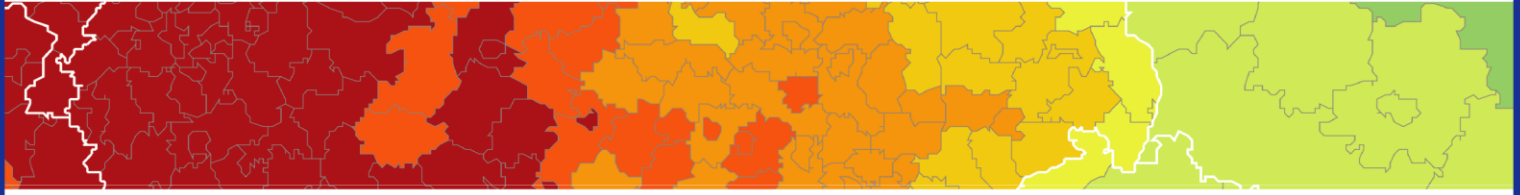


Inspire policy making by territorial evidence



Territories and low-carbon economy

Pazardzhik Province, Bulgaria

Applied Research

Case Study Report

Version 10/05/2017

This applied research activity is conducted within the framework of the ESPON 2020 Cooperation Programme, partly financed by the European Regional Development Fund.

The ESPON EGTC is the Single Beneficiary of the ESPON 2020 Cooperation Programme. The Single Operation within the programme is implemented by the ESPON EGTC and co-financed by the European Regional Development Fund, the EU Member States and the Partner States, Iceland, Liechtenstein, Norway and Switzerland.

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Territories and low-carbon economy

Regional Case Study:
Pazardzhik Province, Bulgaria

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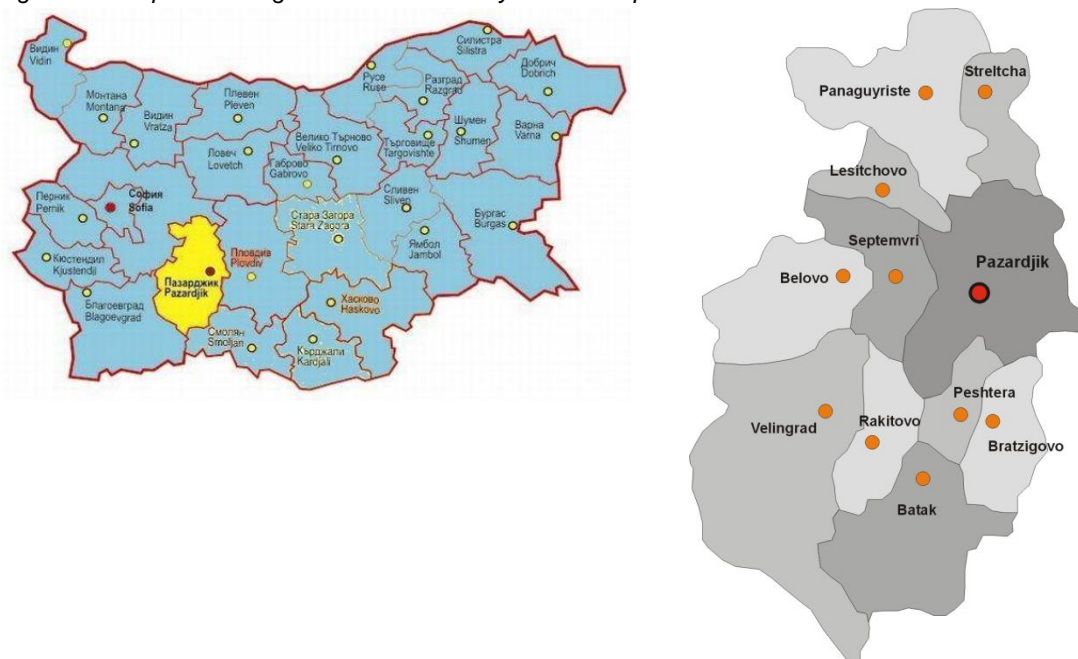
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1 General description of the region

1.1 Location of region and characteristic

The Province of Pazardzhik is one of the 28th administrative regions in Bulgaria according to the administrative-territorial division as of 1999. Following the accession of Bulgaria to the European Union for the purposes of strategic planning, the country was divided into six regions: Northeast, North Central, Northwest, Southeast, South Central, and Southwest. Pazardzhik Province is located in the west part of the South Central planning region. It comprises 11 self-governing municipalities, which include 117 settlements and 96 mayoralties situated on 4,458 sq. km., which is 4% of the total country territory. The greater part (56%) is forested areas and 36% is agricultural lands.

Figure 1.1: Maps of the region within the country and municipalities



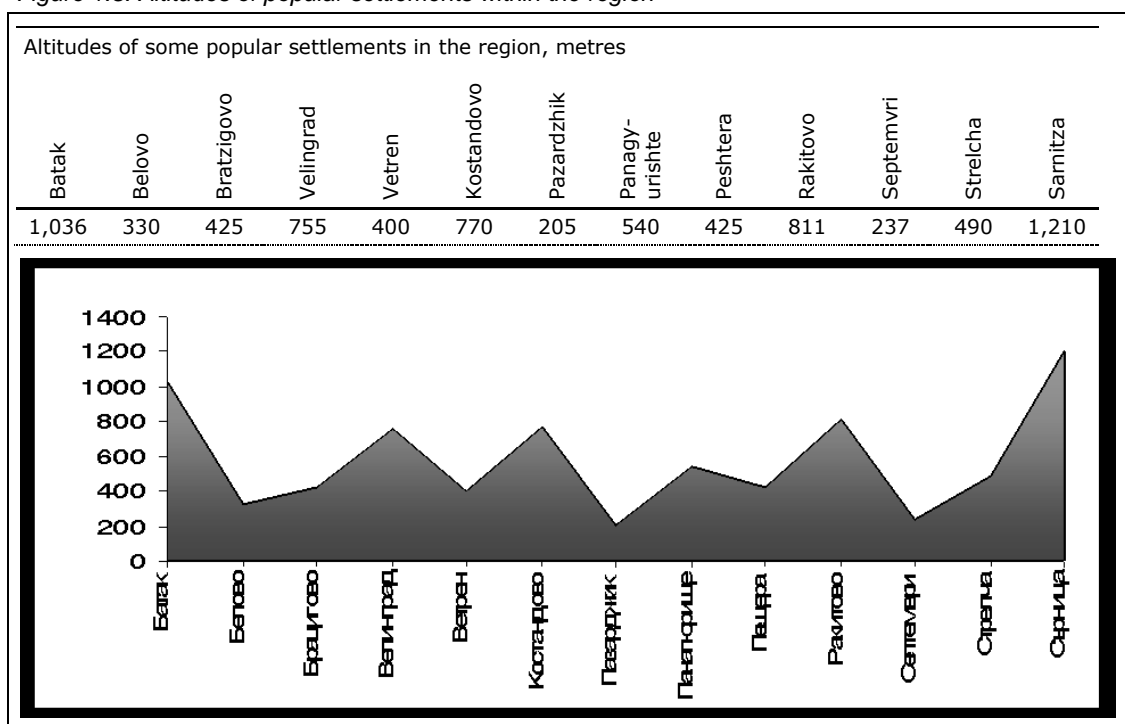
As of the 01/01/2015, a new municipality was established within the administrative boundaries of Pazardzhik Province – Municipality of Sarnitsa.

Figure 1.2: Location of the newly established municipality – Sarnitsa



Relief in the region is diverse: mountainous (parts of Ihtimanska and Sashtinska Sredna Gora, West Rhodopes and Rila) and flat (Pazardzhik-Plovdiv field which is the west part of the Upper Thracian Valley)

Figure 1.3: Altitudes of popular settlements within the region



The region of Pazardzhik ranks 8th with its population of 263,630 citizens (31/12/2015), which is 3.69% of the total country's population.

From administrative-territorial point of view, the Province of Pazardzhik consists of 12 self-governing municipalities, which include 117 settlements, and 96 mayoralties.

Table 1.1: Division by Mayoralties and Settlements

	No. of mayoralties	No. of settlements
Total for the region	96	117
By municipalities		
Batak	2	3
Belovo	7	8
Bratzigovo	5	7
Velingrad	15	21
Lesichovo	6	7
Pazardzhik	31	32
Panagyurishte	8	10
Peshtera	2	3
Rakitovo	2	3
Septemvri	12	15
Strelcha	4	5
Sarnitsa	2	3

Table 1.2: Municipalities and inhabitants (31/12/2015)

	Total	Male	Female
Pazardzhik Province	263,630	129,319	134,311
Batak	5,616	2,791	2,825
Belovo	8,187	3,997	4,190
Bratsigovo	9,037	4,462	4,575
Velingrad	34,511	16,630	17,881
Lesichovo	5,456	2,698	2,758
Pazardzhik	110,302	54,027	56,275
Panagyurishte	23,455	11,566	11,889
Peshtera	18,338	8,954	9,384
Rakitovo	14,706	7,283	7,423
Septemvri	24,511	12,231	12,280
Strelcha	4,691	2,260	2,431
Sarnitsa	4,820	2,420	2,400

1.2 Socio-demographic structure and development

Table 1.3: Demographic structure – age structure (31/12/2015)

Age (years)	Total	Male	Female
Total for the region	263,630	129,319	134,311
0	2,437	1,279	1,158
1 – 4	10,258	5,227	5,031
5 – 9	13,429	6,995	6,434
10 – 14	13,052	6,716	6,336
15 – 19	12,589	6,525	6,064
20 – 24	12,889	6,693	6,196
25 – 29	16,382	8,640	7,742

Age (years)	Total	Male	Female
30 – 34	17,294	9,201	8,093
35 – 39	18,105	9,619	8,486
40 – 44	18,512	9,620	8,892
45 – 49	19,341	9,872	9,469
50 – 54	19,568	9,911	9,657
55 – 59	20,260	10,055	10,205
60 – 64	17,616	8,290	9,326
65 – 69	17,443	7,647	9,796
70 – 74	12,829	5,259	7,570
75 – 79	10,183	3,872	6,311
80 – 84	7,248	2,583	4,665
85 – 89	3,197	1,008	2,189
90 – 94	883	268	615
95 – 99	94	33	61
100 +	21	6	15

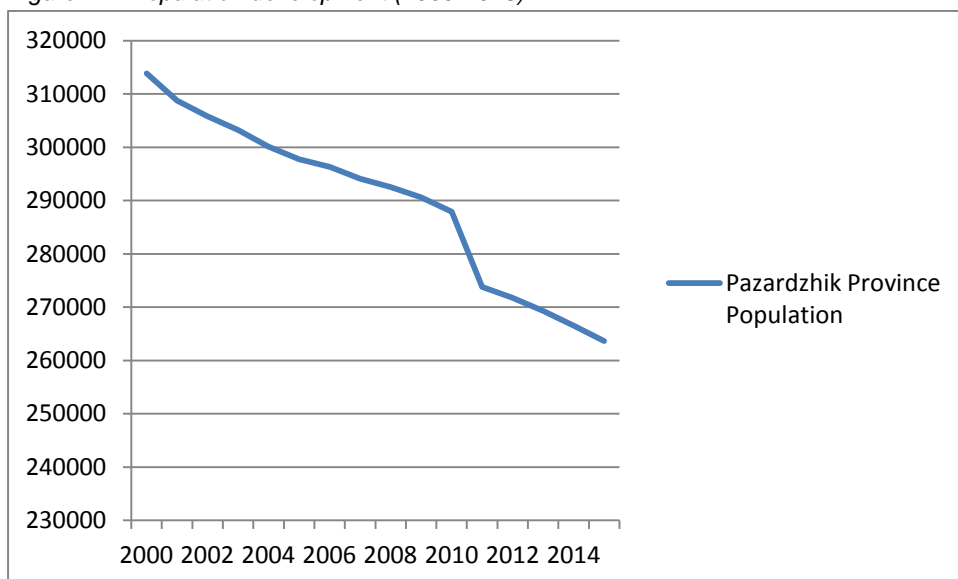
Table 1.4: Demographic structure – Education (31/12/2014)

Pazardzhik Province	Relative share of the population aged between 25 and 64 years with higher education	15.3%
	Relative share of the population aged between 25 and 64 years with secondary education	57.8%
	Relative share of the population aged between 25 and 64 years with primary or lower education	26.9%

Table 1.5: Population of Pazardzhik Province 2000-2015

Year	2000	2001	2002	2003	2004	2005	2006	2007
Population	313 851	308 719	305 790	303 246	300 092	297 781	296 281	294 086
	2008	2009	2010	2011	2012	2013	2014	2015
	292 534	290 614	287 910	273 803	271 721	269 287	266 549	263 630

Figure 1.4: Population development (2000-2015)



There is a steady trend of reducing the population of the region in past 15 years. It has dropped down by 16% in last 15 years, with an average for the country – 12.2%. The main reason for that negative trend is the migration of young and medium aged people to West Europe, the U.S. and Sofia (capital and the largest city in Bulgaria).

1.3 Settlement type and building stock

Table 1.6: Building stock in Pazardzhik Province

Parametre	Measure	Year 2014
Total buildings	No.	86,869
<i>By materials of outer building elements:</i>		
Concrete and panel	No.	2,725
Brick	No.	73,733
Other	No.	10,411
Dwellings	No.	126,806
<i>By property ownership:</i>		
State and municipal	No.	1,458
Belonging to private companies	No.	612
Belonging to individuals	No.	124,736
<i>By number of rooms:</i>		
One	No.	7,603
Two	No.	37,707
Three	No.	41,292
Four	No.	23,556
Five	No.	8,167
Six and more	No.	8,481
Floor area	Sq.m.	9,542,838
living area	Sq.m.	7,353,663
auxiliary area	Sq.m.	1,340,520
kitchens	Sq.m.	848,655

The population inhabits solid buildings, which in terms of technical construction differ significantly. Relatively big part of the citizens from Pazardzhik inhabits multi-storey residential buildings, built from concrete panels. These buildings together with the transport, energy, and commercial infrastructure form residential neighbourhoods. These buildings have been built during the socialist period of Bulgaria, i.e. 40-45 years ago and they have old building systems, bad heat parameters of their elements (walls, windows, roofs, etc.), which lead to increased heat losses during heating season. This type of architecture is typical primarily for Pazardzhik town, while the citizens of smaller towns and villages inhabit mainly family homes, which are in different conditions. Heat demand per m² is high and varies between 150 to 250 kWh/year. However, last 15 years in all towns from the region a sustainable trend is being observed – building of new homes (single-family and multi-family ones), which are characterized by low number of floors and a significantly better quality. Many of the buildings of the old type have been already energy-refurbished and renovated. There is not any central heating

supply in the region. In large administrative units like towns of Pazardzhik, Velingrad, Panagyurishte, and Peshtera, the population uses mainly electricity as a heating/cooling source, while in smaller towns and villages the population uses mainly fire-wood and coal in ordinary low-efficient burning stoves. There is a negative trend observed in recent years in regards to pellets from wood biomass: the region is famous with its pellet producers yielding about 1/3 of the entire state pellet production, but at the same time this type of fuel is poorly known and rarely used by households in the region.

1.4 Transport system and modal split

The transport infrastructure is part of the national infrastructure scheme and part of the Southeast-European scheme. The Euro-Asian transport corridor passes through the territory of the region connecting West Europe with Middle East and Central Asia; the international highway Trakia connects West Europe with Istanbul; the international railway road connects Central Europe with Asia. The light rail starts from Septemvri railway station and connects Trakia with the Rhodopes, Pirin and Rila.

The trolley transport in Pazardzhik is very important for the local community and for transportation of citizens within Pazardzhik town. This service is being carried out by the local municipal company “Trolley transport” established in 1992. The trolley network connects the west part of the town – the central part – the industrial zone – the railway station.

In 2014 there were 117,254 registered vehicles on the territory of the region, which makes *440 vehicles/1,000 inhabitants* (266,549 citizens in 2014).

The total length of the national road network in Pazardzhik region is 739 km, and 714 km of them are asphalt, and 51 km are highway; 59 km are first class, 202 are second class, and 427 km are third class and road connections at intersections and junctions.

The overall accessibility of mountainous areas in the region is a serious problem for the whole socio-economic development. The road network is fully covered by durable asphalt.

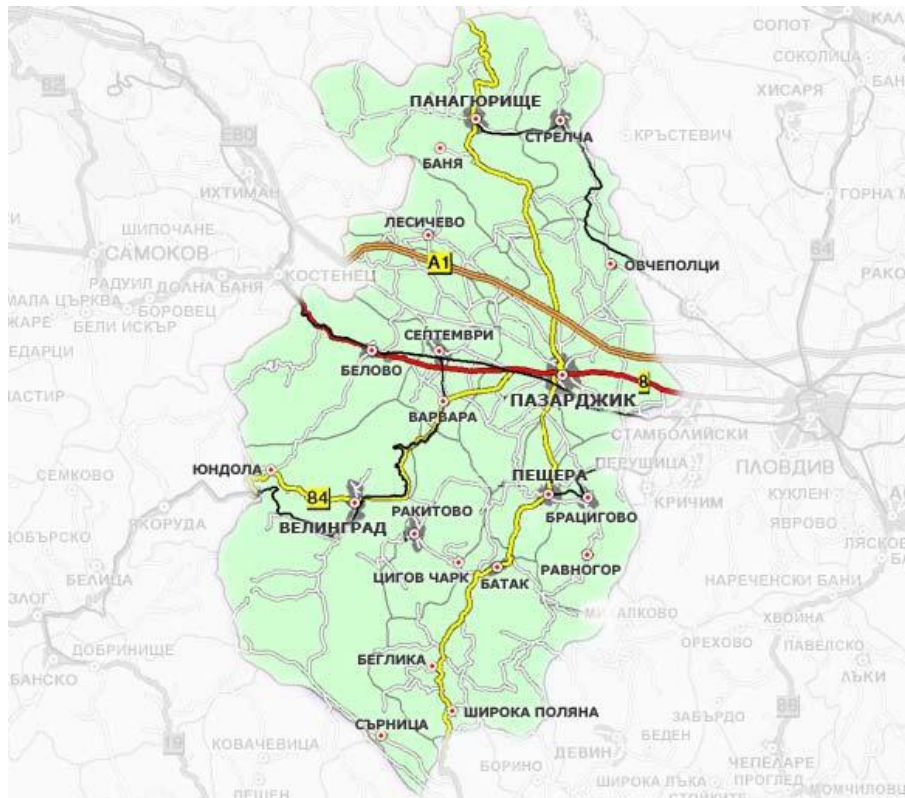
The main south railway line connecting Central Europe and Asia passing through Pazardzhik provides access also to harbours of the Black Sea – Burgas and Varna, and harbours of the Danube River, and the airports of Sofia and Plovdiv.

In winter times, the transport connections of some mountainous areas, located primarily in municipalities of Velingrad, Batak, Sarnitsa, Peshtera, and Rakitovo are problematic due to large distances between settlements and poor operational parameters of the roads. When developing RES projects like for example energy plants based on local RES, some logistics problems, hard terrain accessibility, and poor weather conditions must be taken into account and predict alternative ways of operation under such conditions.

The bus and railway connections between the regional centre – Pazardzhik, and the rest part of Bulgarian large towns are well developed, as it is located at the busiest road in Bulgaria,

Sofia-Plovdiv (the second largest city in Bulgaria with around 350,000 people) which defines its development as a large logistics centre. The town is connected to each station in the country by the national railway. There are regular bus lines between the town and Sofia, Plovdiv, Velingrad, Panagyurishte, Blagoevgrad, etc.

Figure 1.5: Road network in Pazardzhik Province



1.5 Regional economic structure and development

Figure 1.6: GDP, total for the region

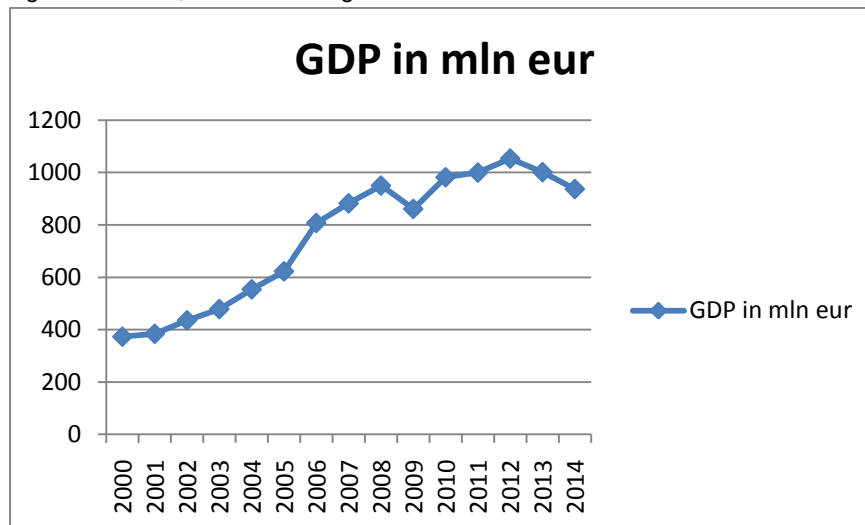


Figure 1.7: GDP per capita – Pazardzhik Province

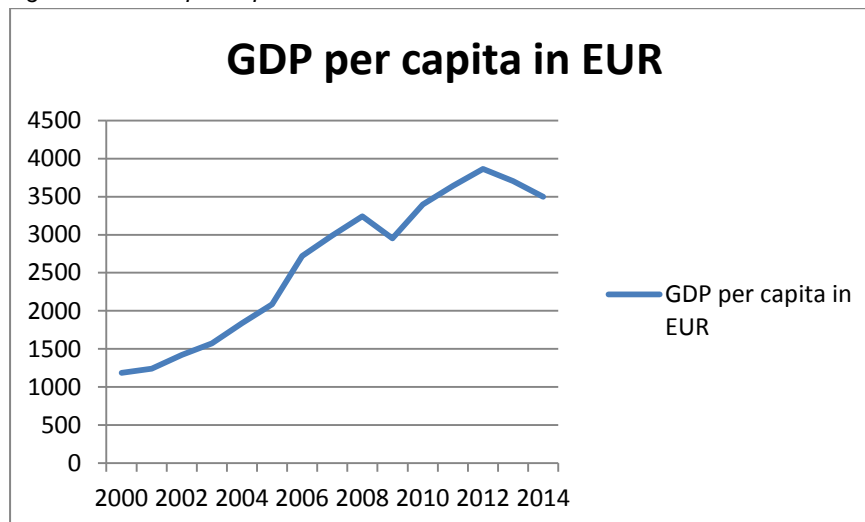


Figure 1.8: GDP per capita – average for the country (Bulgaria)

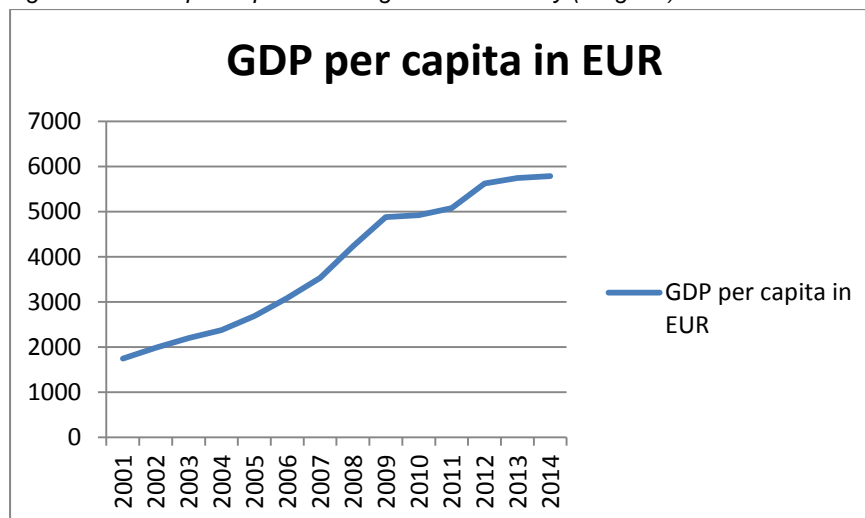


Table 1.7: Gross value added for the region and by sectors

Parametres	Measuring unit	2010	2011	2012	2013
GVA total for the region	million €	852	874	909	862
<i>GVA by sectors</i>					
Agriculture	million €	75	83	76	80
Industry	million €	390	403	443	386
Services	million €	387	387	391	396

Table 1.8: Regional economic profile (employment)

	2013	2014	change
A Agriculture, forestry and fishing	3,329	3,493	164
B Mining and quarrying
C Manufacturing	19,978	20,683	705
D Electricity, gas, steam and air conditioning supply
E Water supply	939	948	9
F Construction	2,555	2,275	-280
G Wholesale and retail trade	8,338	8,338	0
H Transportation and storage	3,152	3,140	-12
I Accommodation and food service activities	2,514	2,610	96
J Information and communication	326	354	28
K Financial and insurance activities	577	463	-114
L Real estate activities	522	511	-11
M Professional, scientific and technical activities	528	547	19
N Administrative and support service activities	1,707	1,401	-306
O Public administration and defence	2,962	2,895	-67
P Education	5,284	5,406	122
Q Human health and social work activities	3,950	4,001	51
R Arts, entertainment and recreation	521	445	-76
S Other service activities	723	699	-24
Total:	59,845	60,089	244

Industry is a major sector in Pazardzhik district. In 2014, there were 194 registered companies on the territory of Pazardzhik district, producing food and beverages (without alcohol and tobacco products). Besides those important enterprises, there are several thousands small and medium-sized enterprises operating in services, construction, commerce, and other specific industries.

The largest share belongs to companies producing bread, bakery products, and other food – 98; followed by beverage companies – 27; canning companies – 18. Incomes of that companies raised around three times for the period 2007-2014, and the number of employed raised by 1,075, and the average annual salary by LEV 1,843 (€ 942). At the same time, labour productivity increased by 63% due to the technological innovation of companies in that sector.

Very important for the local industry is the production of wood, paper, cardboard and their products with share of 15.3% of the total volume of production. The number of firms is 308, and the number of employed exceeds 3,000 people. This is due to the large number of log-

ging companies located primarily in the Rhodope Mountain part of the region and also to the presence of large industrial mills producing paper, cardboards, and their products.

In 2014 companies engaged in production of wood, paper, cardboard and their products (without furniture) achieved net sales of LEV 240,406,000 (€ 122,919,520) which is by 15% more than the total sales of all other companies from the region. Leading producer of papers, corrugated cardboard, and wrapping paper is Duropack-Trakia – Pazardzhik, which has a 60-year tradition in that branch and the most advanced equipment. Customers and partners of that entity are leading enterprises from almost all branches and sectors.

Production of textiles, clothing, footwear and other leather products forms 4.4% of the gross regional output. In 2014 there are 159 firms of that branch operating in the region, and employed are 6,170 people (21.2% of all employed in industry).

A leader in biotechnology sector is Biovet S.A. located in town of Peshtera – a leading European producer of feed additives, premixes, active substances, and drugs for treatment, prevention and improving animal productivity. The company develops also intermediate products and active substances for pharmaceutical industry; it produces enzymes, and enzyme compounds for use in animal farming and other industries such as bread production, juice-, beer-, and wine-production, textile industry.

2 Energy strategy, energy consumption and regional renewable energies

2.1 Regional highlights and challenges

The Province of Pazardzhik represents a typical rural region with a well-developed agricultural sector, including forestry and farming. The region provides very good opportunities for the development of sustainable agro energy chains based on local agricultural residues, and local agri-industrial wastes.

The proportion between agricultural (160,169 ha) and forest (254,669.7 ha) area in total is close to 1:2 (see Table 2.1). 1 ha = 10 dka

Table 2.1: Agri and Forest lands in Pazardzhik region

Municipality	Agricultural land, dka	Forest land, dka
Batak	64670	576442
Belovo	87648	241567
Bratsigovo	97213	119735
Velingrad	100717	670232
Lesichovo	123060	74410
Pazardzhik	461898	77660
Panagyurishte	235295	322231
Peshtera	51359	73097
Rakitovo	44416	194377
Septemvri	204098	111908
Strelcha	131315	85038
Total for the region	1601689	2546697

As it can be seen from Table 2.1, in most of the municipalities the forest land prevails over the agricultural one. This fact determines the bigger feasibility of forest biomass-for-energy processing to other possible energetic chains. This is the situation in the municipalities Batak, Belovo, Velingrad, and Rakitovo where the proportion agricultural/forest land is bigger than 1:5. There the technology for briquetting and pelleting has already been developed.

The municipalities of Pazardzhik, Septemvri, Strelcha and Lesichovo present exclusions from this situation. There the agricultural land dominates considerably over the forest one.

The agro-energetic chains related to processing of wood biomass residues and wastes depend strongly on the distances. In these chains the price of raw material is low but the transportation costs could affect negatively the feasibility of the energy production. That is why it is

important to have in mind the distances between the sources of raw materials and the place where the processing plant is installed.

The production of electricity is quite a topical issue in recent years on the territory of Pazardzhik Province and in Bulgaria, especially from RES because there are preferences (feed-in tariffs) for production of electricity from PV, wind, and biomass. Wind energy is not topical for Pazardzhik province, but only for some regions located near to the Black Sea. However, since 2012 the feed-in tariffs were cut/decreased – later in the document (Section 2.6) it was explained why; and since 2012 there is more promotion of heat energy instead of electricity.

Other opportunities for local sustainable development of energy production represent the geothermal sources in the region. There are geothermal resources in several municipalities from the region: Velingrad, Strelcha, Belovo, and Bratzigovo. The temperature of geothermal waters vary from 20 to 90 °C with largest potential in Velingrad. There are already studies which prove the feasibility and profitability of innovative technologies for production of electricity by combining two renewable energy sources: geothermal energy and biomass. These are the so called “*hybrid systems*”, which have been further analysed during the European project GeoSEE. A cost effective hybrid system of type “geothermal sources – biomass” requires a place, where no access to the natural gas grid exists, and an existing infrastructure is available like roads, power supply infrastructure, etc. In Pazardzhik province these are municipalities Velingrad, Strelcha, and Bratzigovo. Another precondition for a successful hybrid system is the availability of consumers which before building up of the hybrid system are consuming inefficient conventional energy sources – for example, public building with heating based on liquid oil fuel and/or electricity. A distance of up to 1,000 metres between borehole and potential consumers will allow for transportation of geothermal hot water without significant temperature losses. However, depending on the quality of heat insulation of pipes, much longer distances (between consumers and hybrid system) are possible to achieve. In urban areas, the existing underground infrastructure should be taken into account, as well as normative regulations must be followed and complied with. A specific problem that could appear and must be tackled is the passing (installation) of pipeline inside private property. Such situation could impede and slow down project implementation significantly. This will lead inevitably to additional costs for the project.

The use of geothermal energy is an important step towards energy supply diversification for end-users; it represents a real opportunity for diminishing of energy costs in public sector and in households sector within Pazardzhik Province. The environmental impact of implementing such projects is indisputable, and has been proven in past studies within different initiatives and projects, including the GeoSEE project. It can also be a way to establish sustainable energy communities in those areas where such renewable sources exist. On the other hand, geothermal waters, which contain unhealthy ingredients and cannot be used for balneology and direct consumption, can have a real and very good alternative use – production of heat energy and electricity.

2.2 Energy strategy of the region

As according to the latest versions of both Bulgarian Acts, the *Energy Efficiency Act* and the *Energy From Renewable Sources Act*, all regional and local authorities must develop and follow energy programmes in compliance with the above mentioned acts. The Energy Plans and Programmes for their execution are being developed in compliance with the National Strategy under article 7 in the *Energy Efficiency Act*, as well as in compliance with article 10 in the *Energy From Renewable Sources Act*, and in compliance with the National Action Plan for Energy Efficiency, incorporating the specific details of the Regional Development Strategy and Local Development Plans.

Main highlights which should be tackled within these energy policies are:

- To promote sustainable renewable energy sources, biofuels, and energy efficiency at local and regional level;
- To reduce the negative perception among citizens towards innovative renewable energy solutions;
- Increasing of investments in local sustainable energy installations among inhabitants in rural areas, entrepreneurs and local authorities;
- Reduce environmental pollution and CO₂ emissions from industry;
- To meet the 2020 renewable energy obligations.

The responsible authority for development of the Pazardzhik Regional Energy Strategy (PRES) is the Pazardzhik Regional Administration (PRA). By the time of developing of the current case study, PRES has not been finalized yet – it is still in development phase. Although it has a voluntary character to citizens, and SMEs, the main focus and targets of the strategy are very ambitious and include the following:

- Increase of energy efficiency in buildings of the region. Estimations of PRA show that more than 35% of the final energy consumption belongs to buildings. Energy indicators of building performance are low, and the ambition is to improve the performance of residential and public buildings in Pazardzhik Province.
- Industry – all enterprises in the region are privatized. Authorities will focus their efforts in exploration of contemporary technologies for energy efficiency and renewable energy sources within the production cycle depending on the type of production.
- Quantitative targets will be put only for the public sector, and households sector – buildings.

Other topics/issues will be treated by PRES in a more general way due to limited power of the Regional Authority. Local authorities (municipalities) have much more powers in terms of budgets, policy development, and introducing of various incentives for the local RES development. For this reason, local energy plans seem to be much more ambitious in comparison to the PRES.

As according to the Bulgarian legislation, each public building with total built area above 500 m² must perform the following compulsory activities:

- Energy audit and certification
- Measures from the energy audit must be implemented within a 3-year period
- Adoption and implementation of individual energy saving targets
- Carry out energy efficiency inspections of heating boilers and air conditioning systems

2.3 Regional and local energy infrastructure

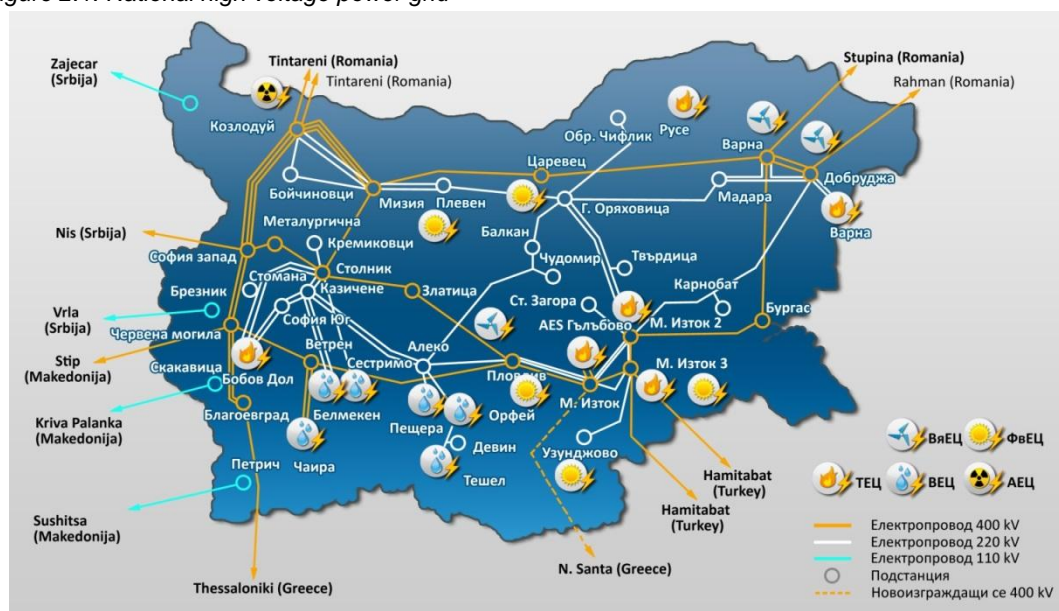
Electricity network

The electricity distribution network in Pazardzhik district consists of the following elements: overhead lines, cable lines, power grid substations 220/110/20 kV and distribution substations 20/0.4 kV serviced by EVN Bulgaria. The current state of these components is as follows:

- Cable line with length 136 km;
- Overhead lines with length 120 km;
- Power grid substations 220/110/20 kV – 5;
- Distribution substations 20/0.4 kV with total installed power 280 MVA – 405.

The power grid of Pazardzhik District represents an integral part of the national power grid system. The map below shows that system including the major sources of energy, the transmission power lines at 400, 220 and 110 kV and the power-lines (connections) to all neighbouring countries.

Figure 2.1: National high voltage power grid



Natural gas distribution network

The national main gas pipeline passes through Pazardzhik District, and it feeds the towns of Pazardzhik and Peshtera. The total length of the gas pipeline built on the territory of the district is 69,100 m. The larger part of industrial companies and those of the public sector in both towns like schools, hospitals, and administration buildings, have been gasified. The percentage of households, however, that uses this type of energy in everyday life is quite insignificant. The total annual consumption of natural gas is 19,400,000 normal m³, split to the following sectors: industry – 58%, public sector – 31%, households – 11%. The supply of natural gas is carried out by the national utility company “Overgas”.

A map of the gas distribution network in Municipality of Pazardzhik is shown below:

Figure 2.2: Gas distribution network in Pazardzhik



In regards to households – there is no access to district heating networks on the territory of Pazardzhik Province, i.e. families heat their premises locally, and individually. Only few public buildings on the territory of Pazardzhik town have access to district heating.

2.4 Patterns of energy consumption

Table 2.2: Energy consumption by sectors 2000-2014 (ktoe)

Year/Sector	Industry	Transport	Households	Agriculture	Services	Total
2000	146	35	93	21	34	329
2001	148	38	89	20	40	335
2002	140	40	95	21	39	334
2003	150	45	101	22	41	358
2004	152	46	94	22	38	353
2005	153	51	95	24	43	366
2006	155	54	97	25	49	380
2007	160	51	92	23	47	374
2008	146	54	95	21	50	367
2009	107	53	96	20	49	325
2010	110	52	100	20	51	333
2011	113	51	102	20	51	337

Year/Sector	Industry	Transport	Households	Agriculture	Services	Total
2012	109	53	102	21	51	336
2013	108	48	96	19	48	319
2014	110	44	94	21	48	316

Table 2.3: Energy consumption by capita (toe)

Year	toe per capita
2000	1.06
2001	1.09
2002	1.10
2003	1.18
2004	1.19
2005	1.23
2006	1.29
2007	1.28
2008	1.25
2009	1.13
2010	1.17
2011	1.24
2012	1.25
2013	1.20
2014	1.23

Table 2.4: Share (%) of energy by sector 2000-2014

Year/Sector	Industry	Transport	Households	Agriculture	Services	Total
2000	44	11	28	6	10	100
2001	44	11	27	6	12	100
2002	42	12	28	6	12	100
2003	42	13	28	6	11	100
2004	43	13	27	6	11	100
2005	42	14	26	7	12	100
2006	41	14	26	7	13	100
2007	43	14	25	6	13	100
2008	40	15	26	6	14	100
2009	33	16	29	6	15	100
2010	33	16	30	6	15	100
2011	34	15	30	6	15	100
2012	32	16	30	6	15	100
2013	34	15	30	6	15	100
2014	35	14	30	6	15	100

Table 2.5: Total energy consumption of households by end-use (final energy) 2000-2014

Year/Sector	Households	Year/Sector	Households	Year/Sector	Households
2000	93	2005	95	2010	100
2001	89	2006	97	2011	102
2002	95	2007	92	2012	102
2003	101	2008	95	2013	96
2004	94	2009	96	2014	94

The total final energy consumption in 2014 was 316 ktoe, and the distribution between sectors is: industry – 35%, households – 30%, transport – 14%, services – 15%, and agriculture – 6%.

Within the period 2000-2014 energy consumption does not change significantly, with peak consumption in years 2006, and 2007. The consumption in sector Industry is decreasing and on the contrary, consumption in sectors Transport and Services is increasing slightly. There was a relatively sharp drop in total energy consumption during 2009 due mainly to the Economic crisis. However, the consumption in Households and Services remains steady regardless of the economic situation. More or less, it could be concluded that the effect of the Global crisis on energy consumption in the region of Pazardzhik (and in Bulgaria) is similar to the effect in other European regions, but with a delay of one-year period because the Crisis affected the Bulgarian economy with a year later in comparison to other EU regions.

2.5 Regional potential of renewable energy

In 2010 there was a detailed study of the *waste and biomass potential* from forestry, agricultural sector, urban waste, and waste waters in Pazardzhik Province within the BIONIC project. The table below show summarized data about all residues in Pazardjik region, which have been estimated within this study.

Table 2.6: Waste and unused biomass potential in Pazardzhik Province and its energy content

Type of residual	Unused quantities	Energy equivalent, toe/y
Twigs and lopping	28,700 dense m ³ /y	5,948
Residues from wood-processing industry	2,000 t dry pulp/y	920
Solid agricultural residues		
- Straw	4,908 t/y	1,670
- Cornstalks	1,375 t/y	1,375
- Flower stalks	2,189 t/y	482
- Vine sticks	7,557 t/y	1,660
- Fruit tree twigs	2,552 t/y	510
- Tobacco stalks	1,276 t/y	255
Residues from stock-breeding and energy content of biogas	12,606,412 m ³	5,481
Solid urban waste and the energy equivalent when combusting it in installations	162,884 t/y	16,200
Landfill gas	13,030,720 m ³	5,597
Biogas from wastewater treatment installations	1,637,025 m ³ /y	695
Total		40,793

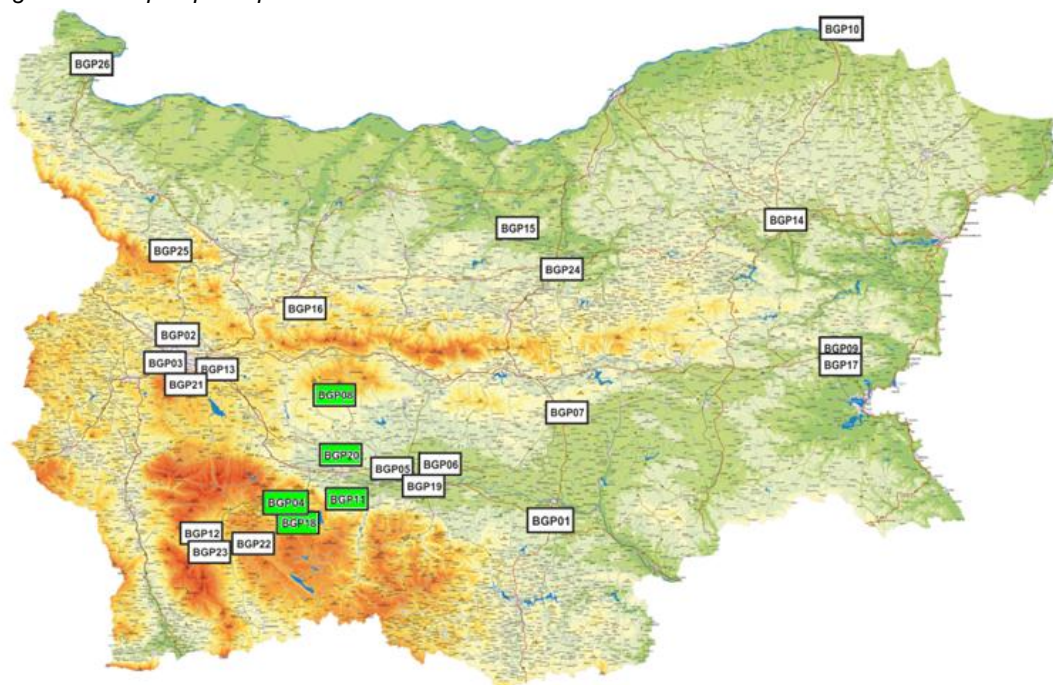
Summarized data in the table above reveals the significant importance of unused residues in the region and its energy equivalent which amounts to 40,793 toe/year.

Pellet sector in the region

The region is famous with its forested area – about 55% of the total area is forests. Due to this potential, and due to the existence of many wood processing companies, the production of wood pellets is a sector which is growing steadily in recent years. Currently, there are five large producers of wood pellets and one of them situated in the town of Velingrad (BGP04). Another large pellet producer is situated in village of Kostandovo, Rakitovo municipality (BGP18). The other producers are located in town of Peshtera (BGP11), town of Pazardzhik (BGP20), and village of Elshitsa, municipality of Panagyurishte (BGP08). The total annual production of pellets is estimated to about 50,000 tons per year.

The next figure shows the pellet producers in Bulgaria, and the location of the five producers in Pazardzhik District, marked with green boxes:

Figure 2.3: Map of pellet plants in Pazardzhik Province



Hydro power plants on the territory of Pazardzhik Province

There are several hydro power plants on the territory of Pazardzhik District which produce 906 GWh electricity per year. These are:

- Four hydro power plants with installed capacity 221.8 MW.
- Hydro-energy power complex “Batashki vodnosilov put” which includes three hydro power plants – “Batak”, “Peshtera” and “Aleko” with total installed capacity 250 MW.
- Power plant “Belmeken” with installed capacity 409 MW.
- Power plant “Chayra” with installed capacity 800 MW.

Some large industrial factories have their own co-generation plants and produce combined heat and power, but that specific production is relatively low and is relevant only to the manufacturers themselves.

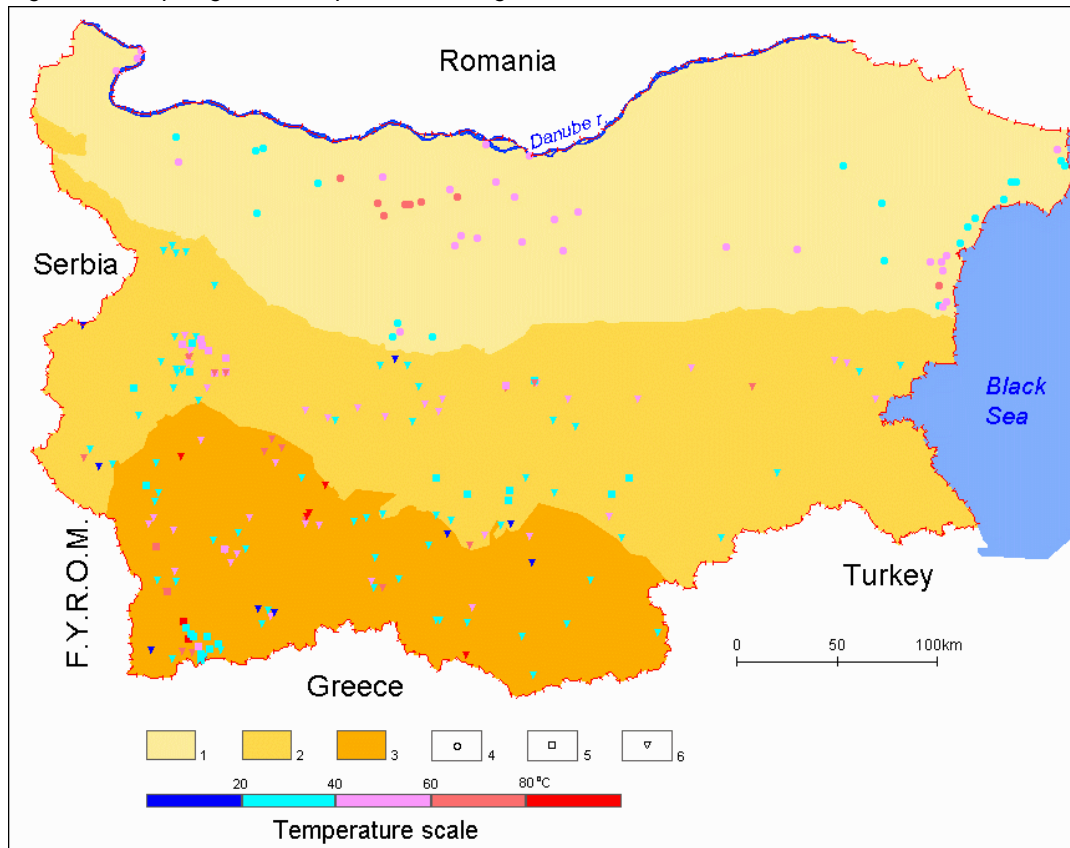
Geothermal potential

There exist approximately 1000 thermal springs and aquifers in Bulgaria, and generally those identified in the southern regions consist of relatively shallow hot springs, while the northern regions have been developed only through deep well borings. Drill depths for those discovered and evaluated resources in the southern regions range in depth from 100 – 1500 m, while the northern regions range from 100 – 5000 m in depth. The majority of these deep well borings have been implemented and financed over the years by the government.

Estimates as to the overall potential of unexploited, probable, and possible resources to be in the neighbourhood of 1800 MWt.

Although at the present Bulgaria does not generate any power from geothermal sources, it has been estimated that the country's estimated power generation potential is 200 MWe.

Figure 2.4: Map of geothermal potential in Bulgaria



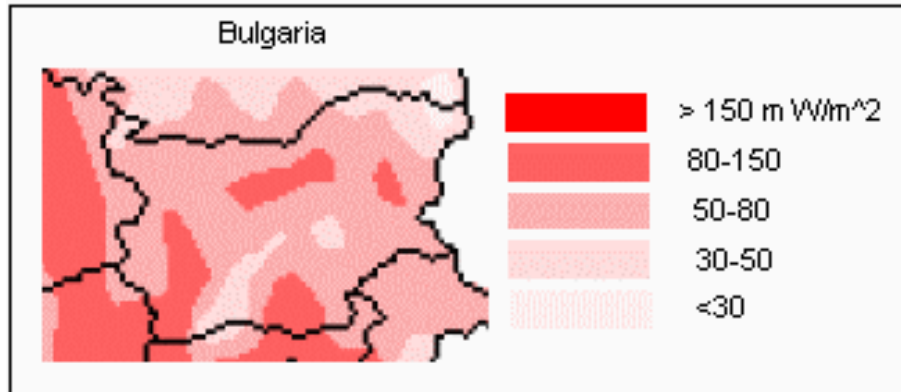
Legend

1. Moesian plate (stratified reservoirs)
2. Sredna gora, incl. Balkan zone (secondary stratified reservoirs, fractured reservoirs)
3. Rila-Rhodopes massif (predominantly fractured reservoirs)
4. Major wells and groups of wells discovering stratified reservoirs in a plate region
5. Hydrothermal sources associated with waters from fractured reservoirs located in Southern Bulgaria.
6. Hydrothermal sources associated with waters from secondary stratified reservoirs located in Southern Bulgaria.

Low-enthalpy geothermal potential

In 1998, the Geological Institute of the Bulgarian Academy for Sciences completed a re-assessment of the geothermal resources from 162 known fields. That assessment found a temperature range between 20°C and 100°C, with the majority of the reservoirs in the 20°C – 30°C and 40°C – 60°C ranges (Figure 2.5).

Figure 2.5: Map of low enthalpy geothermal potential of Bulgaria

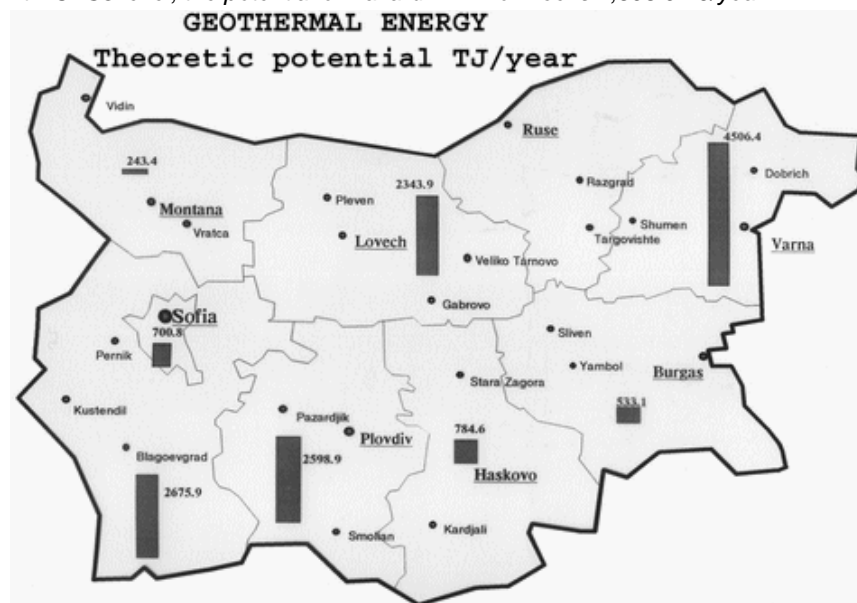


Low-enthalpy geothermal reserves

Bulgaria has a sizable reserve of geothermal energy and is rich in low enthalpy geothermal waters. The country has been utilizing approximately 37 percent of its total potential, or about 109.6 MWt producing some 1,671.5 TJ of energy per year, for use in space heating and air conditioning, greenhouses, drinking water, and for balneology purposes.

Studies of the Bulgarian Academy for Sciences have estimated the overall potential in unexploited, proven reserves to be approximately 440 MWt of thermal energy.

Figure 2.6: Map of distribution of geothermal reserves in Bulgaria
At NUTS3 level, the potential of Pazardzhik Province is 2,598.9 TJ/year



Solar potential

Table 2.7: DNI Value – at NUTS3 level:

NUTS3	DNI value [kWh/m ²] – Yearly global irradiation (kWh/m ²)
BG421 Plovdiv	1,426
BG422 Haskovo	1,469
BG423 Pazardzhik Province	1,408
BG424 Smolyan	1,525
BG425 Kardzhali	1,491

Table 2.8: Probably future solar area at NUTS3 Level

NUTS3	DNI value: Yearly PV power (kWh/1kWp)
BG421 Plovdiv	1,057
BG422 Haskovo	1,088
BG423 Pazardzhik Province	1,047
BG424 Smolyan	1,141
BG425 Kardzhali	1,108

Past feasibility studies of REAP (project “Liquid fuel substitution on the territory of Pazardzhik region” – GEF UNDP) which cover the public building sector on the territory of Pazardzhik Province, reveal a total roof area of about 180,000 m². There is not any reliable data for the Residential sector, and for the Industrial sector.

2.6 Use of renewable energy in the region

Table 2.9: Consumption of renewable energy 2000-2014

Year	Final energy consumption	Energy from RES	RES share
2000	329	18.09	5.50%
2001	335	20.07	6.00%
2002	334	22.39	6.70%
2003	358	27.96	7.80%
2004	353	31.76	9.00%
2005	366	35.13	9.60%
2006	380	36.88	9.70%
2007	374	34.80	9.30%
2008	367	39.59	10.80%
2009	325	38.04	11.70%
2010	333	47.65	14.30%
2011	337	49.91	14.80%
2012	336	55.83	16.60%
2013	319	58.63	18.40%
2014	316	58.42	18.48%

There is a steady increase in share of RES energy in recent years. This is due mainly to the national commitments in regards to the European energy policy. There is not any detailed statistics about the share of RES by sources, but as according to studies of the Regional Energy Agency of Pazardjik, the following distribution applies in regards to the share of RES sources:

- Energy from hydro power plants: 49%
- Energy from biomass and wastes: 34%
- Solar energy: 9
- Geothermal energy: 8%

At the beginning of 2007, when Bulgaria entered the European Union, RES sector was at a very initial phase of development – this applies for the country and also for Pazardzhik Province. The share of RES in the final energy consumption was much below 10%, and in Pazardzhik Province it was mainly consisting of energy produced by the local hydro power plants. By this time, there was not any significant production of energy from PVs, and there was not any production of wood pellets. Wind energy is not topical in the Region. However, soon after the accession, Bulgaria adopted its first legal framework to regulate the RES market and the law provided generous subsidies in the form of preferential prices, long-term contracts (20-25 years), and priority, guaranteed purchase of green energy. The Sector experienced a fast development, especially for solar energy (and, to a lesser extent, for new hydroelectric power plants), and biomass technologies. The preferential policy led to the installation of several PV parks on the territory of Pazardzhik region, and at the same time few large pellet producers emerged mainly in the forested-mountainous area of the Province, putting the region among the top regions in terms of pellet output produced at an annual base, yielding about 1/3 of the entire state pellet production.

The preferential policy, adopted during Bulgaria's accession in the EU, led to a relatively quick achievement of the objectives set at EU level for the country, and from 2012 subsidies (feed-in tariffs) to energy produced from renewable energy sources, especially for electricity produced from RES were gradually cut, and diminished. However, at regional level this negative national policy did not affect much the positive trend in RES energy production due to the significant RE potentials in Pazardzhik Province – hydro, solar, biomass, and geothermal potentials. In last 5 years, geothermal energy and biomass sources are influencing positively the RES sector in the region by increasing the installed capacities in buildings and in industry.

3 Governance and important regional policies

3.1 Regional governance system

The responsible body for governing energy demand and renewable energy use within the region, and within the whole country of Bulgaria is the *State Energy Regulatory Commission*. It is a state authority, which has the following powers in regards to *regulating the activities in the energy sector (some of them)*:

- Issues, amends, supplements, suspends, terminates and withdraws energy licenses;
- Adopts secondary legislative acts;
- Approves Rules on the work with energy services consumers;
- Approves the common conditions of the contracts, provided in the Energy Act (EA) of Bulgaria;
- Approves Rules on the work with energy services consumers;
- Carries out energy price regulation; etc.
- Exercises control, analyzes, periodically reviews and may request amendment of the pricing mechanisms contained in the long-term contracts for availability and electricity purchase concluded with the Public Provider, when they are contrary to the European Union law or are not in accordance with the European Union policies;
- Adopts at the proposal of energy companies Electricity Market Rules, Natural Gas Market Rules and Network Technical rules, including security and reliability rules and controls their compliance and reviews results from past periods;
- Adopts and controls the application of a balancing electricity pricing methodology as part of the Electricity Market Rules under Art. 21, para. 1, p. 9 of EA;
- Lays down Rules for access to the electricity and gas transmission network, respectively to the electricity and gas distribution network and the natural gas storage facilities, including services and supplies quality standards and, if necessary, revises them in order to ensure efficient access.

At regional level: The Regional Governor is the regional legal institution appointed by the Prime Minister to represent the national government at local level. In general, his/her functions are to perform local governance within the region and to ensure for the compliance between national and local interests in fulfilment of the national government's local policies. Main Governor's activities are: coordination of the functions of regional governmental institutions and their interrelations with local governments. In this respect, the Governor has powers to control and coordinate the acts issued by the local governments (municipalities) and regional governmental institutions and to ensure their compliance with the law. It is his responsibility to safeguard and protect state property within the territory of Pazardzhik Province. He is also responsible for the development, implementation and review of regional development strategies and programmes. Additionally, the Regional Governor maintains international contacts at regional level.

The Regional Governor of Pazardzhik Province must summon twice per year an assembly of the *Regional Committee on Sustainable Energy Development*. This committee consists of all local authorities from the region together with representatives of non-governmental sector like

REAP. The Committee defines and outlines key points of energy policy development at regional and local level. The Committee supports the local authorities from Pazardzhik Province in development and implementation of their local sustainable energy programmes. It also discusses issues related to financing and attracting of investments of projects related to EE and RES.

At local level: Each municipality must develop and follow local energy plans and programs for their implementation in compliance with the *Energy Efficiency Act*, and the *Energy From Renewable Sources Act*. The Energy Plans and Programmes for their execution are being developed in compliance with the National Strategy under article 7 in the *Energy Efficiency Act*, as well as in compliance with article 10 in the *Energy From Renewable Sources Act*, and in compliance with the National Action Plan for Energy Efficiency, incorporating the specific details of the Regional Development Strategy and Local Development Plans. The local authorities from Pazardzhik Province can use the Regional Committee on Sustainable Energy Development which is managed by the Regional Governor of Pazardzhik Province, in order to share ideas on how to achieve the goals set up within their local energy plans, and to discuss and adopt priorities which could be included inside the Regional Energy Strategy.

3.2 Involvement of private sector partners

Private sector is mainly represented by large utility companies who supply electricity and natural gas. These companies are very active in the field of sustainable energy by participating in various initiatives and projects with scope of sustainability. For example, one electricity supplier from the region is performing a campaign which targets the youngest citizens in our region – kids, providing to them an informational and educational campaign on advantage of rational use of energy.

However, when developing local and regional policy strategies, the involvement of local SMEs which operate in the field of sustainable energy could be stronger. This will lead to integration of more realistic and practical objectives inside the policy documents related to sustainable energy development, and thus to achieve a good policy performance of these documents.

Regional Energy Agency of Pazardjik – REAP was established in 2005 within the project “Setting up of new energy management agencies in Malaga, Massa-Carrara, and Pazardjik”. The project was co-financed by the Intelligent Energy Europe Programme and supported by the Regional Administration of Pazardzhik Province.

Main domains of activities of the energy agency in Pazardzhik:

- Energy audits of small and medium-sized enterprises (SME), and buildings – residential and public;
- Energy planning and programming at local and regional level;
- Promotion of EE, RES, and sustainable urban mobility strategies, policies and practices at local/regional level;

- Dissemination of Best European practices in the area of rational use of energy, utilization of RES, and sustainable urban mobility;
- To promote international programs that focus on the financing and marketing of projects which emphasize on energy efficiency;
- Sectoral and horizontal initiatives which aim at fostering rational use of energy, energy saving technologies, and RES;
- Development, implementation and funding of energy efficiency projects through energy performance contracting involving ESCOs;
- Awareness raising campaigns, and training in the area of energy efficiency, RES, and sustainable mobility;
- Collaboration and development of joint initiatives with partners from Bulgaria and abroad.

The Agency developed a manual on “Use of local energy sources and improve of energy efficiency in public buildings from Pazardzhik Province”. The manual aims to support local authorities from Pazardzhik Province in implementation of energy efficiency measures, and larger deployment of renewable energy sources, and includes the following topics:

- Legal framework in the area of energy efficiency and RES, and rights and obligations which arise for the local authorities from this framework;
- Planning documents which provide opportunities to local authorities to develop projects in the area of EE and RES;
- Financial tools which can be used to finance energy saving measures and RES projects;
- Good practices from other public buildings, which have been already achieved in the area of EE and RES.

An important lesson learned when working with municipal authorities so far: the local administrations from Pazardzhik Province, especially small ones, lack of administrative capacity needed for fulfillment the activities concerning energy efficiency demands, application of RES and energy planning. REAP offers the municipal authorities approach to integrated energy planning including:

- Identification of local RES;
- evaluation of their economic feasibility if used as alternatives to mineral fuels;
- identifying the municipal energy consumption;
- evaluation (calculating) of energy losses in municipal buildings;
- analyze possibilities for reducing these losses through renovation and automation measures;
- creating local legislations stimulating energy efficiency and RES projects.

All of the above would have been insufficient if there was not funding for the projects. There are three ways of funding in Bulgaria: funding by the European Union, shared among the operational programs; funding by private investors, working through ESCO mechanism, energy performance contracting; and personal funding (e.g. loans from banks or own resources.). Due to lack of administrative capacity, the smaller municipalities do not have access to the first two resources of funding. For that reason, REAP was asked to develop an appropriate documentation for financing the implementation of energy efficient and RES projects. For the first time, this approach was practically applied in Panagyurishte Municipality, and later as a pilot practice in Pazardzhik Region. Afterwards, the approach was used in Belovo Municipality. Definitely, it can be pointed that the described approach is unique not only

for Pazardjik, but also for Bulgaria. The local authorities realized that by using of local RE resources they can turn their regions into sustainable, partially energy independent communities. For REAP this was a valuable lesson, because when we undertook solving municipalities' problems, we did not suspect their complexity and depth. We needed time and put a lot of efforts for the implementation of various technical and financial tools in the field of RES and energy efficiency.

This approach to fund EE and RES project is further explained in Chapter 4, Point 4.1. "*Supply of heat energy*"

3.3 Regional policies

At regional level, the Regional Governor of Pazardzhik Province must summon twice per year an assembly of the *Regional Committee on Sustainable Energy Development*. This committee consists of all local authorities from the region together with representatives of non-governmental sector like REAP. The Committee defines and outlines key points of energy policy development at regional and local level. The Committee supports the local authorities from Pazardzhik Province in development and implementation of their Local sustainable energy programmes. It also discusses issues related to financing and attracting of investments of projects related to EE and RES.

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Regional Development Plan of South Central Region 2014-2020

The Regional Plan for the Development of the South Central Planning Region analyses the socio-economic and ecological state and potential of the region and presents strategic objectives for regional development. The plan complies with the national strategic framework and the regional development strategies of the main administrative units – Pazardzik, Plovdiv, Smolian, Haskovo and Kardzhali. The report notes that towns are distributed quite evenly so inhabitants of remote areas can benefit from the amenities of regional centres. However, the economic indicators highlight great income disparities, an education system that is not geared towards the local labour market needs, as well as insufficient R&D expenditure. In order to

boost SMEs in the region, the strategy envisages infrastructure improvements in industrial zones and the development and support of technology transfer and innovation centres, as well as business networks and clusters. Special attention is also paid to the protection of the environment through better waste and water management. No evaluations have been carried out so far to assess the degree to which the Regional Plan for the Development has achieved its goals.

The Plan was published in 2013, and developed by the Ministry of Regional Development and Public Works. Main aspects of this policy document in regards to environment protection, EE, and RES are:

Strategic objective 1: Increase of competitiveness of the regional economy.

Priority 1.1. Increase of innovation potential, together with the research and technological development in the region.

Specific objective 1.1.1. Foster research and innovation activities in order to boost the technological development of the region, and; Specific objective 1.1.2. Building infrastructure in industrial zones and business parks and maintenance of active and attractive business environment. Measures to achieve the specific objectives will be targeted at: establishment of an environmental friendly energy centre for production of electricity from renewable energy sources in partnership with national research institutes and the business;

Priority 1.5. Preserve the environment in the region and rational use of local resources.

Specific objective 1.5.1. Implement measures to protect environment from industry, and during positioning of RES plants, and Specific objective 1.5.2. Preventive measures which will address climate changes and nature disasters. Activities to realize part of measures of these specific objectives will target at: creation of a Regional Information System with mapping of habitats within “Natura 2000”, as well as promotion of RES investment plans in order to exercise public monitoring on environmental protection. Another measure is larger deployment of environmental technologies – production of pellets, chips, eco-briquettes, biogas, production of energy from PV installations, from biomass, and from geothermal waters. As according to the statement of the Ministry of Environment and Waters (MEW), measures which are included inside the Plan in regards to development of RES projects, must comply with measures and restrictions provided within the “*National Action Plan for Energy from Renewable Sources*” for the period 2011-2020.

Strategic objective 2: Increase of social capital of the region through improvement of living standard and quality of life.

Priority 2.2. Improve the quality and access to health, educational, social, and cultural services and sports events.

Specific priority 2.2.1. Construction and renovation of buildings from social infrastructure including measures to improve energy performance of buildings. Activities for implementation of

the specific objectives will target at implementation of measures for energy efficiency in public buildings, and other municipal and state property.

Priority 2.3. Integrated urban development and environment-friendly living conditions. Specific priority 2.3.1. Elaboration and implementation of integrated urban plans in cities and improvement of living conditions in urban environment; and Specific priority 2.3.2. Improvement of water supply services and introduction of modern technologies for living conditions in urban environment. The specific objectives from this priority aim to provide interrelated and integrated actions on urban development, establishment of new areas with high potential for development, renovation of outdated industrial areas and central urban areas, improvement of residential environment, development of public areas like parks, green areas, children playgrounds, bike lanes, street lighting, etc. They include also activities which aim to improve access to public service (education, health services, and social services), including also disabled people, measures for energy efficiency, production of energy from RES in urban conditions, development of integrated and environmental-friendly urban transport, gasification, improving of air quality, etc. Within the framework of these specific objectives, it is expected that by implementation of these measures will lead to the development of qualitative urban environment which is the precondition to a favorable socio-economic and environmental-friendly development and decent living standards.

The following policy documents have direct impact on energy demand and larger deployment of sustainable energies at local level:

*Local Sustainable Energy Plan of **Strelcha Municipality***

Adopted in June 2010. The Plan includes measures which aim to achieve the following objectives at the local level:

- (1) Diminish heat losses of buildings by improvement of their performance: this could be achieved by insulation, partial or complete;
- (2) Efficient use of energy sources for heating purposes by using contemporary and modern systems, which include management of consumption in order to maintain stable statutory parameters of the microenvironment inside heated premises;
- (3) Substitution of fuels which have low consumption efficiency, by fuels with a higher efficiency;
- (4) Building up systems to utilize local renewable energy sources for production of heat and hot water;
- (5) Dissemination and promotion of good practices in the area of public energy performance contracting (EPC);
- (6) Reduce greenhouse gas emissions;
- (7) Modernization of municipal street lighting by saving energy, and preserving the illumination and lighting quality. Gradual substitution of outdated lighting by new energy efficient street lighting with automated control;

The Plan emphasizes mainly on energy efficiency in public buildings and street lighting, as well as on measures to promote the larger deployment of local renewable energy sources. The region is famous with its potentials of biomass and geothermal resources.

*Local Sustainable Energy Programme of **Peshtera Municipality***

The Programme was adopted in April 2012. The policy of Peshtera municipality in regards to sustainable energy aims to develop an energy balance within the municipality. The main objective is to improve energy performance of local building stock. The municipality has already started to implement various measures and actions in order to achieve this objective.

In 2007, the municipality won a project and got funding resources from the Ministry of Regional Development and Public Works in order to implement energy saving measures in 12 municipal buildings. The savings of energy achieved by implementation of these measures is 3,013 MWh/year which lead also to significant savings of CO₂ emissions. The total cost of the project was 3,734,518.77 BGN (€ 1,909,458.30), and the payback period was 4 years on average for each building which participated in this energy renovation project.

The municipality performed energy audit of street lighting in 2009. After this, the municipality started a gradual substitution of outdated lighting bulbs by new energy efficient lighting. The municipality started also to introduce a modern electronic lighting control which follows the winter and summer times, without any additional settings. However, this modern lighting system has not been fully introduced yet – there is a pending part of the system dedicated to stabilization of operational mode of lighting devices, and thus their optimal capacity will be utilized. Currently, the municipality of Peshtera pays about 153,000 BGN (€ 78,260)/year for lighting which represents about 30% of the entire municipal costs for the electricity consumption in public buildings.

The municipality investigates opportunities to open an energy informational help desk, following the example of Pazardzhik municipality. This help desk will provide consultations to the local citizens and SMEs in the area of energy saving measures, RES projects deployment, and funding opportunities in order to implement such projects.

Other actions in the field of sustainable energy include: carrying out a preliminary survey for the pilot establishment of a biomass logistic centre on the territory of Peshtera municipality in 2011; the municipality supported the setting up of an Energy Agency in Pazardzhik under the IEE programme in 2005.

*Local Sustainable Energy Plan of **Bratzigovo Municipality***

Adopted in May 2014. The main features of this policy document are:

- (1) *Objective 1:* improving the quality of life inside the municipality through efficient use of energy resources;
- (2) *Objective 2:* creation of conditions which will stimulate the development of local economy;
- (3) *Objective 3:* decrease the levels of pollution and reach the established standards for harmful substances in the atmosphere

Sub-objectives

- *Sub-objective 1:* Reduce energy costs in public buildings and facilities by implementation of energy saving technologies, as well as introduction of new energy efficient technologies for maintenance and management of energy systems;
- *Sub-objective 2:* Improve the quality of energy services by achieving the statutory requirements for lighting in educational, children's, health and social facilities, streets, pedestrian zones, etc.;
- *Sub-objective 3:* Increase the level of awareness, expertise and technical background of experts and specialists from municipal administration, as well as citizens from the municipality in order to implement strategical energy efficiency programmes, especially in regards to the national programme "Energy refurbishment of Bulgarian homes", managed by the Bulgarian Ministry of Regional Development and Public Works;
- *Sub-objective 4:* To improve the data collection system in regards to energy consumption of municipal buildings and facilities in order to prepare more precise analyses and to predict future trends more accurately.

*Local Sustainable Energy Plan of **Rakitovo Municipality***

The Plan was adopted in October 2010. The plan foresees adoption of measures for the development of the following priorities:

- (1) Implementation of energy saving measures in public buildings. These measures will lead to reduction of energy consumption in public buildings by at least 30%.
- (2) Implementation of energy saving measures in households: promote initiatives and projects which aim at insulation of households buildings and implementation of energy refurbishment measures. The ambition of the Plan is to reduce energy consumption in households by 50% until 2020.
- (3) Implementation of energy saving measures in service sectors – both, public and private.
- (4) Measures to promote energy management at local level – supportive activities of the municipality to key actors on the local energy market.

*Local Sustainable Energy Plan of **Septemvri Municipality***

Adopted in April 2011. The Plan includes measures which aim to achieve the following objectives at the local level:

- (1) Diminish heat losses of buildings by improvement of their performance: this could be achieved by insulation, partial or complete;
- (2) Efficient use of energy sources for heating purposes by using contemporary and modern systems, which include management of consumption in order to maintain stable statutory parameters of the microenvironment inside heated premises;
- (3) Substitution of fuels which have low consumption efficiency, by fuels with a higher efficiency;
- (4) Building up systems to utilize local renewable energy sources for production of heat and hot water;
- (5) Dissemination and promotion of good practices in the area of public energy performance contracting (EPC);
- (6) Reduce greenhouse gas emissions;

- (7) Modernization of municipal street lighting by saving energy, and preserving the illumination and lighting quality. Gradual substitution of outdated lighting by new energy efficient street lighting with automated control;

*Program for promotion of energy from renewable sources and biofuels of **Peshtera Municipality***

The Programme was adopted in October 2012. Main objectives of this policy document are:

- (1) Decrease energy costs in municipal buildings and facilities by:
 - Introducing energy saving technologies and measures;
 - Introducing of new energy efficient technologies for maintenance and management of energy systems.
- (2) Improve the quality of energy services by:
 - Achieving the statutory requirements for lighting in educational, children's, health and social facilities, streets, pedestrian zones, etc.
 - To provide optimal conditions of work environment.
- (3) Increase the level of:
 - Awareness, knowledge and expertise of managerial staff in municipal facilities, and municipal experts in order to enforce the work on projects related to energy efficiency and renewable energy sources;
 - Qualification of municipal staff.
- (4) Create a data collection system for energy consumption of municipal buildings and facilities in thus to improve the development of analyses and to predict future trends more accurately.
- (5) Development of projects which can be funded by various programmes managed by the Ministry of Economy, Energy and Tourism, Ministry of Regional Development and Public Works, Ministry of Education and Science, the Programme for development of rural regions, Fund Kozloduy, and other programmes and instruments for financing of energy saving technologies and measures, and RES projects.
- (6) Participate in national, regional, and local projects which aim to foster the deployment of RES and implementation of EE measures and technologies.
- (7) Substitute the fuel base in municipal buildings which use liquid oil fuel and electricity for heating by biomass fuel – pellet or wood chips.
- (8) Install solar panels for hot water production on roofs of municipal buildings – kindergartens, schools, health facilities, etc.

*Local Sustainable Energy Plan of **Panaguyrishte Municipality***

Adopted in April 2011. Similarly to the other municipalities, the main purpose of this strategy document is to reduce energy costs in municipal buildings and municipal facilities but at the same time to improve or retain the existing quality of interior comfort, to reduce carbon emissions, to achieve savings in municipal budget, and to reduce energy dependence of the municipality. In order to achieve highest impact of the scope of planned activities, the Plan uses

the approach “Integrated evaluation of a limited number of buildings and facilities”, and that is the most efficient methodology in terms of target groups, because of the following reasons:

- (1) This methodology will provide opportunities to achieve highest savings in terms of energy, and expenditures.
- (2) It will provide opportunities to implement energy saving measures with less favourable payback terms.
- (3) There are statutory requirements for energy performance of buildings, and compulsory minimum level of buildings' energy certificates.
- (4) There is a huge variety/difference in terms of technical conditions of the existing building stock and also of the existing energy systems on the territory of the municipality.
- (5) Different types of energy behaviour and use in similar buildings.
- (6) Flexibility when implementing and managing projects on energy efficiency and renewable energy sources.
- (7) Elimination of low negligible consumers, and consumers which have a steady declining trend of energy consumption in recent years.
- (8) Possibilities to use energy from RES by different target groups.
- (9) The individual energy saving targets, prepared by the Sustainable Energy Development Agency – SEDA (Governmental body), have been taken into account.
- (10) To achieve savings inside the municipality for at least 4.5 GWh/y until end of 2017, which was a target defined by SEDA.

Pazardzhik Municipality

Pazardzhik Municipality is the largest municipality in terms of population, and its administrative centre, town of Pazardzhik, is also an administrative centre for the entire region – Province of Pazardzhik. The municipality has the largest capacity in terms of technical and expert staff, funding opportunities; it is the regional forerunner in the process of development and implementation of sustainable policies at local level. In regards to energy efficiency and renewable energies, the municipality carries out consistent policies to increase EE and promote local RES and strictly follows the national regulations in the above fields. The municipality has adopted a *Municipal Sustainable Energy Programme* and an Action Plan for its implementation, and measures to achieve the programme's priorities are being updated on an annual base. The main priorities within the Local Energy Programme are:

- To maintain and regularly update a municipal energy database;
- Increase energy efficiency in public buildings including schools, kindergartens, hospitals, etc.;
- Entire energy refurbishment of public buildings, and upgrading of street lighting;
- Develop and maintain a local energy help desk with the purpose to support the local community in their EE and RES projects;
- Organize local sustainable energy days;
- Disseminate and demonstrate best practices in the field of EE and RES projects.

The Local Energy Programme of Pazardzhik says that the main purpose of municipal energy planning is to promote energy efficiency and renewable energies by a set of measures which

will eventually lead to increased competitiveness of the local economy, security of energy supply, environmental protection, and decrease of municipal expenditures for energy and fuels. The selection of priorities within the municipal energy planning is made on the basis of integrated evaluation of different target groups. The integrated evaluation combines the following parameters: potential for energy efficiency, and extent of influence by the Municipality over the identified target groups.

In 2015, the municipality opened an Energy Help Desk (EHP) that supports citizens by means of counselling activities and door to door energy audits. This initiative was funded by an EU Programme – the Intelligent Energy Europe Programme, and the municipality intends to retain the operation of the Desk beyond the project end. The municipality selected 2 energy advisors among professionals to work at the local EHD. The local Energy Help Desk in Pazardzhik provides energy consulting services. These services are offered to citizens of the municipality, as well as to citizens who live in a close proximity to Pazardzhik municipality, i.e. to citizens from other municipalities from the region of Pazardzhik. The main services offered by EHD include:

- *FIESTA energy audits for families* – the main purpose of energy audits is to make families aware of their own energy consumption and identify energy saving measures which can be implemented by beneficiaries. Energy saving measures are split into three categories:
 - (1) Behavioural measures – they do not require any financial resources and focus mainly on information like monitoring of energy consumption, changing or adopting habits, awareness of home appliance settings, and regulation.
 - (2) Low-cost measures – includes replacement or purchase of energy efficient equipment, which is affordable for beneficiaries, and does not require significant financial resources.
 - (3) Investment measures – new heating/cooling installations, building renovation, etc.
- *Direct and on-line consulting* – each citizen of Pazardzhik municipality, as well as of the neighbouring municipalities, may receive consultations by city energy advisors in regards to energy consumption issues, possibilities for installation of RES heating/cooling systems, and possible measures to reduce energy consumption at home. The EHD is open at least 2 working days per week, and citizens may receive energy consulting services either at the office, by e-mail, by telephone, or can be visited by city energy auditor at home and receive a more detailed analysis of home energy consumption.
- *Organization of workshops* – in order to reach highest number representatives of target groups, and to disseminate EHD activities, the city of Pazardzhik organizes workshops with:
 - (1) Social housing residents
 - (2) Students
 - (3) Local retailers and installers of heating/cooling systems
- *Organization of Consumer Purchasing Groups (CPG)* – this is another interesting service offered by the EHD. The CPG must involve a large number of consumers of certain heating/cooling equipment or system. Once consumers are identified, the EHD may negotiate better conditions in terms of prices, delivery, installation, and maintenance with local retailers/installers of energy products. The CPG in Pazardzhik is at a very advanced stage. They adopted the CPG methodology from another past EU project – the CLEAR project, but slightly simpler, since there are no legal conditions in the local legis-

lation to undertake a public procurement procedure for such activity.

At the moment, they are linking the winning company with end-users. The selected company gave best offer in terms of: price discount for the required EE equipment; installation conditions; and warranty and beyond warranty maintenance.

The coupon campaign started in August 2016 and will last for a year until August 2017. The CPG concept is something entirely new at local, and also at national level for Bulgaria, and the city of Pazardzhik hopes to have a positive experience which will be transferred later to other Bulgarian municipalities, and at the same time if successful, the Pazardzhik CPG would be repeated again in the following months/years, and will be one of the key activities of the local EHD beyond the project.

- *Organization of local energy lotteries* – this service intends to attract a large number of citizens to visit the EHD and be informed of its activities. The main messages disseminated to citizens during lottery organizations are: “If you don’t save energy, you can’t win” or “Saving energy = saving money”. Lotteries are being organized in a very attractive way and prizes for winners include only energy efficient devices and equipment.
- *Dissemination activities* – EHD performs a large number of dissemination activities like publication of articles in local media, participation in thematic conferences and seminars, a large radio campaign is being performed in order to inform local target groups about the EHD, distribution of dissemination materials, and organization of local energy stands during popular local holidays.

The municipality of Pazardzhik participates in an ERASMUS+ initiative which aims to introduce teaching methodologies based on Open Education Resources (OER) from very early educational age, i.e. in primary schools from the region, in the following topics: energy efficiency, renewable energy sources, and environmental protection. The municipality is testing this innovative teaching approach during the current school year, 2016/2017, in one pilot school from town of Pazardzhik – the Primary school “Kliment Ohridski”. If that pilot action proves to be successful, the municipality will integrate this at local political level, by introducing this approach into the *Local Educational Programme of Pazardzhik Municipality*. The municipality intends to change their existing educational programme by introducing measures to start teaching EE, RES, and EP subjects in an innovative and easy-to-understand way from very early educational age – since the first grade of classes. The local educational programme represents a policy strategy document, which aims to outline the main priorities of one municipality in educational development at local level.

3.4 Membership in low carbon programs and initiatives

There are no members of the local authorities from Pazardzhik Province in the above mentioned programmes and initiatives. However, the EE Plans and programmes for their execution, as well as the RES Plans and programmes for their execution resemble to a great degree the Sustainable Energy Action Plans (SEAPs) which have to be developed and implemented within the Covenant of Mayors initiative. They set up a baseline, and objectives which must be achieved within several years – in terms of energy savings; in terms of CO₂ savings; and in terms of RES energy share.

The municipality of Pazardzhik organizes Energy Days Event which is a major part of the European Sustainable Energy Week, a month-long series of activities to build a secure energy future for Europe. The energy days in Pazardzhik target mainly at the youngest citizens from the region – kids and students from first grades. The local administration organizes for the kids different thematic events and competitions: drawings contests, essay writing, organization of lotteries, cycling, and other contests.

The municipality wants to build up a sustainable energy consciousness among the youngest part of the local population by influencing their behaviour from a very early age. This has two major impacts in terms of time: a long-term impact because kids are growing with energy consciousness and positive attitude toward environmental protection; immediate impact – kids discuss learned issues with their parents and thus involve them also in the behaviour-change process.

Figure 3.1: Energy Days Event in Pazardzhik



4 National and European policy background, complementarity

4.1 Relevant national low carbon policies, interrelation with regional policy

Energy efficiency and renewable energy sources represent important priorities of the National Development Programme of Bulgaria. For the first time in two decades, in past few years there is a strong political will to implement a large-scale national programme for energy renovation in multi-family residential buildings. The serious energy, environmental, social and economic potential of this initiative is a prerequisite for its further development in the coming years, with a view to expanding it into a long-term programme for the renovation of the existing building stock, meaning a strong impact on the quality of life and on the appearance of the settlements.

Building stock in Bulgaria: individual houses (single family houses) in Bulgaria are prevailing in number in the country as a whole (86%), in towns and cities (77%) and especially in rural areas (93%). However, according to their general useful living area, individual houses and apartment blocks (multi-family buildings) have roughly an equal share within the country, while in cities, the useful living area of apartment buildings accounts for about two-thirds (64.7%) of the share of all buildings. Considering their number, residential buildings with 5 or more floors account for only 2% of the total number of buildings; however, the share of their useful living area exceeds half of the total useful living area (52%). Despite the lack of accurate statistics on the distribution of inhabitants in individual houses and multi-family blocks, it can be assumed that the highest density of settlement in multi-family blocks concentrates the majority of the population there, especially in cities.

RES in households: while reliable data about the use of wood biomass and geothermal energy in buildings is missing, there is information on the use of solar panels. By 2011, solar panels for hot water and electricity generation had been installed in only 1.8% of all buildings, the majority (86%) of which are on single family houses. This indicates a very low penetration of this type of renewable energy. The exceptionally large untapped potential for renewable energy will require the implementation of targeted policies and specific technical measures to speed up their introduction in residential buildings. The lack of an appropriate building infrastructure (building pipelines) greatly increases the cost and prevents to a great extent the use of renewable energy systems in buildings.

National Funding Programmes

The latest and most significant policy at national level which affects energy consumption of Bulgarian households is the *Bulgarian National Programme for Energy Efficiency (NPEE)* – the NPEE was adopted by the Council of Ministers on 27 January 2015. It provides for financial assistance to owners of private residential buildings of no less than 36 apartments built under an industrial method. The programme will help reduce household electricity bills and

will extend the life cycle of buildings. Buildings whose applications have been approved will receive 100% grants. Owners' associations have no financial commitments or obligations. The renovation measures include EE measures like: insulation of buildings' facades, substitution of old inefficient windows and frames, insulation and renovation of roofs, other energy-saving measures which could be implemented on buildings' common areas.

The above mentioned scheme "Support for energy efficiency in multifamily residential buildings" applies for the period 2007-2013. For the period 2014-2020, the Bulgarian Government adopted the so called NPEE. This is again connected with the Operational programme for Regional Development, and this time the grant will be 2 billion BGN, which is 40 times higher grant than the previous scheme. Again, awards will be given by "first come first serve" principle.

National Trust EcoFund (NTEF)

The National Trust EcoFund was established in 1995 through the Environment Protection Act. It manages dedicated funds provided by the State budget, including the swaps "Debt for Environment" and "Debt for Nature". The NTEF funds are also raised through international trade of GHG emissions with Assigned Amount Units (AAUs), sales of quotas of GHG emissions from aviation activities, as well as funds made available under different agreements for environment protection of the Republic of Bulgaria with international, foreign or Bulgarian financial sources.

Practices of NTEF: upon completion of the "Debt for Environment" swap, NTEF funded 100 investment projects and provided more than 26.5 million BGN. Thanks to this, the fund has become the decisive factor for the mobilisation of another 115 million BGN from other, mainly foreign, sources for the implementation of projects related to environmental protection in Bulgaria. At the end of 2011, two deals for the sale of Assigned Amount Units with the Republic of Austria were made, according to Art. 17 of the Kyoto protocol. By the end of 2014, under the two deals, 40 public projects amounting to 27.4 million BGN were implemented. The financial participation of NTEF in these projects amount to 23.3 million BGN.

Energy Efficiency and Renewable Sources Fund (EERSF)

The Energy Efficiency and Renewable Sources Fund (EERSF) was established with the Energy Efficiency Act in 2005 with the support and financial participation of the Global Environmental Facility (GEF), the World Bank and the Bulgarian Government. The initial capital was supplemented by donations from the Austrian Government and several private donors. The main advantages of the fund, in comparison with other not specialized financial institutions, are:

- (a) The availability of its own high technical capacity for evaluation of energy efficiency projects;
- (b) Accumulated experience in quality assurance and monitoring of project implementation; and
- (c) Experience in organisation and conduct of monitoring of the project performance after the implementation of energy efficiency measures.

The current rules of the Fund allow funding for complete renovation of both single and Multi-family buildings at preferential interest rates. For Multi-family buildings, the Fund offers guar-

antee schemes for complete renovations. For complete renovations of buildings, EERSF also provides portfolio guarantees for individual bank loans by apartment owners. The scheme is welcomed by commercial banks and can be applied for lending to all apartment owners, including households that are not creditworthy by the standard criteria.

Residential Energy Efficiency Credit Line of EBRD (REECL)

The credit line for energy efficiency in households was opened in 2005 and ended its first stage in January 2010. 24,362 projects for energy efficiency in households were funded by the end of 2009. Among them, projects for energy saving windows (45.2% of the total volume of loans) and heat pumps (27.5%) prevailed. The equivalent of electricity savings from the projects' implementation was about 182.7 GWh per year. The continuation of the credit line for energy efficiency in households started in mid-2011 and ended in 2015, when the funds were fully depleted. The third stage of the same credit line starts in 2016. Each household or association of home owners that get loans under the REECL programme has the right to a 20% or 30% grant (when the renovation of the multi-family building is collective) of the cost of the energy saving project funding, but only after it is successfully completed and all the requirements of the programme are fulfilled. Loans and grants are awarded to fund: energy efficient windows, natural gas boilers, heaters, stoves and biomass boilers, solar panels for hot water, heat pumps for cooling and heating, etc.

Energy performance contracting – ESCO

ESCO contracts are an instrument which allows entities to significantly mitigate the up-front cost of energy efficiency and renewable energy projects. ESCOs are commercial entities which assume the design and implementation of the entire project for a client (usually municipality). ESCOs are responsible for securing financing, by accessing their own resources or, more frequently, raising funds externally. Project costs, including the ESCO's fees, are paid out over time, as the resulting energy savings are realized. This mechanism targets primarily municipal and state-owned entities in Bulgaria, and has been gaining increasing popularity due to its potential to mobilize third-party financing, as well as its flexibility and specific project risk allocation. The recovery of investment is made bit-by-bit in monthly installments paid by the assignor, and these installments are calculated as a difference between the cost of energy consumption before implementation of measures, and the cost of actual monthly consumption after the implementation. This financial scheme is legally regulated in Bulgaria and requires the maximum payback period of an investment to be no longer than 5 years. The financial risk within that scheme is born entirely by the ESCO and it must carry out all activities, including the project design. The advantage of that scheme is that a price difference of the energy-carriers used automatically affects the size of the monthly installments. This scheme is applicable in both – private and public sectors.

Supply of heat energy

This financial scheme has been developed in Bulgaria by REAP upon request of a private company which is an investor in renewable energy and district heating. It has been already applied successfully for several public buildings located in Pazardjik Province. The approach is applicable to public buildings where the local administration is responsible for supply of primary energy-carrier and maintenance of the heating system. The approach includes the following steps: a direct supply of energy heat is being offered to the municipality for a certain building by a private energy supply company. The costs for installation and maintenance of a new system including the supply of primary energy-carrier belong to the energy supply company. A compulsory condition is that the energy expenses drop by at least 30%. This way, the local authority is released from an unusual activity, and on the other hand, the money saved is being redirected to other municipal sectors. An important advantage of that scheme is that immediately after the implementation of the project, the local authority starts to pay less money for energy without having any additional obligations. In order to make that scheme possible, the private energy supply company has to install modern highly efficient heating systems which use RES (in Pazardzhik province this could be either biomass energy or geothermal energy) and the economy/savings come from: 1. efficiency of the new modern systems; and 2. from the lower price of the new energy carrier – in the context of Pazardzhik region: the price of biomass/geothermal energy compared to the price of boiler oil fuel.

4.2 Complementarity of regional, national and EU low carbon policies

Although, energy market in Bulgaria is fully liberalized, there are currently two types of electricity markets: regulated electricity market (with fixed prices – regulated by the State), and free electricity market. Still, more than 99% of households in Bulgaria are positioned on the *regulated* market because there are too many barriers before households if they want to join the free market – mainly bureaucratic and hardware barriers. It is the same in Pazardzhik Province – there is practically only one supplier of electricity (EVN). The regulated market is being used currently by households, public sector, and other small consumers supplied by a low voltage (0.4 kV) by the above mentioned electricity distribution company. They purchase electricity at state regulated prices and cannot change their supplier. The only alternative for these consumers is to build up their own productions, normally based on RES.

At the moment, a real competition at the electricity market exists only for industrial consumers, which can negotiate prices and change their energy supplier, i.e. the market is fully liberalized for industry, but not yet for the public and households sectors.

The import and distribution of natural gas belongs entirely to state company “Bulgargas” and its branches in the country. Prices are state regulated because there is only one supplier. A competition exists between suppliers of compressed natural gas (CNG) for consumers who

are not connected to the national gas grid – in this case, the prices are defined entirely by the market.

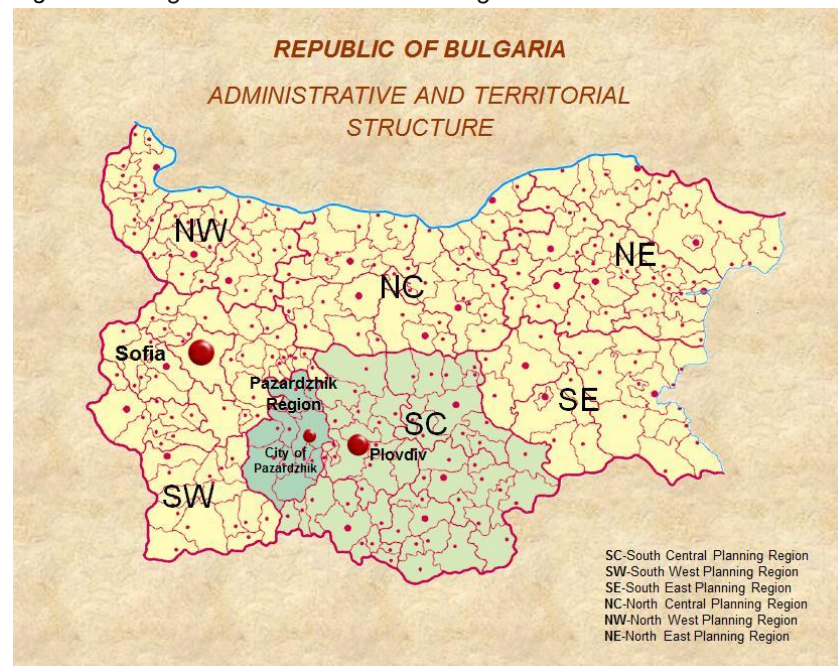
A large competition exists on the market for liquid fuels and LPG for the transport sector, but the Russian company “Lukoil” has some advantage, because it bought the Bulgarian oil refinery “Neftohim” together with its network of petrol stations. There are Austrian, Romanian, Greek, and other petrol station networks operating in the country.

5 The role of cohesion policy for regional low carbon development

Bulgaria joined the European Union as of the 01/01/2007. Since then, the country has access to and opportunity to use funds from the Community under the Cohesion Policy.

As according to the administrative division in Bulgaria, the country has 6 regions of NUT2 level. The Province of Pazardzhik is part of the South Central Planning Region with administrative centre – city of Plovdiv.

Figure 5.1: Regions – NUTS2 Level in Bulgaria



The Cohesion policy has direct and visible impacts on the following priorities:

- Improvement of transport infrastructure and access to remote areas. There was renovation of the large part of the regional road network.
- Support to micro, small and medium-sized business through the financial tool JEREMIE.
- Development of advanced broadband networks for connection and electronic services for the business and citizens.
- There were measures to address employment in the region that had a good positive impact, as well.
- Projects to address conservation of environment, risk prevention and sustainable energy development.

Actually, in its first programming period, Bulgaria did not develop regional Operational Programmes, but 7 national Operational Programmes instead:

- OP Transport
- OP Environment
- OP Regional Development
- OP Competitiveness
- OP Technical Assistance

- OP Human Resources Development
- OP Administrative Capacity

As a result of these policy instruments, there were several positive effects and achievements for the period of 2007-2013 at regional level, Pazardzhik Province:

- Positive effect on creation of new jobs;
- A new modern wastewater treatment plant was established near the town of Pazardzhik which has a capacity to service wastewaters of 156,000 citizens;
- Training programmes: with these programmes more than 10,000 people from the Region acquired or upgraded their vocational qualification and acquired key competencies;
- Realization of several transport infrastructure projects;
- Improve educational infrastructure for over 2,000 students and pupils;
- Invest in energy saving measures in public buildings and schools;
- There are some renovated parks, pedestrian areas, bicycle lanes, playgrounds.

The absorption of financial resources from the Structural and Cohesion Funds in Bulgaria in the first for the country programming period 2007-2013 was accompanied by numerous problems and deficiencies. The absorption rate for Bulgaria in comparison with the other member states was low. The major reason for that was the lack of administrative capacity and experience with the procedures of project management of the operational programs. This was due to the fact that although the pre-accession programs included additional education and training of the national administration for the post-accession process, the administrative capacity was not high enough.

The Bulgarian Operational Programs in the 2014-2020 programming period follow the same logic as of the period 2007-2013 – the country has not developed regional Operational Programs, which could support the underdeveloped regions, but seven national programs:

- OP Good Governance;
- OP Transport and Transport Infrastructure;
- OP Regions in Growth;
- OP Human Resources Development;
- OP Innovation and Competitiveness
- OP Environment
- OP Science and Education for Intelligent Growth

Econometric research has showed that the EU Cohesion Policy funding has been an important driver for the reforms and economic development of Bulgaria since its accession to the EU. It will continue to play this role – for 2014-2020 Bulgaria has been allocated around € 7.6 billion in Cohesion policy funding. The investment priorities have been set out in a Partnership Agreement with the European Commission and include the raising of the competitiveness of the economy, research and innovation, transport infrastructure, urban development, improved water and waste management, employment, raising the share of persons with higher education, strengthening the capacity of public administration and the judiciary and promoting good governance (European Commission, 2015).

Recommendations: projects in the area of research and innovation could be promoted with more policy actions. In the new period, 2014-2020, this can happen with the Research and

Innovation Strategies for Smart Specialisation, which aims at a developmental-economic transformation with a territorial dimension through:

- Focusing policy and investments support on core regional priorities, challenges and needs for knowledge based growth.
- Developing capacities, competitive edges and potential for excellence of the region.
- Support of innovation technology and practice and stimulation of investments in the private sector.
- Achieving the full participation of the involved stakeholders and encouraging innovation and experimentation.
- Evidence based plans for sound monitoring and assessment.

The Cohesion Fund aims to speed up economic, social and territorial convergence in the EU by providing grant financing to environment and transport infrastructure projects. Taking into account the high energy saving potential of the building stock in Pazardzhik Province, as well as the high potential of local renewable energy sources, the Cohesion policy might bring positive effect on the regional development by influencing, and co-funding the so called integrated energy projects. The integrated energy approach is already well-known in some European regions, but yet poorly promoted in some Bulgarian regions, including Pazardzhik Province. It has not been integrated as a prerequisite in the operational programme and has only an advisory character, promoted by REAP. The integrated approach *combines measures to reduce energy consumption* (for example, insulation of outer building's envelope, installation of energy building management systems, etc.) *with measures to utilize the local potential of renewable sources* (like for example photovoltaics, biomass, geothermal waters, etc.). In this way, it will be achieved the synergy effect, i.e. implementation of EE measures will affect positively the introduction of RES and vice-versa. Example: if a public school changes its old and inefficient windows by new energy efficient ones, it will achieve savings in terms of energy, costs, and CO₂ emissions. The payback period will be probably few years – 7-8 years. However, if this measure is combined with introduction of local renewable energy source, for example this could be a substitution of an existing heating system which uses boiler oil fuel, by a new modern heating system which uses wooden fuel (pellets or chips), then the payback period will reduce significantly, probably to 3-4 years, due to the synergy effect of the two measures, and at the same time a significant effect in terms of CO₂ savings will be achieved.

This integrated approach is applicable first in public buildings which might serve as demonstration pilots to the local community, and pave the way for the other two main target groups – the local industry and the residential sector. Once these two sectors realize the positive advantages of such integrated approach, they will certainly follow the local authorities in implementing these and transferring this experience and approach in their industrial premises/industrial systems and in their residential buildings.

6 Good practices and successful approaches

6.1 Setting up an Energy Help Desk in Pazardzhik Region

The region of Pazardzhik participates through its administrative centre, Pazardzhik city, in a European project called FIESTA, which is funded by the Intelligent Energy Europe Programme. The main purpose of this project is to set up a local sustainable body called Energy Help Desk (EHD). The main activities of the EHD are:

- Providing direct and on line consulting to citizens on topics like: measures to reduce energy consumption, use of sustainable/renewable energy at home, how to apply for funding of EE and RES measures, etc.;
- Implementation of home energy audits – this activity is being performed by 2 energy advisors (auditors) engaged in the EHD. The auditors passed a technical training session in the University of Zaragoza, Spain, where they were trained on how to perform home energy audits, and how to use specific software for energy audits which was developed especially for the project. They are actually the main driver towards a more energy-efficient citizens' behaviour and purchasing habits related to domestic heating and cooling systems and technologies with a large energy-saving potential.
- Organization of thematic workshops in order to raise awareness on topics related to EE and RES among households
- Organization of other events and activities like FIESTA lottery and Consumer Purchasing Groups (CPG)

The EHD is already established in Pazardzhik, and in 13 other EU cities from Italy, Spain, Croatia, and Cyprus. Each citizen/family from Pazardzhik Province can take advantage of the services offered by the Pazardzhik EHD. The project activities are funded (75%) by the Intelligent Energy Europe Programme, and 25% is the co-funding rate of city administrations. The project will end up in October 2017, but EHDs must continue their operation/activities beyond the official end of project. Furthermore – they must transfer the positive experience to other neighbouring administrations.

So far, the project in Pazardzhik gives very positive results by involving more than 1,500 citizens and about 160 families from the region who benefit from the various activities and services offered by the local FIESTA EHD.

Results from the two-year period of the project:

- 160 families from Pazardzhik Province involved in home energy audits. Home energy consumption was analysed in all participating families, and customized energy saving measures have been given to each family. Further support is provided to families by FIESTA energy advisors on how to implement the recommended measures. Saving potential of about 300,000 kWh per year was identified so far. The measures within energy audit reports are split into three categories: 1) Behaviour change measures which do not require any financial sources; 2) Small purchases which require relatively small amount of financial resources (like for ex. substitution of incandescent lights by LED bulbs); 3) Large investment measures – like for example, substitution of the existing heating system, or insulation of walls, etc.

- 20 workshops with children from primary schools in the region, 2 workshops with local installers and maintenance companies in the field of EE and RES products and services, and 2 workshops with representatives of the residential sector.

Figure 6.1: Workshops with schools in Pazardzhik



Figure 6.2: Workshops with local installers and distributors of EE and RES equipment



- Organization of a consumer purchasing group (CPG) on the territory of Pazardzhik Province. The CPG concept is relatively new in Bulgaria, and for this reason the team in Pazardzhik decided to adopt the CPG concept from another EU project – the CLEAR Project, but slightly simpler, since there are no legal conditions in the local legislation to undertake a public procurement procedure for such activity. The selected company gave best offer in terms of:
 - Price discount for the required EE equipment
 - Installation conditions
 - Warranty and beyond warranty maintenance

The coupon campaign started in August 2016 and will last for a year until August 2017. The Local Negotiation Table was held in July 2016 in town of Pazardzhik and main attendees were sellers and installers of EE equipment, as well as other stakeholders. The CPG is something entirely new at local, and also at national level for Bulgaria, and the team in Pazardzhik hopes to have a positive experience which will be transferred later to other Bulgarian municipalities, and at the same time if successful, the Pazardzhik CPG would be repeated again in the following months/years, and will be one of the key activities of the local EHD beyond the project.

- The EHD in Pazardzhik carries out also a large dissemination campaign which aims to inform citizens about services which are offered by the local EHD, as well as to raise awareness on rational use of energy and local RES of the local community. There were 2 public stands so far, organized during large public holidays. Several radio campaigns, and many articles in local newspapers. There was also a lottery organized few months where citizens could win 10 thematic prizes.

6.2 Larger deployment of innovative smart metering solutions in public buildings in Pazardzhik Province

Smart metering and smart energy solutions are yet poorly known and poorly used in Bulgaria, and especially in public buildings of Pazardzhik region, as well as in households. For this reason, the region decided about 4 years ago to join an EU project which was aiming to develop, test, and validate innovative smart metering solution for public buildings, which could subsequently be used by families from Pazardzhik region as well.

The project EPLACE (funded by the ICT PSP) started the beginning of 2013 and ended in the middle of 2015 with duration of 30 months. There were two public buildings from the region of Pazardzhik which were used as pilots to test the innovative EPLACE system that was developed during the project. These were the administrative building of the local administration in Septemvri town, and the Medical centre in the same town. The EPLACE project has implemented pilots in 7 European public buildings together with a number of measurements to reduce energy. Also energy audits have been completed over the course of the project. The energy use was measured using the WeSave system installed in each pilot building before and during the energy-saving action to determine the effectiveness of each of these actions. The energy use is compared to baseline energy use and EnPIs established in the energy audits according to the eeMeasure method and the Common Audit Methodology developed by the EPLACE project to evaluate savings. This included the development of energy models based on regression analysis of energy data with respect to independent “predictor” variables including heating degree days, cooling degree days and occupancy/activity data.

An important finding of the project is that, where sites do not have comprehensive energy metering in place, it is recommended to install metering to establish a baseline prior to the implementation of energy conservation measures.

The EnPIs were analysed for correlation before its application. EnPIs used mainly were:

- Electricity, gas consumption vs heating degree day
- Electricity consumption vs cooling degree day

Energy consumption was compared to baseline but results were normalised taking into account the temperatures registered. Also other sources of variability such as change of opening hours, and visitor numbers were analysed and accounted.

The change in energy use resulted as follows:

Table 6.1: Validation Results – EPLACE project

Pilot Site	Validation Result in % energy reduction
Community facility, Guadalinfo Cartaya, Spain.	21% reduction due to awareness measures.
City Council Cartaya, Spain.	19% reduction relative to baseline EnPI. Attributable to reduced cooling demand and awareness actions.
Cultural Centre Cartaya, Spain.	23% reduction relative to baseline EnPI. Changes in energy use are complicated by large variations due to different activities and events in the centre. It is not possible to develop an EnPI to account for these changes.
Administration Building Septemvri, Bulgaria.	23% reduction in electricity use.
Medical Centre Septemvri, Bulgaria.	7% reduction in use. Large use for essential medical equipment relative to other uses.
Finglas Leisure Centre, Dublin, Ireland.	9% reduction in gas use according to gas vs degree day EnPI. 17% increase in electricity use. Net 6% reduction. Awareness actions had limited effect. ESCO procurement in process to deliver large energy savings.
South Dublin County Council Library, Dublin, Ireland	11.5% reduction in electricity use validated. Primarily due to targeting electricity use by air handling units in the summer months.

Having mounted the hardware equipment to the seven pilot buildings, the consortium developed the EPLACE platform that is fully functional in 4 European languages: English, Spanish, German, and Bulgarian, and currently can be reached at: www.enerplace.eu. A training session was organized in Bulgaria involving representatives of local/regional authorities in order to teach them on how to use the Platform. At the end of the project the monitoring and validation activities showed a significant energy savings (from 7 to 23%) in the pilot buildings by implementing only behavioural change measures, low-cost measures, and by using the EPLACE system (both the hardware and the Platform).

6.3 Project GeoSEE – Innovative uses of low temperature geothermal resources in South East Europe

The Province of Pazardzhik is famous with its geothermal potential, especially in Velingrad municipality which has many springs and boreholes with water temperatures varying from 30°C to 90°C. On the other hand, the region has a very large potential of wood biomass – about 55% of the total area in Pazardzhik Province is covered by forests. The region wanted to study new and innovative solutions in the area of energy production from renewable sources like geothermal waters and biomass. The project GeoSEE, conducted from 2013 to 2015, provided a good opportunity for that. The project managed to develop concrete technical solutions for hybrid systems utilizing low-temperature geothermal based on 9 examined pilot case study locations. In Bulgaria, the pilot case study location was Velingrad town, and the proposed technical hybrid solution included geothermal energy in combination with wood biomass boiler for production of electricity and heat energy. Furthermore, the GeoSEE consortium developed a regional model of integrated hybrid systems based on process optimization with the intention of evaluating possibilities for upscaling. On the basis of this acquired information and measures, the GeoSEE consortium researched the investment feasibility,

innovative and unconventional funding sources and developed market penetration models for the uptake of such hybrid systems.

A variety of tools were developed during the project in order to address the stakeholders of the participating region. One of these tools represents the online geospatial information system or WebGIS (<http://geosee-webgis.tesaf.unipd.it:8000/geosee/>), which makes it easier for local authorities, investors and other key target groups to define, evaluate and quantify the potential of low-temperature geothermal and other RES from the 9 participating European regions: Velingrad (Bulgaria), Topolšica (Slovenia), Acquapendente (Italy), Battaglia terme (Italy), Oradea (Romania), Budapest (Hungary), Križevci (Croatia), Palilula (Serbia), Kocani (FYROM).

Based on the former research conducted, the consortium developed a comprehensive set of guidelines compiled in Transnational Strategy Documents dealing with economic modelling, environmental benefits, social and community benefits, policy recommendations and viable investment strategies and guidelines, targeting all 3 target groups.

Figure 6.3: GeoSEE WebGIS Tool



The GeoSEE project was set to research the possibilities of incorporating additional energy resources with geothermal, in order to achieve sufficient enthalpy difference for the production of electricity. This was achieved by developing 9 pilot conceptual designs, which included technical, environmental and socio-economical aspects. Result confirmed the applicability of such hybrid power installations in several different environments, and also defined the pa-

rameters that must be met in order to achieve attractive investment value. The consortium has also developed relevant policy recommendations which will be used to induce required reforms in the legislative process. The partner consortium has identified several conceptual design studies which exhibited feasible investment return. It's assumed that some of these projects will come to life in the following time period, up to 2020 and beyond. It was concluded that at least 6 proposed pilot case study locations (namely Oradea in Romania, Kocani in Macedonia, *Velingrad in Bulgaria*, Aquapendente and Battaglia Terme in Italy, and Budapest Airport in Hungary) are viable for funding. The economical studies proposed a compound funding, partially with own funds and the rest through structured bank loans and purposely structured funds like for example the Joint European Support for Sustainable Investment in City Areas (JESSICA), Joint Assistance to Support Projects in European Regions (JAS-PERS), European Investment Bank (EIB), as well as other nationally and internationally based funding mechanisms. Many of the conducted economically feasibility demonstrated returns on investment exceeded 10% which means that funding could be carried out via commercially available bank loans.

Job creation was one of the most important features considered when assessing the direct benefits to the involved communities. It was projected that the implementation of these installations would provide direct and indirect job growth in the associated areas. Primary job growth would be the result of power installation operation and maintenance, as well as the numerous possibilities for supplying raw materials like biomass. Secondary job growth would be realized by attracting outside capital to the communities located in the vicinity of the installation, as these areas would offer many advantages including a stabile energy supply, affordable price of energy, educated and knowledgeable human resources, etc. Additional jobs could be created by the development of alternative products and services such as green tourism.

6.4 ERASMUS+ project “We grown up with eco resources”

This project started at the end of 2015 with duration of 2 years, and it is funded by the EU Programme ERASMUS+. Partnership includes the following 6 partners from Macedonia and Bulgaria:

- Municipality of Kochani – Lead Partner
- Municipality of Pazardzhik
- Primary School Rade Kratovche
- First Primary School Kliment Ohridski
- Association for Supporting Economic Development – Local Action Group Kochani
- Centre for Sustainability and Economic Growth

Utilization of renewable energy resources and increasing energy efficiency together with environment protection (EP) represent contemporary topics which are currently a worldwide trend.

Unfortunately, those topics are not very popular among students due to lack of attractiveness. However, there is a real necessity of their implementation to prevent negative influence of industrial development and more and more obvious climate changing.

Municipality of Kochani and Municipality of Pazardzhik decided to make one innovative approach for their youngest inhabitants, students in primary schools, by developing a Strategic partnership through preparation of “Strategy for development of education cooperation between schools from Kochani and Pazardzhik”. The project involves also 2 pilot primary schools from the participating countries (Macedonia and Bulgaria) which will participate in development of innovative teaching methods for implementing of renewable sources, energy efficiency and environmental protection, on adequate way in accordance with students age.

Teacher’s training will be supported by experts from Macedonia and Bulgarian NGO’s from Kochani and Pazardzhik (LAG and CSEG) who have large experience in utilization of RES, EE and EP as well as great practical experience in implementation of Open Education Resources for educational purposes.

There are two main target groups for trainings:

Group No. 1: Teachers from Pilot Primary schools in Kochani and Pazardzhik that are teaching students of age from 7 to 10 years old

Group No. 2: Teachers from Pilot Primary schools in Kochani and Pazardzhik that are teaching biology, chemistry, physics, and mathematics to students of age from 11 to 14 years

Both groups will be trained on RES, EE & EP by using contemporary open education resources in order to integrate those thematic fields into their educational programmes

The other specific objectives envisaged within the project are:

- Provide teachers with practical ideas about how to integrate RES, EE and EP into their existing lessons;
- Familiarize teachers with current Web 2.0 and Internet trends;
- Giving an opportunity for exchange of experiences and good practices among teachers coming from different countries who work in the same field;
- Improving teamwork skills through the use of ICT in promotion of RES and EE;
- Sharing of best practice in teaching and learning with colleagues from other primary schools in Kochani and Pazardzhik

Targets to be achieved within the project include 900 students from the two Pilot Primary schools that are currently studying with increased knowledge on EE, RES and EP by using contemporary OER, as well as all future students from the primary schools in the two municipalities take advantage of this innovative educational approach.

Both training sessions mentioned above have been already implemented: one in December 2015, and one in January 2016. Currently, the projects tests this innovative teaching approach in the two pilot schools from Bulgaria and Macedonia. If that pilot action proves to be successful, the municipality will integrate this at local political level, by introducing this approach into the Local Educational Programme of Pazardzhik Municipality. The municipality

intents to change their existing educational programme by introducing measures to start teaching EE, RES, and EP subjects in an innovative and easy-to-understand way from very early educational age – since the first grade of classes.

Figure 6.4: Training session on EE, RES and EP for teachers in Pazardzhik, Bulgaria



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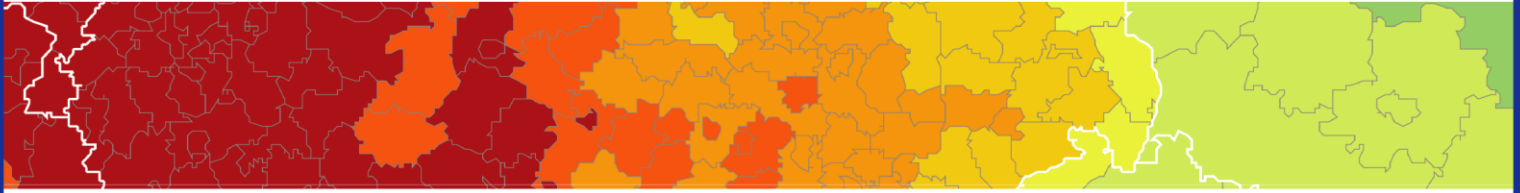
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Dipl.eng. Ivan Tilev – Regional Administration of Pazardzhik Province

Mr. Angel Tonchev – energy advisor in Pazardzhik EHD

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The ESPON EGTC is the Single Beneficiary of the ESPON 2020 Cooperation Programme. The Single Operation within the programme is implemented by the ESPON EGTC and co-financed by the European Regional Development Fund, the EU Member States and the Partner States, Iceland, Liechtenstein, Norway and Switzerland.