Intelligent Energy Europe

TRANS-SOLAR

BULGARIAN NATIONAL REPORT

Sofia Energy Centre

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A. Introduction

1. Overview of the country

The Republic of Bulgaria is located in the south-eastern part of Europe on the Balkan Peninsula. The country borders on Greece and Turkey to the south, the Former Yugoslav Republic of Macedonia and Serbia to the west, Romania to the north and the Black Sea to the east. The country has a population of around 7 640 240 (2007) and covers a territory of 110 912 (km) ^{2}.

Figure 1: Geographical map of Bulgaria (Source http://www.omda.bg/engl/priroda/geogr_bulgaria.html)

1.1. Statistics in brief

Area: 110,910 km²

Land boundaries: 1,808 km

border countries: Greece 494 km, Macedonia 148 km, Romania 608 km, Serbia 318 km, Turkey 240 km

Coastline: 354 km

Climate: temperate; cold, damp winters; hot, dry summers

Terrain: mostly mountains with lowlands in north and southeast

Elevation extremes: lowest point: Black Sea 0 m
highest point: Musala 2,925 m

Population: 7 640 240 (2007)

Capital: Sofia (1 231 622 inhabitants, end of 2005)

Currency: Bulgaria lev (BGN), convertible

1,95583 BGN = EUR 1 (constant)

1,25061 BGN = USD 1 (21.05.2008)

1.2. Meteorology: temperatures, global daily radiation

1.2.1. Climate

The climate is temperate continental with four clearly marked seasons. A Mediterranean influence is felt in the country's southern regions. The average annual temperature is 10.5°C. The average January temperature is around O°C. Average summer temperatures rarely exceed 30°C.
Considering its small area, Bulgaria has an unusually variable and complex climate. The country lies between the strongly contrasting continental and Mediterranean climatic zones. Bulgarian mountains and valleys act as barriers or channels for air masses, causing sharp contrasts in weather over relatively short distances. The continental zone is slightly larger, because continental air masses flow easily into the unobstructed Danube Plain. The continental influence, stronger during the winter, produces abundant snowfall; the Mediterranean influence increases during the summer and produces hot, dry weather. The barrier effect of the Balkan Mountains is felt throughout the country: on the average, northern Bulgaria is about one degree cooler and receives about 192 more millimetres of rain than southern Bulgaria. Because the Black Sea is too small to be a primary influence over much of the country's weather, it only affects the immediate area along its coastline.
Average precipitation in Bulgaria is about 630 millimetres per year. Dobruja in the northeast, the Black Sea coastal area, and parts of the Thracian Plain usually receive less than 500 millimetres. Higher elevations, which receive the most rainfall in the country, may average over 2,540 millimetres per year.

1.2.2. Mountain climate

The mountainous climatic region covers the mountain parts at altitudes above 900-1,000 m. Temperatures decrease with height, whilst snowfalls increase. The snow cover stays for five to six months and is over 1.5 m thick. The average January temperatures on the high mountain peaks reach up to -20°C and are around -5°C in the valleys and ski resorts. Average summer temperatures vary between 14°C and 19°C. There are about 250 sunny days a year.

1.2.3. The coastal climate

The coastal climate is moderated by the Black Sea, but strong winds and violent local storms are frequent during the winter. Winters along the Danube River are bitterly cold, while sheltered valleys opening to the south along the Greek and Turkish borders may be as mild as areas along the Mediterranean or Aegean coasts.

1.2.4. Solar Radiation

Bulgaria receives vast amount of solar energy because of its southern location and comparatively small amount of cloudiness. In Bulgaria the average annual period of sunshine is about 2.100 hours; in some of its regions it may reach 2.500 hours.

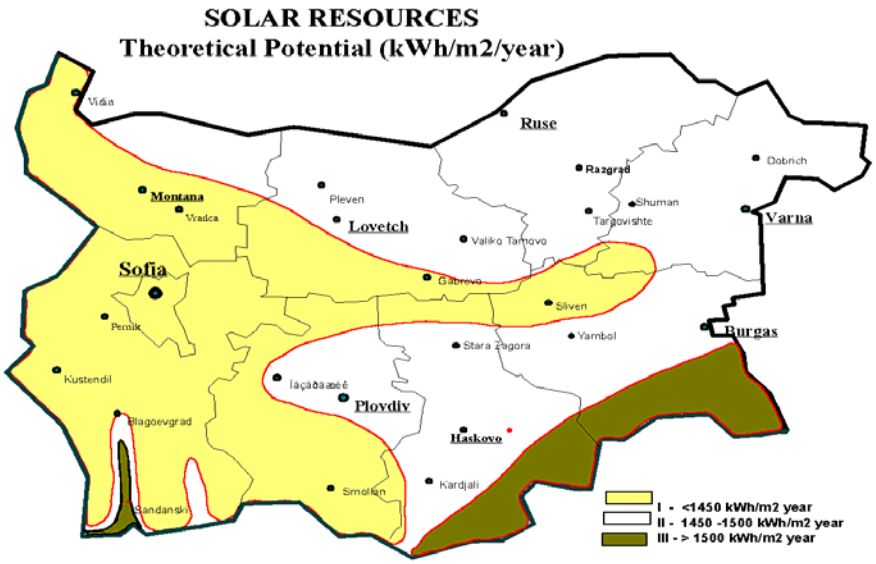

Figure 2: Solar energy zones in Bulgaria (Source: Final Report - Bulgarian Renewables (PHARE BG9307-03-L001)

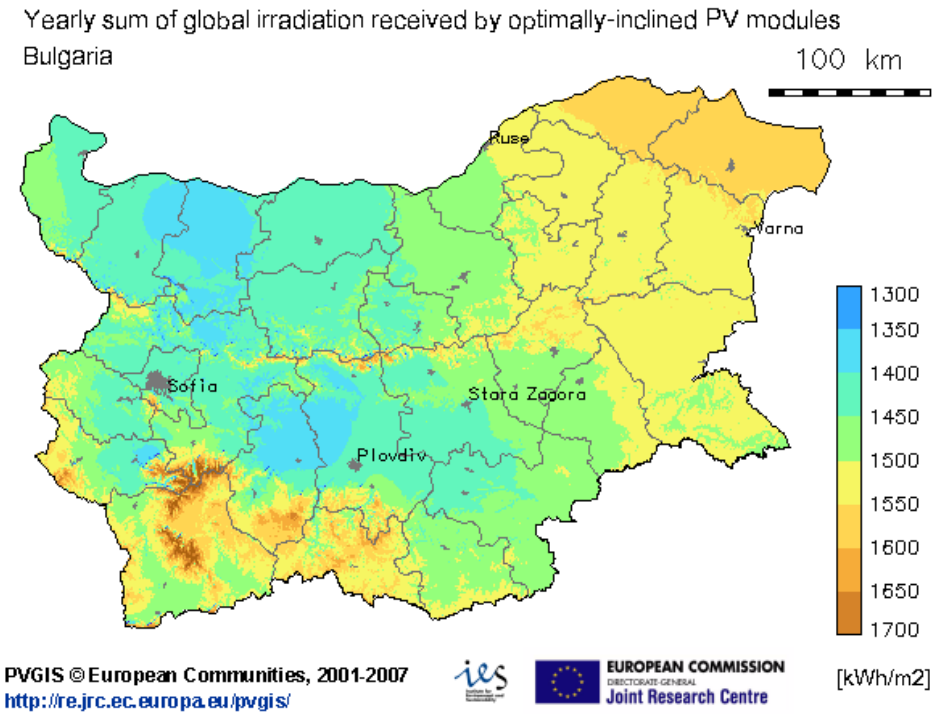

Figure 3: Annual distribution of total solar radiation (Source: http://re.jrc.ec.europa.eu/pvgis)

The solar monthly radiation changes during the year from 41-52 kWh/m² in January till 200-238 kWh/m² in July. Annually, on horizontal surface, for different sites, the total solar radiation varies between 1400 kWh/m² and 1674 kWh/m². This energy is coming mainly during the summer and spring seasons, particularly during the average weather conditions.
Significant for solar systems are not the highest temperatures, but the average summer temperatures.

The average annual temperature in the country is 10.5 °C. In winter, the average temperature in the country is about 0 °C. The lowest temperature is –38.3°C, measured in 1947. The average monthly temperatures for the capital city of Sofia range from –3.7°C in December to 28.2°C in August.
The geographical location of Bulgaria makes the country suitable for solar energy utilization. Over 80% of the territory of Bulgaria is suitable for utilization of solar energy.
In Bulgaria, the average annual period of sunshine is about 2 100 hours. In some of its regions it may reach 2 500 hours.
Solar thermal potential in Bulgaria:

- The average solar radiation is 1517 kWh/m² (1410-1600 kWh/m²);
- The average annual period of sunshine is 2150 hours (2100-2500 hours);
- The total theoretical potential of the country is about $13x10^3$ ktoe;
- The utilizable annual potential is about 390 ktoe. (4535 GWh).

For the region of Bulgaria the selective and non-selective solar thermal installations can produce hot water with temperature T>60°C for the period of four months – from June to September, with T>50°C – from the end of April until October and with T>40°C for a period of more than 9 months.

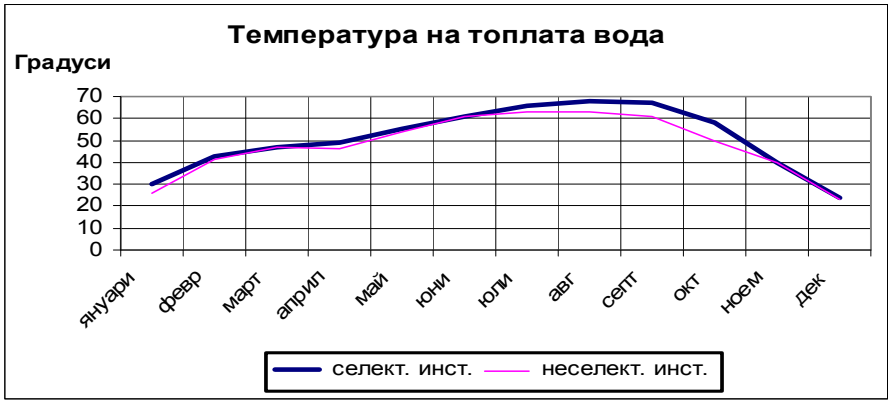

Figure 4: Temperature of the produced hot water by months for selective and non-selective installation. (Source: Solmed II Project (NNE5/2002/86) "Domestic hot water from the Sun")

1.3. Relief

The relief of Bulgaria is quite varied. Characteristic for the relief is the alteration from North to South of lands with plain to hilly relief, mountainous, low land and high mountainous relief. According to the altitude the territory of the country is divided into five zones with different characteristics:

► **Low land** */0-200 m altitude./*, which covers 31,5% of the territory of the country. It encompasses parts of the Danube plain, the High Thracian lowland, the Burgas lowland, the Black see coast and others.

► **Plain to hilly** */200-600 m altitude./*, which covers the biggest part of the country – 41% and encompasses parts of the Danube plain, the plains around the mountains and others.

► **Low mountainous** */600-1000 m altitude./*, which covers 15,2% of the territory. Included in it are big parts of the Balkan Mountain and parts of other mountains.

► **Mid mountainous** */1000 – 1600 m altitude./*, covering 9,8% of the country territory. It covers parts of the Balkan mountain and other mountains.

► **High mountainous** */above 1600 m altitude/*, covering only 2,5% of the territory. Included in it are the highest parts of the Bulgarian mountains.

About 2/3 of the territory of the country are in the lowland and plain to hilly zone. The average altitude for the country is 470 m. In general, the altitude decreases from South to North and from West to East.

1.4. Population: evolution for the last 10 years, actual situation and forecast

The population of Bulgaria at the end of 2007 was 7 640 240 people. The following table shows the development of the population from 1996, the density of population and the natural increase.

Table 1: Demographic indicators of Bulgaria (Source: Statistical reference book 2007. Bulgarian National Statistical Institute)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Population as of 31.12 x10^3	8283.2	8230.4	8190.9	8149.5	7891.1	7845.8	7801.3	7761.0	7718.7	7679.3
Population density /km²	74.6	74.2	73.8	73.4	71.1	70.7	70.3	69.9	69.5	69.3
Natural increase‰	-7.0	- 6.4	- 4.8	- 5.1	- 5.6	- 5.8	- 5.7	-5.2	-5.4	-5.1

The tendency is for further reductions in the population.

1.5. Additional available statistics

Table 2: Main macroeconomic indicators (Source: Statistical reference book 2007. Bulgarian National Statistical Institute)

	2000	2001	2002	2003	2004	2005	2006
GDP at current prices/ mil. €	13,679	15,190	16,533	17,594	19,569	21,448	25,100
GDP per capita in €	1,674	1,919	2,101	2,249	2,515	2,771	
Total household income per capita in €	804,8	812,4	1014,9	1088,5	1174.9	1234.7	
Household income per capita (1995 = 100)	78,0	73,3	86,6	90,7	92.2	92.3	

1.6. Statistic data of energy consumption, dependency energy imports, price evolution, forecast energy consumption, CO_2 emissions

1.6.1. Primary energy consumption (PEC) in Bulgaria for the period 2000 – 2005

Table 3: Quantities of fuels and energies in PEC (Source: Statistical reference book 2007. Bulgarian National Statistical Institute

	year	2000	2001	2002	2003	2004	2005
Coal and other fuels	ktoe	6759	7266	6570	7365	7873	8267
Oil	ktoe	4220	4092	4473	4653	4899	5156
Natural gas	ktoe	2932	2738	2404	2500	2644	2814
Nuclear	ktoe	4925	5277	5463	4594	4475	4251
Hydro	ktoe	230	149	189	255	256	189
El. energy (export)	ktoe	-397	-595	-541	-472	-505	-480
Timber, etc	ktoe	558	543	647	709	801	834
PEC	ktoe	19227	19470	19205	19604	20441	21030

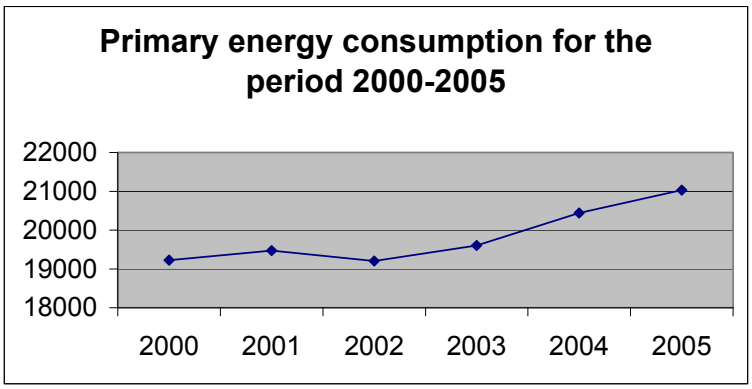

Figure 5: Primary energy consumption (Source: Statistical reference book 2007. Bulgarian National Statistical Institute

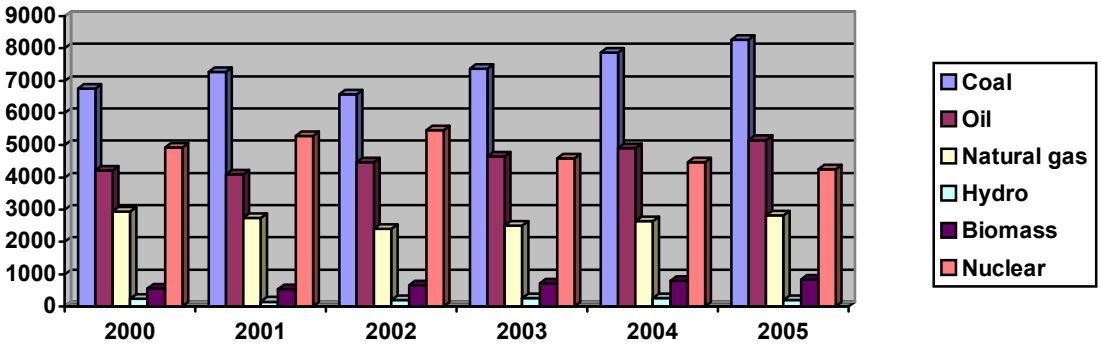

Figure 6: Fuel and energy in PEC for the period 2000 – 2005 (Source: Statistical reference book 2007. Bulgarian National Statistical Institute

Table 4: Final energy consumption (FEC) in Bulgaria for the period 2000 – 2005 for energy needs (Source: Statistical reference book 2007. Bulgarian National Statistical Institute

	Year	2000	2001	2002	2003	2004	2005
Liquid fuels	ktoe	3007	3114	3184	3468	3651	3843
Natural gas	ktoe	937	778	741	814	869	943
Coal	ktoe	986	936	1028	1127	1199	1252
El. energy	ktoe	2075	2110	2067	2153	2208	2270
Heat	ktoe	876	935	859	911	951	986
Timber	ktoe	555	541	642	706	801	834
Total	ktoe	8435	8414	8521	9179	9678	10127

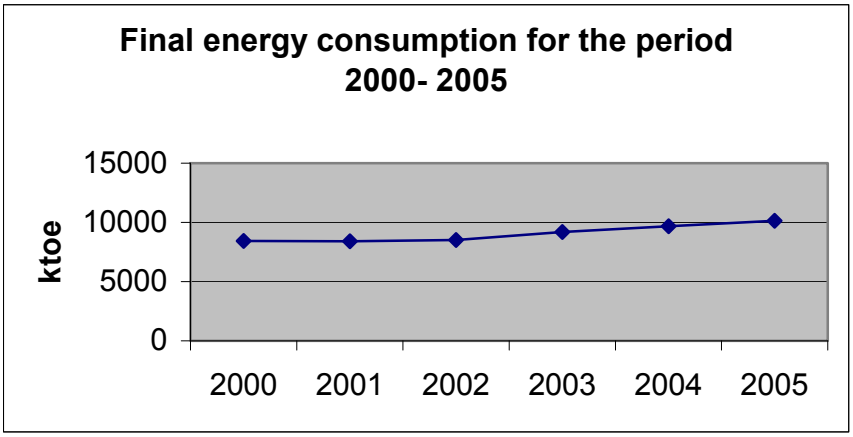

Figure 7: Final energy consumption (Source: Statistical reference book 2007. Bulgarian National Statistical Institute

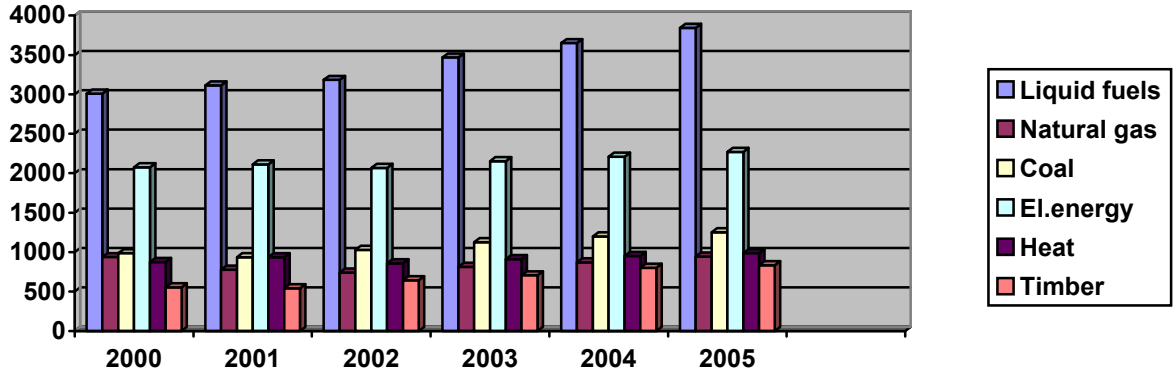

Figure 8: Fuels and energy in FEC for the period 2000 – 2005 (Source: Statistical reference book 2007. Bulgarian National Statistical Institute)

Bulgaria is heavily dependent on energy as it imports more than 70% of its primary energy sources. The only significant domestic energy source is low-quality lignite coal with high content of sulphur, some hydro potential and RES. Bulgaria is mainly reliant on energy sources from Russia: oil, natural gas, high-quality coal and nuclear fuel. This structure of the energy balance causes concern in terms of the energy supply security . The European Union, whose dependence on imports is less (about 50%, but with a trend towards increasing this share up to 70% in 20 years' time), is making strenuous efforts in two key areas:

- Reduction in energy use per GDP; and
- Utilization of local renewable energy sources (RES).

1.6.2. CO_2 emissions

The following figure shows the historical development, the present condition and a prognosis is made for CO_2 emissions by sectors – end users until 2015. After 2001 the sectors of "Transport" and "Industry" are the main sources of CO_2 emissions as this situation is very likely to remain for the next ten years.

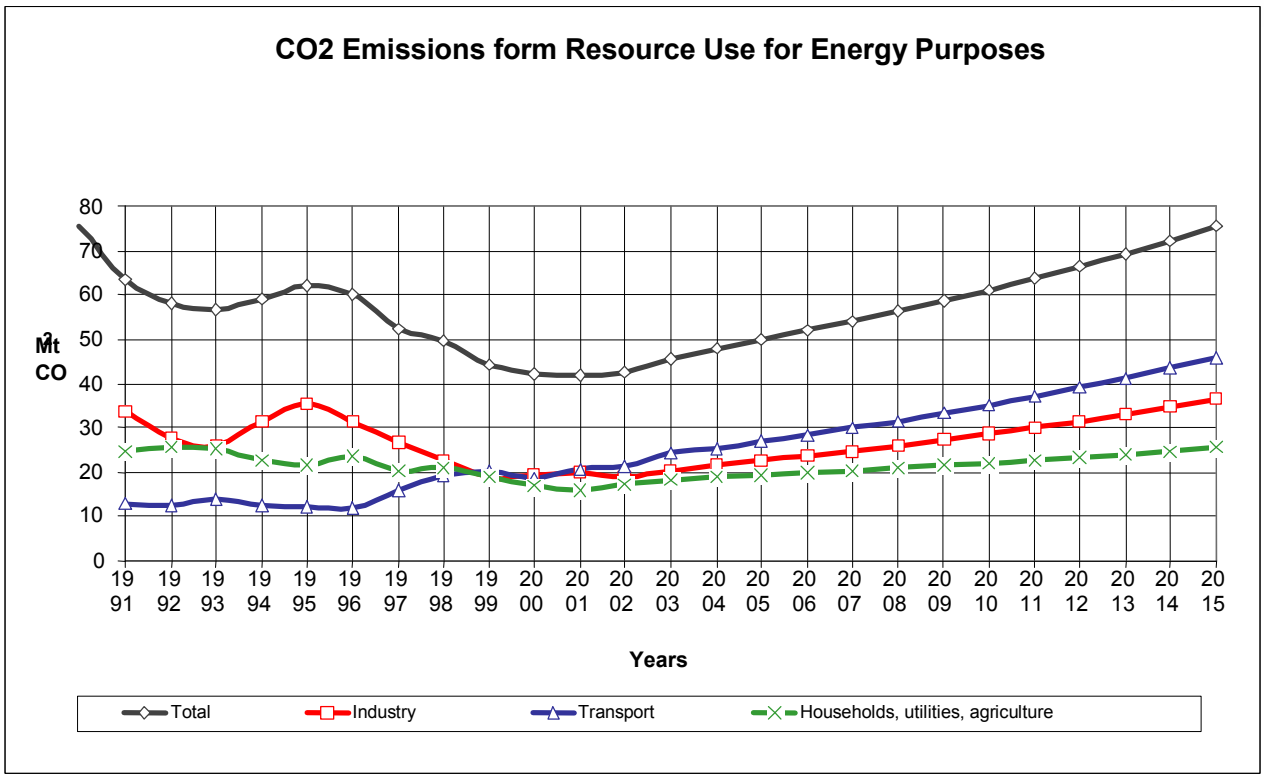

Figure 9: CO_2 Emissions from different economic sectors (Source: Annual Greenhouse Gas Emission Inventory 2007, Institute for Energy, Bulgaria

B. State of the Market

2. Overview of the market situation

Bulgaria was the leader in Eastern Europe in design and production of solar thermal installations. The first Bulgarian solar thermal collectors have been panel type radiators with an area of 2 m²; the next step in design was the flat plate collectors with areas of 1,46 and 1,76 m² . The first Bulgarian solar collector was designed and produced in 1977. The state enterprise “New Energy Sources” (NES) was in a position to solve technical problems related to research, design, testing, manufacturing and assembling of solar thermal installations. NES implemented a large–scale governmental program for designing, manufacturing and installing 50 000 m² solar collectors. These collectors were installed during 1977 – 1990, mainly in the tourist facilities for hot water supply at the Black sea coast. Solar collectors were also applied in industry for DHW and for drying agricultural products.
From 1990-2000, different solar thermal demo projects (e.g. within the Phare program) were implemented after which the market of solar thermal systems started to grow, with an annual average of 5 000 m² SC installed.

2.1. Problems encountered

Arbeitsgemeinschaft ERNEUERBARE ENERGIE – AEE, supported by the Austrian Ministry of Environment and Youth, implemented in 1998 – 99 the project “Statistic evaluation and analysis of large scale Bulgaria solar installations”. The report explains in detail the situation of large–scale solar installations in three regions of Bulgaria – Burgas, Plovdiv and Sofia. Detailed surveys were done reviewing the condition of the various elements of solar collectors and installations. The main conclusions are very characteristic and significant for the solar thermal installations market in the country and also review the main factors influencing it.

- The installation of 50 000 m² solar collectors for the period 1977- 90 was made in the framework of a governmental program and was financed by the government, local authorities, etc.
- This policy was not related with the market penetration of solar thermal installations for households, small hotels, etc.
- The low energy prices for fuel and electricity at that time and high costs for solar energy discouraged the use of solar collectors.
- Since 1990, Bulgaria is in transition and major part of the tourism facilities and industrial enterprises have been privatised or are undergoing this procedure. This is one of the reasons for poor maintenance, leading to the present bad state of the installations.
- 54% of the installations in the tourist facilities are still operational, but for the industrial sector only 8%.
- Major parts of the existing installations require repair. The main problems include the corrosion of steel collector surrounding and the absorber coatings, lack of frost protection, and broken glasses.

2.2. Reasons of success or failure

For the last 15 years many development and demonstration programs have been implemented, which covered practically all-renewable energy sources, including solar thermal ones.
However, the low quality of the equipment and the installations made in Bulgaria, and the lack of maintenance in many of the early installations resulted in dissatisfaction, creating for a moment an additional barrier to further solar energy utilization.
R&D activities, manufacturing and installation almost stopped since 1990 because of economic transformation and the resulting difficult economic situation.

It should be mentioned, however, that in the transition period the price of the main energy source utilized for obtaining of DHW in the tertiary sector, in the service sector and in some industrial sectors - electrical energy – has increased significantly. This led to a change in the psychology of the population and to a change in its attitude toward RES, including a demand for utilization of solar energy.

2.3. Demonstration projects of high visibility

Solar Thermal System for NEK Holiday Home (Primorsko):

- Description: Solar installation for DHW built in 2003 on a horizontal terrace with inclination of 45° and straight south orientation. Approximate distance between the collector array and the technical premise is 18 m
- Collectors
  - Manufacturer: Ezinc, Turkey; Vacuumsol, Czech Rep.
    Type: flat aluminum vacuum
    Surface: 84,60 m² 56,39 m²
  - Storage tanks: Number: 2 7 x 1,5
    Total volume: 1,0 m³ 10,5 m³
  - Hot water consumption: 14 000 litres per day
  - Auxiliary hot water heating: electricity

Figure 10: The collectors in NEK Holiday Home in Primorsko (Source: EIE EAST GSR Project 05/208/S12.420214

2.4. Factors which affected the market during the last few years

There is a gradual growth of the installations in the last few years as a result of several factors:
- Rapid increase of tourist facilities and necessity of DHW;
- Increase of energy prices and therefore the price of hot water;
- Increased income of the population.

2.5. Description of the present situation

The market for solar thermal systems in Bulgaria is starting to develop at a good rate. Of great importance at this still early stage in this market, are correct and professionally done planning, implementation and maintenance.
The majority of installed solar collectors during the last years in public buildings and in industrial enterprises are implemented under different programs, as was mentioned above. The annual market of solar collectors for household systems is not big. A big part (90%) of the sales of solar systems belongs to those who build new houses or new private hotels.
Expert estimations show that in 2005 in Bulgaria there were 56 000 m² SC. The actual expected installation of SC is 5000 m²/year by 2010 and 8000 m²/year by 2015. So in reality it is expected in 2010 for Bulgaria to have 80 000 m² SC and in 2015 to have 120 000 m² SC installed. Statistical data for the market of solar thermal systems is not available. Estimation of the market development of SC is done by reviewing the respective sectors.

The technologies applied for solar thermal energy conversion are the same as the ones applied in other European countries.
The solar thermal installations, implemented under different programs, were mainly for:

- Hot water in public buildings (hospitals, kindergartens, etc.), in domestic and tourist sectors;
- Solar dryers in the wood processing and agricultural products industries.

The following main clients in the collective sector are distinguished now:

- Hotels, holiday houses, camping, swimming pools;
- State and municipality buildings (hospitals, kindergartens, social houses, elderly people's homes, etc.);
- Multi-storied buildings (mainly in new buildings);
- Industry – for wood processing and agricultural products.

It should be mentioned that during the last years there are a lot of solar installation projects for hot water in hotels and private houses, mainly along the Black sea coast and in the mountain areas. The data for them is difficult to be obtained due to the private initiatives of their installation process. There is no statistic data for the solar thermal systems built during the last years.
Concerning the installation of solar collectors in state and municipal buildings, in the period until 1990 a certain number of them have been installed under a state programme. From 1990 to 2002 many demonstration projects (under different European programmes) have been executed. Now with the new opportunities under the structural funds it is expected that such installations will increase.

Concerning the building of collective solar installations in existing multi-storied buildings it should be noted that in Bulgaria the apartments in a block of flats are privately owned and belong to different people. Furthermore, with the existing DHW system, building collective solar systems in many cases is accompanied by difficult decisions, arising from the structure already in place. In Sofia there is such a system in the Panel residential block 25 in "Levski" B district. The collective solar system is build with funding from "Techem-Services" as a pilot project. The system was calculated for all 73 flats. Due to some miscalculations and large pipe system, the generated DHW was not enough for all of them, so entrances C and G were disconnected from the system. For this reason now the solar system supplies DHW only for entrances A and B.
Building collective solar systems in new blocks of flats is expedient because the investor of the building includes the respective part of the solar system in the price of the individual apartments. In addition, the building and solar system are planned simultaneously and the most expedient decisions are made.
Up to now solar systems in industrial buildings for the needs of DHW are limited. From the answers of the questionnaire made under the current project 7 of the 19 firms which participated state that they have made installations in industrial enterprises and in agricultural and processing enterprises.

2.6. Import / export figures

In Bulgaria there are a few firms producing solar collectors, both flat plate and vacuum tube. However most of the collectors are imported. The imported collectors are from Turkey, China, Germany, Greece, Czech Republic, Italy and Austria. The most popular collectors are Chinese and Bulgarian.

There are no statistics on the exact number of imports. From the survey made under this project out of the 19 participating firms 42.1% of the firms offer Bulgarian collectors, 10.5% of the firms offer Turkish collectors, 47.4% of the firms offer Chinese collectors, 36.8% offer German collectors, 5.3% offer Czech, 5.3% offer Italian, 5.3% offer Austrian and 5.3% offer Greek collectors.

2.7. Installer organization

All suppliers of solar collectors have contacts with different installers or corresponding organizations. There are more than 100 firms which are offering solar thermal applications. The firms working in the sector are mostly installers of heating systems, which also offer solar thermal systems. In Bulgaria there is not an association that incorporates the producers, suppliers and installers of solar thermal systems. There is an organization called the National Installation Union, in which some of the solar thermal firms are members.
Establishment of an Association in Bulgaria for Solar Thermal Systems with its Solar Market function will contribute to the increase of solar thermal systems.

- Members of the association could be producers and importers of elements for solar thermal systems, companies which design, install and maintain these systems, scientific and testing laboratories, and others;
- Research on the solar thermal market in Bulgaria for different sectors (dwelling buildings, public buildings, hotels, sports complex, industry, etc.), as well as for the different types of collectors (seasonal and all year utilization);
- Assistance to implementation of Third Party Financing and also of Guaranteed Solar Results;
- Organization of information campaigns, aimed mainly at the potential users;
- Assistance to local producers of elements for solar thermal systems for testing of their products in respective laboratories;
- Assistance for establishment in Bulgaria of joint venture companies for implementation of the newest technologies for production of elements for the solar thermal systems.

2.8. Types of solar systems

In Bulgaria the solar market depends mainly on the private investors and on dependence from the type of solar installation; the type of solar systems then is chosen.
There are only a few cases in Bulgaria in which the gravity systems – direct or indirect - have been applied. The application of direct or indirect pump solar systems depends both on the size of the solar installation and from the variations of DHW needed. These types of solar systems are most common in Bulgaria.

Regarding the type of the solar collectors, most application have flat plate collectors with a selective absorber. Close loop systems with a pump, heat exchanger, integrated heat storage and antifreeze protection is most common.
The vacuum tube collectors become widely accepted, regardless of their higher price. They are used mainly in systems, whose production of hot water is necessary all year.

3. Solar collector production and sales

Table 5: Solar collectors production and sales

Year	Flat Plate Collectors				Vacuum Collectors				Unglazed Collectors in m²
	Production and sales in m²				Production and sales in m²				
	A	B	C	D = A-B+C	A	B	C	D = A-B+C	
	Total national production	Exports	Imports	Total home market sales	Total national production	Exports	Imports	Total home market sales	Total home market sales
1985	50,000								
2006				5000					
2007				5000					
Total									

Statistical data for the market of solar thermal systems is not available. According to expert estimates there were 56,000 m² solar collectors in 2005 and the average growth of the market is 5000 m² annually. This means that in 2007 the estimated solar collectors are 66,000 m².
The number of square meters of solar collectors per 1000 capita installed at the end of 2007 are 66,000/7,640= 8.64 m² solar collectors per 1000 capita.

Out of the 19 firms participating in the questionnaire, 36.8% offer both flat and vacuum tube collectors, 36.8% offer only vacuum tube collectors and 21% offer only flat collectors. One firm offers tracking solar collectors with parabolic concentrators.

*3.1. Estimated solar park in working order in 2007**

Flat plate collectors in m² n.a.
Vacuum collectors in m² n.a.
Unglazed collectors in m² = n.a.
Total in m² = 66,000 m²

In Bulgaria there is no Solar Thermal Association and there are no detailed statistics about installed systems with different collector types.

3.2. Estimated annual solar thermal energy production in 2007

Flat plate collectors = m² x kWh/m²*year = n.a.
Vacuum collectors = m² x kWh/m²*year = n.a.
Unglazed collectors = m² x kWh/m²*year = n.a.

If we take an average of 600 kWh/m²*year for the different type of collectors than in total estimated annual solar thermal energy production in 2007 would be 66,000 m² x 600 kWh/m²*year = 39,600 MWh

3.3. CO_2 emissions avoided in 2007 (on the basis of oil)

Flat plate collectors	=	MWh/year	x tonnes/MWh	= n.a.
Vacuum collectors	=	MWh/year	x tonnes/MWh	= n.a.
Unglazed collectors	=	MWh/year	x tonnes/MWh	= n.a.

An average on the basis of oil if we take productivity of 600 kWh/m²*year the avoided emissions are 210 kg/ m²*year. Thus if we have 66,000 m² of solar collectors installed, the CO_2 emissions avoided in 2007 are 66,000 m² x 210 kg/ m²*year = 13,860 t.

The analysis of RES utilization possibilities shows real potential for reduction of CO_2 emissions with about 8 129 kit CO_2 equivalent in 2015.
In the next table are given the summarized possibilities for saving of CO_2 emissions, through implementation of RES.

Table 6: Emission savings from RES utilisation (Source: National Long Term Programme for Promotion of RES till 2015, Energy Efficiency Agency of Bulgaria

RES	Saved greenhouse gases emissions			
	Electric energy		Heat energy	
	toe	kt CO_2 eqv.	ktoe	kt CO_2 eqv.
Biomass	73	705	1227	4 270
HPP	257	2 480	0	0
Wind energy	22	214	0	0
Solar energy	4	39	21	72
Geothermal energy	3	25	93	324
TOTAL	**359**	**3 463**	**1341**	**4 666**

Used emissions coefficients are summarized: for electric energy 830 gCO_2 /kWh, and for heat energy 300 gCO_2 /kWh.

For utilization of solar energy the prognosis from PV installations is for electric energy of 4-ktoe/ year to be produced. From implementation of solar collectors the prognosis is for production of heat energy amounting to 239 GWH/ year, which will lead to CO_2 emissions reduction of about 72 kt CO_2.

4. Product types and solar thermal applications

4.1. Product types

The major type of solar collector used is the flat plate collectors with selective absorber. Close loop systems with pump, heat exchanger, integrated in heat storage and antifreeze protection are most common.
Typical flat solar collectors are produced by the one of the major manufacturer Sunsystem New Energy Systems Ltd. (NES), which could be with an ordinary or selective absorber.

Figure 11: Flat plate collectors in Elderly People's Home in Silistra Town, Bulgaria

The typical solar collectors are:

4.1.1. Solar collector Standard/Standard new line:

It is elaborated mainly for seasonal systems for DHW, as for the period April – October the solar system covers the needs of the consumer for hot water between 80 and 100%. Technical characteristics:

- Absorber: copper
- Absorption coefficient : 95%
- Reflecting ability: 5%
- Heat carrying liquid: PG
- Degree of conversion: 364kWh/m² annually

4.1.2. Solar collector Select Classic/ Select New line:

It is elaborated for systems with all-year utilization of DHW. It has the following advantages: better thermal insulation and the cover of the absorber is selective. It is type "Tinox", a high–temperature cover made from titanium oxide. It is characterized by a high absorbing ability of 0.95 and low degree of reflection, 0,005. Technical characteristics:

- Absorber: copper
- Absorption coefficient: 95%
- Reflection ability: 5%
- Heat carrying liquid: PG
- Degree of conversion: 600kWh/m² annually

4.1.3. Vacuum tube collector Sunsystem CPC

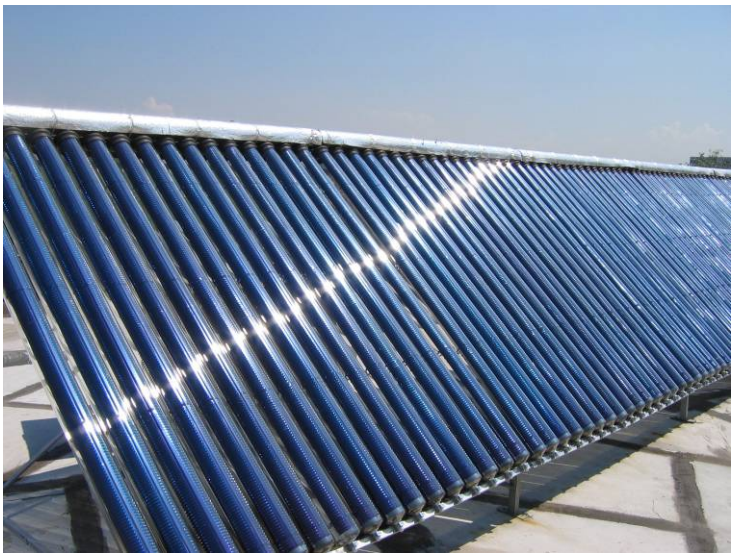

Figure 12: Vacuum-tube collectors installed in Iberostar Hotel, Sunny Beach, BulgariaHotel

Technical characteristics:

- Heat carrier: TYFOCOR, PG
- Volume: 0.8 / 1.6 / 2.4 l
- Gasket: high quality vacuum
- Absorption coefficient: 95%
- Reflection ability: 5%
- Degree of conversion: 660 kWh/m² annually

The vacuum tube collectors are becoming widely accepted, regardless of their higher price. They are used mainly in systems whose production of hot water is necessary all year around.
There are only a few cases in Bulgaria in which the gravity systems – direct or indirect - have been applied. The application of direct or indirect pump solar systems depends as from the size of solar installation, so as from the variations of DHW needed. These types of solar systems are most common in Bulgaria.

4.2. Applications

There are no statistical data about installation figures by segments. However the following tendencies can be mentioned.

4.2.1. Domestic hot water production

This is a large segment of the solar thermal applications in Bulgaria. 94.7% of the participating firms in the questionnaire have as clients single family houses.

4.2.2. Large collective solar systems

This the largest segment of solar thermal applications in Bulgaria. There are especially a lot of solar installation projects for hot water in the hotels and private houses, mainly along the Black sea coast and in the mountain areas. The data for them is difficult to obtain due to the private nature of their installation process. Out of the 19 participating firms in the questionnaire, 89.5% have hotels and tourist facilities, 84.2% have multi family houses (both new and old construction), 68.4% have public buildings, 26.3% have industrial enterprises, and 10.5% have agricultural and processing enterprises.

4.2.3. Space heating

There are very few applications for space heating in Bulgaria so far.

4.2.4. District heating

There are no district heating applications so far in the country.

4.2.5. Air conditioning and industrial process heating

There are no air conditioning applications so far and industrial process heating is very rare.

5. Market share of major manufacturers

There are a few major firms,which produce solar collectors of their own design. They are Erato Holding, Sunsystem, Ekotop, and Ecotechnoproduct:

Sunsystem New Energy Systems Ltd. (NES) Shumen
This company produces flat solar collectors, which could be with an ordinary or selective absorber and also vacuum tube collectors. They are produced in three sizes. The produced collectors are sold mainly on the Bulgarian market. It should be mentioned that at the present moment New Energy Systems operates at full production capacity.

"ERATO Holding" – Haskovo
The company produces the vacuum tube collector "Ray" and flat collector "Ecoline"
Sunsystem and Erato Holding are big companies with a distribution network throughout Bulgaria. Many small firms distribute their collectors together with other imported collectors.

ECOTOP Ltd. – Sofia
ECOTOP designs complete solar systems and implements complete engineering – design, delivery, mounting and service (guarantee and beyond guarantee).
ECOTOP Ltd. has been producing a wide range of solar collectors since 1993: flat plate.
All the products are tested according to their technical parameters in the testing center of ECOTOP, where they go for tests for durability and reliability.

Apex Solar Ltd.
Apex Solar Ltd. is popular with its brands FPS - PrizmaSelect™: "selective" solar collectors with prismatic glass, produced in Bulgaria.

Heliotech Solar Energy Systems
Heliotech is a joint venture with a Chinese producer and is a producer and system integrator of vacuum-tube collectors of three types.

KORADO – Bulgaria (Razgrad)
KORADO – Bulgaria produces solar collectors with aluminium profiled fins and copper tubes with collector area of 1,7 m². The simple type of installation is the self–circulating equipment (thermo siphon) with boiler of 100 l.

ECOTHERMAL ET – Burgas
ECOTHERMAL is a new company producing flat plate solar collectors.

6. Employment

There are no statistical data on employment in the solar thermal market

- Manufacturing of components of solar thermal systems: The employment figures in manufacturing are not big having in mind the small number of manufacturing plants in Bulgaria.
- Installation, maintenance and distribution: There are about 100 firms in Bulgaria which offer delivery, installation and maintenance of solar thermal applications. A few of them are major firms which have distribution network around the country. Most of the other firms are small, which are dealing with heating systems in general and offer also solar collectors.
- Sales and marketing: About 100 firms are dealing with sales of solar collectors.
- Testing, quality assurance and research: There is no certified laboratory in Bulgaria for solar collectors. Some of the major manufacturers have their testing facilities, but they are not certified. Almost no research is done in the sector. The employment figures are very low.
- Training and consultancy: There is no association of solar thermal firms or other institution which is doing training and consultancy. Training is mostly done in the framework of different projects funded by European or other funds.

C. State of Production

7. Product technology and production methods

7.1. Product technology description

- Collectors (usual sizes in m²): mainly flat plate collectors with selective absorber; usual size 2.15 m²
- Absorber material: copper
- Surface treatment.
- Insulation: mineral wadding
- Transparent cover: prismatic thermo-glass
- Casing: eluxated aluminum profile
- Storage tank.
- Cover: Selective cover Tinox
- Pump: direct or indirect pump systems
- Expansion tank
- Heat exchanger
- Additional heating

*7.2. Product technology description**

7.2.1. Collectors

- flat plate collectors with selective surface
- vacuum tube collectors

Both types of collectors have been installed in Bulgaria. Unfortunately there is no available data about concrete parameters of different types of solar collectors, so the table below cannot be filled.

7.2.2. The common materials and technologies used in Bulgaria

Absorber material

- copper absorbers

Surface treatment

- selective layers - Black chromium, Sunselect (highly solar absorptive aluminium substrate with a selectively coated surface), TiNOx (copper substrate with good reflection + thin titanium carbide layer serves as adhesion layer + absorber layer consisted of a titanium composition with oxygen and nitrogen)

Insulation

- casing insulation usually made of mineral wool
  - 20 mm on sides of casing
  - from 60 to 70 mm at the bottom of casting
- pipes and fittings are insulated with several types of insulation materials (for example Mirelon – polyetylene foam)

Transparent cover

- most collectors have a transparent cover made of 4 mm thick safety solar glass
- some have a transparent cover of prismatic glass to increase solar yield

Casing

- stampings made of aluminum alloys

Storage tanks

- in most of application, they are used for hot water storages
- monovalent hot water storages are usually used in those cases where the solar system is mounted into an existing heating system
- bivalent hot water storages are used mostly in new applications (storage is prepared for additional heat source connection)
- volume of hot water storages is different depending on suggestion parameters and operating mode of solar system

Pump

- solar pump unit is usually used in solar systems, it consists of pump, fittings, manometer, thermometer and relief valve

Expansion tank

- there is a need to use expansion tanks which are resistant against chemical incidence of glycol (expansion tanks must have membrane made of nitrile or EPDM - ethylene propylene diene monomer)

Heat Exchangers

- internal heat exchangers made of smooth or ribbed pipes integrated in storages

Additional heat source

- additional heat source connected to heat exchanger (gas-fired boilers, gas-fired condensating boilers, solid fuel-fired boilers, biomass boilers)

Specific solar gains in Bulgaria are between 400 and 700 kWh/m² year for systems using flat plate collectors and between 700 and 1200 kWh/m².year for systems using collectors with evacuated tubes. Values are dependent on location and specifics of each system.

7.3. Product technology description

The standards, certification, current practices and technologies are described in other chapters.

The companies involved in producing the collectors are listed in Annex A but the data about the production methods is not available. To monitor all companies interested in producing all the possible components was not achieved due to the large number of the possible components and companies involved in, for example, heating systems.

7.4. Product technology description

About 10 companies are producing solar collectors
Most of them import the absorbers and the rest are produced and assembled in Bulgaria.
The quality is generally not very high, but due to the lower prices the locally produced solar collectors are used often.

Below are given some major characteristics of locally produced solar collectors

Absorber material

- copper absorbers

Surface treatment

- selective layers - Black chromium, Sunselect (highly solar absorptive aluminium substrate with a selectively coated surface), TiNOx (copper substrate with good reflection + thin titanium carbide layer serves as adhesion layer + absorber layer consisted of a titanium composition with oxygen and nitrogen)

Insulation

- casing insulation usually made of mineral wool
  - 20 mm on sides of casing
  - from 60 to 70 mm at the bottom of casting
- pipes and fittings are insulated with several types of insulation materials (for example Mirelon – polyetylene foam)

Transparent cover

- most of collectors have a transparent cover made of 4 mm thick safety solar glass
- some have transparent cover of prismatic glass to increase solar yield

Casing

- stampings made of aluminum alloys

Storage tanks

- in most of application are used hot water storages
- monovalent hot water storages are usually used in those cases where solar system is mounted into existing heating system
- bivalent hot water storages are used mostly in new applications (storage is prepared for additional heat source connection)
- volume of hot water storages is different depending on suggestion parameters and operating mode of solar system

Pump

- solar pump unit is usually used in solar systems, it consists of pump, fittings, manometer, thermometer and relief valve

Expansion tank

- there is need to use expansion tanks which are resistant against chemical incidence of glycol (expansion tanks must have membrane made of nitrile or EPDM - ethylene propylene diene monomer)

Heat Exchangers

- internal heat exchangers made of smooth or ribbed pipes integrated in storages

Additional heat source

- additional heat source connected to heat exchanger (gas-fired boilers, gas-fired condensating boilers, solid fuel-fired boilers, biomass boilers)

8. Breakdown of solar systems costs

The price of an installed solar system (250 litres) depends on the type of collectors, the type of the system and the conditions of the site, but in general it is between 1.500 BGN and 5.000BGN. Why is the difference so big? The price and the effectiveness of the system depends on some variables:

- Number of months, during which solar heated water will be used;
- Size and type of the system – thermo siphon does not require specialized automation;
- Type of collectors – the flat plate collectors operate from April till October, in comparison to the "all–year-round" vacuum tube collectors;
- Type of roof on which the collectors will be installed – are there any additional stands needed;
- Professional or "Do–it-yourself" system.

Table 7: Typical unit solar system costs (Source: EAST-GSR Project 05/208/S12.420214

Solar Systems Costs for Typically Sized Systems		
	6m²	**15m²**
Total costs (excl. VAT)	314.16 Euro / m²	264.16 Euro / m²
VAT (%)	62.83 Euro / m²	52.83 Euro / m²
Total cost (incl. VAT)	**377 Euro / m²**	**317 Euro / m²**

Typical prices for solar systems of one of the major producers with one of the biggest market shares Sunsystem (NES) for 2008:

Table 8: Prices of solar systems in Bulgaria (Source: The survey made among Bulgarian importers and producers of solar thermal systems within Trans-solar project

Solar system	Elements	Price (Euro)
Solar package "Sunsystem" – 100 l	1 selective collector 2.15 m², water storage 100 l, pump, management system, additional components	1110.27
Solar package "Sunsystem" – 150 l	1 selective collectors 2.70 m², water storage 150 l, pump, management system, additional components	1226.83
Solar package "Sunsystem" – 200 l	2 selective collectors 2.15 m², water storage 200 l, pump, management system, additional components	1686.83
Solar package "Sunsystem – 300 l	3 selective collectors 2.15 m², water storage 300 l, pump, management system, additional components	2433.07
Solar package "Sunsystem" – 400 l	4 selective collectors 2.15 m², water storage 400 l, pump, management system, additional components	2911.95
Solar package "Sunsystem" – 500 l	5 selective collectors 2.15 m², water storage 500 l, pump, management system, additional components	3408.14

At present, in the Bulgarian market, the cost of solar thermal systems varies significantly. The cost depends mainly on the type of collector, whether it is flat plate or vacuum tube, and in which country it is manufactured.
The cost of the Bulgarian flat plate solar collectors is only 100-150 Euro/m² and the price of vacuum tube solar collectors is 250-350 Euro/m².

The main benefit for the state from implementation of solar thermal systems is that they replace a substantial amount of electricity and are environmentally friendly.

Allocation of cost by system components (Bulgarian produced elements)

Table 9: Solar collectors cost allocation by type of equipment in Bulgaria (Source: The survey made among Bulgarian importers and producers of solar thermal systems within Trans-solar project)

Cost Component	Cost (%)
Design	4
Solar collectors	55
Hot water storage tank	13
Connecting pipes + valves	10
Support stand	8
Installation	10
TOTAL	100

Table 10: Cost allocation for whole solar systems in Bulgaria (Source: The survey made among Bulgarian importers and producers of solar thermal systems within Trans-solar project)

	Flat plate selective	Vaccum
Production (materials and labor) – without water storage	60.4%	67.3%
Installation	37.8%	31.3%
R&D	1.8%	1.4%
Source: Heliotech – www.heliotechbg.com		

9. Typical solar domestic hot water systems

9.1. Single family house, Bistritza, Sofia

- System type Solar thermal system for domestic hot water production
- Collector type: vacuum tube
- Collector area (m²). 3.6 m²
- Collector area per person (m²/person): 0.9 m² /person
- Hot water storage (liters): 120 l
- Price per m² system costs: 264 Euro/m²
- Amortization based on the present energy price: 7
- Eventual subsidies. Possible subsidies from the Energy Efficiency Fund (up to 20%) and from the Operational Program Rural Development for houses in rural municipalities (up to 70%).

Figure 13: The house in Bistritsa

9.2. Residential building, Simeonovo, Sofia

- System type. Solar thermal system for domestic hot water production

- Collector type: SEIDO5-16 vacuum tubes
- Collector area (m²). 2x18=36 m²
- Collector area per person (m²/person) = 0,55 m ²/person
- Collector area per dwelling (m²/dwelling): 1.38 m²/dwelling
- Hot water storage (liters): 5+5, total volume 2.5+2.5 m^3
- Price per m² system costs: n.a.
- Amortization based on the present energy price: n.a.
- Eventual subsidies. Possible subsidies from the Energy Efficiency Fund (up to 20%) and from the Operational Program Rural Development for houses in rural municipalities (up to 70%).

Figure 14: The collectors on the roof of Simeonovo residential building

9.3. Radnevo Hospital

- System type. Solar thermal system for domestic hot water production
- Collector type: flat collector with copper absorber selective type
- Collector area (m²): 212 m²
- Collector area per person (m²/person): 0,1 m²/person
- Hot water demand at 60°C: 198 MWh/y
- Hot water storage (liters): 5000
- Price per m² system costs: 296.14 Euro/ m²
- Amortization based on the present energy price: 15,9
- Eventual subsidies. Possible subsidies from Operational Program Rural Development for rural municipalities (up to 100%).

9.4. Hotel Elit, Balchik, Black Sea Coast

- System type: Solar thermal system for domestic hot water production
- Collector type: flat copper, Ezink, Turkey
- Collector area (m²): 32.40 m²
- Collector area per person (m²/person): n.a.
- Hot water demand at 60°C: 3 700 litres/ per day at 65°C
- Hot water storage (liters): 3 storage tanks with total volume: 1,5 m^3
- Price per m² system costs: n.a.
- Amortization based on the present energy price: n.a.
- Eventual subsidies. Possible subsidies from Operational Program Rural Development for hotels in rural municipalities (up to 70%).

Figure 15: The collectors on the roof of Hotel Elit in Balchik, Black sea coast

9.5. Elderly people home, Plovdiv

- System type. Solar thermal system for domestic hot water production
- Collector type: flat plate
- Collector area (m²): 132 m²
- Collector area per person (m²/person): n.a.
- Hot water demand at 60°C: n.a.
- Hot water storage (liters): 6 m^3
- Price per m² system costs: 488.63 Euro/ m².
- Amortization based on the present energy price: 3,6
- Eventual subsidies: the Elderly home in Plovdiv was subsidized by a five year program of the Greek government for assistance to neighboring countries. Currently there are opportunities for subsidizing such installations under the Rural Development Operational Program for rural municipalities (up to 100%).

Figure 16: The collectors on Elderly peoples home in Plovdiv

9.6. Typical consumer motivation

- For single family houses the typical motivation is cutting energy costs for hot water production. With rising energy prices the pay-back period is shortened. It is also fashionable for people with enough income and thus widespread in the southernmost regions.
- For multi-family dwellings the motivation is the same as in single family houses – i.e. cutting energy costs for home-owners. The investor in newly built dwellings is motivated by the fact that this will promote and encourage people to buy his apartments rather than those of competitors where energy costs are higher
- For hospitals the existing systems have been mostly demonstration projects financed through different programs and the state. For them the motivation can come from using the opportunities for financing under the structural and rural development funds.
- For hotels the main motivation is rapid growth due to high demand for hot water, rapid development of the tourist sector and favorable conditions, especially at seaside resorts. Installation of solar thermal systems in hotels cuts the energy costs and thus improves their competitiveness.

10. Typical solar combined systems for a single family house, a dwelling, a hospital, hotel

Combined systems are just starting to be developed in this country. Most of the working installations are only for DHW. The main reason is the high investment costs of the combined systems.
Therefore no examples of combined systems can be shown as in Chapter 9 for DHW systems.

11. Conventional water heating and energy prices

In Bulgaria there are no collective schemes for payment of energy.

Table 11: (Source State Commission for Energy Regulation :

Conventional Energy Prices		
Date: 2008	**Housing** VAT incl.	**Collective** VAT incl.
Electricity - normal	0,05 Euro/ kWh	0,084 Euro/ kWh
Electricity - discounted rate	0,02 Euro/ kWh	0,042 Euro/ kWh
Electricity – peak rate Electricity - low rate	Euro/ kWh-not applicable Euro/ kWh – not applicable	0,084 Euro/ kWh 0,042 Euro/ kWh
Fuel - Oil	0,1 Euro/ kWh	0,1 Euro/ kWh
Bottled gas Natural gas	0,046 Euro/ kWh 0,04 Euro/ kWh	0,046 Euro/ kWh 0,04 Euro/ kWh
District heating (basic fee)	- Euro/ kWh	- Euro/ kWh
District heating (heating fee)	0,046 Euro/ kWh	0,046 Euro/ kWh
District heating total	0,046 Euro/ kWh	0,046 Euro/ kWh
Wood	0,013 Euro/ kWh	0,013 Euro/ kWh

11.1. Electricity prices for households

In Bulgaria there are 3 Electricity Distribution Companies which sell electricity to households. Their respective prices for 2008 are:

Table 12: Prices of CEZ Electro

Way of measurement	Zones	Price Euro/kWh with VAT
With two scales	Day	0.05
	Night	0.021
With one scale		0.05

Table 13: Prices of EVN Bulgaria

Way of measurement	Zones	Price Euro/kWh with VAT
With two scales	Day	0.0489
	Night	0.0198
With one scale		0.0489

Table 14: Prices of E.On Bulgaria

Way of measurement	Zones	Price Euro/kWh with VAT
With two scales	Day	0.047
	Night	0.0179
With one scale		0.047

11.2. Prices for heat energy

Heat energy is supplied by different heat suppliers in Bulgaria. Below are the heat energy prices regulated by the state commission of energy and water regulation as of 01.08.2007 with VAT.

Table 15: Prices of heat from different DHC in Bulgaria

No	Heat supplier	Prices of heat energy with heat carrier	
		Water vapor, Euro/kWh	Hot water, Euro/kWh
1.	Heat Energy Provider Sofia	0.0737	0.0369
2.	Heat Energy Provider Plovdiv	0.109	0.0422
3.	Heat Energy Provider Pleven	0.0445	0.0389
4.	Heat Energy Provider Shumen		0.0446
5.	Heat Energy Provider Varna		0.0445
6.	Heat Energy Provider Vratza		0.0408
7.	Heat Energy Provider Pravetz		0.0638
8.	Heat Energy Provider Ruse	0,0450	0,0329
9.	Heat Energy Provider Pernik	0,0290	0,0333
10.	Heat Energy Provider Sliven	0,0716	0,0403
11.	Heat Energy Provider Gabrovo	0,0586	0,0429
12.	Heat Energy Provider Burgas	0,0497	0,0402
13.	Heat Energy Provider Razgrad		0,0493
14.	Heat Energy Provider Kazanluk	0,0638	0,0776
15.	Heat Energy Provider V.T.		0,0552
16.	Heat Energy Provider Yambol	0,0449	0,0461
17.	Heat Energy Provider Loznica		0,1008
18.	"TEGE 21" Ltd		0,0473
19.	"Heat Power Plant Svileza	0,0386	
20.	"Heros" Ltd.	0,0695	
21.	"Brikel"		0,0267
22.	"Yambolen"	0,0368	
23.	Nuclear power plant Kozloduy		0,0160
24.	Deven	0,0175	
25.	Vidachim		
26.	Biovet	0,0352	
27.	Kamibo	0,0275	0,0264
28.	Zahar	0,0284	
29.	Gerrad	0,0696	
30.	Zebra	0,0443	0,0439
33.	Bul Eco Energia Ltd.		0,0592
34.	Active Co Ltd.		0,0430

The State Commission on Energy and Water Regulation envisages increase of the prices of heat energy in the country with 14,01% from 1 July 2008. Thus the weighted average of the price of heat energy becomes 35.59 Euro/MWh. In 2007 the weighted average price was 31.21 €/MWh.

11.3. Prices for natural gas

The State Commission of Energy and Water Regulation defined the price of natural gas currently valid (2008). The limit price for natural gas for selling from the public supplier to consumers, connected to the transmission network is 253.68 Euro/1000 m^3 with VAT.

Table 16: Evolution of natural gas prices for households (in GJ) (Source: EU Energy and Transport in figures. Statistical Pocketbook 2007/2008. Directorate General for Energy and Transport)

2004	2005	2006	2007
6.27	6.84	7.11	8.10

12. Standards and codes of practice

There is no obligation for certification and there is no laboratory in Bulgaria for testing solar collectors, which is authorized to give the needed certificates. Therefore no quality certificate can be granted for collectors made in Bulgaria.
Furthermore there are no certification procedures for solar collectors in Bulgaria. The imported solar collectors, as well as the imported absorbers, have the necessary certificates for the respective characteristics. In Bulgaria no additional testing for their qualities is made when they are imported.

Below is a list of existing Bulgarian standards for Thermal solar systems and components:

Table 17: Bulgarian standards for solar systems and components

БДС EN 12975 – 1: 2006	Thermal solar systems and components – Solar collectors – Part 1: General Requirements
БДС EN 12975 – 2: 2006	Thermal solar systems and components – Solar collectors – Part 2: Test methods
БДС EN 12976 – 1: 2006	Thermal solar systems and components – Factory made systems – Part 1: General Requirements
БДС EN 12976 –2: 2006	Thermal solar systems and components – Factory made systems – Part 2: Test methods
БДС EN 61725: 2004	Analytical expression for daily solar profiles (IEC 61725: 1997)
БДС ENV 12977 – 1: 2002	Thermal solar systems and components – Custom built systems – Part 1: General Requirements
БДС ENV 12977 – 2: 2002	Thermal solar systems and components – Custom built systems – Part 2: Test methods
БДС ENV 12977 – 3: 2002	Thermal solar systems and components – Custom built systems – Part 3: Performance characterization of stores for solar heating systems

In the Central Laboratory for Solar Energy and New Energy Sources a laboratory was constructed for testing water collectors, which is equipped with instruments and is using methods, required by the European standards EN12975, EN12976, EN12977. The laboratory is envisaged to be authorized.– BAS, 72, Tzarigradsko chaussee blvd., 1784 Sofia, tel.: 778 448, fax: 754 016.
One of the few private companies which maintain R&D groups or finance research is Business Group Ecotop, which has its own “Specialized scientific-research laboratory for innovative activities” and has licensed laboratory for testing, including solar thermal collectors. Other private companies also have their own laboratories.

13. Level of R & D

13.1. Type of R & D activities

Primarily the Technical University of Sofia, Technical University of Varna and the Central Laboratory for Solar Energy and New Energy Sources are involved in designing, construction, research of the working regime, simulation and models of different water and air heat collectors. Many private firms also got involved in this process, the majority of which are Ecotechnoproduct, Erato Holding, Ekotop, Sunsystem, which produce collectors by their own design.
In the area of selective coverage (low and high temperature) research groups from the Central Laboratory on Solar Energy and New Energy Sources, the Electronics Institute and the Central Laboratory for Optical Recording as well as the Technical Unviersity of Sofia are working.

13.2. Specific programs

There are no specific programs for R&D in this sector.

13.3. Role of government (national, regional)

There is no governmental program or support for R&D in the sector. Although under the RES legislation it is envisaged to have R&D in the sector, the legislative framework is still narrow for effective R&D.

13.4. Role of institutes and universities

The Central Laboratory on Solar Energy and New Energy Sources at the Bulgarian Academy of Science (www.senes.bas.bg) is carrying out some research and development projects regarding solar thermal applications. The financing of the laboratory is both based on European-funded projects and by national financing.

13.5. Level of financing by industry and public funds (EU incl.)

Some small-scale R&D is done at producers' firms, such as ECOTOP.

D. State of Marketing

14. Distribution and marketing methods

Distribution is done by about 100 firms which are in the heating business and distribute and install Bulgarian and mostly imported solar collectors. There are no guiding marketing principles in the sector. The major manufacturers have distribution network which cover the whole country.
There is no practice of use of solar collectors as standard facilities in housing projects. Some investors in new housing buildings decide to install solar collectors with the construction of the building but there are no special incentives for this.
There is no practice of guaranteed solar results contracts in Bulgaria and they haven't been applied so far. Mostly the distribution is done by the installers. At the moment of purchase of equipments for solar thermal systems the qualities of the various components (solar collectors, tanks, etc.) are guaranteed for a certain number of years. There is no practice of concluding agreements for guaranteed solar results
During the last 15 years in Bulgaria there is no state programme to encourage the use of solar thermal energy and no awareness campaigns of national importance have been held.
There are no specialized fairs for solar thermal applications. There is a big technical international fair in Plovdiv where usually most of the firms are presented.
Usually the guarantee for the solar collectors is 5-6 years.

15. Incentives and financing methods

15.1. What kind of financial incentives have been used in the past and are used presently and at what level

- The Kozloduy International Decommissioning Support Fund (KIDSF) administered by EBRD. The financial support under KIDSF could be also for utilization of RES (e.g. wind, hydro, biomass, solar). The support could be pure grant or partial financing in various co-financing structures with other loan applications.
  Usually the owners of RES projects receive a 20% discount on the principal of the loan after the completion of the project.
- Introduction of solar collectors in the building sector is considered energy efficient and is supported by "Energy Efficiency Fund". The Kozloduy and Energy Efficiency Fund are on national level, the Program for rural development applies for 231 municipalities which are in the rural areas in Bulgaria.
- Under the Program for rural development 2007-2013, financed by the European Rural Development Fund it is envisaged to have for rural municipalities (231 eligible municipalities):
  - Financial aid up to 100 % of the eligible municipalities from rural areas for developing and equipping installations for production of heat and/or electric energy for municipal owned buildings from RES.
  - For micro enterprises and farmers from rural regions, for projects for energy production from RES up to 1 MW, financial aid in the amount of 70% of the approved expenses is envisaged.
- Under the Operational Program Regional Development and Operational Program Competitiveness, co-financed by the EU structural funds there are also measures for increasing the energy efficiency in enterprises and for the use of RES, including solar collectors.

15.2. Public support for investments

There are no fiscal/tax incentives, especially for solar thermal systems.

15.3. Third party financing

ESCO scheme and guaranteed energy result contracts start to gain speed in Bulgaria nowadays. There are some companies such as Erato, Ecotop Termocofort, and others that provide financing to their customers by means of financing solar systems and then taking back the invested funds from the cost saving resulting from the use of solar energy for hot water production.

E. Future Prospects

16. National energy policy

16.1. Brief description of the present and past energy policy and the role of solar thermal energy

Bulgaria is heavily dependent on energy as it imports more than 70% of its primary energy sources. The only significant domestic energy source is low-quality lignite coal with high content of sulphur, some hydro potential and RES. Bulgaria is mainly reliant on energy sources from Russia: oil, natural gas, high-quality coal and nuclear fuel. This structure of the energy balance causes concern in terms of the security of the energy supply.

Table 18: Main energy indicators of Bulgaria

in Mtoe	1990	1995	2000	2005	2006
Gross inland consumption	27.96	23.30	18.59	18.87	19.9
Production	9.14	10.19	9.85	10.20	
Import	17.82	13.48	8.68	9.12	
Import dependency %	63.61	57.17	46.54	48.04	47.1
Final energy consumption	16.09	11.40	8.58	9.03	9.5
Industry	8.97	6.03	3.64	3.58	3.7
Transport	2.52	1.98	1.82	2.37	2.6
Households	2.23	2.26	2.16	2.10	2.1
Commerce, etc.	2.37	1.14	0.96	0.98	1.1
Energy intensity (toe/Meuro'00)		1631	1356	1142	
Energy per capita (kgoe/cap)	3208	2772	2275	2425	
CO2 per capita (kg/cap)	8310	6908	5164	5671	

During the years of market transformation the initially low energy prices have been raised a lot and become more and more the focus of both industries and households. This makes the issues related to energy savings and resulting cost savings and use of RES more and more important.
In view of the above, RES are a high priority in the national energy strategy of Bulgaria, though mainly RES-based electricity generation is the focus – most incentives in the policy documents are related to solar PV, wind, biomass CHP, etc. Solar thermal energy is emphasized less in the policy priorities and there are no incentives for its application except EBRD credit line for domestic energy efficiency and RES application where solar thermal is eligible to 20% grant of total project costs not exceeding 2000 Euro.

16.2. Priorities of the current energy policy and driving forces, national policies

The National Strategy for the energy sector and energy efficiency development until 2010, adopted by the Council of Ministers and endorsed in principle by the National Assembly in 1999, sets long-term universal objectives reflecting the needs of the country for secure energy supply, energy efficiency, environmental protection and nuclear safety.
The Renewable Energy Sources national objectives are based on the accessible potential of different types of RES. Under the Law on renewable energy sources and biofuels there are preferential prices for purchasing energy produced from wind, hydro power, biomass and solar energy and a fixed contract for 12 years is signed between the producer and electricity transmission or distribution company.

16.3. Energy mix of the country - share of renewables, share of solar thermal energy.

In the next table are given the shares of the fuels and energy in FEC.

Table 19: Energy mix of Bulgaria (Source: Statistical Yearbooks - National Statistical Institute of Bulgaria)

		2000	2001	2002	2003	2004	2005
Liquid fuels	%	35.6	37.0	37.4	37.8	37.7	37.9
Natural gas	%	11.1	9.2	8.7	8.9	9.0	9.3
Coal	%	11.7	11.1	12.1	12.3	12.4	12.4
El. Energy	%	24.6	25.1	24.3	23.5	22.8	22.4
Heat	%	10.4	11.1	10.1	9.9	9.8	9.7
Timber	%	6.6	6.4	7.5	7.7	8.3	8.2
Total	%	100	100	100	100	100	100

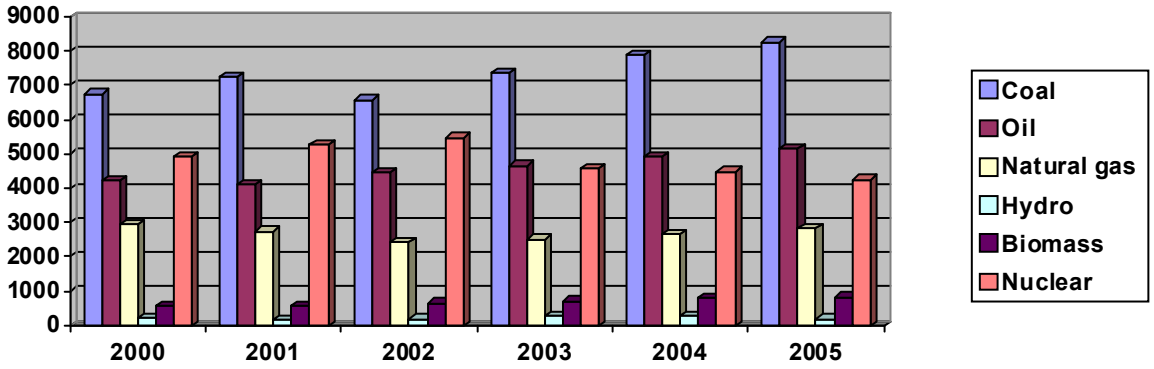

Figure 17: Fuel and energy in PEC for the period 2000 – 2005 (Source: Statistical Yearbooks - National Statistical Institute of Bulgaria)

Renewable energy sources (RES) represent another local source that can help reduce reliance on import, improve the security of energy supply, and meet the commitments to protect the environment and contribute to employment generation. Moreover, much of the RES (biomass, small hydropower plants, geothermal energy, etc.) have a significant resource, technical and economic potential. Nevertheless, being used irregularly and insufficiently, their share in the total gross energy consumption is negligible. A serious obstacle to their development is the higher cost of initial investments.

Below is the gross inland consumption of RES in 2005 (in ktoe)

Table 20: RES gross inland consumption in Bulgaria for 2005 (Source: EU energy and transport in figures. Statistical pocketbook 2007/2008. Directorate General for Energy and Transport.)

Renewables	Biomass	Hydro	Wind	Solar	Geothermal
1123	717	373			33

In the following table is given the theoretical and technically feasible potential of the RES in Bulgaria.

Table 21: RES potential in Bulgaria (Source: Bulgarian Energy Efficiency Agency. 2005. National Long-term Program for Encouraging the Use of Renewable Energy in Bulgaria 2005-2015.)

RES	Theoretical potential 10^3 toe/ year	Technically feasible potential (2010) 10^3 toe/ year	Usage
Solar	13 x 10^6	246	Domestic hot water
Biomass	3608	380	Heating, cooking, industrial needs
Hydropower	2276	428	Electricity generation
Geothermal	482	95	Green – houses, health care, domestic heating
Wind	75000	31,5	Electricity generation and water pumping for irrigation

After the adoption of the new Law on RES in 2007 and the preferential prices for purchase, the obligation for connection and the contract for purchase for minimum 12 years, there is growth in installations on RES, especially wind power and PV.

16.4. Are there any targets to meet?

There are national targets for Bulgaria, specified in accordance to the EU targets until 2020. The targets set for Bulgaria are by 2020 to have 16 % of energy from renewable sources in final energy consumption. Currently Bulgaria has 9.4% of energy from renewable sources in final energy consumption. The major part of the current renewable energy production in Bulgaria is from hydro power.

16.5. What is the legislation affecting solar thermal market?

The Energy Law treats only the promotion of electric energy generation from RES. The Law on Renewable and Alternative Energy Sources and Biofuels also does not cover solar thermal energy. National strategy and programs of activities are based on the solar conditions and the prognosis of the development of thermal market in the country.
It is provided that heat energy consumption increases with speed a bit lower (~ 4% annually) compared to the speed of GDP increasing. This trend is slightly bigger from the trend of increasing of electric energy (~ 2% annually). This prognosis is based on the significantly lower levels of heat energy consumption in Bulgaria that on average for EU countries, which suggests a sharp recovery from previous years' worsened thermal comfort.

In the next figure is given the development of the heat energy.

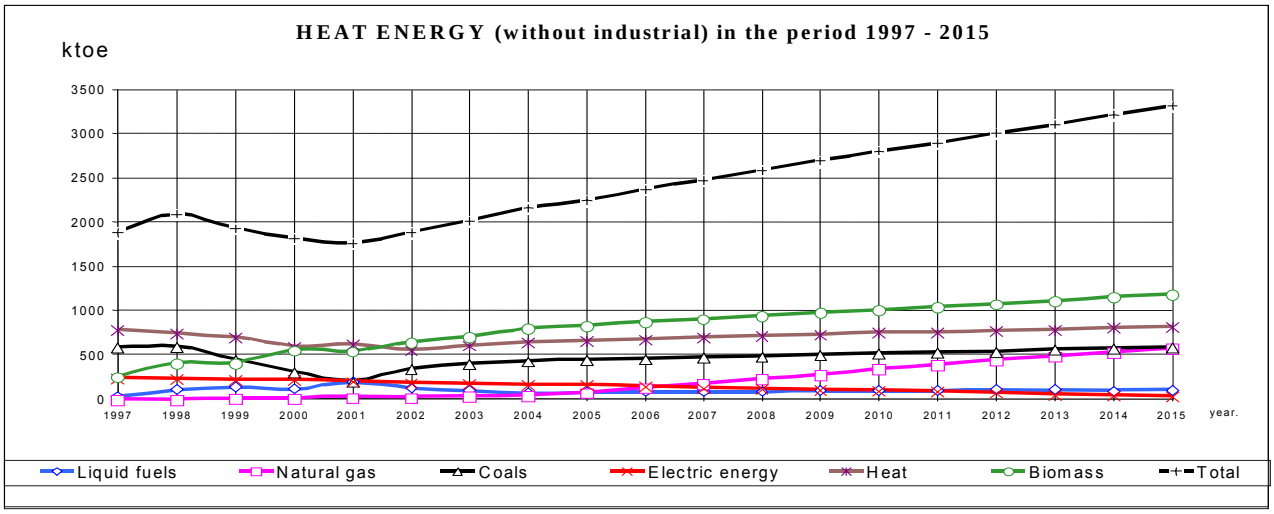

Figure 18: Heat energy production (Source: Bulgarian Energy Efficiency Agency. 2005. National Long-term Program for Encouraging the Use of Renewable Energy in Bulgaria 2005-2015)

At the end of the period of 2005 – 2015, it is expected that the heat energy will come from biomass (36%), central heating (25%), coal and natural gas (on 17% each). The liquid fuels and electricity will fill the gap with 5%. It is expected that in 2015 the energy necessary for heating and DHW will exceed 3 300 ktoe annually, from which at least 10% or about 330 ktoe are for producing DHW. These quantities do not include RES, except for biomass. In practice, part of the conventional fuels and energy will be substituted with RES.
The heat energy production from RES will always have to be regarded not only as accessible energy potential, but also as an effective delivery of the generated energy to the end consumers.
The solar radiation, transformed into heat through conventional thermal solar collectors, may be set as a priority for production of hot water from late spring, summer and Indian summer.
In the Long-Term National Programme for Encouragement of RES Utilization (2005-2015) it is foreseen to have:

- 260x103 m² solar collectors in 2010;
- 470x103 m² solar collectors in 2015.

17. Local bodies, prescribers, certification

17.1. Solar energy laboratories, tests centres: existing organisations with relevant addresses and contacts

There is one experimental laboratory in Bulgaria equipped for testing the characteristics of solar collectors. The laboratory is not recognized as a certification body. It is established at the Central Laboratory of Solar Energy and New Energy Sources (CLSENES) – Bulgarian Academy of Science (BAS).

- Prof. Petko Vitanov, Chief of CLSENES in BAS, Tzarigradsko chausse Blvd №72, 1784 Sofia, Tel. +359 2 778 448, Fax. +359 2 754 016, www.senes.bas.bg

There is also a certified testing laboratory for solar collectors at the Business Group ECOTOP, which is producing solar collectors.

Some other companies also have simple testing facilities. For example:

- ERATO, 67 Saedinenie Blvd, 6300 Haskovo, Tel. +359 38 662 012, Fax. +359 38 661 356, E-mail: toplo@erato.bg, www.erato.bg
- ECOTHERMAL, 47 Slivnitza Str., 8000 Bourgas, Tel. +359 56 814 215, Fax. +359 56 841 522, E-mail: ecothermal@ecothermal-bg.com, www.ecothermal-bg.com
- Business group ECOTOP, Sofia 1618 , Borovo, Ladoka st. 208, e-mail: kirov@ecotop.bg, www.ecotop.bg

17.2. Solar energy certification

In Bulgaria there is not a body or a laboratory that are authorized to give certificates for solar thermal installations.

17.3. List of existing training organisms and specialised professional schools

- Technical University of Sofia, 8 Kliment Ohridski Str, 1000 Sofia, www.tu-sofia.bg
- Faculty of Power Engineering and Power Machines, Ass. Prof. Merima Zlateva, Tel. +359 2 965 2509, E-mail: mzlat@tu-sofia.bg
- University of Architecture, Civil Engineering and Geodesy, Sofia, 1 Hristo Smirneneski Blvd., 1421 Sofia, Tel. +359 2 963 5245, Telex. +359 2 865 6863, www.vaceg.bg
- Ass. Prof. Rossen Savov, 23a Lyulyakova Gradina Str., 1113 Sofia, Tel. +359 887 333 217, E-mail: rossen@savov.net

17.4. Companies and manufacturers

See Annex A.

17.5. Solar association

There is no solar thermal association in the country.

18. Objectives for the solar industry / market

The prognoses for solar thermal systems in Bulgaria are in 2010 year to have 260 000 m² SC and in 2015 to have 470 000 m² SC. Given that 56 000 m² was installed in 2005, this means that on average 40 000 m² SC will be installed annually. This is an optimistic prognosis.

18.1. Prospects for market development by sector

The following sectors are distinguished as most suitable for application of solar thermal systems:

- Hotels, holiday houses, campaigns, swimming pools, etc.;
- State and municipal buildings (hospitals, kindergartens, social houses, etc.)
- Multi-story buildings (new and old ones).
- Individual houses – single and double family houses

It should be mentioned that:

- Solar thermal systems are used mainly for DHW production;
- For the calculation purposes it is accepted 500 kWh average annual productivity per m² SC.

18.1.1. Hotel sector

In the hotel sector for three-year period 2002-2005 the number of accommodation facilities increased by 70 % (from 914 to 1555). The number of beds increased 54 % (from 143 707 to 221 144) and the number of bookings increased 56 % (from 10 285 668 to 16 071 313).

The average electricity consumption is 3,3 kWh/booking. DHW, when it is obtained from electricity, accounts for 45-55 % of the electricity consumption.
The calculations made show that in order to satisfy 60% of the needs for DHW for all new accommodations for the period of May to September, it is necessary to construct 13,000 m² SC annually.

18.1.2. State and municipal buildings

The number of state and municipal buildings is substantial. As suitable for applying big solar systems the following can be listed:

- 3301 kinder-gardens;
- 303 hospital establishments with 47709 beds;
- 241 social establishments with 55192 beds.

Assuming that 1/3 of the state and municipal buildings without kindergartens are suitable for SC and a ten-year program for their construction is followed, it means that annually 1700 m² SC have to be constructed.

18.1.3. Multi-storied residential buildings.

The Bulgarian experience with setting up a big solar thermal system in an existing residential building in Sofia “Levski” B district , building 25, shows that:

- In most cases the existing conditions on the roofs and in the basements are not suitable for building solar collectors and boilers;
- The resulting pipe system is too big and has substantial heat losses;

Building solar system in new residential building (Sofia – Simeonovo district) is very expedient, because the corresponding part of the solar system is included in the price of the individual apartments. Therefore the new owners have flats with the corresponding part of the solar system. The cost of the solar system represents only about 1% of the cost for one 100 m² apartment and the payback period is 5-7 years. The next table shows the completed residential buildings and dwellings for the period 2001-2006:

Table 22: Constructed multi-family residential buildings in Bulgaria (Source: Statistical reference book 2007. Bulgarian National Statistical Institute.)

Completed in	New	Enlargement	Number of dwellings	Total useful floor area (m²)
2006			13270	1088000
2005			12059	995000
2004	1394	106	8267	728947
2003	677	58	6296	575446
2002	597	37	6153	562060
2001	657	30	5937	541324

The necessary volume of hot water per day for one person is about 60 litres. In accordance with the type of the used solar collectors this is achieved by 1 to 2 m² SC.
From the above presentation it can be concluded that it is advisable to promote the building of large-scale solar thermal systems simultaneously with the construction of new residential buildings.

At 8000 new dwellings constructed per year and at 2,7 persons/dwelling it is necessary to build between 20 000 to 30 000 m² SC annually.
It can also be concluded that the potential for construction of big solar thermal systems is approximately 40,000 m² SC/year. This is in line with the optimistic prognosis of the National Program.

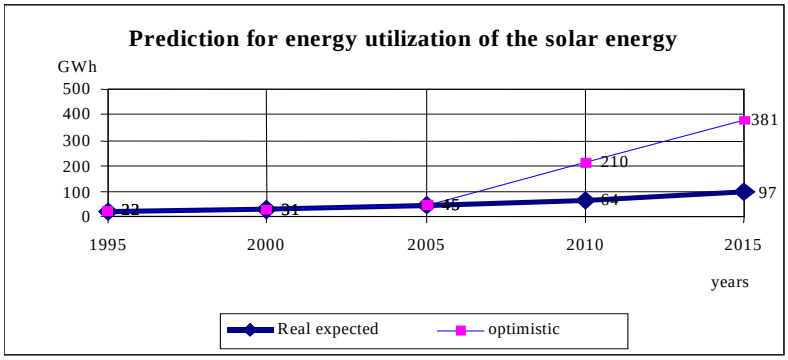

Figure 19: Forecast for utilisation of solar energy (Source Bulgarian Energy Efficiency Agency. 2005. National Long-term Program for Encouraging the Use of Renewable Energy in Bulgaria 2005-2015)

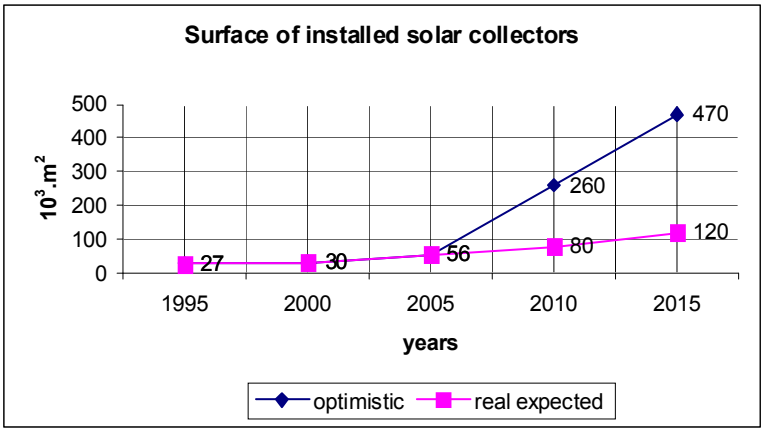

Figure 20: Forecast for surface of installed solar collectors (Source Bulgarian Energy Efficiency Agency. 2005. National Long-term Program for Encouraging the Use of Renewable Energy in Bulgaria 2005-2015)

18.1.4. Individual houses - single and double family houses

Below are given statistical data about single and double family houses in Bulgaria.

Table 23: Dwelling buildings stock by number of storeys (Source: National Statistical Institute – Census of population, building stock and farms, 2001)

	TOTAL	*number of storeys*			
		1	2	3-5	6 and more
In towns	740450	410987	247846	65239	16378
In villages	1384083	951668	419364	12976	75
TOTAL	2124533	1362655	667210	78215	16453
%	100	64.1	31.4	3.7	0.8

Table 24: Inhabited dwelling buildings according to the number of housings in them (Source: National Statistical Institute – Census of population, building stock and farms, 2001)

	1985	2001
1 housing	1459482	1259087
2 housings	112135	156913

As it can be seen there is a significant number of single and double familiy houses in Bulgaria (more than a half of total building stock) but most of the one and two storey buildings are located in villages. Thus the potential for solar collectors in terms of number of solar systems is large but in view of the fact that these are small systems of 5-10 square meters the overall potential is rather limited compared to hotel sector and multi-family houses presented above. The advantage of solar systems in individual houses is the fact that there is only one owner who can decide for himself whether to install it or not. The disadvantage is the lower incomes in the villages compared to cities in Bulgaria due to highly centralized development and thus the financial constrains for house owners to install solar collectors. Furthermore most of village families use cheap locally-produced firewood as a heating source both for hot water production and for space heating and for them the economic feasibility of solar collectors is lower than in the case of using other energy sources like liquid fuel, gas, and electricity.
It should be mentioned, however, that many middle and high income families have summer houses or villas in the countryside and they can afford to install solar collectors. Many of these villas have swimming pools and are used all year round which makes installation of solar systems more economical.

19. Strategy to overcome the barriers to market development

19.1. Description of major barriers by category

19.1.1. Technical

- Insufficient highly qualified technical service. Lack of installation experience, especially for installations for solar heating;
- The Bulgarian-produced SC cannot be certified as there is only one experimental laboratory in Bulgaria equipped for testing the characteristics of SC but it is not a recognized certification body. In Bulgaria there is no production of selective absorbers or vacuum tube SC so they are imported.

19.1.2. Institutional

- The Energy Law (adopted in 2003) treats only the promotion of electric energy generation from RES and cogeneration of heat and electricity;
- The Law on Renewable and Alternative Energy Sources and Biofuels also does not include solar thermal energy.
- The various state institutions although having a positive attitude towards RES, still don't pay the necessary attention to solar thermal energy;
- Lack of regional and municipal structures, dealing with energy planning and utilization of RES;
- There are no authorized laboratories for quality control of the produced equipment.
- Lack of related codes and standards covering the technical requirements of the equipment and installations.

19.1.3. Economic

- Until now there were not enough financial incentives for applying solar thermal. With new EU funds more such opportunities exist.
- In some cases, renewable energy is still more expensive than the consumer price of heat and electricity. The pay–back period for solar thermal installations, in most of the cases, is more than 5 years;
- Lack of financial stimulus for production, import and installation of solar systems;
- Lack of money in the state budget for implementing of solar collectors for DHW in buildings of state and municipal ownership.

19.1.4. Educative

- Low level of information and awareness of the population about the solar thermal applications;
- Lack of qualified personnel;
- Lack of scientific bodies and institutes for application of new technologies and their mass use;

19.1.5. Quality

- There is no practice of concluding agreements for Guaranteed Solar Results.
- Lack of an authorized laboratory for quality control of the produced equipment.
- "Garage," or unprofessionally-production collectors are offered on the market with low quality and prices. This leads to disappointment by consumers and to a negative attitude towards the use of solar collectors.

19.2. Description of main measures (actions) needed to extend the solar thermal market by category

19.2.1. Institutional

- Creation of local and regional authorities to be responsible for RES development, including solar thermal systems;
- The establishment of an association for solar thermal systems, which will protect both the interests of the stakeholders and those of the end-users;
- The changes in Proprietary Law with a view to easier mounting of installations in multi–story privately-owned buildings.
- In cases of newly-built buildings or in case of modernization of state or municipally owned buildings, ,the project should prescribe solar collectors to be installed.
- Creation of conditions for increasing and guaranteeing of quality both of solar thermal systems and of respective technical services (design, construction and maintenance);
- Creation of a laboratory for testing and certification of solar collectors;

19.2.2. Economic

- National Fund for supporting RES utilization should be established that includes solar thermal energy
- To apply economic preferences for installing thermal collectors and systems (e.g. reduced VAT);
- More flexible and faster credits.
- The liberalization of energy sector will lead to an increase of the price of electricity and soon it will be in line with international levels, making RES energy more competitive;
- Changing price dynamics that make solar thermal system prices lower than that of conventional energy. This leads to shorter pay-back period of solar systems which is one of the main prerequisites for enlargement of solar thermal markets. As an example the simple pay-back period of 16 years for 3 hospitals in Southern Bulgaria, constructed in the period 1995-1997

while the pay-back period is 2,9 years for the SC system in the elderly people's home "St. Vassilii Veliki", which was built in 2002 year.

19.2.3. Educative

- Large scale campaign for presenting the economic and environmental benefits of solar thermal applications;

19.2.4. Quality

- Application of guaranteed solar results contracts.

19.3. Suggestions from key actors

The questionnaire was sent by e-mail to 75 producers and installers of solar thermal systems in Bulgaria. 19 completed questionnaires were received. The results of the questionnaire are presented below.

What are the main barriers in Bulgaria for the development of the market of solar thermal applications?

84.2% of the participating firms point out **economic reasons** as the major barriers for development of solar thermal applications. More concretely the economic reasons include:

- The relatively high initial investment; especially high for vacuum tube collectors;
- The energy efficiency credits do not cover the expectations of the consumers. 20% of the amount is a grant, but up to a certain amount, not over the whole investment;
- Not enough financial schemes for support.
- The low technical competence of the installers leads to artificial increase of the system cost.

31.6% of the firms think there are **educational problems** for applying solar thermal applications, which include:

- Low level of information and awareness of the population about the solar thermal applications;
- Lack of qualified personnel;
- Lack of scientific bodies and institutes for application of new technologies and their mass use;
- Low level of marketing and promotion.

26.3% of the firms think that there are **institutional problems**, which include:

- No clear policy for promoting energy-saving technologies; no municipality or government organization for example makes any effort to apply such technologies in their buildings, etc.
- Not enough preferences for using RES and complicated procedures for obtaining co-financing by the energy efficiency fund.
- Extremely heavy documentation and application procedure for tenders for RES.
- There is a lack of real state policy for support of SMEs.

15.8% of the firms think there are **technical barriers** for the wider application of solar thermal, namely:

- "Garage" production collectors are offered on the market with low quality and prices. This leads to disappointment by the consumers and to negative attitude towards the use of solar collectors.
- Lack of installation experience, especially for solar heating;
- Low qualification of the management;
- The trade is done in non-specialized stores.

15.8% of the firms think there are **cultural problems** for the wider application of solar thermal.
10.5% of the firms think that there are **barriers connected to the quality**, which are the following:

- There are both high and low quality collectors on the market. There is nobody to pose requirements on the quality of collectors or to be a major factor on the market.
- The use of non-certified and untested (e.g. by European laboratories) solar collectors.

15.8% of the firms think there are no barriers for the development of solar thermal applications.

Overall the major barriers perceived by the producers and installers are economic, and to a lesser degree institutional and educational.

What are the major measures for overcoming the barriers?

68.4% of the participating firms think that the major measures for overcoming the barriers for wider use of solar thermal applications are economic, which are the following:

- Increase of the income of the consumers;
- More flexible and faster credits.
- Many more state incentives for using solar thermal;
- To apply economic preferences for installing thermal collectors and systems (e.g. reduced VAT);
- Reduction of the price of solar collectors and high quality local production;
- Assistance to specialized firms with equipment and finances.

42.1% of the participating firms think that institutional measures can encourage the use of solar thermal, such as:

- Adoption of certain rules and norms for the encouragement of the installation of solar systems;
- Removing the required condition for taking a bank loan for participating in the energy efficiency fund and possibility for direct contracting between the supplier of the service and the final user.
- Simplifying the application documents for application to tenders and other schemes.

42.1% of the firms think that there should be educational measures for overcoming the barriers, such as:

- More media articles and TV and radio spots for information on solar thermal applications;
- Large scale campaign for presenting the economic and environmental benefits from solar thermal applications;

5.2% of the firms think there should be technical measures such as:

- Training technically of installers.

5.2% of the firms think there should be measures connected to quality for overcoming the barriers, and more concretely:

- Not to allow on the market collectors and systems which do not meet the European quality norms (KEYMARK Certificate).

How can the Trans-solar project contribute in this respect?

52.6% of the participating firms think most helpful would be to organize business missions for development of partnerships between Bulgarian and other European organizations.

Transfer of experience from the most advanced solar thermal markets to Bulgaria:

- 63.2% of the firms would like to have transfer of experience regarding incentives in Europe for encouraging the market of solar thermal applications;
- 47.4% of the firms would like to have transfer of experience regarding marketing and advertisement of solar thermal applications as well as technologies and technological aspects.
- 36.8% of the firms would like to have transfer of experience regarding European standards and Assistance in developing local laboratory for certification of solar collectors.

20. Concluding remarks

To achieve successful thermal energy policy and especially solar thermal it is necessary for the government institutions to treat thermal energy as a substitute for electricity or the energy from natural gas or liquid fuels. This means that the preferential treatment and financial incentives of the different types of energy should be on equal level. The current financial incentives for green electricity in Bulgaria led to significant developments in wind energy, PV-systems and co-generation with biomass.

For production of half of the necessary DHW energy for the country (134 ktoe; 1 554 GWh), installations not less than 3 000000 m² of selective thermal solar collectors (500 kWh average annual productivity per m²) are necessary.

When working out short-term programs this possibility has to be detailed with priority, taking into account the possibilities for installation of solar thermal systems for DHW in the areas with high population density and high radiation potential. Very suitable and economically effective will be multi – family buildings in sunny regions. These systems can be viewed as a supplement to central district heating systems in big cities, which will supply the subscribers with hot water during sunny months, when the costs of the hot water, carried by the systems of central heating is relatively high.

The short–term program for the next three years, for the use of solar thermal collectors, should include suitable state and municipal buildings consuming electricity or liquid fuels for production of DHW. Good examples for this are social houses, kindergartens, hospitals and other municipally owned buildings. On preliminary estimations, in 2015 these buildings will consume about 64 ktoe or 742.10^6 kWh(t) of heat energy. If we assume that half of the energy needed for DHW (32 ktoe) had been produced through the sunny days of the year from solar thermal collectors, no more than 1.10^5 m² of solar thermal collectors will be necessary. The state could be an example by eliminating the use of expensive electric energy and liquid fuels for the production of heat energy.

References

1. Sofia Energy Centre. 2006. EAST-GSR project: National Report on Solar Thermal Energy in Bulgaria.
2. Survey of 19 Bulgarian solar thermal producers/installers in the framework of Transsolar project, March-May 2008. Pers. Comm.
3. Bulgarian Energy Efficiency Agency. 2005. National Long-term Program for Encouraging the Use of Renewable Energy in Bulgaria 2005-2015.
4. First National Action Plan for Energy Efficiency 2008-2010. June 2007.
5. Bulgarian Energy Efficiency Agency. 2005. National Long Term Program for Energy Efficiency.
6. State Commission on Energy and Water Regulation http://www.dker.bg/
7. Energy Efficiency Agency. http://www.seea.government.bg/
8. Ministry of Economics and Energetics. http://www.mi.government.bg/ind/inov.html
9. Toneva, Atanaska, Association “Energia 21”, 2007. State of the scientific studies in the area of renewable energy sources in Bulgaria.
10. Joint Research Centre. European Commission. Photovoltaic geographic information systems. http://re.jrc.ec.europa.eu/pvgis.
11. EU Energy and Transport in figures. Statistical Pocketbook 2007/2008. Directorate General for Energy and Transport.
12. Statistical reference book 2007. Bulgarian National Statistical Institute.
13. Statistical yearbooks 2000-2007. Bulgarian National Statistical Institute
14. National Statistical Institute – Census of population, building stock and farms, 2001
15. Sunsystem New Energy Sources Ltd. Pers. Comm. March-May 2008.
16. STS Solar Ltd. http://solar.sts.bg.forum
17. Erato Holding. http://www.erato.bg
18. Heliotech Ltd. http://www.heliotech.org
19. Apex Solar. http://www.apexexperts.com
20. Business Group ECOTOP. http://www.ecotop.bg
21. BNNS Solar Systems. http://www.bnns.bg

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Annex A: Solar Thermal Directory

List of firms producers, suppliers and installers of solar thermal systems in Bulgaria

No	Name	Address	Telephone/Fax	E-mail	website	Services	Origin of solar collectors:
1	Amigo Ltd.	Sofia bul. Evropa 180	+359 88931265; +359 2 240768	amigoltd@gbg.bg	www.amigoltd.hit.bg	Selling and installation of solar collectors	Solar, Sunsystem
2	Apeiron	Kjustendil, 210 Tzar Osvoboditel st.	+359 888299928, +359 878276280	apeiron@abv.bg	www.apeiron-bg.com	Installation of solar systems	Sunsystem NES
3	Apex Solar	Sofia, 49 Bulgaria blvd.	+359 2 958 5777; +359 888 629522	solar@apexexperts.com	www.apexexperts.com	Production and installation of solar collectors	
4	Apogei	Velingrad	+359 58634; +359 898 630 132			Selling and installation of solar collectors	
5	Aquaclima	Varna, bul. “Osmi Primorski polk” 128, et. 2, office 27	+359-52300824 +359 52304185	office@aquaclima.com	www.aquaclima.com	Solar thermal systems	
6	Bg Therm Ltd.	Sofia, 17 Akad. Mladenov st.	+359 2 9697122; f: +359 2 8625410 +359 889 603 343	bgt@bgtherm.com	www.bgtherm.com	Solar collectors	SunsystemViessmann
7	BNNS Solar Systems	Sofia, Vasil Levski, 545 str. No5	+359 2 945 4511	office@bnns.bg	www.bnns.bg	Design, supply, installation and maintenance of solar systems	TiNOX, Seido,
8	Bora-97 Ltd.	Blagoevgrad, Elenovo dist. Bl. 5, vh. B ap. 19	+359 73 840 990 +359 885 012349	Bora97@mail.bg		Supply and installation of vacuum-tube collectors	
9	Bramac Pokrivni Sistemi EOOD	Promishlena zona, Po B. 182 7500 Silistra	+359-86-813-110 F: +359-86820-870	office.bg@bramac.com	www.bramac.bg	Solar roof systems	Bramac
10	Build-ec Ltd.	Sofia, 13 Hr. Botev blvd.	+359 2 9522510 f: +359 2 9522510	buildec@abv.bg		Supply and installation of solar collector systems	
11	Bulclima	1164 Sofia, Lozenetz, 66 Sv. Naum blvd.	+359 2 965 0065; +359 2 963 1716	sofia@bulclima.com	www.bulclima.com	Import and installation of solar systems	Orange Solar Systems; Sunsystem

No	Name	Address	Telephone/Fax	E-mail	website	Services	Origin of solar collectors:
12	Bulgarian Energy	Sofia, 50 Tzar Asen st. et. 1 ap. 2	+359 2 491 24 18 f: +359 2 4707589 +359 888 986251	office@bulgarianenergy.com	www.bulgarianenergy.com	Selling and installation of solar collectors	Viessmann, Heliotech
13	Bulterm Ltd.	Sofia 1734, 51 Prof. Kiril Popov st.	+359 962 4529; f: +359 962 1477	bulterm@internet-bg.net	www.buderus-bg.com	Import and installation of solar collectors	Buderus
14	Deplan Ltd.	8000 Burgas, Pobeda district, 28 Chataldzha st.	+359 56/84 82 60 f: +359 56/847115	deplan@abv.bg	http://deplan-ad.hit.bg	Solar systems	Sunsystem
15	Eco solar industry Ltd.	Karlovo, p.box 4300, 55A General Karcov st.	+359 885174999 +359 896781935	ecosolarind@abv.bg	www.ecosolarind.com	Installation and maintenance of solar collectors	
16	Ecoset	Sofia 1404, 23 Silivria st.	+359 2 859 1193; +359 888 955 671	gpisin@ecosetbg.com bstoichev@ecosetbg.com	www.ecosetbg.com	Supply, installation and maintenance of solar systems	China
17	Eco-solar Ltd.	Sofia 1113, 15 Tintiava st.	+359 2 868 9597, +359 899 88 12 88 f: +359 2 8689597	office@eco-solar.com	www.eco-solar.com	Design, supply, installation and maintenance of solar systems	
18	Ecotechproduct Ltd.	Sofia, 79 F. J. Kjuri st., bl. 314 Raina Zlatanova	+359 2 963 1656	ecotech@nad.bg		Selling and installation of solar collectors	
19	Ecotermal	Burgas 8000, 47 Slivnitza st.	+359 56 814215; +359 2 979 0545 +359 56 841522	ecotermal@ecotermal-bg.com	www.ecotermal-bg.com	Import, design and installation of solar systems	Baymak; Viotherm;
20	Ecotermengineering	Sofia, 51 Vurban Genchev st.	+359 2 9621377			Selling and installation of solar collectors	
21	Ecotermica Ltd.	8002 Burgas, Pobeda dist. PO Box 9 Ivan Asenov	+359 56 40175; f: +359 56 40159	ecotermica@dir.bg		Selling and installation of solar collectors	
22	Ecotop Ltd.	Sofia, Borovo district, bl 208-AB, vh. B	+359 2 955 99 58 ф: +359 2 8554538	kirov@ecotop.bg	http://www.ecotop.bg	Production of solar collectors, installation, maintenance	Bulgaria
23	Eisentraum Ltd.	Burgas, 6 Maritza st.	+359 56 811 653	eisentraum@abv.bg		Development of solar installations	
No	**Name**	**Address**	**Telephone/Fax**	**E-mail**	**website**	**Services**	**Origin of**

							solar collectors:
24	Eldorad	Sevlievo, 59 Knjaz Boris I st.	+359 675 30155, 35355, +359 888 895136	eldorod@mail.bg	www.club-eldorod.com/Eldorod/index.html	Selling and installation of solar collectors	Seido
25	Energoconsult – SR Ltd.	Sofia 1404, Tvurdishki prohod 23	+359 2 958 8113; +359 2 958 8109	office@energoconsult.eu mirkov@mobikom.com	www.energoconsult.eu	Import, design, installation and maintenance of solar collectors and systems	Gasokol, Austria
26	Energy Solutions	Pernik, Vladaisko vustanie st.	+359 76 681 472	info@energysolutions.gr	www.energysolutions.gr	Selling and installation of solar collectors	
27	Enti Ltd.	Sofia, 41 Otec Paisii st.	+359 885 71 98 89	enti.ood@gmail.com	www.enti-ood.com	Selling and installation of solar collectors	GTC Solar
28	Eraterm Total	Sofia, 132 Geo Milev blvd.	+359 2 875 10 25 f: +359 2 9747860	eratotal_sl@abv.bg	www.eratotal.com	Selling and installation of solar collectors	Erato, Sunsystem
29	Erato	Suedinenie blvd, 67, 6300 Haskovo	+359 38 662012; f: +359 38 661356	toplo@erato.bg mbox@erato.bg	www.erato.bg	Production and installation of solar collectors	Erato, Mactech
30	Esco Engineering Ltd	Ul. “Savet na Evropa” 13 Sofia Bulgaria	+359 2 955 27 67 +359 2 955 26 25	info@esco-engineering.biz	www.esco-engineering.biz	Design and construction of solar thermal systems	REHAU, Viessmann Wolf
31	Eurocom 2000	Sofia 1172; 1 Nikola Gabrovski st. Dianabad district	+359 2 / 9 659 090 f: +359 2 9659099	office@eurocom²000.net	www.eurocom²000.net	Retailing and installation of solar systems	Sunsystem
32	Eurotrans Service	Sofia, 56 Iskar st.	+359 897 936680			Selling and installation of solar collectors	
33	Evon BG	Sofia 1407, 70-72 Cherni vruh blvd.	+359 2 962 19 97 ф: +359 2 9622003 +359 888 77 09 50	evonbg@yahoo.com	www.evonbg.com	Design and construction of solar thermal systems	
34	Gaskomfort Inc.	Sofia, 251 Tzar Boris III blvd	+359 2 856 5000, f: +359 2 8561100	info@gaskomfort.com	www.gaskomfort.com	Solar systems	Vaillant
35	GII Ltd.	Vratza, 1 R. Aleksiev st.	+359 92 654495	Gil_ood@abv.bg		Selling and installation of solar collectors	Erato
36	HEIZUNG-V.Georgiev SP	Sofia, 17 Mayor Toshev st. №17	+359 899 853 141	heizung@abv.bg		Solar installations for hot water	REHAU SOLECT
37	Heliotech Solar Energy Systems	Kazunluk, Aleksandur Batenberg st. 8B, Ivan Velchev	+359 887 995 579	office@heliotechbg.com	www.heliotechbg.com	Production and installation of vacuum-tube solar collectors and export	Heliotech, Bulgaria
No	**Name**	**Address**	**Telephone/Fax**	**E-mail**	**website**	**Services**	**Origin of solar**

							collectors:
38	Ilios	Varna, 33 Nikola Kozlev st.	+359 888 099 244	office@illios-bg.com	www.ilios-bg.com	Installation and maintenance of solar systems	
39	Integral 2005	Tervel, 26 Tzar Kaloyan st.	+359 5751 2058 +359 885 162 813	office@integral2005.com	www.integral2005.com	Production and installation of solar collectors	
40	Intermetal Ltd.	Sofia	+359 2 9366024		www.intermetal.bg	Retailing and installation of solar systems	Sunsystem
41	IV – 8 Ivanka Rusinova	Burgas 8000, Bratia Miladinovi District, bl. 71, et. 7, ap. 31	+359 5680130; f: +359 56812941	eratobs@yahoo.com		Selling and installation of solar collectors	Erato,
42	Ivan Subev SP	Bansko, 1 Angel Balev st.	+359 7443 4060	dics@bitex.com		Selling and installation of solar collectors	
43	Ivaterm Ltd.	Tovarna gara 8000 Burgas	+359 56 800345	info@ivaterm.com	www.ivaterm.com	Design, installation and maintenance of solar systems	Sunsystem
44	Ivo Gergov – IVG SP	Vratza, 1 Dragan Tzankov st.	+359 92 661881; +359 886 111001	ivg@gyuvetch.bg		Selling and installation of solar collectors	
45	Kit Engineering	Plovdiv, ul. Konstantin Velichkov 77	+359 32 622504; +359 888 230415	kitengineering@abv.bg	www.kitengineering.hit.bg	Selling and installation of solar collectors	
46	Klimasot	Blagoevgrad, 8 Sracin st.	+359 73 832281 +359 888 765094	mishelosh@yahoo.com	www.klimasot.vibs-bg.com	Selling and installation of solar collectors	
47	Klimat 90 – V. Marinov SP	Vidin, 29 Han Asparuh st.	+359 94 606 331; +359 888 683 791			Selling and installation of solar collectors	Erato
48	Kovex	1606 Sofia, 34 Totleben blvd. Svetoslav Shterev	+359 2 952 1772; f: +359 2 952 6569	kovex@kovex.biz kovex@omega.bg	www.kovex.biz	Import and installation of solar collectors	Sunda Solar Energy Tech, Seido; DASA
49	Latoka Ltd.	Petrich, N8A Bitolia st.	+359 745 61 843 +359 887/808 186	lazar_kaikov@abv.bg		Selling and installation of solar collectors	Erato, Germany, China
50	LUCKY-Nikolay Angov	13 Hristo Botev Str. Kazanlak; Nikolay Angov	+359 897 961 815 +359 895 054 300	lucky@loop-bg.com	www.solar.loop-bg.com	Distributor of solar collectors; designer and installer of solar thermal systems	
No	**Name**	**Address**	**Telephone/Fax**	**E-mail**	**website**	**Services**	**Origin of solar collectors:**

51	Mevida Ltd.	Kazunluk, 16 Treti Mart st.	+359 431 64111; +359 431 64363	mevidaood@abv.bg		Selling and installation of solar collectors	Erato; Sunsystem
52	MK Ltd.	Kurdzhali, 50 Republikanska st.	+359 361 620 80 f: +359 361 62081	mbm@dir.bg		Selling and installation of solar collectors	Erato; Sunsystem
53	M-term Ltd.	Sofia, Lulin-9, Asen Nikolov 9a	+359 2 826 64 30	m_term@abv.bg	www.m-term.hit.bg	Selling and installation of solar collectors	Erato
54	Multiterm	Plovdiv 4002 8 Brezovska st. Dimitur Kunev	+359 32 960258; +359 888 770790	office@multiterm.org; multiterm@abv.bg	www.multiterm.org	Import and installation of vacuum-tube collectors	Kloben
55	MZ - Razlog	Razlog, South industrial zone Petur Mishkov	+359 747 80013; +359 888 322 035	Petar_mishkov@mail.bg Mz-razlog@mail.bg	www.mz-razlog.com	Solar collectors	Heliostar
56	Nekoterm Ltd.	Sofia 1113, 5 T. Shevchenko	+359 2 973 3303 f: +359 2 871 84 14	nekoterm@abv.bg; nekoterm@yahoo.de	www.nekoterm.com	Selling and installation of solar collectors	Erato
57	NES New Energy Systems Ltd. Sunsystem	Shumen, 12 Madara st	+359 887 790939, f: +359 54 874 552	techno@sunsystem.bg ftrade@sunsystem.bg sunsystems@ro-ni.net	www.sunsystem.bg	Production and installation of solar systems including export	Sunsystem
58	New energy sources	Razgrad	+359 84 29521; f: +359 84 32252			Selling and installation of solar collectors	
59	New Solar Technologies	Industrial zone – ZIENO, 9700 Shumen Emil Metev	+35954832358 +359887997356	info@foreversol.com	www.foreversol.com	Design and development of solar thermal systems	
60	Niko-96	Gorna Oriahovitza Nikola Petrov st.	+359 618 6 44 67 +359 899 146 597	Niko_96@abv.bg	www.niko96.com	Selling and installation of solar collectors	Erato
61	Nora GKP SP	Yambol, 4 Kabile st.	+359 46 669409	nora_gpk@abv.bg		Selling and installation of solar collectors	Erato, Sunsystem
62	Oveka-92 Ltd.	Sofia, Druzhba 1, bl. 84, vh. Б, ap 24	+359 2 9791072, 979 10 74 f: +359 2 9791072	oveka92@abv.bg	www.oveka92.com	Design and installation of solar systems	
63	Passivehouse SP	Sofia, 28 Boliarska st.	+359 899 967 080			Selling and installation of solar collectors	
64	Pavel Boshnakov SP	Burgas, Hypermarket “Masterhaus”	+359 56 857022; f: +359 56 857033	boshnakovltd@yahoo.com		Selling and installation of solar collectors	
No	**Name**	**Address**	**Telephone/Fax**	**E-mail**	**website**	**Services**	**Origin of solar collectors:**
65	Popov Ltd.	San Stefano Str.	+359 56 833 556	info@popov.bg	www.popov.bg	Designs, distributes	

		62, Trade Centre 8000 Burgas	+359 56 833 555			and installs solar thermal installations	
66	Presta Termal	Sofia, 9 Hemus st.	+359 2 871 4583; +359 898 963794	office@kolektori.com	www.kolektori.com	Design, installation and maintenance of solar collectors	Sunsystem
67	Prometei Ltd.	Kurdzhali 85 Republikanska st.	+359 361 67715 +359 896 892598	prometei_ltd@mail.bg		Selling and installation of solar collectors	SunsystemGermany, China
68	RGS Ltd.	Gabrovo	+359 898 625 555	Viessman_rgs@mbox.contact.bg		Distribution and installation of solar collectors	Viessman, Sunsystem
69	Ruvex	1712 Sofia 41 Alexander Malinov Blvd Maria Hristova	+359 2 976 15 20 +359 2 976 15 15	mhristova@ruvex.bg	www.ruvex.bg	Designs, distributes and installs solar thermal installations	DE DIETRICH
70	RYOKO K	Sofia, 79A Slivnitza blvd	+359 2 822 1541			Selling and installation of solar collectors	
71	Slunchevi otoplitelni sistemi			bgteh1@abv.bg		Solar systems	Czech, China
72	Snezhana Popova SP	Goce Delchev, Dunav st	+359 751 61172 +359 751 61170	Snejana_popova@abv.bg		Selling and installation of solar collectors	Erato
No	**Name**	**Address**	**Telephone/Fax**	**E-mail**	**website**	**Services**	**Origin of solar collectors:**
73	Solar eco systems	Sofia, 48 Konstantin Irechek st.	+359 2 951 50 89, +359 885 554293 f: +359 2 9515089	solarline@mail.bg	www.solarlinebg.com	Selling and installation of solar collectors	Solar Machin Systems
74	Solar Technology	Varna, 277 Vl. Varnenchik st, et 6	+359 52 500 848 +359 899 11 51 41	my@solartechbg.info	www.solartechbg.info/	Selling and installation of solar collectors	
75	Solaris M	Sofia, 47 Nikola Petkov blvd.	+359 2 896 1756	solarism@mail.bg	www.solarism.eu	Production, import and installation of vacuum-tube collectors	
76	Solkav Bulgaria Ltd.	Sofia 1113, 31A Dragan Tzankov blvd.	+359 2 9608130, +359 888 491244 f: +359 2 9608131	a.valkanova@solkav.net office@solkav.net	www.solkav.net	Rubber solar absorbers	Solkav
No	**Name**	**Address**	**Telephone/Fax**	**E-mail**	**website**	**Services**	**Origin of solar collectors:**
77	SP Ecoterm	Burgas 8000, 9 Tzar Kaloian st.	+359 56 / 843 671 f: +359 56 845014	office@ekotermbg.com	http://ekotermbg.com	Retailing and installation of solar	Sunsystem

						systems	
78	Stema RS Ltd.	Ruse, 46 Treti Mart blvd.	+359 82 828237	office@stemabg.com		Selling and installation of solar collectors	Erato; Sunsystem
79	Stoper Ltd.	Plovdiv, Maritza blvd. 140	+359 32 625 204	info@stoperbg.com	www.stoperbg.com	Production and installation of solar collectors	
80	STS Solar Inc.	5300 Gabrovo, 14 Stancionna st.	+359 (66) 817 404 +359 (66) 817 407	solar@sts.bg	www.solar.sts.bg	Design, supply, installation and maintenance of solar systems	
81	Stubel	Varna, 70 Radecki st.	+359 52 613719; +359 888 938884			Selling and installation of solar collectors	Erato
82	Sun Solar	6400 Dimitrovgrad, Bratia Miliadinovi Metin Ibryamov	+359 391 61701	sunsolarbg@abv.bg	www.sunsolarbg.com	Design, supply, installation and maintenance of solar systems	China
83	Sunny build	Sofia 1612, 62 Kjustendil st.	+359 888 207 580; +359 2 950 4455	sunnybuild@dir.bg	www.sunnybuild.com	Design, supply, installation and maintenance of solar systems	
84	Sunny-del Ltd.	9700 Shumen, , Industrial district	+359 54 860 190, +359 897 923 979, +539 984 486 754	office@sunny-del.com	www.sunny-del.com/	Design, production, installation of solar thermal systems	
85	Termaexpert plus	Plovdiv, 37A Knjagina Maria Luiza st	+359 320666999	office@termaex.com	www.termaex.com	Selling and installation of solar collectors	Erato
86	Termal engineering Ltd.	Burgas, 36 Traicho Kitanchev st.	+359 56 810917 +359 89 795 46 10	termal@abv.bg		Selling and installation of solar collectors	Erato
87	Termoavtomatika	V. Turnovo, 3 Bulgaria st., vh. B	+359 62 639747 +359 888224879			Selling and installation of solar collectors	Erato, Sunsystem
88	Termodinamika Ltd.	Pazardzhik 4400, 3 Georgi Mashev st.	+359 34443595 f: +359 34442289	Termo_di@abv.bg	www.termodinamika.hit.bg	Selling and installation of solar collectors	SunsystemErato, China, Greece, Turkey, Germany
No	**Name**	**Address**	**Telephone/Fax**	**E-mail**	**website**	**Services**	**Origin of solar collectors:**
89	Termokomfort Ltd.	Sofia, Pavlovo District, 36 Pushkin blvd.	+359 2 955-91-17 ; +359 2 955-91-20	sofia@termokomfort.com	www.termocomfort.com	Design, installation and maintenance of solar systems	Erato, Sunsystem Wolf, Ray,

							Ezinc
90	Terratherm	Pleven, 12 San Stefano st.	+359 64 838290 f: +359 64 838290	info@terratherm-bg.com	www.terratherm-bg.com	Selling and installation of solar collectors	Erato
91	Thermocomers	Burgas, 3 Industrialna st.	+359 56 855269	office@thermocomers.com	http://thermocomers.com	Selling and installation of solar collectors	Sunsystem
92	Thermoconsult	1202 Sofia, 88 Dunav st. et. 6, office 21	+359 2 8 313 683 f: +359 2 8313783	thermoconsult@netissat.bg office@thermoconsult.net	www.thermoconsult.net	Supply and installation of solar collectors	Heliokami (Megasun)
93	Thermoeconomic	Burgas 8000, 8 Tzar Kaloian st.	+359 56 / 843 731		www.thermoeconomic.com	Retailing and installation of solar systems	Viessmann Sunsystem Greece
94	Thermtrade Ltd.	Sofia, Suhata Reka, bl. 51, vh. B, ap. 10	+359 895 625 071	atanasov@thermtrade.bg	www.thermtrade.bg	Supply, installation and maintenance of solar installations	RAY, Seido, WOLF, Erato
95	Toploengineering Ltd.	Sliven 8800, Pech Komplex	+359 44667454; +359 44662955	toploinj@ibs-bg.net		Selling and installation of solar collectors	Erato; Sunsystem
96	Toplokomfort		+359 887235303; +359 75124153	toplokomfort@all.bg	www.toplokomfort.free.bg	Design and installation of solar systems	SunsystemWolf
97	Toplotehnika Ltd.	Blagoevgrad, 29 V. Levski st.	+359 73 886783; 832 962			Selling and installation of solar collectors	Sunsystem
98	Toshko Petrov – Radi	Blagoevgrad, 38 Dame Gruev st.	+359 73 886867			Selling and installation of solar collectors	
99	Utilities Ltd.	8800 Sliven, Misho Todorov 2 Petrana Naneva	+359 44 622 543; f: +359 44 622543	info@utilitiesbulgaria.com	www.utilitiesbulgaria.com	Selling and installation of solar collectors	Seido, SunsystemTurkey, Germany
100	Victoria-R	Blagoevgrad 2700, 1 Andrey Lyapchev st.	+359 73 835 075	sales@victoria-r.com	www.victoria-r.com	Import and installation of solar systems	Macsun
101	Zizi Ltd.	Varna 9000, Vl. Varnenchik st., bl. 225-226	+359 52 510655, +359 52 505665	zizi@erato.bg		Selling and installation of solar collectors	Erato, Sunsystem Vaillant, Wolf
102	K&SH Ltd.	Velingrad, 31 Pionerska st.	+359 359 50510; +359 886 849 885			Selling and installation of solar collectors	

Annex B: List of major legislative documents

List of major legislative documents in Bulgaria

- Energy Law. National Gazette, Issue 107 from 9 December 2003, last amendment National Gazette, Issue. 36 of 4 April 2008.
- Law on Renewable and Alternative Energy Sources and Biofuels. National Gazette, Issue 49 from 19 June 2007
- Energy Efficiency Law. National Gazette, Issue 18 of 5 March 2004, last amendment National Gazette, Issue 55 of 6 July 2007.
- Law on Territory Planning. National Gazette, Issue 1 of 2 January 2001, last amendment, National Gazette, Issue 33 of 28 March 2008.
- Decree No.18 of 12.11.2004 for energy characteristics of objects.
- Decree No.19 of 12.11.2004 for certification of buildings for energy efficiency.
- Decree No.7 of 15.12.2004 for heat storage and energy efficiency in buildings.
- Decree on regulation of the prices of electrical energy.
- Decree on regulation of the prices of heat energy.