0.62	0.00	0.69	0.25	0.84

Source: A Regional Review of Social Safety Net Approaches In Support of Energy Sector Reform Appendix 3: Energy Reform and Social Protection in Bulgaria

In the long-term, an increase of heat consumption may be expected in both the industrial and residential sectors. There are several \ reasons for this. One is that changes are expected in the structure of the GDP through a decreasing share of mining and processing industries, with an increase in the share of services (which have lower energy-intensity). Another is privatisation, which results in the phase-out of inefficient and energy-intensive technologies and manufactures. Also, there is a reduction of energy costs for the purposes of raising the competitiveness of production output, the introduction of measures for heat conservation in compliance with the requirements and purchasing power of the end-users, individual energy control and metering devices, and improvement of the thermal performance characteristics of buildings.

There is a possibility that some flats in a given apartment block might change their mode of space heating from DH to other cheap alternatives, such as wood or coal, and such examples have been observed. In the biggest cities with DH networks, such as Sofia and Plovdiv, these cases are rare, if any. There are several main reasons for this:

1) The inhabitants of these cities are financially better off.
2) In many buildings there are no chimneys or these chimneys are out of use, therefore it would be necessary to construct an improvised chimney by opening holes in the windows/walls and fitting additional pipes, making all investments associated, in addition to the purchase of stoves.
3) The smoke from the stoves will raise serious discontent among the neighbours, who will try to prevent it by any means.
4) The people shall have to allocate space within the boundaries of their property for storage of fuel, which will take living area.
5) The use of fuels is connected with physical effort, indoor air and space pollution, and the heating units and pipes are aesthetically not very attractive.

The next section describes all available heating options by fuels followed by the cost estimates for those heating options.

10.2 NATURAL GAS

Local space heating and direct combustion of natural gas are serious alternatives to centralized district heating, however the development of new gas distribution networks is not competitive as compared to the already constructed district heating networks. The investments for construction of replacement low-pressure gas distribution networks and their maintenance costs exceed the price per unit heat far beyond the costs for the existing district heating networks, provided the latter were upgraded. In addition, the costs for the procurement of the natural-gas-fired appliances and devices are estimated to amount to about BGN 1 500 (about 1000 USD) per flat. The connection fee is between 209 and 888 BGN for the households, depending of the which is the Gas Supply Company and 768 and 2758 BGN for the public (non industrial) customers. As it is presented in Table 40 the energy price of gas is comparable with the price of DH companies.

MEER reports that the total amount of consumers, connected to gas distribution networks has grown from 1525 in the middle of 2002 to 4620 in the end of 2003. The distribution of different consumer groups is as follows:

- Industrial - 307;

- Public - administrative and business - 953;
- Households - 3360.

According to preliminary data by the end of 2004 the number of household consumers was over 4700 and industrial over 1500.

The growth of household consumers in 2004 in comparison with 2003 is 80% and the biggest part of it is a result of new consumers in municipalities where district heating is not available – Stara Zagora, Pazardgik and Sevlievo. Officially, there is no state regulation preventing gas supply in neighborhoods where DH operates, In practice, for example in Sofia till now SWERC gives licenses for gas supply only fro this parts of the city where DH is not available.)

Development of gasification is the strongest in the public sector and industry, where a larger percentage of the potential customers demonstrate preference for that alternative. In industry this is related also to the opportunity to use natural gas in the technological processes, while in the public sector this is a fuel shift involving replacement of the expensive light oil for space heating in the buildings by cheaper, cleaner and environment-friendly natural gas. Gasification in the residential sector proceeds at a slower pace because of the expensive investments and the high price of the fuel. In the residential sector, natural gas is most frequently replaced by heaters running on electricity (electricity has not been subsidized since 2004). The comparative values of electric and gas-fired heating are presented in Table 40.

10.3 ELECTRICITY

Electricity has previously been an acceptable alternative for the subscribers, who have resigned from the services of the district-heating network, because the price of electricity for the residential sector has been subsidized. Despite the higher price of electricity as compared to that of district heating it used to appear an acceptable alternative for many people since electricity allowed precise individual control on consumption and limiting the consumption depending on the purchasing power of the households. With the installation of the thermostatic valves at DH end-users, similar conditions were created for such individual control of DH as well. For that reason in the cities with existing DH networks preference to the use of electricity for space heating is no longer a common practice. In rural areas electricity as a heating option has almost entirely been replaced by solid fuels.

In the very last years air to air heat pumps are becoming more popular for heating purposes in the apartments replacing sometimes DH but still their use is not so much widespread. Using this technology is financially more profitable for the end-users than DH in the periods of the beginning or the end of the heating season when outside temperatures are above 0^{o}C but not in the colder periods.

Electrical heating is almost entirely absent in the public sector and in industry, although it is worth noting that only in the commercial sector (hotels, etc.) it is still used to somewhat higher extent for space heating wherever the alternatives DH and/or natural gas are not available.

10.4 WOOD AND COAL

This continues to be the most popular mode of space heating among households in rural areas. A significant increase wood or coal fired heating has been observed in urban areas in the smaller towns, whereat it has radically ousted the use of electricity and even DH for space heating. However, this trend is not observed in Sofia and the big cities, in which DH networks exist. In the public sector these fuels mainly come to replace light oil.

Table 40. Comparison of prices for available space heating options

	Calorific value	Fuel Price		Energy price
	kWh/kg	Unit	Price	USD/MWh
District heating - Max. Price - Kazanluk				**62.35**
District heating - Min. Price - Ruse				**29.15**
Fire wood				
Stove	2.91	USD/ton	56.89	39.13
Pirolisys boiler	2.91	USD/ton	56.89	23.86
Boiler	2.91	USD/ton	56.89	26.09
Sviloza wooden briquettes				
Stove	5.47	USD/ton	119.76	36.52
Pirolisys boiler	5.47	USD/ton	119.76	26.72
Boiler	5.47	USD/ton	119.76	29.22
Coal briquettes				
Stove	2.50	USD/ton	77.84	51.90
Boiler	2.50	USD/ton	77.84	39.92
Bulgarian coal				
Stove	2.81	USD/ton	83.83	49.80
Boiler	2.81	USD/ton	83.83	38.31
Imported coal				
Stove	6.75	USD/ton	95.81	23.67
Boiler	6.75	USD/ton	95.81	18.21
LPG				
Stove	12.79	USD/ton	1023.95	90.99
Boiler	12.79	USD/ton	1023.95	87.04
Natural gas	13.66	USD/1000 m^3	379.06	44.47

Municipalities and Commercial - MAX				
Natural gas Municipalities and Commercial - MIN price	13.66	USD/1000 m^3	188.56	22.12
Natural gas Residential - MAX. price	13.66	USD/1000 m^3	421.57	49.46
Natural gas Residential - MIN. price	13.66	USD/1000 m^3	222.84	26.14
Natural gas Industrial - MAX. price	13.66	USD/1000 m^3	321.38	37.71
Natural gas Industrial - MIN. price	13.66	USD/1000 m^3	177.64	20.84
Light oil	11.63	USD/ton	859.28	86.92
Heavy oil	11.06	USD/ton	417.96	44.48
Electricity Households	daily tariff over 75 kWh	USD/MWh		105.24
	night tariff	USD/MWh		56.25
	daily : night tariff = 2 : 1	USD/MWh		88.91
Electricity Industry	daily tariff	USD/MWh		91.94
	night tariff	USD/MWh		43.55
	daily : night tariff = 2 : 1	USD/MWh *		75.81

Notes:
The prices are as of November 2005, including V.A.T.
The price of DH heat contains also the capacity charge under the assumption that the capacity demand of a flat is 10 kW and the annual consumption is 20 MWh.
**Only an energy price for electricity, not a fuel price. Units correspond to the last column.*

10.5 OIL

Because of the high price of this fuel, currently it is almost not used in the residential sector. Oil is still used for space heating in the public sector wherever natural gas supply is not available. In the reverse case there is a mass shift to natural gas. It is also notable that in the public sector ever more often a shift to space heating with wood, wooden briquettes or coal is observed, replacing light oil. In this case the trend to fuel shift is less apparent, although financially it is more favourable for the owners, the reason being that many decision-makers view it as a step back in terms of technological development – a wrong interpretation, since the local market currently offers modern and efficient heat production systems for these fuels.

Figure 45 compares different heating options in the residential sector. It is evident from the diagram that the most expensive modes are those involving the use of electricity, light oil and Propane-Butane gas. DH is competitive in prices as compared to natural gas and coal of local origin and more expensive as compared to firewood and imported coal.

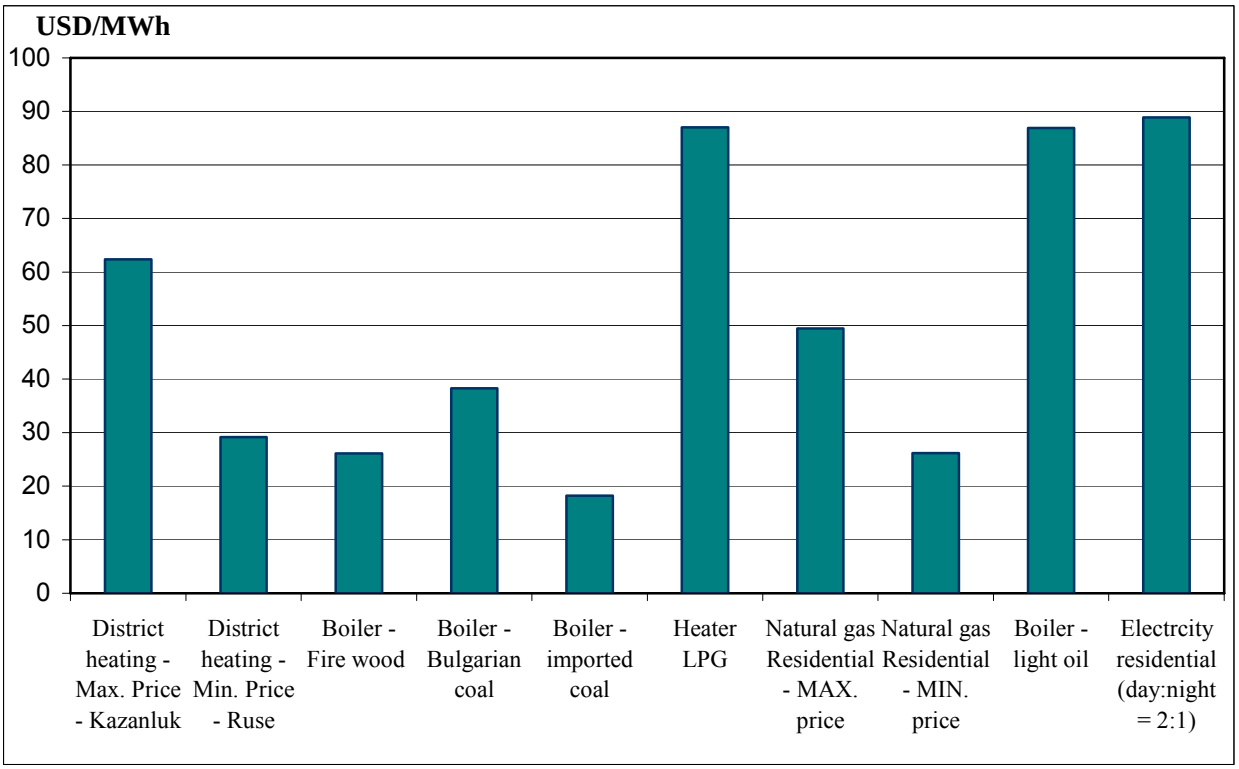


Figure 45. Comparison between the different heating options in the residential sector

10.6 COMMONLY USED HEATING OPTIONS IN MULTI-APARTMENT BUILDINGS

According to data from the last census of the population, housing stock and agricultural farms (2001), published by the National Statistical Institute (NSI), if one plots the number of dwellings vs. the number of buildings in Bulgarian cities, it appears that there are 3 dwellings per building, which does not comply with the definition of multi-apartment buildings. If we assume the definition that this type of buildings are those having minimum three storeys, then the share of multi-apartment buildings in the cities in percentage is some 12.3%. Nearly two-thirds of all the multi-apartment buildings are concentrated in the cities, in which there are DH companies. Among these cities the share of multi-apartment buildings in the total building stock is the highest in Sofia (24.4%), followed by Plovdiv (17.2%), Burgas (16.5%), Varna (14.75), Gabrovo (13.5%) and Veliko Tirnovo (13.0%). Half of the buildings of this type countrywide is concentrated in these cities. Nearly 18.6% of all the multi-apartment buildings in the country are situated in Sofia. Because of the boom of housing construction in the big cities and above all in Sofia, Varna and Burgas during the recent years one may expect that the percentage of multi-apartment buildings in the big cities as compared to the rest of the country has increased even more. The analysis of the NSI data from 2001 shows that in the cities in which there are DH networks the buildings with in-house systems for district heating account for 21.7% of all buildings. Some of the new buildings are designed to be connected to DH, some are not. There is no norm to say what kind of heating should be implemented in a new building. This depends on the

investor's decision but if the investor wants the new building to be connected to DH, this should be negotiated with the DHC.

From the above brief analysis of the building stock, and in view of the data in Table 30 showing that district heating was used by about 70% of people in Sofia and about 13% of those in the other cities with DH networks, one can conclude that district heating is one of the most commonly used space heating option in multi-apartment buildings. According to data from Toplofikacija Sofia SJsC currently 87% of people in Sofia are customers of the DHC.

Without available statistical information or analyses, based on expert's assessments on the subject and direct observations, one may only conclude that the other most characteristic space heating option is the electric one. Natural gas is gradually winning its place, however its share in multi-apartment buildings yet negligent. Local boiler houses are constructed in some of the newest buildings in the biggest cities, which are running predominantly on electricity or natural gas. In Sofia, in particular, quite a large share of the newly constructed buildings is connected to the DH network. In new buildings in cities where DH is available, it is up to the investor whether to connect to the DH network. It is more typical in the smaller cities firewood to be used for space heating, even in multi-apartment buildings using individual stoves

11 Role of Local Government and Different Types of Management in the Provision of Heating

11.1 Impact of Heating on Public Budgets

The impact of the prices of heat energy supplied by the DH systems and those of the alternative heating options on the public budgets may be considered in two ways. On one hand, what is the impact of the subsidization of these prices from the budget through allocation of part of these budgets for retention of the prices at levels below their production costs or through the granting of targeted energy assistance to the low-income strata of the population for their heating costs. On the other hand, public budgets are also influenced by these prices due to the fact that both the state and the municipalities are end-users through the sites, which are their property and whose energy cists are paid from their own budgets.

As already described in this report, until 2005 the prices of heat supplied by the individual DHCs was directly subsidized by the state. The process of liberalizing the energy market deregulating energy prices was performed through a phased reduction of the volume of subsidies for DHCs. Table 41 presents data about the amount of subsidies for the period 2000-2004, as well as about the expenditure portion of the state budget and the GDP of the country for the same period.

As evident from these data, in the year 2000 the subsidies alone in the DH sector accounted for more than 0.5% of the total amount of expenditure of the consolidated state budget and

more than 0.2% of the national GDP. During the period under review the rate of reduction of the volume of subsidies is higher than the rate of macro-economic development of the country. In 2004, the last full year of subsidized heat energy prices, with a 35% increase in the expenditure side of the budget compared to 2000, the level of subsidies dropped by 71.4% compared to expenditures, while at 42% increase of the GDP the subsidies vs. the GDP has dropped down to 0.06% or by 75%. Currently, as from the beginning of the 2005/2006 heating season (since October 2005) the subsidies for heat energy prices have been entirely dismantled. The graph illustrating the impact of energy subsidies on the consolidated state budget is presented on Figure 46.

Table 41. Impact of energy subsidies in district heating in Bulgaria on national budget

Indicators	2000	2001	2002	2003	2004
Energy subsidies - nominal value[1], mil. BGN	63.7	50.0	37.0	44.8	24.3
Expenditures in national budgets[2], mil. BGN	11334	12097	12733	14069	15199
GDP[2], mil. BGN	26753	29709	32335	34547	38008
Average annual exchange rate[2], BGN/USD	2.12	2.19	2.08	1.72	1.57
Energy subsidies - nominal value, mil. USD	30.0	22.9	17.8	26.1	15.5
Expenditures in national budgets, mil. USD	5336	5536	6130	8180	9681
Energy subsidies as percentage of national budget, %	0.56	0.41	0.29	0.32	0.16
GDP, mil. USD	12595	13597	15568	20085	24209
Energy subsidies as percentage of GDP, %	0.24	0.17	0.11	0.13	0.06

Sources:
1. Bulgarian Energy Sector 2001-2004
2. Webpage of Ministry of Finance

An assessment of the impact of prices of heat from different sources on municipal budgets in Bulgaria may be made from the database of the Municipal Energy Efficiency Network EcoEnergy about several cities in which there is a district heating system in operation. The data covers the municipalities of Pleven, Ruse, Gabrovo, Sliven and Varna and their energy costs for the period 1999-2002. The data is presented in Figure 47.

In the five municipalities under review the percentage of DH consumption for the individual years between 1999 and 2002 varies between 35% and 44 % of the total energy consumption of the sites with a distinct upward trend. This increase may be explained by the fact that municipalities usually perform a limited number of fuel deliveries to their sites because of shortage of finances in their budgets and as a rule these supplies are insufficient in quantity for achieving in full the required level of heat comfort in the buildings. The increase in the prices of fuels, and above all in the price of light oil (the most frequently used type of fuel), leads to ever-greater self-imposed limitations in the size of the supplies. In the case of DH supply and in natural gas consumption such dramatic curtailing is not done since the energy is delivered to the sites directly along the respective transportation network.

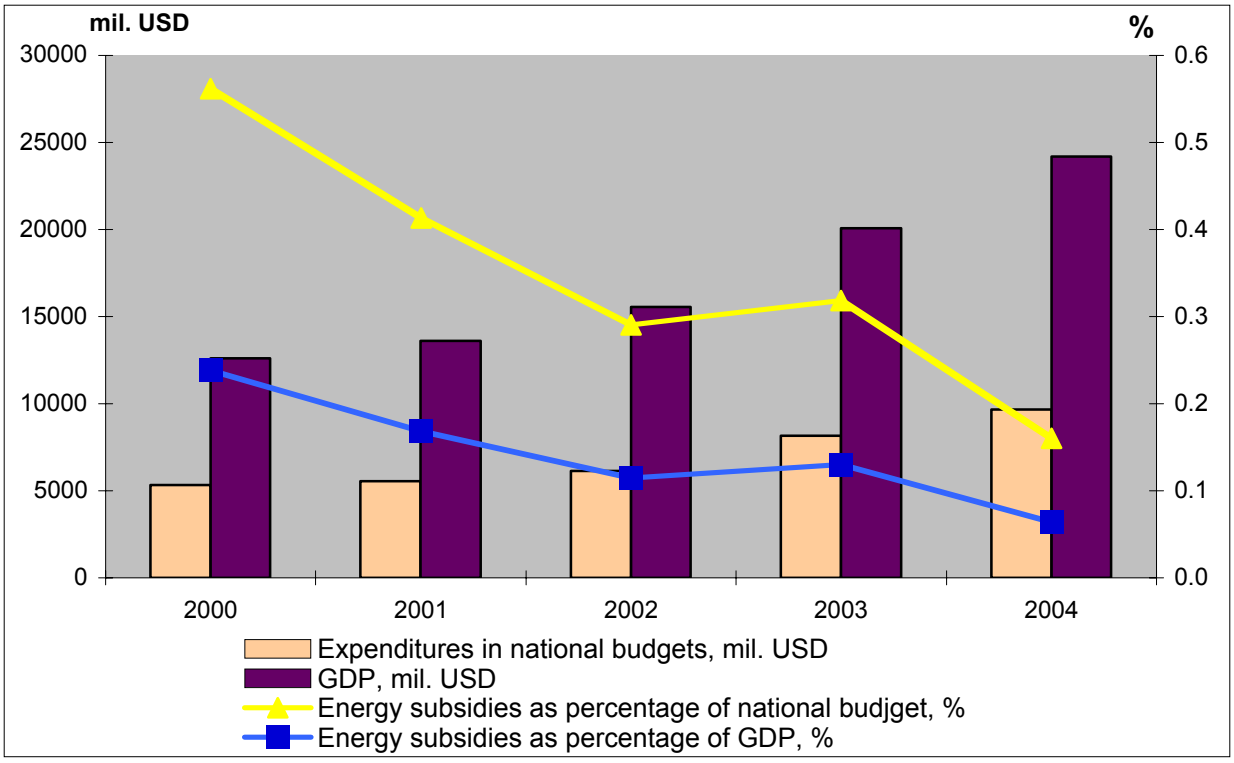


Figure 46. Impact of subsidies in district heating in Bulgaria on national budget

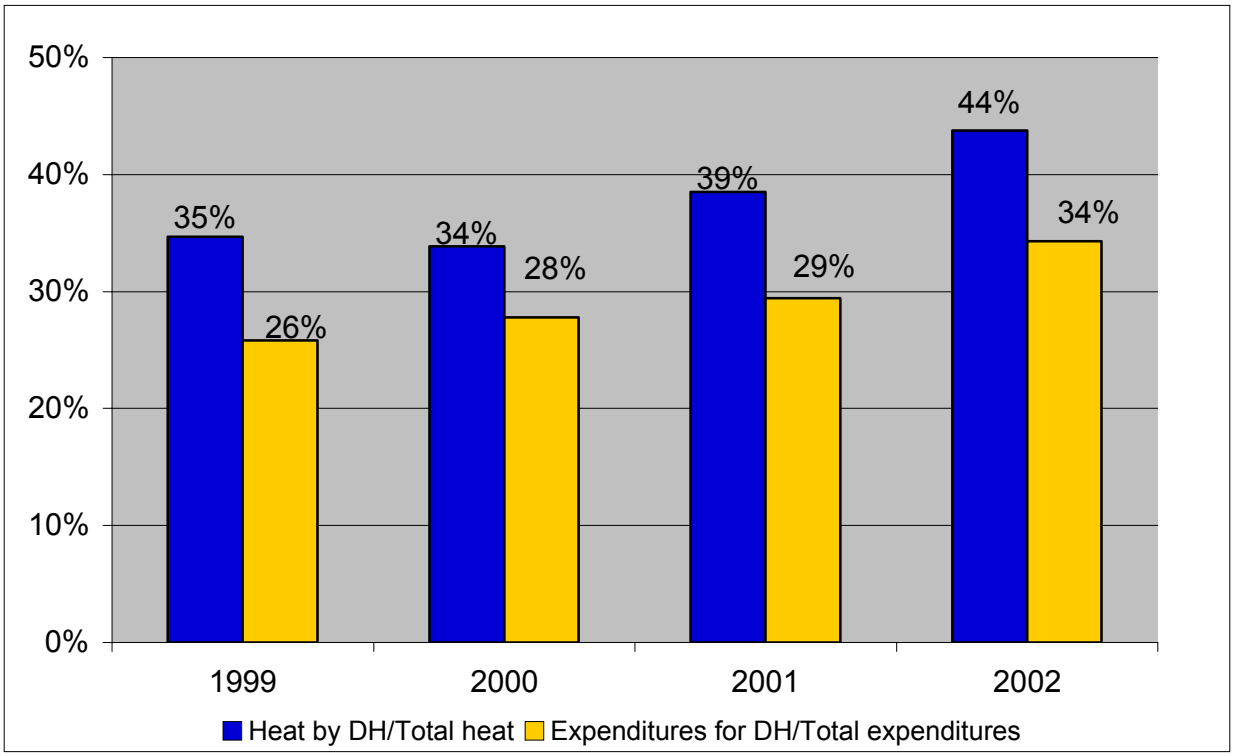


Figure 47. Impact of district heating and other heat sources on municipal budget in Bulgaria

According to data provided by EcoEnergy the energy costs off municipalities in Bulgaria account for some 8%-15% of the total expenditure from municipal budgets. For the five municipalities under review the DH energy costs related to the total energy costs for the period 1999-2002 demonstrate an increase between 26% and 34 %. The percentage values are lower than the energy consumption ratios for a variety of reasons, the major one among them being the lower price of district heat as compared to the most frequently used other energy source options - light oil and electricity. On the other hand, DH billing is posterior as regards the time of consumption as different from the supplies of liquid and solid fuels and therefore provides an opportunity for delay of payments.

11.2 Role of Local Governments in Providing Municipal Services

With respect to the provision of utility services the role of municipalities in Bulgaria is limited mainly to the water supply and sewerage sector, in which numerous municipal companies operate. With regard to urban heating, in Bulgaria there are two DHCs with municipal involvement in their ownership. These are "Toplofikatsiya Sofia" JsC and the public-private "TEGE-21" Ltd. in the city of Stamboliyski. In Sofia the role of the municipality consists mainly in endorsement and approval by the Municipal Council of investment strategy and projects for development and modernization of the plants and the DH transportation network. In the case of "TEGE-21" Ltd. the municipality is partner in the company, its contribution consisting in granting of land for construction of the DH plant and of the right to free-of-charge use of the existing heat transportation network. It holds 41% of the company shares. The rest of the DHCs in the country in general are not municipal property and hence the role of municipalities and their opportunity to influence heat supply is limited mainly to their position of end-user.

11.3 Role of Housing Associations, Private Management Companies and Energy Service Companies (ESCOs) in Heat Supply

In Bulgaria as yet there is almost no practice with respect to the involvement of HOAs and private maintenance companies in the process of EE improvement in multi-apartment buildings. The only involvement of an HOA was a pilot project, titled "Management and maintenance of the housing stock in condominium buildings, Block 10", for rehabilitation of a 60 years old residential block in Sofia. The project was implemented in the *Zakharna Fabrika* Housing Estate through a partnership between the HOA of Block 10, *Zakharna Fabrika* Housing Estate, the Bulgarian Housing Association, Sofia Municipality – *Ilinden* Urban District, and the Dutch housing associations "De Nieuwe Unie" from Rotterdam and "Woondrecht" from Dordreht.

For the implementation of project the residents of the block registered with the Court as a non-profit company – a housing association. The concrete financing scheme, the energy efficiency measures to be implemented and the contractor were all selected by virtue of a decision of the housing association.

The value of the rehabilitation of the building is BGN 104 000. The costs are financed through a loan extended by the Dutch housing associations at 5% annual interest and payoff period of 20 years. The 13 families will pay back the credit at the rate of BGN 25-30 per month in the course of 20 years.

The implemented EE project in the residential building comprises external thermal insulation of the building façades and construction of a new roof (sloped at two gradients), building of an attic floor at 2.20 m minimum height of the rooms. The residents of the block will use the attic premises as dwellings or ateliers, which they previously owned but two additionally created dwellings are now owned by the HOA and let for a rent, which will help them in the repayment of the debt. The roof has been implemented with adequate thermal insulation and waterproofing. Some of residents have additionally replaced for their own account the windows and the internal systems in their flats.

HOA of Block 10 has submitted an application to the DHC in Sofia for alleviation on their DH bills after the rehabilitation of the building. Such a preferential treatment is envisaged in the Energy Act for HOAs, however one year after the date of submission of the application, it has not yet been honoured by the DHC in Sofia.

By the time of drafting of this study monitoring of the project results is underway and for that reason there is no available information about the energy saved and the financial indicators of the project.

Concerning the role of ESCOs in Bulgaria there are a number of companies, both with foreign participation and Bulgarian, which have declared their preparedness to operate under that scheme, and at this stage there are already some random implemented projects either under the energy performance contracting modality or as energy contracting. The projects implemented under the energy contracting modality are usually limited to the level of individual buildings and there is no available information about implemented projects for heat supply of a group of buildings. Some of the very first attempts for implementation of EE projects through energy performance contracting were followed by disputes between the two parties on the subject of payments due to inadequately precise clauses in the contracts. The general conclusion to be made is that the broader development in this field is still forthcoming.

12 Indicators Relaying to Heating in Bulgaria

12.1 Pricing and Subsidies

Tariff for MWh of heat energy

Since 1 November 2005 heat prices and heat installed capacity prices are approved to 16 district heating companies.

- Average heat price – 61.28 BGN/MWh with 20 %VAT included
- Average heat capacity price – 13.06 BGN/kW/year with 20 %VAT included

Tariff as a % of market price: 100% since 1 November 2005.

% heat consumers not receiving heat bills: 0 %

% consumers needing heat subsidies
The total number of DH customers receiving social assistance for heating in the last heating season 2004-2005 is 18 000, which is approximately 2% of all customers of DH.

% of billed fees collected: Average amount of bills not paid by households in Sofia is 543 BGN. (*Source: Web page "Toplofikatsiya-Sofia")*

% of heat end-use paid according to m² of heated space: a small percent, only in the residential sector where heat accounting has not been introduced.

% of heat end-use metered: 100 % metering on substation level in every sector.

% of heating costs in municipal budgets: 8-15 % for different municipalities

% municipal ownership of district heating:
- Toplofikatsiya Sofia SJsC – % to be specified
- "TEGE-21" Ltd, town of Stamboliyski – 41 %
- All other DHC – 0 %

12.2 HEAT SECTOR FINANCING

Total $$ invested in heat sector over past 10 years: 2001-2004 – 252 million BGN

% interest rate for heating projects ESCO financing: 5-10%

% of heat supply by ESCOs: Heat supplied by ESCOs is still very limited. Compared to total heat consumption in the country it should be almost 0%.

12.3 HEAT GENERATION AND DISTRIBUTION

MW installed heat energy generation capacity: Complete information, dated 1997 about all DHC in Bulgaria is presented in Table 2. More updated information is available for DHC in Sofia 5306 MW and DHC in Gabrovo 220 MW.

Number of DH company employees per GWh heat energy produced:
Complete information, dated 1997 about all DHC in Bulgaria is presented in Table 5. The value calculated for DHC of Sofia based on data from 2003 is 0.29 person/GWh heat energy produced and 0.23 people/GWh for total (heat and electricity) produced.

% of heat supplied by CHPs
Heat supplied to the final consumers from DHC with CHP in 2004 is 95.1% of all heat supplied by all 14 DHCs. This is not exactly percentage of heat supplied by CHPs because most of the DHC has not only steam-turbine capacities installed but heating-only boilers as well.

% Average efficiency of generating capacities

- Heat generation – 91.9%
- CHP generation – 68.9%
- Heat generation – 82.5%
- Power generation – 41.9%

Average % losses in distribution systems

- Average hot water distribution losses 2004 – 19.1 %
- Hot water distribution losses in Sofia 2004 – 16.2%
- Average steam distribution losses 2004 – 39.0 %
- Steam distribution losses in Sofia 2004 – 62.5%
- Average heat (hot water + steam) distribution losses 2004 – 19.2 %%
- Sofia heat (hot water + steam) distribution losses 2004 – 16.6 %%

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