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# Results of investigation on energy efficiency initiatives and the deployment of renewable energy sources in Rhodope Region

D3.2 Report

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## Preface

This report is prepared within the framework of Horizon2020 CITYinvest project with the main aim to obtain up-to-date information and data on the deployment of energy efficiency and renewable energy initiatives in Rhodope Region in order to lay the grounds for preparation of the necessary measures to achieve the expected impacts that were estimated for the region.

The report is based on information collected through different means: receiving data from a questionnaire and interviews with the 22 members of Rhodope Municipalities as well as on the information from their SEAPs and other sustainable energy policy and planning documents.

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# 1. Introduction

Prior to implementing capacity building activities in Rhodope region SEC has undertaken an investigation of the status of initiative related to energy efficiency and renewable energy implementation in the region. The approach adopted is based on contact with the local supporting partner Association of Rhodope Municipalities who distributed a questionnaire to its members and obtained data from seven municipalities, direct contacts with municipalities and public source data. There are 22 municipalities-members of ARM, representing about 400 000 inhabitants, namely: Municipality of Devin, Municipality of Septemvri, Municipality of Rudozem, Municipality of Zlatograd, Municipality of Velingrad, Municipality of Asenovgrad, Municipality of Smolyan, Municipality of Bratsigovo, Municipality of Chepelare, Municipality of Kardzhali, Municipality of Banite, Municipality of Madan, Municipality of Laki, Municipality of Batak, Municipality of Rakitovo, Municipality of Nedelino, Municipality of Dospat, Municipality of Borino, Municipality of Rodopi, Municipality of Momchilgrad, Municipality of Kirkovo, Municipality of Strelcha. The three biggest municipalities are Municipality of Asenovgrad (68 000 inhabitants), Municipality of Smolyan (41 452 inhabitants) and Municipality of Kardzhali (70 196 inhabitants) followed by Municipality of Velingrad (37 670 inhabitants), Municipality of Rodopi (30 674 inhabitants) and Municipality of Septemvri (26 412 inhabitants). The six biggest municipalities together make about 70 % of the population of the region.

## 2. Methodology for data collection

In order to obtain data for the investigation of past activities and future identified initiatives in the fields of energy efficiency and renewable energy utilization, SEC has approached its local supporting partner Association of Rhodope Municipalities and implemented also direct contacts with a number of municipalities from the region (Asenovgrad Municipality and Smolyan Municipality). As a result data were obtained from three main sources: data from a questionnaire to municipalities, data from various municipal programs and plans for energy efficiency and RES utilization and data from public sources. Following is a more detailed description of data from the three sources:

### 2.1 Data from questionnaire obtained from municipalities

Data from a questionnaire on the already implemented measures and the potential available for future activities – answers were obtained from seven municipalities form Rhodope region, namely: Municipality of Smolyan; Municipality of Kardzhali; Municipality of Velingrad; Municipality of Septemvri; Municipality of Rudozem; Municipality of Zlatograd; Municipality of Devin.

### 2.2 Data from municipal programmes and plans for energy efficiency and renewable energy sources

Different types of sustainable energy planning and implementation documents have been adopted by the municipalities in the region. These types include: SEAPs, Programmes for Energy Efficiency, Programmes for Renewable Energy Utilisation, Integrated Plans for Urban Development. In some cases the issues of energy efficiency and renewable energies have been merged in a single

document. In some cases the issues of energy efficiency and RES utilization have been included in the scope of wider municipal policy documents like Municipal Operational Programmes, Integrated Plans for Municipal Development, etc.

Following is the breakdown of data sources from different municipal programmes and plans:

- SEAPs: There are two municipalities in the region that have signed CoM and already prepared their SEAPs – these are Asenovgrad Municipality and Smolyan Municipality. Data from the SEAPs was obtained and used for the present assessment. Bratsigovo and Zlatograd Municipalities have signed CoM recently but still haven't prepared their SEAPs
- Programmes/Plans for Energy Efficiency: Septemvri Municipality, Bratsigovo Municipality; Municipality of Madan; Municipality of Laki, Municipality of Chepelare; Municipality of Septemvri, Municipality of Zlatograd
- Programmes for Renewable Energy Utilization: Chepelare Municipality; Septemvri Municipality of Borino, Municipality of Madan, Municipality of Rodopi, Municipality of Septemvri, Municipality of Zlatograd
- Plans/Programmes for Municipal Development (inc. EE and RES priorities): Municipality of Kardzhali (2014-2020), Municipality of Devin, Municipality of Dospat, Municipality of Nedelino, Municipality of Banite, Municipality of Rodopi, Municipality of Velingrad, Municipality of Kirkovo, Municipality of Batak, Municipality of Laki, Municipality of Momchilgrad, Municipality of Rakitovo, Municipality of Rudozem, Municipality of Septemvri, Municipality of Strelcha

### 2.3 Data from previous projects and actions under EU IEE Programme

- Zlatograd Municipality: a project for utilization of geothermal energy for space heating of municipal buildings – a feasibility study prepared in the framework of IEE Green Twinning Project – the project has started with the construction of the geothermal water collection facilities but needs further investment for construction of the heating network/piping system to connect the buildings to the geothermal source as well as for construction of the substations in the buildings.
- Kardzhali Municipality: a project for replacement of street lighting with LED luminaries - a feasibility study prepared in the framework of IEE Green Twinning Project. It has started with lamp replacement on four centrally located streets (replacement of around 300 lamps or 3,5 % of the required 9000 luminaries in total) and measurements and technical/executive

drawings for the rest of the planned replacement but need further financing for the rest of the investment.

- Smolyan Municipality: a project of biomass fueled DH station feasibility study prepared in the framework of IEE Green Twinning Project – pending due to investment shortage

## 2.4 Data from publicly available sources – National Operational Programme Regional Development and others

Energy efficiency initiatives at municipal level have been applied under different financing schemes like Kozloduy Fund (Kozloduy International Decommissioning Support Fund (KIDSF) (EBRD initiative), Operational Programme for Regional Development (EU structural funding), Bulgarian Energy Efficiency Fund, various bilateral agreements of Bulgaria (Netherlands, Japan, Switzerland). There is a public registers of applied projects under Operational Programme for Regional Development and also public official information on the rest of major donor programmes and these sources have been used to comply the present report.

## 3. Potential and priorities in the 22 Rhodope municipalities

### 3.1 Energy Efficiency Potential and Policy Priorities

Municipality	Short description of current policy documents and measures	Priority Sectors
Asenovgrad	Sustainable Energy Action Plan with an overall overall CO <sub>2</sub> emission reduction target is 28 % by 2020. The main energy sources used are natural gas and electricity – 45 % and 39 % of the energy consumption in the municipality respectively.	<ul style="list-style-type: none"> <li>• Energy savings in buildings through building refurbishment mainly municipal and residential buildings;</li> <li>• Street lighting refurbishment;</li> </ul>
Banite	Municipal Development Plan (2007-2013)	<ul style="list-style-type: none"> <li>• Energy savings in buildings through building refurbishment mainly municipal and residential buildings;</li> <li>• Street lighting refurbishment;</li> </ul>
Batak	Municipal development plan (2007-2013) with qualitative priorities without specific measures and actions.	<ul style="list-style-type: none"> <li>• Energy savings in buildings through building refurbishment mainly municipal buildings;</li> <li>• Street lighting refurbishment;</li> </ul>
Bratsigovo	Energy Efficiency Plan (2014)	<ul style="list-style-type: none"> <li>• Energy savings in buildings through building refurbishment mainly municipal buildings;</li> <li>• Street lighting refurbishment;</li> </ul>
Borino	Programme for Promotion of Renewable Energy Sources (2013-2015) incl. energy efficiency with general priorities	<ul style="list-style-type: none"> <li>• Energy savings in buildings through building refurbishment of municipal buildings;</li> <li>• Development of monitoring and control systems for energy consumption in municipal infrastructure</li> <li>• Street lighting refurbishment</li> </ul>
Chepelare	Strategy for Energy Efficiency and Programme for Promotion of Renewable Energy Sources (2014) Energy Efficiency Programme (2014-2020)	<ul style="list-style-type: none"> <li>• Building refurbishment and incorporation of RES (biomass/wood chips/waste) in municipal buildings</li> <li>• Street lighting refurbishment</li> </ul>
Devin	Municipal Development Plan (2014-2020) with qualitative priorities without specific measures and actions	<ul style="list-style-type: none"> <li>• Energy savings in buildings through building refurbishment in municipal buildings and in private buildings</li> </ul>

Dospat	Municipal Development Plan (2014-2020) with qualitative priorities without specific measures and actions	<ul style="list-style-type: none"> <li>• Energy savings in buildings through building refurbishment mainly municipal buildings;</li> <li>• Street lighting refurbishment;</li> <li>• Gas distribution system development</li> </ul>
Kardzhali	Municipal Development Programme MDP 2014-2020 and a Plan for Implementation of MDP with concrete measures and projects	<ul style="list-style-type: none"> <li>• Gas distribution system development</li> <li>• Street lighting refurbishment and rehabilitation of street and park infrastructure;</li> <li>• Energy savings in buildings through building refurbishment mainly municipal buildings (educational, administrative)</li> </ul>
Kirkovo	Municipal development plan (2013-2020)	<ul style="list-style-type: none"> <li>• Energy savings in buildings through building refurbishment mainly municipal buildings;</li> <li>• Street lighting refurbishment;</li> </ul>
Laki	Municipal Programme for Energy Efficiency (2014-2016) Municipal Development Programme (2014-2020)	<ul style="list-style-type: none"> <li>• Street lighting refurbishment;</li> <li>• Energy savings in buildings through building refurbishment mainly municipal buildings;</li> </ul>
Madan	Energy Efficiency Programme (2007-2013) Programme for Promotion of Renewable Energy Sources (2013-2016)	<ul style="list-style-type: none"> <li>• Energy refurbishment of municipal buildings;</li> <li>• Street lighting refurbishment;</li> <li>• Energy efficiency in private residential buildings</li> </ul>
Momchilgrad	Municipal development plan (2014-2020) with qualitative priorities without specific measures and actions	<ul style="list-style-type: none"> <li>• Energy refurbishment of municipal buildings;</li> <li>• Natural gas distribution network development;</li> <li>• Street lighting refurbishment;</li> </ul>
Nedelino	Municipal Development Plan (2014-2020) and a Programme for Implementation of MDP with concrete measures and actions	<ul style="list-style-type: none"> <li>• Energy refurbishment of municipal buildings;</li> <li>• Street lighting refurbishment;</li> </ul>
Rakitovo	Municipal Development Plan (2014-2020) with qualitative priorities without specific measures and actions	Refurbishment of municipal buildings
Rodopi	Municipal Development Plan (2014-2020) no concrete project (indicative budget overall 5 000 000 Euro) Municipal Programme for Promotion of RES (2013-2023)	<ul style="list-style-type: none"> <li>• Refurbishment of municipal buildings</li> <li>• Introduction of monitoring and control systems in municipal buildings.</li> <li>• Measures for RES deployment in municipal buildings during energy refurbishment.</li> <li>• RES deployment in street lighting refurbishment</li> </ul>



Rudozem	Municipal Development Programme MDP 2014-2020	Energy refurbishment of municipal and private buildings;
Septemvri	Energy Efficiency Plan (2011), Municipal Development Plan (2014-2020), Programme for Promotion of RES (2012-2015)	<ul style="list-style-type: none"> <li>• Energy refurbishment of municipal buildings;</li> <li>• Refurbishment of lighting in streets and municipal buildings and increase of comfort;</li> </ul>
Smolyan	Sustainable Energy Action Plan with an overall overall CO <sub>2</sub> emission reduction target is 20 % by 2020. The main energy sources used are electricity (47 %) and fire-wood (27 %) of the energy consumption in the municipality respectively.	<ul style="list-style-type: none"> <li>• Energy savings in buildings through building refurbishment mainly municipal and residential buildings;</li> <li>• Street lighting refurbishment;</li> </ul>
Strelcha	A Programme for Management of Municipality (2011-2015) with general priorities Municipal Development Plan 2014-2020 Energy Efficiency Plan (2007-2013)	Energy savings in municipal buildings through building refurbishment.
Velingrad	Integrated Plan for Urban Regeneration and Development (2014) with general priorities, no concrete actions and measures	<ul style="list-style-type: none"> <li>• Energy efficiency in administrative and residential buildings (incl. incorporation of RES in buildings)</li> <li>• Street lighting refurbishment.</li> </ul>
Zlatograd	Municipal Programme for Energy Efficiency 2007-2013 Programme for Promotion of RES (2014-2020)	<ul style="list-style-type: none"> <li>• Energy efficiency in municipal buildings;</li> <li>• Energy efficiency in private residential buildings</li> <li>• Street lighting refurbishment</li> </ul>

There are **several main conclusions** from the above data and materials:

- All 22 municipalities of Rhodope region have incorporated energy efficiency and/or RES as their priority for development by means of preparing of a strategic policy document (several have more than one document) that includes these priorities.
- Energy efficiency in public municipal buildings is a commonly recognized priority in all 22 municipalities, especially regarding educational infrastructure (schools and kindergartens). Some projects have been already implemented but there is a lot more that need further development and financing that can serve as a starting point for CITYinvest activities;
- In many policy documents there are also action plans and specific measures outlines with foreseen funding necessary that can serve as a starting point for CITYinvest activities.

- Most of the municipal buildings have been heated by heavy fuel and electricity which makes feasible considering projects for fuel switch to biomass (given the local potential in Rhodope region);
- In some cases PV installation on rooftops of municipal buildings has been considered and projects need to be developed and financed.
- Another promising area is street lighting refurbishment and replacement of luminaries with more energy efficient ones (LED). Some projects have been applied (Kardhali) but most of the municipalities need funds for project development and implementation
- Widely recognized measures include also incorporation of RES in buildings, involvement in private residential buildings refurbishment, promotion of RES depending on local potential and others.

### 3.2 Building stock inventory

Based on information provided by a number of municipalities following is an inventory of the building stock in Rhodope Region:

## Residential buildings

Municipality	Total number of residential buildings:	Total number of dwellings	Total building surface (sq.m.)
Asenovgrad	14 285	20 3390	1 888 233
Banite	2 874	4 085	304 107
Batak	2 935	3 698	288 561
Bratsigovo	5 273	6 104	414 610
Borino	926	1 457	121 313
Chepelare	3 637	5 802	446 927
Devin	3 681	6 941	504 977
Dospat	2 234	3 015	289 102
Kardzhali	13 566	30 817	2 413 266
Kirkovo	9 846	10 753	1 042 883
Laki	1 276	2 434	144 073
Madan	2 783	6 131	449 367
Momchilgrad	5 287	7 759	676 101
Nedelino	2 687	3 828	296 410
Rakitovo	4 495	5 491	385 127
Rodopi	16 757	18 635	1 509 379
Rudozem	2 432	4 896	388 743
Septemvri	11 190	11 359	890 829
Smolyan	11 347	23 197	1 881 455
Strelcha	2 744	2 931	246 645
Velingrad	10 098	15 370	1 230 809
Zlatograd	3 373	6 170	480 835

## Municipal buildings

Municipality	Total number of municipal buildings*:	Of which educational	Total building surface* (sq.m.)
Asenovgrad	40		
Banite			
Batak		8	
Bratsigovo	30	15	36 800*
Borino			
Chepelare	29	7	n/a
Devin			
Dospat			
Kardzhali			
Kirkovo	67	47	n/a
Laki			
Madan	18	12	32 266
Momchilgrad			
Nedelino			
Rakitovo		9	
Rodopi	44	21	43757
Rudozem			
Septemvri	43	23	47 595
Smolyan			
Strelcha	21	3	18 180
Velingrad			
Zlatograd	24	12	48369

\*estimate

**The main conclusions** of the building stock inventory are:

- **Residential buildings:** the total area of residential buildings in Rhodope region is 16 293 752 square meters. Several municipalities have stated residential building refurbishment as a priority in their strategic policy documents and action plans for energy efficiency and RES deployment, namely Asenovgrad, Banite, Devin, Rudozem, Smolyan, Velingrad, Zlatograd, which makes the potential of 6 679 159 area for residential building refurbishment in those municipalities. Currently in Bulgaria there is a National Programme for Residential Building Refurbishment which can be used for some pilot cases which then to be made show-cases for large scale energy efficiency refurbishment in respective municipalities.

- **Municipal buildings:** the available data of municipal building stock in Rhodope region shows 226 967 square meters of municipal building area. Although significant part of the municipal buildings

have already been refurbished (see section 4.4.1 Implemented Energy Efficiency Projects”) it can be estimated that the potential for project identification is still high. Furthermore, many of investigated municipalities have already made energy audits and/or estimation of the number of municipal buildings to be refurbished and the necessary funding for these initiatives (see section 5.1. Planned Energy Efficiency Projects”)

### 3.3 Renewable Energy Potential and Priorities

Municipality	Short description	Priority Sectors
Asenovgrad	<p><b>Location and demographics:</b> The Municipality of Asenovgrad is situated along the two banks of the Assenitsa (Chepelarska, Chaya) River. It covers a small part of the Thracian Lowland to the north, and encompasses spacious areas of the Rhodope Mountains to the south, as a result of which a substantial part of the terrain is strongly indented and inclined. The population of the municipality is approximately 68 000 inhabitants. The municipal centre Asenovgrad is the largest town in the Rhodopes and the second largest in the Province of Plovdiv. It is situated at the foot of the mountain at an altitude about 220 m above sea level and is 19 km away from the town of Plovdiv, 85 km away from the town of Smolyan and about 180 km away from the capital Sofia.</p> <p><b>Climate:</b> transitional-and mountainous climate characterized by cool summer and longer winter with very cold days. Rain is more in the form of snow that lasts sometimes until April. Thracian lowland is characterized by cool spring, warm summer, mild autumn, winter is relatively mild and also with higher warming under the influence of Mediterranean cyclones. Snowfalls are few and do not stay for long. There are water resources including spa and thermal waters.</p>	<ul style="list-style-type: none"> <li>• <b>Solar energy:</b> Asenovgrad Municipality has the potential between 30-60 MW, due to the ability to utilize the roof space to generate electricity and/or hot water for domestic use.</li> <li>• <b>Wind energy:</b> the potential of wind in the Municipality of Asenovgrad is assessed up to 250 MW at places in the mountainous part of Asenovgrad Municipality at an altitude of more than 1000 meters above sea level.</li> <li>• <b>Biomass:</b> fuel switch from heavy fuel oil to biomass (wood chips); There are two HPPs on the municipal territory: HPP Assenitsa 1 with 6,7 MW capacity and HPP Assenitsa 2 with 1,6 MW</li> </ul>
Banite	<p><b>Climate and geography:</b> situated at 450-2000 meters above sea level, mountainous climate transitional Mediterranean with cool summers and mild snowy winters. Abundant water resources with several rivers. Mineral spring with about 40 degrees temperature used for treatment of different diseases</p> <p>64 % of territory is covered by forests –potential for wood biomass</p> <p><b>Population:</b> 20 settlements with 6 657 inhabitants in total.</p> <p><b>Economy:</b> mountain and spa tourism</p>	<p>Potential for:</p> <ul style="list-style-type: none"> <li>• Geothermal</li> <li>• Solar</li> <li>• Biomass (wood waste)</li> </ul>
Batak	<p><b>Climate and geography:</b> situated in central Rhodope Region, at about 1100-1200 m above sea level, 83 % of territory covered with forests, abundant water resources, Batak water reservoir as a major tourist destination, five more smaller reservoirs,</p> <p><b>Population:</b> 3 settlements with 7 500 inhabitants</p>	<p>Potential for:</p> <ul style="list-style-type: none"> <li>• Biomass (wood waste)</li> <li>• Solar</li> </ul>

	<b>Economy:</b> tourism and wood logging/processing,	
Bratsigovo	<b>Climate and geography:</b> transitional-and mountainous climate characterized by cool summer and snowy winter. Situated between 300 and 1400 m above sea level, over 55 % of its territory is covered by forests. There is a mineral spring (low temperature) with 5 drilling holes	Potential for: <ul style="list-style-type: none"> <li>• Geothermal</li> <li>• Solar</li> <li>• Biomass (wood waste)</li> </ul>
Borino	<b>Climate and geography:</b> situated in South-Western part of Rhodope mountains at about 1000-1600 m above the sea level, surrounding mountain relief with high peaks and river valleys, climate conditions are mountainous, cold snowy winters and cool summers. <b>Population:</b> 5 settlements with 3 579 inhabitants in total. <b>Infrastructure:</b> there is a road network but due to the mountain relief it is rather difficult to maintain. The roads are narrow and curved. All settlements are centrally water and electricity supplied.	Potential for: <ul style="list-style-type: none"> <li>• Solar (thermal and PV)</li> <li>• Biomass (wood waste)</li> </ul>
Chepelare	<b>Climate and geography:</b> situated in central Rhodope Region, along Chepelarska River, at about 1100-1200 m above sea level, primary touristic location with the major skiing resort Pamporovo <a href="http://pamporovo.me/en/">http://pamporovo.me/en/</a> <b>Population:</b> 13 settlements with 7 494 inhabitants <b>Economy:</b> industrial sectors developed: tourism and wood logging/processing, Ski manufacturing factory Amer Sports (Atomic and Salomon brands):	<ul style="list-style-type: none"> <li>• RES (biomass/wood chips/waste) utilization in municipal buildings</li> <li>• Solar PV installation;</li> <li>• Small hydropower</li> </ul>
Devin	<b>Climate and geography:</b> situated along Vacha River valley at about 1000-1500 m above the sea level, surrounding mountain relief, climate conditions are mountainous with average yearly temperatures between 4°C and 10°C depending on the altitude, cold snowy winters with minimal temperatures up to -15° C and summers with +30° C maximum temperatures. <b>Population:</b> 16 settlements with 12 745 inhabitants in total. <b>Infrastructure:</b> there is a road network but due to the mountain relief it is rather difficult to maintain. The roads are narrow and curved. All settlements are centrally water and electricity supplied. <b>Economy:</b> hydro power production, wood processing, forestry, mineral water bottling and selling, tourism: mountain, spa, medical tourism. There are also mines for non-metal ores exploration – fluorite and others.	Potential for: <ul style="list-style-type: none"> <li>• solar,</li> <li>• hydropower,</li> <li>• geothermal (10 mineral springs)</li> <li>• biomass (coniferous forests cover 74 % of territory).</li> </ul> <p>There are HPPs with total installed capacity of 220 MW (shared with Dospat Municipality) Forthcoming is the construction of one more big HPP and there is potential for numerous SHPPs all around the municipality</p>
Dospat	<b>Climate and geography:</b> at about 1300 m above the sea level, surrounding mountain relief, two river valleys, forests and mountain peaks. Transitional Mediterranean climate, cool summers and snowy winters. <b>Population:</b> 8 settlements with 9 116 inhabitants in total. <b>Infrastructure:</b> there is a road network but due to the mountain relief it is rather difficult to maintain. The roads	Potential for: <ul style="list-style-type: none"> <li>• biomass (coniferous forests cover 70 % of territory).</li> <li>• Hydropower: Dospat reservoir – the second largest in Bulgaria with</li> </ul>

	<p>are narrow and curved. All settlements are centrally water and electricity supplied.</p> <p><b>Economy:</b> hydro power production, wood processing, forestry, mineral water bottling and selling, tourism: mountain, spa, medical tourism. There are also mines for non-metal ores exploration – fluorite and others.</p>	<p>2200 hectares of water surface. HPP complex Dospat-Vacha with 220 MW total installed capacity</p> <ul style="list-style-type: none"> <li>• solar,</li> <li>• geothermal (2 mineral springs)</li> </ul>
Kardzhali	<p><b>Climate and geography:</b> situated in South East Bulgaria, along Arda River valley at about 700-800 m above the sea level, Surrounding low mountain hilly relief, climate conditions are mild due to the Mediterranean influence and feature average yearly temperature of 11-13 °C. The winter is mild and the summer is hot with temperatures reaching 40 °C. The climate is characterized with very high level of solar radiation even during winters suitable for solar thermal and PV utilization. 52 % of the municipal territory is arable land which is a prerequisite for agriculture development and agricultural biomass wastes potential.</p> <p><b>Population:</b> 117 settlements with 70 196 inhabitants in total.</p> <p><b>Infrastructure:</b> The road network is well developed; All settlements are centrally water and electricity supplied; all settlements have street lighting networks. There is a technical project for natural gas supply network development.</p> <p><b>Economy:</b> Industry is a significant economic sector featuring non-ferrous metal production (lead and zinc production), machine building, textile and knitwear, food and beverage, and electronics. There are significant reserves of natural zeolite, bentonite and perlite – precious industrial minerals with commercial value. There are also reserves of raw materials for cement production and quality marble and limestone (the latter still not exploited). In agriculture the tobacco production and vegetables production is well developed as well as animal breeding – cattle, cow, sheep. Forests covering about 36 % of municipal territory that substantiates wood logging and wood processing industries.</p> <p><b>RES potential:</b> due to suitable geographic condition the potential for solar thermal and PV and waste wood and agricultural biomass utilization in Kardzhali Municipality is high. There is also potential for hydro power on the Arda River.</p>	<p>Potential for:</p> <ul style="list-style-type: none"> <li>• Hydropower: There is an existing HPP Kardzhali of 124 MW installed capacity and the construction of Hydro Power Cascade Gorna Arda is underway consisting of three HP plants with total installed capacity of 170 MW.</li> <li>• Solar PV</li> <li>• Biomass (agricultural and wood)</li> </ul>
Kirkovo	<p><b>Climate and geography:</b> plain to low hilly relief, at Eastern Rhodopi pre-mountainous areas, at 523 m above sea level</p>	<p>Potential for:</p> <ul style="list-style-type: none"> <li>• Solar (PV and thermal)</li> </ul>



	<p>average altitude, transitional Mediterranean climate with mild winters and long sunny summers, not abundant water resources causing sometime water shortage, 50 % of territory covered with forests.</p> <p><b>Population:</b> 73 settlements with 23 421 inhabitants in total.</p> <p><b>Economy:</b> agriculture: tobacco growing, animal breeding, milk and dairy, garment manufacturing.</p>	<ul style="list-style-type: none"> <li>• Biomass: agricultural wood wastes, biogas</li> </ul>
Laki	<p><b>Climate and geography:</b> situated in mountainous relief with river bed canyons, altitude from 660 to 1600 meters above sea level, mountainous climate, transitional Mediterranean with cool summers and mild snowy winters. Abundant water resources with several rivers. Active sliding of earthen masses, 80 % of territory is covered by forests –potential for wood biomass</p> <p><b>Population:</b> 11 settlements with 2 837 inhabitants in total.</p> <p><b>Economy:</b> wood logging, mountain tourism</p>	<p>Potential for:</p> <ul style="list-style-type: none"> <li>• Biomass (wood waste)</li> <li>• Solar PV</li> </ul>
Madan	<p><b>Climate and geography:</b> at about 700 m above the sea level, surrounding mountain relief, five rivers lower mountain relief with forests Transitional Mediterranean climate, cool summers and mild snowy winters.</p> <p><b>Population:</b> 44 settlements with 12 276 inhabitants in total.</p> <p><b>Infrastructure:</b> there is a road network with curved roads due to the terrain. All settlements are centrally water and electricity supplied.</p> <p><b>Economy:</b> none-ferrous ore mining (in decline), wood processing and wood logging.</p>	<p>Potential for:</p> <ul style="list-style-type: none"> <li>• Biomass for space heating</li> <li>• Small hydro</li> <li>• Solar PV</li> </ul>
Momchilgrad	<p><b>Climate and geography:</b> mainly mountain relief of Eastern Rhodope, at about 200-600 meters above sea level, climate transitional Mediterranean with mild winters with snowfalls and hot summers with a lot of sunshine. Significant water resources from two local rivers, 50 % of municipal territory is covered by forests</p> <p><b>Population:</b> 49 settlements with 16 263 inhabitants in total.</p> <p><b>Economy:</b> mainly agricultural region with animal breeding, tobacco growing and manufacturing, textile and garment industries, wood-processing industry;</p> <p><b>Infrastructure:</b> The road network is well developed; All settlements are centrally water and electricity supplied; all settlements have street lighting networks. There is a technical project for natural gas supply network development</p>	<p>Potential for:</p> <ul style="list-style-type: none"> <li>• Solar PV</li> <li>• Biomass for space heating</li> <li>• Small hydro</li> </ul>
Nedelino	<p><b>Climate and geography:</b> at 500 m above sea level, surrounding mountain relief with forests Transitional Mediterranean climate, cool summers and snowy winters. 72 % of territory covered by forests.</p> <p><b>Population:</b> 16 settlements with 6 922 inhabitants in total.</p>	<p>Potential for:</p> <ul style="list-style-type: none"> <li>• Solar PV</li> <li>• Biomass (wood wastes) for space heating</li> </ul>

	<b>Economy:</b> wood processing and wood logging, tourism	
Rakitovo	<p><b>Climate and geography:</b> at 811 m above the sea level, surrounding mountain relief with forests Transitional Mediterranean climate, cool summers and mild snowy winters, abundant water resources, five mineral springs, one with temperature of 51 degrees. Solar days average 275/annum. 78 % of territory covered with forests</p> <p><b>Population:</b> 3 settlements with 8 122 inhabitants in total.</p> <p><b>Infrastructure:</b> there is significant road network with curved roads due to the terrain. All settlements are centrally water and electricity supplied.</p> <p><b>Economy:</b> wood processing and wood logging, mineral water bottling.</p>	<p>Potential for:</p> <ul style="list-style-type: none"> <li>• Solar (thermal and pV);</li> <li>• Geothermal;</li> <li>• Biomass (wood wastes)</li> </ul>
Rodopi	<p><b>Climate and geography:</b> very diverse terrain mostly lowlands and plains but also mountainous parts with 1500 m above sea level. Diverse climate, a lot of water resources, fertile land suitable for agriculture.</p> <p><b>Population:</b> 21 settlements with 32 602 inhabitants</p> <p><b>Economy:</b> agriculture, mineral quarries, food-processing, in the mountains – tourism, animal breeding</p>	<p>Potential for:</p> <ul style="list-style-type: none"> <li>• Solar;</li> <li>• Agricultural waste</li> <li>• Wood waste</li> </ul>
Rudozem	<p><b>Climate and geography:</b> situated along Arda River valley at about 700-800 m above the sea level, surrounding low mountain hilly relief, high level of solar radiation even during winters suitable for solar thermal and PV utilization. There are deciduous forests on the municipal territory covering 82 % of territory so the potential of wood waste biomass utilization is significant.</p> <p><b>Population:</b> 23 settlements with 10 069 inhabitants in total.</p> <p><b>Infrastructure:</b> The road network is well developed. All settlements are centrally water and electricity supplied; all settlements have street lighting networks.</p> <p><b>Economy:</b> Industry is a major economic sector featuring lead and zinc metal ore extraction and processing. Chemical industry (hear-dying and cosmetics) is also well developed as well as wood logging and wood processing. Agriculture is mainly represented by animal breeding – sheep and cow breeding, poultry.</p> <p><b>RES potential:</b> due to suitable geographic condition the potential for solar thermal and PV and waste wood biomass utilization in Rudozem Municipality is high. There are three PV installations already constructed on the municipal territory - one of them is big with total installed capacity of 78,4 MWp and the other two in the range of several hundred KWp.</p>	<p>Potential for:</p> <ul style="list-style-type: none"> <li>• Solar PV</li> <li>• Biomass (wood waste)</li> </ul>
Septemvri	<p><b>Climate and geography:</b> situated in the Thracian Valley, transitional continental climate with mild winter and long</p>	<p>Potential for:</p> <ul style="list-style-type: none"> <li>• Solar PV</li> </ul>

	<p>warm autumn. mostly agricultural land (59 % of municipal territory). 28 % of municipal territory is covered by forests.</p> <p><b>Population:</b> 14 settlements with 27 243 inhabitants in total.</p> <p><b>Infrastructure:</b> The road network is well developed; there is also a railroad network. There is also a highway crossing the municipal territory. There is also a gas supply networking on the municipal territory the municipal centre Septemvri town is connected and gas distribution network has been constructed providing natural gas to industries, public municipal buildings and private buildings.</p> <p><b>Economy:</b> Agriculture and food-processing industry, machine repair industry – railroad wagons and locomotive repairs. Wood processing is also developed. Agriculture is represented by cereal crops harvesting, vegetable gardens and orchards, and animal breeding – sheep and cow breeding, poultry.</p> <p><b>RES potential:</b> due to suitable geographic condition the potential for solar thermal and PV utilization in Septemvri Municipality is high. There are six PV installations already commissioned and thirteen more under development. There is also potential for wood waste utilization. Due to animal breeding there is also potential for biogas utilization as well as biodiesel and bioethanol production and usage. There are no TPPs and HPPs constructed on the municipal territory.</p>	<ul style="list-style-type: none"> <li>• Biomass (wood and agricultural waste)</li> <li>• Biogas;</li> <li>• Biofuel production</li> </ul>
Smolyan	<p><b>Climate and geography:</b> situated in Rhodope Mountains at about 1000 m above the sea level, surrounding mountain relief, characterized by high peaks and deep river valleys. The climate is transitional continental with Mediterranean influence. The municipal centre Smoljan is situated along a valley. The average yearly temperature is 7-9° C in the valley and 4-5° C on the ridges of mountain peaks. Snow stays about 8-120 days/year and the surrounding mountain ridges protect the valley from extreme colds which makes excellent skiing conditions. Summer is cool and humid and autumn is mild and long. Climatic conditions and rich coniferous forests favour also mountain tourism and recreation.</p> <p>Smoljan Municipality covers 854 square meters of which over 60 % are coniferous woods which makes wood waste biomass potential significant. There are also mineral springs located on the municipal territory that haven't been studied and utilized yet. There are also some brown coal deposits and deposits of limestone and sandstone. There are also non-ferrous ore deposits located but not exploited yet. Marble stone and limestone extraction is developed on the municipal territory.</p>	<p>Potential for:</p> <ul style="list-style-type: none"> <li>• Biomass for space heating</li> <li>• Small hydro</li> <li>• Solar PV</li> <li>• Geothermal power</li> </ul>

	<p><b>Population:</b> 86 settlements with 41452 inhabitants in total.</p> <p><b>Infrastructure:</b> there is a road network but due to the mountain relief it is narrow and curved. The main road connects Smoljan with Plovdiv. All settlements are centrally water and electricity supplied. There are also street networks in municipal settlements. There is a DH network in the municipal centre Smoljan that currently is heavy fuel oil fired. Studies have been made to switch fuel from heavy fuel oil to biomass as well as for network refurbishment to reduce transmission losses. There is no gas supply infrastructure in Smoljan Municipality. The energy consumption of the municipality is formed by heavy fuel oil – 68,40 %, followed by electricity – 28,6 % and the rest is solid fuels (3%). The high conventional liquid fuel prices combined with favourable RES conditions make it feasible to investigate fuel switch from heavy fuel oil to biomass and utilization of solar thermal and PV for heat/DHW and electricity production (respectively). Geothermal power is also an option to consider as well as small HPP.</p> <p><b>Economy:</b> Industry is represented by machine building and cable production. Also developed are garment manufacturing, dairy, wood processing, forestry, tourism (skiing). 90 per cent of the industrial entities are small (below 10 employees) and there are only two with more than 100 employees. Agriculture is not well developed as there is not enough agricultural land. It is mainly potato and tobacco planting and cattle and sheep breeding, as well as bee breeding.</p> <p><b>RES potential:</b> due to suitable climatic and geographic conditions the potential for RES utilization in Smoljan Municipality is high. It is solar thermal and PV, waste wood biomass, hydropower and geothermal power.</p>	
Strelcha	<p><b>Climate and geography:</b> between 500 and 1000 m above the sea level, surrounding mountain relief with forests, cool summers and mild snowy winters, abundant water resources, mineral springs with hot water, a lot of days with solar sunshine.</p> <p><b>Population:</b> 5 settlements with 4 774 inhabitants in total.</p> <p><b>Infrastructure:</b> there is significant road network with curved roads due to the terrain. All settlements are centrally water and electricity supplied.</p> <p><b>Economy:</b> wood processing and wood logging, spa tourism.</p>	<p>Potential for:</p> <ul style="list-style-type: none"> <li>• Solar PV on municipal rooftops;</li> <li>• Geothermal;</li> <li>• Biomass (wood wastes)</li> </ul>
Velinograd	<p><b>Climate and geography:</b> Situated at 700-2100 m above the sea level, in Western Rhodope Mountain along valley of the Chepiska River, surrounding mountain relief. Due to</p>	<p>Potential for:</p> <ul style="list-style-type: none"> <li>• Solar</li> <li>• Geothermal;</li> </ul>

	<p>the influence from the Mediterranean climate the winter is mild and the summer is not very hot. The weather is characterized with high solar radiation with an average annual number of 215 clear solar days which provides for solar thermal and PV potential. Forests cover 83 % of municipal territory and there are mainly coniferous woods (82 %) so the potential of wood waste biomass utilization is high. There are a large number of small rivers along the main rivers Chepiska and Dospatska, and due to the mountain terrain with big declinations there is potential for small hydro power plants. There are many geothermal springs on the municipal territory which makes Velingrad a significant spa and health recreation centre.</p> <p><b>Population:</b> 25 settlements with 40 707 inhabitants in total.</p> <p><b>Infrastructure:</b> there is a road network developed on municipal territory, crossed by the second-class international road E-84 that connects Greece, Macedonia and South-West Bulgaria with Upper Thrace and further to Turkey and Middle East.</p> <p>There is a narrow-rail network developed. All settlements are centrally water and electricity supplied.</p> <p>One of the biggest dams – Dospat and the biggest hydro power cascade in Bulgaria – Dospat-Vacha, are situated partially on the municipal territory but the power generation capacities (HPPs) are situated outside Velingrad Municipality.</p> <p><b>Economy:</b> The combination of mild climate, solar radiation and mountain forests together with hot mineral springs makes tourism an important economic sector in Velingrad Municipality. The geographic and climatic conditions favour eco-tourism, ski-tourism and hunting tourism. Another significant economic sector is wood logging and wood processing as well as some chemical industry and machine building..</p> <p><b>RES potential:</b> There is high available potential for RES utilization in Velingrad Municipality in solar thermal and PV, waste wood biomass, geothermal power, small hydro power. There is untapped potential of Small HPPs as well as of space heating and DHW preparation using geothermal power from the hot mineral springs some of which can go up to 91° C temperature.</p>	<ul style="list-style-type: none"> <li>• Biomass (wood wastes, wood chips)</li> <li>• Small Hydro</li> </ul>
Zlatograd	<p><b>Climate and geography:</b> Situated at 385-1118 m above the sea level, surrounding mountain relief, climate conditions are mountainous with average yearly temperature of 10,8° C. Due to the influence from the Mediterranean climate the winter is mild and the summer is not very hot. There is quite high volume of precipitation</p>	<p>Potential for:</p> <ul style="list-style-type: none"> <li>• Solar</li> <li>• Geothermal;</li> <li>• Biomass (wood wastes, wood chips)</li> </ul>

	<p>and sometimes due to intensive raining there is danger of floods. The municipality borders Greece. Forests cover 82 % of municipal territory and additionally 8 % are covered with pastures. So the potential of wood waste biomass utilization is significant. There are some geothermal springs on the municipal territory.</p> <p><b>Population:</b> 9 settlements with 12 321 inhabitants in total.</p> <p><b>Infrastructure:</b> there is a road network but due to the mountain relief it is rather difficult to maintain. The roads are narrow and curved. No rail network developed. All settlements are centrally water and electricity supplied.</p> <p><b>Economy:</b> Industry is a major economic sector featuring lead and zinc metal ore extraction and processing. Machine building and repairing are also well developed as well as garment manufacturing industry. Wood logging and processing is also present as economic activity. Recently eco-tourism has been developed. Agriculture is mainly represented by animal breeding – sheep and cow breeding, poultry.</p> <p><b>RES potential:</b> There is available potential for RES utilization in Zlatograd Municipality in solar thermal and PV, waste wood biomass, geothermal power.</p>	
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Several conclusions can be drawn from the above data:

- Generally Rhodope region favourable climate conditions for deployment of RES and thus significant RES potential, part of which has already been tapped but there is still much room for renewable energy projects development and implementation in the region.
- The climate and geography of the region substantiate potential for:
  - Biomass, mostly wood waste but also agricultural waste, for space heating and CHP (in all 22 Rhodope Municipalities);
  - Solar both PV and thermal (in all 22 Rhodope Municipalities);
  - Small hydro energy 8 municipalities namely Chepelare, Devin, Dospat, Kardhali, Madan, Momchilgrad, Smolyan, Velingrad)
  - Geothermal energy for space heating in 9 municipalities namely Banite, Bratsigovo, Devin, Dospat, Rakitovo, Smolyan, Strecha, Velingrad, Zlatograd.

## 4. Implemented actions and projects

### 4.1 Energy Efficiency Projects

Municipality	Project Short description	Year	Total Investment Euro	Source of Funding
Asenovgrad	Refurbishment and Energy Improvements in nine educational buildings (schools and kindergartens)	2013	2 725 000	80 % Operational Programme Regional Development
Banite	Energy efficiency improvements of three municipal buildings (two schools and a kindergarten)	2012	225 000	82 % Operational Programme Regional Development 18 % own funding
Batak	Energy efficiency improvements (window replacement, heating system refurbishment, thermal insulation of building shell, luminaries replacement) of 10 municipal buildings (three schools, 3 kindergartens, 3 administrative buildings and the historical museum)	2008	1 200 000	Kozloduy Fund (100 % funding)
Bratsigovo	• Energy efficiency improvements (window replacement, heating system refurbishment, thermal insulation of building shell, luminaries replacement) of one school and two kindergartens	2010	400 000	80 % Operational Programme Regional Development/20 % own funding
	• Energy efficiency improvements in two schools and one kindergarten	2013	500 000	80 % Operational Programme Regional Development/ 20 % own funding
	• Energy efficiency improvements in four municipal buildings;	2014	350 000	Energy Efficiency Fund (loan)
	• Energy efficiency improvements in one kindergarten;	n/a	55 000	Own funding
	• Heating system refurbishment in disabled children home	n/a	44 000	Own funding
Borino	• Energy efficiency improvements of one municipal building – school	2013	371 856	70 % Operational Programme Regional Development
	• Energy efficiency improvements in 2 kindergartens	2008-2009	379 000	80 % State budget/20 % own funding
	• Heating system refurbishment in 2 kindergartens	2009	119 000	
	• Energy efficiency refurbishment of municipal administrative building	2013	350 000	Kozloduy Fund



Chepelare	<ul style="list-style-type: none"> <li>Energy Efficiency improvements in a kindergarten;</li> <li>Refurbishment of a school</li> </ul>	2012	144 155	Kozloduy Fund (100 % funding) 80 % EU funding (Beautiful Bulgaria programme)/20 % own funding Own funding  65 % Swiss bilateral cooperation programme /35 % own funding
		2005	60 000	
	<ul style="list-style-type: none"> <li>Refurbishment of 2 municipal administration buildings (town Chepelare and Pamporovo resort)</li> </ul>	2008-2009	144 908	
	<ul style="list-style-type: none"> <li>Energy audits of three educational facilities with total surface of 15 588 sq.m.</li> <li>Heating system refurbishment in a municipal buildings</li> </ul>	2006	33 000	
Devin	<ul style="list-style-type: none"> <li>Energy efficiency improvements (window replacement, heating system refurbishment, thermal insulation of building shell, luminaries replacement) of one municipal building – school</li> </ul>	2011	425 000	Operational Programme Regional Development 10 % own funding  Beautiful Bulgaria Project
	<ul style="list-style-type: none"> <li>Energy efficiency improvements in a kindergarten</li> </ul>	2009	126 620	
Dospat	Energy efficiency improvements (window replacement, heating system refurbishment, thermal insulation of building shell, luminaries replacement) of one municipal building – high school	2013	484 000	Operational Programme Regional Development and 10 % own funding
Kardzhali	Energy efficiency improvements (window replacement, heating system refurbishment, thermal insulation of building shell, luminaries replacement) of 8 municipal buildings – 4800 sq.m (three schools, 4 kindergartens, one nursery)	2014	1 520 000	84 % Operational Programme Regional Development and 16 % own funding
Kirkovo	Refurbishment of sports facilities of municipal school	2009	460 000	85 % Operational Programme Regional Development and 15 % own funding
Laki	<ul style="list-style-type: none"> <li>Energy efficiency improvements of 2 municipal buildings (a school and a kindergarten)</li> </ul>	2013	268 500	Kozloduy Fund  na
	<ul style="list-style-type: none"> <li>Energy efficiency refurbishments in two municipal buildings</li> </ul>	On-going	91 218	

	(administrative and elderly peoples home)	(May 2015)		
Madan	<ul style="list-style-type: none"> <li>Energy efficiency improvements of 2 municipal buildings (a school and a kindergarten)</li> <li>Energy efficiency improvements of one municipal building (a kindergarten)</li> <li>Street lighting refurbishment</li> </ul>	2009	500 000	88 % Operational Programme Regional Development and 12 % own funding
		2013	330 000	80 % Operational Programme Regional Development and 20 % own funding
		2009	30 000	Own funding
Momchilgrad	<ul style="list-style-type: none"> <li>Energy efficiency improvements of 2 municipal buildings (schools)</li> <li>Refurbishment of 3 municipal buildings (2 kindergartens and a nursery)</li> </ul>	2013	598 000	84 % Operational Programme Regional Development 16 % own funding
		2010	466 000	90 % Operational Programme Regional Development 10 % own funding
Nedelino	Energy efficiency improvements of 2 municipal buildings (a school and a youth hostel)		508 000	70 % Operational Programme Regional Development 30 % own funding
Rakitovo	<ul style="list-style-type: none"> <li>Energy efficiency improvements of 3 municipal buildings (a school and 2 kindergartens)</li> <li>Energy efficiency improvements of a municipal buildings - school</li> <li>Energy efficiency improvements of 4 municipal buildings - 2 schools, one kindergarten and one cultural</li> </ul>	2013	463 000	83 % Operational Programme Regional Development
		na	na	State budget
		2012	na	Kozloduy Fund
Rodopi	Energy efficiency improvements of 6 municipal buildings (schools)	2012	2 729 115	Operational Programme Regional Development
Rudozem	Energy efficiency improvements of three municipal buildings -school and two kindergartens	2012	350 000	85 % Operational Programme Regional Development 15 % own funding
Septemvri	<ul style="list-style-type: none"> <li>Energy efficiency improvements of three municipal buildings ( kindergartens)</li> <li>Energy efficiency improvements of seven municipal buildings (six schools and a kindergarten)</li> </ul>	2013	n/a	Kozloduy Fund
		2013	1 007 245	Operational Programme Regional Development

Smolyan	• Refurbishment of administrative municipal building (20 000 sq.m.)	2013	350 000	Kozloduy Fund
	• Energy refurbishment of 7 educational structures	2010	2 574 000	85 % Operational Programme Regional Development
	• Energy refurbishment of 4 social structures (elderly people's homes)	2012	2 829 000	85 % OP Regional Development
	• Street lighting refurbishment	2009	824 000	Kozloduy Fund
	• Experience in private residential building refurbishment - 8 buildings	2011	500 000	80 % grant from UNDP/GEF programme
Strelcha	Energy efficiency improvements of 3 municipal buildings (two schools and 1 kindergarten) – heating systems refurbishment and solar thermal systems installation	2014	310 000	Operational Programme Regional Development
Velingrad	Energy efficiency improvements (window replacement, heating system refurbishment, thermal insulation of building shell, luminaries replacement) of 9 municipal buildings (schools and kindergartens)	2014	1 000 000	Operational Programme Regional Development
Zlatograd	• Refurbishment and energy improvements of municipal hospital	2015	1 000 000	Operational Programme Regional Development
	• Refurbishment and energy improvements of municipal buildings (two schools and the administrative building)	2013	224 000	Kozloduy Fund
	• Refurbishment of a kindergarten	2008	37 615	Bilateral programme for cooperation with Japan

### Conclusions:

- There is significant experience gained in energy efficiency refurbishments in the region. The available data shows that so far there are 47 projects for energy efficiency in buildings and street lighting refurbishment already implemented in the region with total investment of more than 24 MEuro investment;
- Most of these projects are directed toward educational infrastructure, but there are also municipal administrative buildings refurbished as well as cultural, health-care and other municipal buildings.

- The sources of funding vary but most of the project have used different donor programmes combined with own municipal funding as well as bank loans. So far there no project in the region that have applied ESCO schemes (although there are some examples of ESCO projects in Bulgaria).
- There is almost no actual monitoring of already applied project so it is difficult to refer to actual data about the achieved saving results.

## 4.2 Renewable Energy Projects

Municipality	Project Short description	Year	Total Investment	Renewable energy capacity and/or other benefits	Source of Funding
Bratsigovo	Solar thermal system for domestic hot water and for hybrid space heating in abandoned children's home		98 900	n/a	Own budget
Chepelare	Installation of biomass (wood chips/pellets)-fired heating system in five municipal buildings (three kindergartens, administrative municipal building and a school)	2011	139 420	60 % cost savings	Own budget
Kardzhali	<ul style="list-style-type: none"> <li>• PV plant ground based</li> <li>• PV plant;</li> <li>• PV plant</li> <li>• PV plant</li> <li>• PV plant</li> <li>• PV plant</li> </ul>	n/a	n/a	4 000 29 30 79 197 77,55	EVN Bulgaria Private investment
Madan	<ul style="list-style-type: none"> <li>• PV plant in Madan on rooftop;</li> <li>• PV plant in Bukovo Village</li> <li>• PV plant in Srednogortsi Village;</li> <li>• „PV plant in Srednogortsi Village</li> </ul>	n/a	n/a	131 30 66 117,6	Private investment

	<ul style="list-style-type: none"> <li>Green energy system - a solar park with 42,8 kWp and a small HPP in Srednogrtski village</li> </ul>			42,8	
Rodopi	<p>Three small HPPs with total capacity of 9 MW</p> <p>Three PV stations with total installed capacity of 210 kW</p>	n/a		9 000 210	Private investment

## 5. Planned project and actions

### 5.1 Energy Efficiency Projects

Municipality	Project Short description	Number of buildings	Building area (sq.m.)	Investment needed (Euro)	Planned sources of Funding
Asenovgrad	Refurbishment of 8 educational buildings incl. heating systems refurbishment and use of renewable energy sources (solar and biomass)	8	na	2 809 000	Beautiful Bulgaria Programme OPRD or other
Banite	Refurbishment of the heating system and installation of a biomass fueled boiler in a school	1	4 545	130 000	ESCO scheme Erato holding
Batak	n/a	n/a	n/a	n/a	
Bratsigovo	Energy audits and energy efficiency improvements in 19 municipal buildings	19	15 562	2 300 000	Operational Programmes Own funding PPP/ESCO
Borino	EE refurbishment of four municipal administrative buildings	4	n/a	n/a	
Chepelare	<ul style="list-style-type: none"> <li>• Energy audits</li> <li>• Energy efficiency improvements in municipal buildings</li> <li>• Street lighting refurbishment</li> </ul>	10	n/a	50 000	Not identified
		10	n/a	500 000	
		-		225 000	
Devin	n/a	n/a	n/a	n/a	
Dospat	Street lighting replacement	-	-	110 000	Operational Programme 20 % own funding
Kardzhali	<ul style="list-style-type: none"> <li>• Street lighting refurbishment with LED</li> <li>• Refurbishment of infrastructure and lighting in a park;</li> <li>• Energy Efficiency refurbishment of</li> </ul>	-	-	8 500 000	95 % external funding
				500 000	95 % external/5 % own funding
		3		1 000 000	100% external funding

	three municipal buildings	6		1 350 000	95 % external/5 % own funding
	<ul style="list-style-type: none"> <li>• Refurbishment of 6 municipal administrative buildings</li> <li>• Refurbishment and energy improvements in 16 educational buildings</li> </ul>	16		2 850 000	External funding
Kirkovo	<ul style="list-style-type: none"> <li>• Refurbishment of municipal buildings (schools)</li> <li>• Refurbishment of municipal buildings (kindergartens)</li> <li>• Refurbishment of municipal buildings (cultural)</li> </ul>	6		1 145 000	Mostly external funding
		14		785 000	
		12		200 000	
Laki	Refurbishment and energy efficiency improvements in 8 municipal buildings	8	-	1 150 000	Not identified yet ESCO considered
Madan	<ul style="list-style-type: none"> <li>• Heating systems refurbishment and RES utilization (biomass and solar) in a kindergarten and a school</li> </ul>	2		322 000	Financial mechanism of European Economic Area
	<ul style="list-style-type: none"> <li>• Energy refurbishment of a municipal hospital</li> </ul>	1	7 728	320 000	Financial mechanism of European Economic Area
Momchilgrad	n/a	n/a	n/a	n/a	n/a
Nedelino	<ul style="list-style-type: none"> <li>• Refurbishment and energy improvements in three educational buildings</li> </ul>	3	n/a	650 000	Programme for Development of Rural Areas
	<ul style="list-style-type: none"> <li>• Refurbishment and energy improvements in five educational buildings and 5 administrative buildings</li> </ul>	10	n/a	2 550 000	Not identified yet
		-	-	43 875 000	

	<ul style="list-style-type: none"> <li>Street lighting improvements in 16 settlements</li> </ul>				Programme for Development of Rural Areas
Rakitovo	<ul style="list-style-type: none"> <li>Refurbishment and energy improvements in educational buildings</li> </ul>	4	na	400 000	Not specified
Rodopi	Energy efficiency improvements of municipal buildings Introduction of RES in buildings	na	na	3 000 000	Not identified yet ESCO and Energy Efficiency Fund considered
Rudozem	Energy efficiency measures in public municipal buildings Energy efficiency and RES measures application Development of a municipal programme for refurbishment of dwellings Informational campaign on promotion of RES	na	na	500 000 500 000 50 000 50 000	Not identified yet Operational programmes, ESCO considered
Septemvri	na	na	na	na	
Smolyan	<ul style="list-style-type: none"> <li>Energy efficiency refurbishments of 9 educational buildings</li> <li>Energy efficiency refurbishments of social buildings</li> <li>Energy efficiency refurbishments of cultural buildings</li> </ul>	9	n/a	3 926 000 1 420 000 3 180 000	Not identified yet Operational programmes, ESCO considered
Strelcha	na	na	na	na	
Velingrad	na	na	na	na	
Zlatograd	<ul style="list-style-type: none"> <li>Energy efficient street lighting improvements</li> <li>Energy efficiency refurbishments of</li> </ul>	- 19	 35 531	1 500 000 6 672 000	Not identified Operational programmes, ESCO considered



	municipal buildings (8 schools, 6 kindergartens, 1 hospital, 2 museums, 2 others)				
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It can be seen from the above table that currently there are projects for refurbishment of 147 municipal buildings in the region that have been identified and are waiting to be financed. The necessary funding for those projects amounts to more than 37 MEuro. There are also five currently identified projects for street lighting improvements amounting to 54 MEuro that also need to be financed.

CITYnvest project activities can play significant role in putting forward those projects and in provision of knowledge to local authorities on innovative financing schemes that they could apply to realize their planned energy efficiency projects.

## 5.2 Renewable Energy Projects

Municipality	Project Short description	Investment needed (Euro)	Planned sources of Funding
Bratsigovo	Installation of solar PV on rooftops of four municipal buildings with total area 2689 sq.m.(about 170 kWp)	240 000	Not specified yet
Borino	<ul style="list-style-type: none"> <li>Installation of solar thermal systems on school and 2 kindergartens</li> <li>Installation of wood pellet boiler in a school</li> </ul>	na	Donor programmes/own funding
Chepelare	<ul style="list-style-type: none"> <li>Solar thermal systems on 10 municipal buildings</li> <li>Solar PV installation on 10 municipal buildings</li> </ul>	50 000 75 000	Own budget plus external financing
Devin	CHP with thermal gasification of waste wood from logging with 1,5 MWe and 2,5 MWth capacity	1 500 000	Private investment supported by the municipality
Madan	Three small PV plants	n/a	Private investment
Rakitovo	Energy production from biomass	150 000	Public-Private Partnership
Smolyan	<ul style="list-style-type: none"> <li>PV installation on municipal buildings rooftops</li> <li>DH on biomass</li> </ul>	n/a 2 425 568	Public Private Partnership (roof lease to private investor) Public-private partnership
Zlatograd	<ul style="list-style-type: none"> <li>Space heating of 8 municipal buildings using high-temperature geothermal energy of 90°C</li> <li>Solar PV installation on rooftops of municipal buildings</li> </ul>	9 650 000 1 500 000 2 500 000	Public-private partnership and/or donor programme

	<ul style="list-style-type: none"> <li>Biomass space heating in municipal buildings</li> </ul>		
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There are municipal renewable energy project identified in Rhodope region amounting to 14 MEuro and a number of RES projects supported by the municipality through Public/Private Partnerships. Identification of innovative applicable financing schemes through CITYinvest activities can significantly contribute to the realization of these projects.

## 6. Financing instruments for energy efficiency and RES projects in Bulgaria

Type of financing instrument	Type of projects covered by the instrument	Name and description of the instrument	Links
Non repayable subsidies (state loan from EBRD)	Energy efficiency in residential buildings, household refurbishment	National programme for energy efficiency in multifamily residential buildings: 100 % financing of certain types of residential pre-fabricated concrete buildings	<a href="http://mrrb.government.bg/?controller=category&amp;catid=117">http://mrrb.government.bg/?controller=category&amp;catid=117</a>
Non repayable subsidies (EU structural funds)	Energy efficiency and RES in municipalities	Operational programme for regional development 2007-2013 (new programming period 2014-2020 expected)  Usually around 70-80 % of project costs the rest is covered by municipal own funding	<a href="http://umispublic.government.bg/Default.aspx">http://umispublic.government.bg/Default.aspx</a>
Non repayable subsidies (EU structural funds)	Energy efficiency and RES in municipalities	Operational programme for competitiveness 2007-2013 (new programming period 2014-2020 expected)  Usually around 70-80 % of project costs the rest is covered by municipal own funding	<a href="http://www.opcompetitiveness.bg/">http://www.opcompetitiveness.bg/</a>
Low interest credit	Energy efficiency in buildings	Energy Efficiency Fund  Revolving fund:  provides soft loans to municipalities;	<a href="http://www.bgeef.com">www.bgeef.com</a>

		acts as a guarantee fund for ESCO projects	
Energy Efficiency Certification	Energy efficiency projects	Tradable white certificate scheme (forthcoming)	<a href="http://www.seea.government.bg/bg/component/content/article?id=9374%20">http://www.seea.government.bg/bg/component/content/article?id=9374%20</a>
Feed-in tariff	Energy Generation from renewable energy sources, incl. RES based CHP	Act for the Energy from RES, published in State Gazette, Issue 35 from 03.05.2011.  Establishment of feed-in tariffs depending on the RE sources used and priority connection to the grid	<a href="http://dv.parliament.bg/DVWeb/showMaterialDV.jsp?idMat=48899">http://dv.parliament.bg/DVWeb/showMaterialDV.jsp?idMat=48899</a>
Feed-in tariff	Electricity generated by CHP	Energy Act, published in State Gazette, Issue 107 from 09.12.2003  Establishment of feed-in tariff and priority connection to the grid.	<a href="http://lex.bg/laws/ldoc/2135475623">http://lex.bg/laws/ldoc/2135475623</a>
ESCOs	Energy efficiency and RES integration in buildings	Provision of ESCO services and guaranteed results contracts by private companies;  Implemented mainly in public/municipal buildings	Erato Company <a href="http://erato.bg/otoplenie/en/news_details.php?news_id=186">http://erato.bg/otoplenie/en/news_details.php?news_id=186</a>  ENEMONA Company <a href="http://enemona.bg/english/index.php?97">http://enemona.bg/english/index.php?97</a>
Private Capital	Energy Efficiency and RES	Public-Private Partnerships (PPP) – e.g. renting municipal roofs for PV installation to private sector, concession for biomass fueled DH, etc.	

## 7. References:

- [http://www.rodopi-bg.org/index.php?option=com\\_content&view=article&id=232&Itemid=191](http://www.rodopi-bg.org/index.php?option=com_content&view=article&id=232&Itemid=191)
- <http://umispublic.government.bg>
- <http://www.smolyannews.com/news/obshtina/obshtina-zlatograd-podpisa-dogovora-za-izgrazhdane-na-geotermalna-otoplitelna-sistema>
- <http://www.zlatograd.bg/?pid=4,302>
- <http://umispublic.government.bg/>
- <http://www.flag-bg.com/?act=project&i=32>