



Master Plan

*for innovative energy structures in
Nowa Sol Region in Poland,
which could be feasible for funding in the
Structural Funds Programmes in the period 2007- 2013*

Energy 4 Cohesion - Deliverable 4.2

Elaborated by SEGI-AT Sp. z.o.o.

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Executive Summary

The elaborated Master Plan for Nowa Sol County aims at promoting sustainable energy management in the Polish target region.

As a first step the target region has been thoroughly analyzed and described putting special emphasis on the energy-related data. The description of Nowa Sol Region has been based upon available statistical data, existing reports as well as on information collected on site in co-operation with Polish Ecological Club – a local branch of one of the most famous environmental NGOs in Poland. Both the natural and socio-economic features of the region are presented in chapter 2 along with the detailed energy balance for the county.

In addition available financing opportunities for renewable energy (RE) and energy efficiency (EE) projects, especially in the framework of Structural Funds have been explored in detail in order to design an optimal financing scheme for the local projects.

Furthermore, a concept for improvement of energy management and enhancing use of renewables in Nowa Sol County has been developed in chapter 3, so called “Energy Vision”. It contains the overall objectives (qualitative and quantitative) as well as suggested measures (so called milestones) aiming at achieving the fixed goals.

Finally, after having interviewed some interested stakeholders from the region and taking into account available background information several pilot projects have been selected as the most prospective ones for further realization and presented briefly in the end of chapter 3. They are supposed to serve as Best Practise examples for the future investments in and outside of the target region. A pre-feasibility study has been elaborated for 3 projects (chapter 4, 5 and 6) taking into account the technical, social and economic aspects, thus proving the sustainable character of the planned investments. Along with the basic technical description certain financial engineering for each project has been suggested. Each subchapter includes a thorough study on how various EU Structural Funds might contribute to the successful realization of the particular projects. Future possible advantages and profits of the projects for the region, especially of social and environmental nature, are presented in addition.

The last chapter 7 presents some overall conclusions emerged in the course of the project and as a result of the elaborated Master Plan as well as some suggestions and recommendations for the future sustainable energy management in the target region of Nowa Sol County.

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1. Introduction

1.1 Background

Regional focus

The Master Plans presented with this report has been developed in the scope of the **Energy 4 Cohesion (E4C)** project, funded under the Intelligent Energy for Europe (IEE) Program. E4C strives to prepare the ground for the extended use of Structural Funds for innovative renewable energy actions in rural regions of Europe which make use of the regional renewable energy potential and increase the energy efficiency. The European social **cohesion** requires a balance in the economic and social conditions in all European regions. **Energy** can play a major role in achieving this balance. The availability of cheap and reliable energy contributes to sustainable social and economic development. Moreover, the exploitation of the own energy resources of a region means to bring additional employment knowledge and investment into the region which otherwise would be dragged into the more developed municipal regions.

In view to this regional approach the eight E4C target regions are the focus of all project related strategy and planning efforts. These regions have been selected for their suitability for extended use of renewable energies and energy efficiency actions, namely:

- Rich resources for renewable energy generation particularly biomass resource
- Clear support of the political and administrative decision makers
- Availability of an extended knowledge and data basis for the planning process.

Based on these requirements the following target regions have been selected:

1. **Czech Republic: Zlin Region**
2. **Estonia: Saaremaa Island**
3. **Greece: Prefecture of Evros**
4. **Italy: Alta Locride**
5. **Latvia: Limbazi Region**
6. **Lithuania: Kaunas Region**
7. **Poland: Powiat Nowa Sol**
8. **Slovak Republic: Velky Krtis**

Cooperative Approach

In each target regions all main stakeholders have been brought together for a successful and efficient definition of innovative energy actions in the respective region. The E4C actor cycle includes municipalities, households, media, capital provider and financial experts. Within this actor cycle the E4C consortium partners were responsible for the coordination of the different actors, and the preparation of the regional **Master Plans**. Main focus was put to integrate suggestions and ideas existing in the region rather than exposing priorities from outside.

Action focused strategy

Comprehensive investigations were undertaken, starting from an abstract and general view on the regions, leading to concrete innovative energy set-ups, consisting of a range of RE and EE actions. A comprehensive and detailed methodology was developed within E4C, which is illustrated in chapter 1.3 of this report.

Targeted towards Structural Fund Support

The cornerstone of the E4C – strategy is to support the implementation of energy pilot actions in the selected regions feasible for public financial support, with main focus on **European Structural and Cohesion Funds (SF and CF)** during the funding period from 2007-2013. The main focus during the current programming period of SF and CF lies on the Lisbon Criteria. This reflects the ambition of the EC to reach greater sustainability, more employment and increased economic growth, targets that were set in the Lisbon Agenda. As stated above, renewable energies can contribute to these targets; moreover they increase the competitiveness of communities and regions, and foster European cohesion. However, up to date in most countries of Eastern and Southern Europe, only a small percentage of SF and CF measures have been dedicated to RE and EE projects. E4C strives to overcome the various constraints which currently hinder the broader use of Structural Funds for innovative energy actions in less developed and rural regions of Europe.

Conclusions

With the finalization of the Master Plans the core milestone of Energy 4 Cohesion has been accomplished. The large efforts undertaken by the respective partners in the regions have resulted in the selection of highly feasible and sustainable project ideas. The intense work for the Master Plans also has stimulated the interest and support of the local and regional decision makers for these results.

1.2 Objectives

The general objective of this Master Plan is to implement efficient and sustainable energy management patterns in the target region of Nowa Sol County. Thus, the document aims at undertaking actions to maximize energy-related autarchy of the region and to enhance use of locally available natural resources for the purpose of energy production.

The main goal of the Master Plan is to **increase share of renewables in the total electricity and heat production in the coming 15 years by up to 40%**. Specifically, provided that the Master Plan suggestions are realized, significant improvement in air quality is expected, mainly as a result of SO₂ and NO_x emissions reduction. Besides, it is intended to introduce different energy efficiency measures and thus save energy especially in the municipal sector. The realization of the Energy Vision, which is the integral part of the Master Plan, and selected investments listed in the document, will also create new jobs in the renewable energy sector as well as its supply chains. It will also boost local RES infrastructure and all connected branches taking advantage of the EU Structural Funds that seem to be of great interest for the investor in the field of RES.

Finally, it is desirable that the proposed actions listed in the Master Plan (or at least some of them) will be virtually implemented in the target region and will not only improve the existing energy-related infrastructure, but will also affect the public awareness in this regard.

1.3 Methodology of Master Plan Development

This Master Plan is elaborated based on a methodology, which was elaborated within Task 3.2 of the Energy 4 Cohesion project. The aim of the methodology is to facilitate the decentralized energy actions planning in 8 Target regions within the context of European Cohesion Policies. The methodology presented on next page (Figure 1.1) should ensure that:

- The results of the Target region planning can be compared;
- The coordination work for the many regions is supported with a strong tool;
- The local partners find help and guidance for assessing their potential and defining suitable renewable energy and energy efficiency actions.

The Master Plan methodology includes 3 main elements: 1.) Target Region Portrait, 2.) Analysis of future energy options, 3) Identification and investigation of concrete RE and EE actions. In this way it is ensured that concrete action potential is highlighted which is imbedded in an overall RE promotion concept for the region.

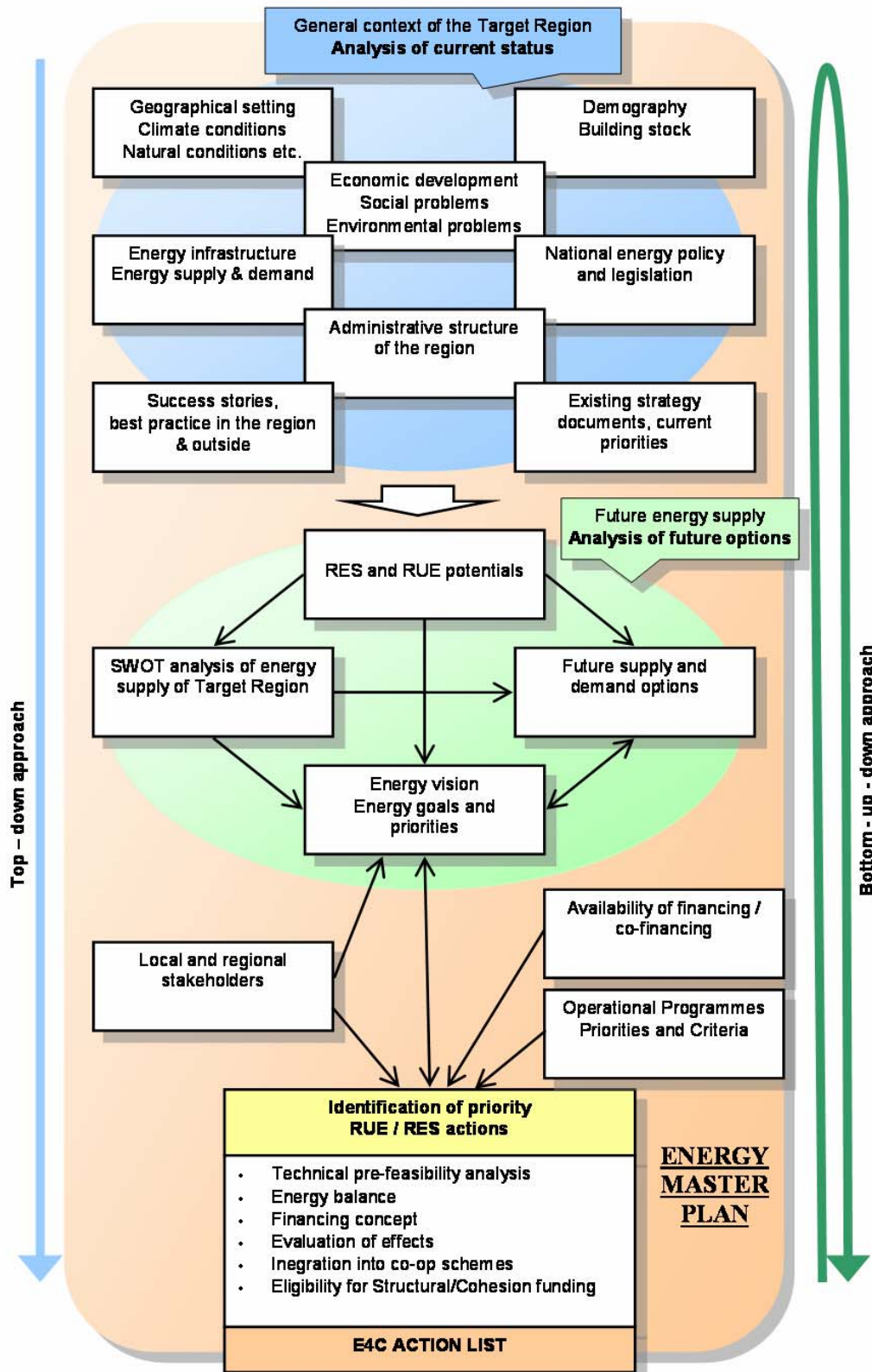


Figure 1.1: Methodology for elaboration of Master Plan

2. Target Region Portrait

2.1 Description of general context of the region

2.1.1 Geographical setting, natural conditions, climate, historical context

Nowa Sol County is located in the north-eastern part of Lubuskie Voivodeship not far from the German frontier. It borders at five other counties: Wschowa, Zielona Gora, Zagan in Lubuskie Voivodeship, Glogow in Lower Silesia and Wolsztyn in Wielkopolskie Voivodeship. The area of the county stretches in total over the surface of 772 km². The headquarters of the county is the city of Nowa Sol with its population of forty-thousand, located on the left Odra's bank. The name meaning literally New Salt has a historical context. In the medieval times salt was delivered to Silesia from the southern part of Poland, so in order to obtain some independence from Polish merchants, the first salt works was taken into operation on the Oder's bank in 1533, which gave the beginning to the city of Nowa Sol.



Figure 2.1: Location of Lubuskie Voivodeship



Figure 2.2: Location of Nowa Sol County in relation to Lubuskie Voivodeship

The Odra river divides the surface of the county into 2 parts: the eastern and the western connected to each other with bridge in Nowa Sol. With its very good location Nowa Sol county is a perfect communication centre. It has fairly well-developed roads network, lies on the main railway track from the northern to the southern part of the country and has access to the inland water transport route along the Odra river. The landscape of the county has resulted from the glacier's activity, which explains its versatile and interesting hilly character (up to 200m) with numerous lakes.

Nowa Sol County offers valuable natural resources, in particular the wet forest in the river valleys and old riverbeds which are unique in a European scale. Over 21% of the total county area is legally protected in form of various nature conservation areas.

Climate of the county can be described as very mild, since the Odra Valley is one of the warmest regions in Poland. The main meteorological parameters are illustrated in the table below. Total annual precipitation reaches 580mm on average, the temperature - ca. 7,5°C.

Table 2.1: Meteorological data for Nowa Sol county

Average annual temperature	7,1-7,6°C
Average annual precipitation	552-607 mm
Clouding	6,3-6,6
Average min. temperature in January	-5,1 -6,3°C
Average max. temperature in July	23-24°C

Surface waters in the county are relatively abundant. Apart from the Odra there are over 10 essential rivers in the region and 8 lakes with an overall surface of ca. 228 ha. Two of them (Swietobor and Mesze) are located within the nature conservation areas. Unfortunately due to the chemical pollution their water is of non-classified quality. Concerning their quality rivers of the county are predominantly qualified as III class water. However, considering the concentrations of particular pollutants substantial improvement could have been noticed over the last few years.

Since agriculture plays a major role in Nowa Sol County, types and quality of local soil are crucial for the properly designed and successful development of this sector. A significant share of land is used for agricultural purposes (over 50%). Most of the soils in the county offer rather poor conditions with their V and VI class (ca 51%), however, soils of higher quality can also be found on this area (II, III and IV class), in particular some very fertile alluvial soils in riverbed of Odra.

Nearly 40% of the county's area is covered by forests (predominantly pine woods). Almost all forests of Nowa Sol County are state-owned and managed by 7 forestry units, which unfortunately do not correspond with the administrative structure of the county. Therefore hardly any detailed information and statistical data are available in this respect. In the recent years ca. 750 m³ wood have been obtained annually from the total forest area of ca. 30.000 m².

2.1.2 Administrative structure of the Region

Nowa Sol County consists of 8 municipalities of different character, as listed in the table below. There are altogether 4 towns and 100 villages in the county.

Table 2.2: Municipalities of Nowa Sol County

Name of municipality	Character of municipality	Number of villages	Surface [km²]
Nowa Sol	urban	-	22
Nowa Sol	rural	23	176
Kolsko	rural	17	81
Otyn	rural	8	92
Siedlisko	rural	9	92
Bytom Odrzanski	mixed (urban-rural)	11	52
Kozuchow	mixed (urban-rural)	22	179
Nowa Miasteczko	mixed (urban-rural)	10	77
Total Nowa Sol County	-	100	771
Total Lubuskie Voivodeship	-	-	13.989

There are 3 main administrative self-governmental levels in Poland: municipality (gmina), county (powiat) and region/voivodeship (województwo). In general the territory of Poland is divided into 16 voivodeships which consist of a variable number of counties each (from 12 up to over 40). On the other hand, a number of municipalities constitute each county. This administrative structure, however, does not imply any hierarchical relations between the particular levels.



Figure 2.3: Map of Nowa Sól County

2.1.3 Administrative structure of Nowa Sol County

The county itself hardly has any competences in the area of energy management. Energy sector does not belong to the own areas of activity of the county listed in the appropriate legal act. However, taking into account selected legal responsibilities of the county concerning environmental, educational, agricultural as well as health- and unemployment-related issues; certain position can be ascribed to the county in the discussion about the renewable energy sources. Main responsibility for the energy sector is on the side of municipalities, for they are obliged to provide their community with electricity, heat and gas. The decision- making system is therefore decentralized

2.1.4 Demography and the building stock

The population of Nowa Sol County reaches ca. 88.000, which makes it one of the largest counties in Poland, with the second largest population in Lubuskie Voivodeship. Around two thirds of the population lives in urban areas. Nowa Sol region is characterized by the highest migration rate of ca. 0,4%.

Table 2.3: Population and population density of Nowa Sol County

Name of municipality	Population	Population density [prs./km²]
Nowa Sol - urban	41.030	1.865
Nowa Sol - rural	6.677	38
Kolsko	3.332	41
Otyn	6.121	67
Siedlisko	3.505	38
Bytom Odrzanski	5.400	104
Kozuchow	16.314	91
Nowe Miasteczko	5.623	73
Total Nowa Sol County	88.002	114
Lubuskie Voivodeship	1.008.600	72

The largest social problem in the county is a very high unemployment rate, which has often reached up to 35%. The principal reason for that is restructuring of huge state-owned farms and collapse of large industrial plants during the political transformation process in Poland. Most of them ended up insolvent and deteriorated leaving hundreds of people redundant. Some of them haven't managed to re-qualify and can barely find any suitable jobs. Municipal authorities attempt to elaborate innovative solutions for reintegration of the long-term unemployed persons with the society. High potential for the improvement of bad labour-related situation can be seen in the EU Structural Funds.

Housing stock in the county is relatively large and sufficient; however a high percentage urgently requires refurbishment and modernization (both the buildings and their infrastructure). There are in total ca. 27.000 flats in the county, with ca. 13% owned by the municipalities. On average 306 flats are shared by 1000 inhabitants, which is a fairly acceptable level.

The structure of the housing sector in Nowa Sol County can be presented as follows:

- 20,5% old buildings (mansion houses) constructed before 1998
- 29,5% multi-family buildings with only 2% constructed after 1997
- 50,0% individual housing with only 2,5% constructed after 1997

In general solely 1,8% buildings have been constructed after 1997, when new standards in terms of thermal insulation of residential buildings were introduced. The remaining majority of buildings need modernization to improve their thermal parameters and thus reduce heat consumption. Some municipalities have already undertaken some energy efficiency measures and intend to continue the insulation and modernization works in the public buildings, whereas some do not.

2.1.5 Other important information about the region

Nowa Sol County has rather a post-industrial character, since most of the large industrial plants haven't survived in the new market conditions after political system change in Poland. However, due to activeness of local authorities certain revival can be noticed in the county. A special economic-industrial zone has been established in the suburbs of Nowa Sol city recently. The favourable taxing terms offered by the municipality encourage especially foreign investors to start their activity in this area. This might certainly be a strong incentive and good start for the further intensive socio-economic development of the county.

At the moment there are ca. 6.500 economic entities registered in the county, 10% of which are state-owned and the rest belong to the private sector. The great majority of enterprises represent the small- and medium-sized sector with a predominantly service-related and commercial profile. With its versatile picturesque landscape, mild climate and large areas covered with woods Nowa Sol Region offers perfect conditions for development of tourism. Sold production of industry per capita is one of the lowest in the Voivodeship with ca. 9.000 PLN.

2.2 Current energy situation

The Nowa Sól region imports nearly 100% of its primary energy. Within the region there are no power plants and most of the electricity in Polish power plants is produced by combustion of coal. District heating networks are scarce, not developed and present only in bigger cities (i. e. Nowa Sol, Kozuchow) or locally owned by residential communities. In general, the household sector mainly relies on individual heating systems and appliances. The whole region is highly dependent on coal, which accounts for 82% of the total energy needs. The gas network is in the process of fast development, but only in the largest towns in the region (Nowa Sól, Kozuchów and Bytom Odrzański). The total estimated annual consumption of energy used in the Nowa Sól region is 3.717 TJ, of which 2.795 TJ is consumed as heat.

Table 2.4: Annual energy consumption in the Nowa Sól Region

Thermal energy consumption	2.795 TJ/year
Electrical energy consumption	922 TJ/year (ca. 256 GWh/year)
Total energy consumption	3.717 TJ/year

2.2.1 Current energy infrastructure

As for the electrical energy Nowa Sol region does not possess any infrastructure for electricity production except one existing renewable energy source: a small hydropower plant in Nowa Sol with very low nominal power of 22 kW. Distribution of electricity takes place along the aerial transmission lines.

The table below presents data on types of heating in the household sector in Nowa Sol county. It clearly shows that the great majority of heating installations is fired with coal, usually fine coal of a very bad quality, with high content of sulphur. As a result individual sector together with other small local heat sources (schools, public buildings, shops, workshops etc.) contribute to a large extent to the so-called decentralised air pollution mainly with SO₂ and dust. Nevertheless, in Poland coal still remains the cheapest fuel, which makes it very attractive to the consumers, who care much more about the financial than environmental aspects. In spite of this unfavourable trend some stoves and boilers have been refurbished and switched to gas or oil in the recent years. Whereas it has definitely affected ambient air quality in a positive way, it constitutes a serious hurdle for a switch to renewable fuels due to the large investments.

Table 2.5: Distribution of heating sources used in Nowa Sol County

Name of municipality	Estimated share of population by sort of heating used [%]					
	coal	coke	gas	electric	oil	others
Nowa Sol - urban	87,2	4,5	7,5	0,5	0	0,3
Nowa Sol - rural	89,9	10	0,1	0	0	0
Kolsko	No data	No data	No data	No data	No data	No data
Otyn	80	4	5	1	0	10
Siedlisko	99,8	0	0,004	0,001	0,003	0,11
Bytom Odrzanski	51	14	9	1	1	24
Kozuchow	86	10	4	0	0	0
Nowe Miasteczko	75	5	5	5	10	0
County average	81,3	6,8	4,4	1,1	1,6	4,9

Natural gas network is accessible to altogether over 15.000 users, specified by sector as follows:

- households - 14.700
- industry - 2
- services - 136
- commerce - 174
- others - 84

Gas network has gradually been extended and has reached the total length of ca. 185 km. Further development of gas network is planned in the nearest future, especially in the towns of the county.

2.2.2 Current energy supply and consumption

In the electricity sector a general slightly rising trend could have been observed lately. Today, there are ca. 22.000 low-voltage power consumers connected to the grid. Two thirds of them are located in the urban areas, 1/3 – in the countryside. Consumption of low-voltage electricity in the household sector has reached almost 62.000 MWh annually. An overall sales of electricity – inclusive the industrial customers – was ca. 256.000 MWh. Due to the anticipated intensive economic-industrial development of the Nowa Sol Region, a significant increase in energy consumption can be expected in the next years.

Since there is only a single installation in operation that produces renewable electricity in the county, the share of renewables hardly accounts for 0,02% in the total electricity sales in the region.

Annual consumption of natural gas has constantly been increasing over the recent years and has finally reached ca. 10 Mio m³. However, out of the total number of gas consumers, only 23% use natural gas for residential heating. Correspondingly, ca. 55% of the total gas consumption accounts for heating purposes.

2.3 Analysis of RUE/RES potentials

After analysing the resources of renewables in the region of Nowa Sol, a substantial development potential has been proved.

2.3.1 Biomass potential

Due to a relatively high afforestation index (39% land is covered by forest), many animal production farms and nearly 40% of arable land, the area Nowa Sól county has a very high biomass potential.

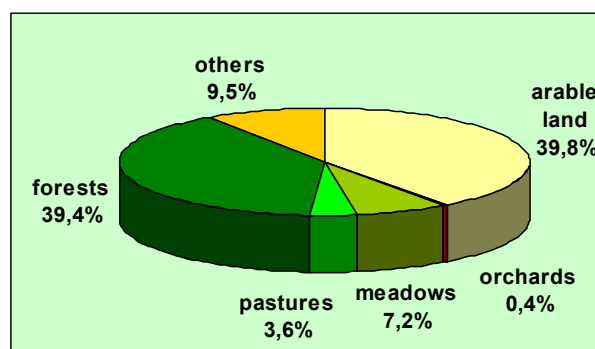


Figure 2.4: Land use structure in Nowa Sol county

In the municipalities with the typically agricultural character straw is the most prospective source of biomass, whereas in the municipalities with the significant afforestation wooden biomass offers higher potential. The total wood biomass resources in the county are ca. 75.000 Mg annually. Approximately 50% of this amount is used by various wood industries, another 25% by sawmills. Taking into account all of the available wood biomass resources retrieved from forests including felling site residues Nowa Sól region has a potential of 30.000 Mg of wood.

In the county, there are 14.500 ha of grain crops, which lead to production of ca. 40.000 Mg of various types of straw annually. We estimate the total amount of available straw is 25.000 Mg dry mass per year, since the rest is currently used by animal farms and champignons production. The greatest future RES prospects might be seen in energy crops. First experiences have already been collected in the region both by local farmers and municipal authorities. For Polish agriculture needs restructuring and solutions alternative to large food production, cultivation of energy plants (willow, poplar, etc.) seems to be very promising in the future. This is in particular true if additional EU funding for all sorts of energy crops is taking into account.

We have defined waste biomass as all forms of biomass that is considered waste by various branches of the animal production industry. This definition includes manure, slurry, by-products from animal production, waste straw etc. The available amount of this biomass can be estimated from the area of the county covered by arable land. There are 30.000 ha of arable land in the county, which yield ca. 110.000 Mg of biomass annually (calculate into dry mass). Most of this biomass is used as animal feed, which means it is subsequently excreted. Assuming waste biomass production of ca. 60.000 Mg/year (dry mass) it is technically possible to produce ca. 60.000 MWh of electricity.

2.3.2 Wind energy potential

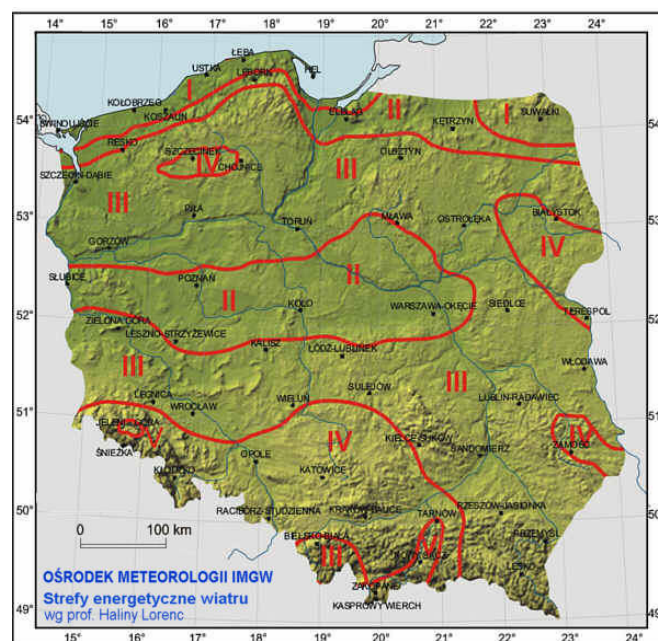


Figure 2.5: Wind energy potential in Poland

Poland can be divided into four regions defining wind potential. Regions I and II have the highest potential, regions III and IV are less favourable. As shown on the map above the Nowa Sól region is in region III. These measurements suggest that in this part of Poland renewable energy in the form of wind power should not be considered a high priority. Studies of conditions at specific locations in Lubuskie Voivodeship: in Zielona Góra and Gorzów Wielkopolski showed very unfavourable results: 2,8 m/s and 2,4 m/s respectively. This range of wind speed unfortunately does not qualify the region for utilizing the wind power for energy production and construction of rentable wind parks. Specific long-term measurements might prove existence of particular locations with wind speed exceeding the minimum 4m/s, therefore they should be supported by the local authorities.

2.3.3 Solar energy

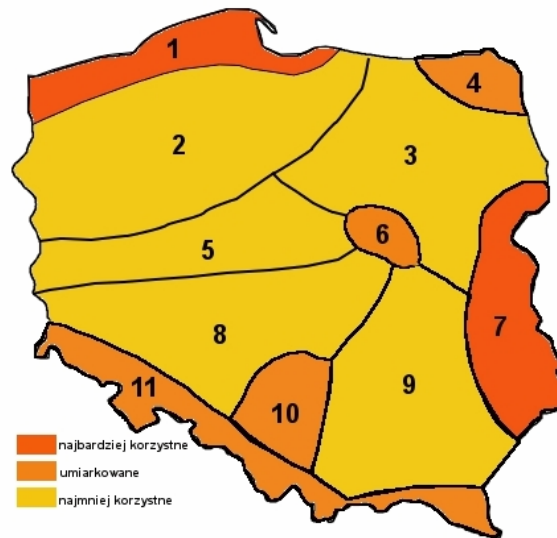


Figure 2.6: Solar energy potential in Poland

The diagram above shows solar energy potential in Poland. Regions 1,7 have high potential, regions 4,6,10,11 have medium potential and regions 2,3,5,8,9 are less favourable. Despite Nowa Sól County being in region 5 more detailed calculations show, that the average solar radiation is ca. 3,17 kWh/m²/day. The result of these calculations is shown in the table on next page.

Table 2.6: Calculation of average solar radiation in Nowa Sól County

Results			
Month	Solar Radiation (kWh/m ² /day)	AC Energy (kWh)	Energy Value (zloty)
1	0.68	49	18.45
2	1.73	144	54.23
3	3.19	305	114.86
4	4.11	370	139.34
5	5.58	501	188.68
6	5.15	440	165.70
7	5.39	473	178.13
8	4.69	413	155.54
9	3.54	309	116.37
10	2.29	199	74.94
11	1.05	84	31.63
12	0.51	33	12.43
Year	3.17	3320	1250.31

Photovoltaic panels are the most effective way of using solar energy. However, the rate of return of such investments is still very poor. Feasibility of such installations depends greatly on the national/regional RES policies in the form of tax deductions, green certificates etc. Calculations show that in the Nowa Sól County a 4 kW PV installation can produce 3300 kWh of electricity per year.

2.3.4 Hydropower

Within the area of the county operates one small hydropower plants, there are some more in the neighbouring counties. Initial studies conducted in the region show, that there is potential for three hydropower stations within the region with an electrical output in the range 250-900 kW. A location on the Bóbr River is being closely looked at.

3. Energy Vision

3.1 Energy vision milestones

Based on the above analysis of RES potentials by 2022 we should be able to:

- Produce up to 40% of both electrical and thermal energy locally;
- Radically reduce the coal dependency of the region. This is already happening due to rapid growth of natural gas networks, but should be accompanied by a rapid growth of RES, which as shown have a huge potential. Coal dependency should drop from 82% to ca. 40%;
- 90.000 MWh/year of electricity can be produced from biomass, including the organic fraction of municipal waste. This means it is technically possible to produce 35% of the total electrical energy demand from biomass;
- 2.900 TJ/year of thermal energy can be produced from RES plus municipal waste. This is more than 100% of the total annual consumption, but does not mean it is possible to cover 100% of the demand all year round. In the winter months RES and municipal waste can theoretically cover ca. 50% of the thermal energy demand and 100% during the summer months.

3.2 Objectives and priorities

The energy milestones for the Nowa Sól County have been set based on the analysis of RES potential in the region. Achieving these milestones is possible through development of RES according to the following development plan (these tasks are organised from top priority to lowest priority):

1. **Development of biogas plants.** New regulations will soon forbid disposal of large quantities of animal waste biomass as natural fertilizer without previous processing. Therefore biogas plants are a key priority. The Nowa Sól region has an especially high biogas potential due to a large number of various animal production farms.
2. **Small and medium sized cogeneration (CHP) plants** producing both heat and electricity. We suggest implementing both combustion and gasification technologies. Biomass (including wood, straw etc.) and various fractions of municipal waste can be used for energy production.

- 3. Increasing energy efficiency of buildings** through thermal modernisation projects. This includes both better insulation of buildings and changing the heat source from coal/oil to various forms of RES.
- 4. Solar energy and wind energy.** Despite the initial costs PV systems should be developed, appropriate funds are available and the green certificate system makes PV grid connected systems an attractive investment providing initial funding is obtained. Wind energy requires detailed studies at specific locations, but initial analysis shows wind is not a priority RES in the county.
- 5. Hydropower.** There are three potential hydropower locations in the county. In these locations small hydro should be built, but due to lack of major rivers in the area hydropower can not be considered a high priority.
- 6. Parallel to this investment projects awareness raising initiatives** are urgently needed in the region and their meaning for the further success of renewables cannot remain underestimated. Experiences in contacts with local stakeholders, especially with the representatives of the local authorities show that the level of knowledge on existing technical as well as financing possibilities is very low. Strong scepticism towards new solutions being in opposition to the conventional fuels is noticeable in the municipalities. Therefore, educational work is really crucial for the further successful development of RES-sector in Polish target region. Through project work in the region, occasional events and on-going dissemination of results we hope to achieve interest and certain level of competence among the stakeholders and especially local authorities.

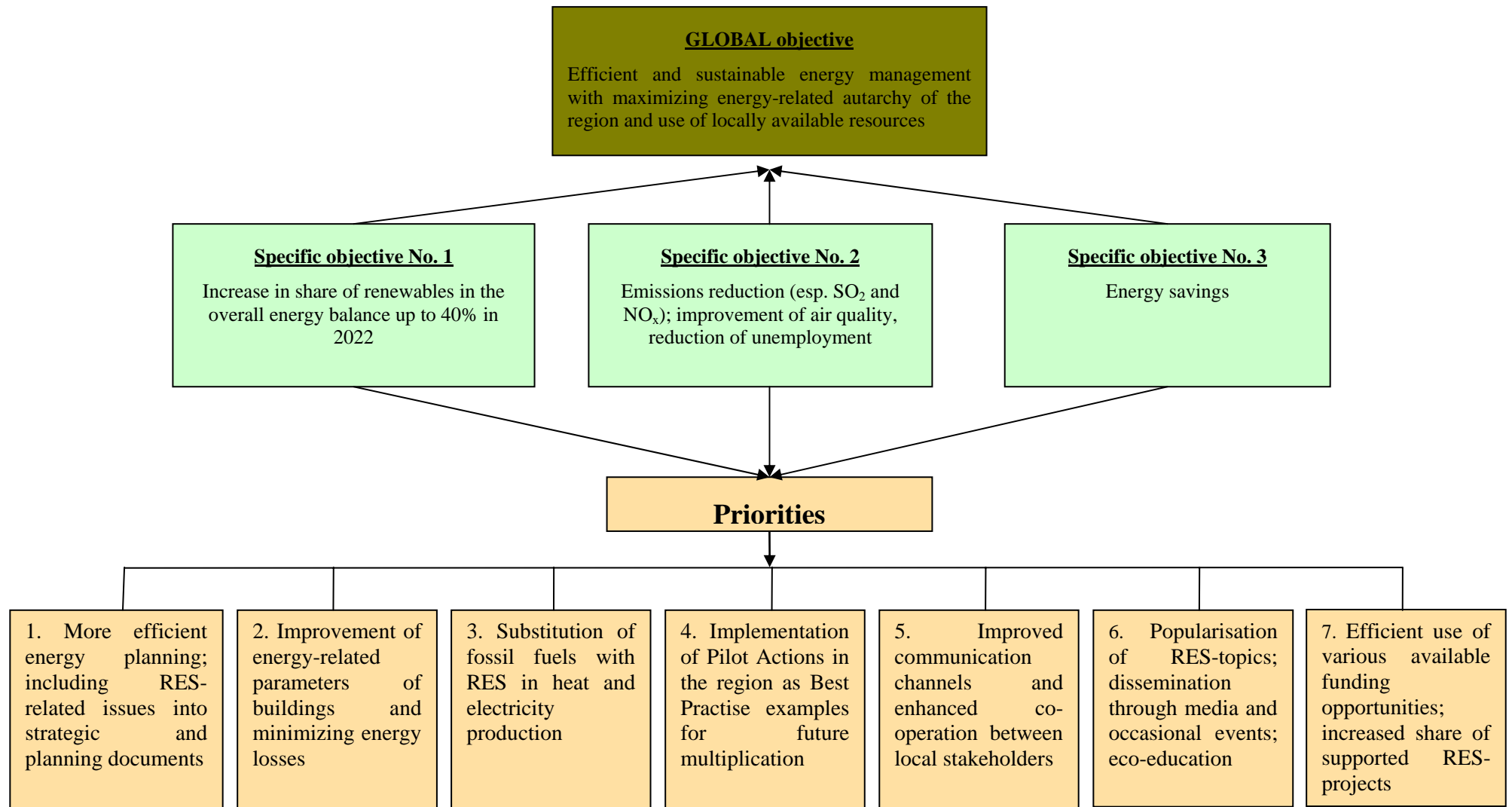


Figure 3.1: Objectives and fields of priorities of the Energy Vision of Nowa Sol region

3.3 Presentation of feasible Energy Actions suitable for Structural Funds

Project Proposal 1 – Biogas plant in Niedoradz, Otyń Municipality
Proposal concerns construction of a biogas plant in Niedoradz. The main input would be pig slurry from a large pig farm in Niedoradz. Amount of produced slurry is ca. 30.000 t annually. Additional input would be grain, silage and organic waste from external suppliers.
Current state
The farm currently disposes of all waste biomass by using it on its own fields and paying specialised companies to dispose of the surplus. The company operating the farm is looking for a solution to the problem of large quantities of waste. We suggest a biogas CHP plant.
Technological solution
Biogas plant construction – company ZENERIS (Poznan, Poland) <i>Technical parameters of the biogas station:</i> Installed capacity: ca. 1.000 kWe Number of CHP units: 1 Annual heat production: 35.000 GJ Annual power production: 7.500 MWh Inputs consumption: 50.000 t biomass (slurry + grain)
Investors
Company Pol-Lean Sp. z o. o.
Benefiting groups
Farm owner Pol-Lean – own heat and electricity supply leads to substantial energy costs reduction; disposal of troublesome residues from animal husbandry; additional profit from disposal of slurry delivered by local farmers and from RES green certificates, improved image of the company in the region Local farmers: solution for the troublesome farming waste, source of high quality fertilizer in the form of fermentation residues Local population: reduction of environmental hazards due to the migration of slurry products to groundwater as well as reduction of CH ₄ emissions Expected fossil fuel savings: ca. 1.500 t coal which corresponds to ca. 3.000 t CO ₂ emissions
Logistics
Pig slurry will be supplied from the farm itself as well as from neighboring farms. The fermentation residues from biogas plant will be used as fertilizer.

Financing
PoI-Lean will apply for subsidy from EU Structural Funds OP “Innovative Economy” (50% of eligible costs); additional support from National Fund for Environmental Protection and Water Management will be applied for. The rest of costs will be covered by own sources and bank loan.
Expected investment costs
ca. 2 Mio Euro
Expected implementation time
Year 2008

<p>Project Proposal 2 – Small hydropower plant in Leszno Dolne, Municipality Szprotawa</p>
<p>Proposal concerns construction of a small hydropower plant in Leszno Dolne, on the Bobr river, in the neighboring county.</p>
<p>Current state</p>
<p>Hydrotechnical installation is not used for energy production at the moment.</p>
<p>Technological solution</p>
<p>Small hydropower plant (SHP) – company “Hydroenergia”</p> <p><i>Technical parameters of the SHP:</i></p> <p>River flow: 30 m³/s</p> <p>Descent: 3 m</p> <p>Installed capacity: ca. 900 kWe</p> <p>Annual power production: 7.200 MWh</p>
<p>Investors</p>
<p>SEGI-AT Sp. z o. o. – private company</p> <p>Zygmunt Gackowski – technical support</p>
<p>Benefiting groups</p>
<p>ENEA S.A. energy supplier in the region – fulfillment of legal obligation to prove the RES share in the total energy production</p> <p>SEGI-AT – additional profit, new area of activity, presence and good image in the region, creation of new jobs</p> <p>Zygmunt Gackowski – profit from consultancy, additional professional experience</p> <p>Expected fossil fuels savings: ca. 1.100 t coal which represents savings of 2.250 t CO₂ emissions</p>
<p>Logistics</p>
<p>n.a.</p>
<p>Financing</p>
<p>SEGI-AT will apply for a preferential loan from the sources of National and Regional Fund for Environmental Protection and Water Management. The rest of costs will be covered by own sources of SEGI and Zygmunt Gackowski as well as bank loan (Bank Ochrony Środowiska).</p>

Expected investment costs
ca. 1,5 Mio euro
Expected implementation time
Year 2010

<p>Project Proposal 3 – Gasification of municipal waste for heat production, Nowa Sol municipality</p>
<p>Proposal concerns construction of a gasification plant in Nowa Sol with 5MW thermal output which would substitute one of the coal-fired boilers. The main input will be segregated municipal waste without the organic fraction. Amount of input waste is estimated for ca. 7.000 t annually. Additional input would be biomass from local energy plantations and any other available organic waste.</p>
<p>Current state</p>
<p>The municipal heating plant with the total energy output of 15 MW is currently fired with the lowest quality fine coal. Conversion of one boiler from traditional fossil fuel to alternative fuel will decrease emissions of SO₂ and other pollutants (dust, NO_x etc.) and substantially improve air quality in the town.</p>
<p>Technological solution</p>
<p>Gasification plant: design and construction – company MTF Sp. z o. o.</p> <p><i>Technical parameters of the gasification plant:</i></p> <p>Installed capacity: ca. 5 MWth</p> <p>Annual heat production: 145.000 GJ</p> <p>Input consumption: 8.000 t (waste + additional biomass)</p>
<p>Investors</p>
<p>Municipality Nowa Sol</p> <p>Energetyka Ciepna Opole - heat supplier</p>
<p>Benefiting groups</p>
<p>Municipality Nowa Sol – own independent source of energy based on the local input, reduction of heat production costs, CO₂ and SO₂ emissions reduction, contribution to the green image of the municipality, reduction of the biodegradable fraction of municipal waste sent to the landfill (fulfillment of legal obligations)</p> <p>Residents of Nowa Sol – improved ambient air quality, new employment opportunities</p> <p>MTF Sp. z o. o. – profit, new experiences</p> <p>Municipal services company in Nowa Sol – manager of landfill in Kielcz - reduction of the non-organic fraction of municipal waste sent to the landfill (fulfillment of legal obligations)</p>

Expected fossil fuels savings: ca. 6.300 t of low quality coal
Logistics
Combustible fraction of municipal waste will be sorted out from the waste stream at the landfill area in Kielcz (ca 10 km away from the town) and then transported back to the heating plant in the town of Nowa Sol. Similarly, any additional biomass from the municipal plantations of energy willow will be collected on the premises of the district heating plant. Since the plant is located close to the residential area it will not be possible to store large reserves of input material and the deliveries must be performed regularly. Ashes will be transported back to the landfill.
Financing
EC Opole will apply for subsidy from EU Structural Funds OP “Innovative Economy” (ca. 50% of eligible costs). The rest of costs will be covered by own sources of project developer.
Expected investment costs
ca. 3 Mio euro
Expected implementation time
Year 2008-2009

Project Proposal 4 – Refurbishment of municipal buildings, Nowa Sol County
Proposal concerns energy efficiency measures to reduce energy demand of three municipal buildings: Secondary School Complex, Social Care Centre and Town Hall in Nowa Sol. The savings of ca. 40% on average could be expected annually.
Current state
Most of the public buildings owned by the Nowa Sol County have already been modernized and their energy efficiency parameters have substantially improved. However, there are still 3 of them which remained not modernized with very bad energy-related technical parameters.
Technological solution
Scope of works: modernization of the heating system, insulation of roof and walls (inclusive elevation of the building), replacement of door and window frames as well as windows.
Investors
County Nowa Sol
Benefiting groups
Nowa Sol – lower energy demand for heating of public buildings, reduction of heating costs, CO ₂ and SO ₂ emissions reduction, contribution to the green image of the county and municipality Residents of Nowa Sol – improved ambient air quality
Expected savings on heat demand: ca. 40%
Logistics
n.a.
Financing
Nowa Sol county intends to apply for appropriate funding within the Regional OP for Lubuskie Voivodeship (up to 75% of eligible costs) or optionally from Norwegian Fund; the remaining costs will be covered by own sources of the county.
Expected investment costs
ca. 4.250.000 Euro
Expected implementation time
Year 2007/2008

4. Energy Action 1 – Biogas Plant in Niedoradz

The proposal concerns construction of a biogas plant in Nieoradz. A large pig farm in Niedoradz is interested in solving its problem with pig slurry, which is currently partially used on local fields and the rest is disposed of by specialized companies. The project will introduce new technology in the region and improve cooperation between local farmers, who will be suppliers of additional green biomass required by the biogas plant. The plant will produce both electric and thermal energy, which will be used by the farm. Excess electricity will be sold to the power grid. Pol-Lean Sp. z o.o., which is the owner of the farm hopes to operate the plant both as a successful business and a positive incentive for waste management and green energy projects in the region.

4.1 Step 1: Technical pre-feasibility

4.1.1 Detailed technical project description

The suggested technology is anaerobic methane fermentation. We propose a system consisting of:

- Slurry reception and storage tank with pump station (to pump waste into the fermentation tanks). Size: ca. 500 m³;
- Biomass reception and storage tank with loading system. Size: ca. 300 m³;
- Two concrete fermentation tanks with floating roofs, which will act both as fermentation tanks and biogas storage tanks, with no access of light or atmospheric air. Both tanks will be equipped with a system in order to guarantee proper mixing of the substrates. Fermentation tanks will be heated using heat produced by the CHP unit and the temperature will be constantly maintained at ca. 37°C. Inside the fermentation tanks a stable pH in the range 7.0-7.7 must be maintained. Size of each fermentation tank: 5.000 m³. Fermentation time: ca. 28 days (depending on the exact composition of the biomass input);
- Fermentation residue tank. When the biomass load passes its maximum gas productivity period the remaining residue is stored and used as a fertilizer. Size: ca. 2.000 m³;

- Main building. This building will house the pump stations responsible for pumping substrates into appropriate tanks the CHP unit (a Jenbacher type gas engine with power generation unit) and the automatic control system. A separate room will be used as an office and control room for the biogas operators;

Main technical parameters/energy production:

Installed electric energy capacity	1.000 kWe
Annual electricity production	7.500 MWh
Annual heat production	35.000 GJ
Annual slurry input	app.30.000 t
Annual biomass input	app. 15.000 t
Own use and process losses	18.000 GJ

Produced electricity will be sold to the national power grid. Producing electricity from biomass allows for the generated power to be treated as energy from renewable sources, which enables obtaining a “green certificate”. Traditional power plants (most plants in Poland are coal fired) have to buy a certain amount of these green certificates every year. These certificates are traded on a stock market principle. Additionally the grid has to buy “green” energy from the producer at average prices for conventionally produced power. As of June 2007 “green” electricity can be sold for ca. 100€ / MWh, of which app. 63€ is the price of the certificate (37€/MWh is the average price of conventional electricity). Most specialists and market analysts predict this price will remain stable for the next few years.

4.1.2 Suitability of production technology

The proposed technology is widely used in many European countries. Using a mixture of slurry and green biomass enables production of a richer gas, more electricity and faster fermentation than compared with systems using only slurry. Considering the volume of available slurry without mixing with biomass (in order to obtain an increase from 5 to 15% dry mass) the plant would produce not more than 250 kWel. Green biomass is a certain constraint, as it requires acquisition by the operator. Initial investigations show most of the 15.000 t/year of green biomass can be obtained cheaply as waste from various food industries.

4.1.3 Availability and suitability of site

The community is very positive about introducing new technologies. The nature of biogas plants as closed systems mean they have a negligible environmental impact compared to the current waste management situation. This project would be an incentive for better cooperation between regional farmers to start building an organized biomass production scheme. Local biomass suppliers would also be recipients of the fermentation residue, which can be used as a fertilizer.

A combination of high unemployment and introduction of new technology will be a sufficient incentive for skilled workers to apply for jobs at the biogas plant. The plant will need three to four skilled workers for its operation.

4.1.4 Raw materials

The proposed technology has a wide range of biomass that can be used, e.g. various types of silage, corn, straw, grass, food industry waste. Farmers and small factories in the region will easily be able to supply the required amount of ca. 15.000 t of biomass to the biogas facility. Several pig and poultry farms in the area will be able to supply slurry in case the Niedoradz farm stopped production.

4.2 Step 3: Financial analysis

4.2.1 Investment Cost

Costs of the location: 5.000 €

Equipment and material costs: 1.680.000 €

Taxes: 45.000 €

Engineering and managing the project

completion (including project preparation costs): 150.000 €

Other costs: 100.000 €

Other capital costs: 20.000 €

4.2.2 Financial Engineering

Table 4.1: Financial engineering of - Energy Action 1 – Biogas Plant in Niedoradz

		Total investment	
		2.000.000 Euro	
Private Funding		Public Funding	
1.000.000 Euro		1.000.000 Euro	
Equity	Commercial loan	Structural Fund	Other grants
300.000 Euro	700.000 Euro	1.000.000 Euro	-
Project life time		15 Years	

4.2.3 Economic Analysis

Table 4.2: Economic Analysis of Energy Action 1 – Biogas Plant in Niedoradz

Investment costs [thous. EUR]	2.000
Investment subsidy from SF / CF [thous. EUR]	1.000
Economic lifetime [years]	15
Discount rate	5%
Combined rate of increase of prices	2,0%
Net Present Value (NPV) [thous. EUR]	1 338
Internal Rate of Return (IRR)	20,2%
Profitability indicator (PI)	67%
Simple payback [years]	5,1
Real (discounted) payback [years]	5,6

4.3 Step 4: Positive effects in view to overall energy vision

Intended biogas plant will definitely have a favorable effect both on the local environment and in the global scale. Firstly, thanks to the environmentally sound way of slurry's disposal the risk of groundwater contamination with its possible serious negative effects is substantially decreased. Secondly, the surface unorganized emissions of CH₄ which is a dangerous gas with a very high greenhouse effect potential can be avoided.

The global impact regards the reduction of CO₂ and thus contribution to the minimizing of the greenhouse effect. The energy to be produced by the installation from the CO₂ neutral biomass equals to ca. 1500 t coal, which is usually used in Poland for electricity production. As a result, on the one hand the exploitation of resources of fossil fuels can be reduced, on the other significant savings in CO₂ emissions of ca. 3000 t annually can be expected.

The local farmers will benefit from the high quality natural organic manure in the form of fermentation residues with very high nutritious value. What is very essential: in comparison to the slurry used for dunging this fertilizer is completely safe for the environment, since it has already been neutralized in the fermentation process.

This new investment will activate the local workforce in the construction phase. In the long run 3 to 4 new permanent positions will be offered to the appropriately educated employees, which will positively affect the local labor market.

For there is only one agricultural biogas plant operating in Poland at the moment, this investment might be seen as a very innovative contribution to the technical potential of the region. It could be arranged as a pilot installation for the whole region to be multiplied in the future in other locations. Thanks to this installation, the concept of renewable energy sources may become more prominent and can thus successfully be spread over the region.

4.4 Step 5: Cooperation scheme

Since there is no bundling foreseen within the project, no particular co-operation schemes need to be developed.

4.5 Step 6: Strategy for financing Energy Actions by Structural Funds

The total value of the project is estimated for ca. 2 Mio Euro. Substantial financial support is expected in the framework of the European Structural Funds foreseen for the financing period 2007-2013. The project developer – company Pol-Lean, the owner of the pig farm is considering two possibilities for co-financing from EU resources at the moment. One opportunity is offered by the Regional Operational Programme for Lubuskie Voivodeship, the other by the Rural Areas Development Programme which is a specific support scheme for agricultural sector. As for the Regional OP the measure 3.2. Improvement of air quality, energy efficiency and development of renewable energy sources is of great interest to the beneficiary. Until the latest version of the Regional OP was elaborated there was unfortunately no opportunity for support for the representatives of the private sector. However, thanks to the intervention following the national seminar in Nowa Sol, that took place within the E4C project, also the enterprises have been included to the list of eligible beneficiaries of this measure. The basic level of subsidizing private sector lies at 50%. For the guidelines concerning the geographical distribution of financial support within the territory of the country have not been elaborated so far, it is hard to define the maximal available level of support.

However, it might be expected that the Structural Funds' share will probably reach 60% of the total qualified project costs. Nevertheless for the purpose of completion of the action's financial engineering we cautiously assume only 50% subsidy. Provided that higher level of support will finally be approved, the financial and economic results will only improve.

However, since detailed documentation thoroughly describing the exact conditions for support in the framework of the particular priorities or measures within the Operational Programmes is not available at the moment, the final decision concerning the selection of appropriate support programme must be postponed correspondingly. It is highly probable that there will be some restrictions regarding the size of the project in case of the agriculture-related programme and that the project in question will not be eligible provided those criteria.

Equity share is estimated for ca.15% of the project, therefore the remaining 35% are to be covered by a commercial bank loan.

5. Energy Action 3 – Municipal Waste Gasification in Nowa Sól

5.1 Step 1: Technical pre-feasibility

The proposal concerns construction of a gasification plant for heat production in Nowa Sól. The plant is planned to produce 5 MW thermal output. Implementation of the project would enable the local Nowa Sól district heating plant to switch off one of the 5 MW coal-fired boilers and therefore significantly reduce emissions (due to much more restrictive emission standards for waste incineration compared to burning coal). The gasifier will be fuelled by segregated municipal waste without the organic fraction. This fuel is coded 19 12 10 – alternative fuel and is free of organic material, mineral waste, large objects etc. There is no other sensible way to make use of the non-biodegradable fraction of municipal waste (after recovering certain commonly recyclable materials, such as metal and plastic bottles) than thermal incineration (or other thermal technologies). The only alternative is depositing it on landfills. The segregation plant will be located by the local landfill in Kiełcz. The segregation plant is part of a separate project and is currently being developed by a private company in order to implement proper waste management.

5.1.1 Detailed technical project description

The suggested technology is a fixed-bed counter-current gasifier. Gasification is a process that converts carbonaceous materials, such as coal, biomass, petroleum, waste etc. into a flammable gas, consisting mainly of hydrogen, carbon monoxide and carbon dioxide. Gasification of biomass and waste has recently become popular due to big improvements in the gasification technology and flue gas treatment, enabling these systems to combine high efficiency whilst maintaining low emission levels. In contrast to all combustion based technologies gasification takes place in a reducing environment, therefore many dangerous oxides are not produced during the gasification reactions. We propose a system consisting of:

- The gasifier, which is the heart of the installation. The unit is cylindrical, with a cone shaped bottom (through which ash is removed), about 3m in diameter. In the gasifier solid waste is converted into a flammable gas.
- The combustion unit. In this cylindrical unit gas from the gasifier is burnt in a special burner. The hot exhaust gases are the carrier of thermal energy.
- A 5MW thermal energy heat recovery boiler, in which the thermal energy from the flue gas stream is recovered (by heating water in the boiler). The boiler will be connected with the local district heating network.
- Flue gas cleaning unit. The planned unit is an integrated dust filter and cleaning reactor (lime water is injected into the flue gas stream)
- Activated carbon filter (installed as a safety filter).
- Smokestack. The existing smokestack of the heating plant will be used.

Table 5.1: Main parameters of municipal waste gasifier

Installed thermal capacity	5 MW
Installed electricity production capacity	0 MW
Annual heat production	144 000 GJ
Net annual heat production	115 000 GJ
Total amount of alternative fuel (waste code 19 12 10) used annually	ca. 8000 Mg
Proposed amount of high quality biomass (optional) annually	ca. 2000 Mg

In order to produce 5 MW/h of thermal energy the system needs to be fed ca. 18 GJ/h. Taking into account heat losses in the process and boiler we can assume, that with an input of 18 GJ/h we will be able to produce app. 4 MW/h of usable thermal energy. Adding high quality biomass to the alternative fuel makes the process easier to control as the reactions take place faster. Adding biomass also reduces the amount of ash (using clean wood the amount of ash is below 1%, alternative fuel has an ash content of ca. 5-10%).

5.1.2 Suitability of production technology

The proposed gasification technology is not very popular, but there are several examples of operational gasification systems (in Poland, Austria, France, Denmark, and Finland). A lot of research is now under way to produce electricity using gas from gasification reactors. Gasification of waste has positive effects both economically and environmentally. Due to rigorous emission requirements gasification of waste emits fewer pollutants into the atmosphere. Gasification leads to a 90% mass reduction of the input waste stream, thus greatly reducing the amount of material deposited on landfills.

5.1.3 Availability and suitability of site

The proposed site is an existing district heating plant. The owner is interested in removing one of the 5 MW_{th} boilers and replacing it with a complete gasification system. The gasification system will cover the total energy demand during summer. Implementing a high-tech solution in the area will have a positive effect, attracting attention and opening many new research possibilities. Locating the system within the existing plant enables connection to existing infrastructure and use of the existing smokestack. High unemployment in the region combined with implementation of an innovative technology should make it easy to find qualified labour to work at the new installation. The new system will require employment of 8 to 10 people depending on the organisation details.

The local community may initially be against this system, as to some it is a waste incineration plant. However, proving reduced emissions and detailed explanation of the technology should gain acceptance of the community for the project to be built.

5.1.4 Raw materials

The main fuel used in the gasification system will be alternative fuel (waste with a code 19 12 10), which will be produced at the nearby landfill (near Kielcz, ca. 15 km from Nowa Sól). The installation will require ca. 8000 t/year of fuel. To improve performance various types of biomass can be used. Mixing with biomass should be done after detailed analysis of prices and types of biomass easily available in the area. Initially, we suggest using only alternative fuel and then adding various biomass until the optimal characteristics of the input load are found.

5.2 Step 3: Financial analysis

5.2.1 Investment Cost

Costs of the location: 8.000 €

Equipment and material costs: 2.660.000 €

Taxes: 55.000 €

Engineering and managing the project

completion (including project preparation costs): 200.000 €

Other costs: 100.000 €

5.2.2 Financial Engineering

Table 5.2: Financial Engineering of Energy Action 3 – Biogas Plant in Niedoradz

		Total investment	
		3.000.000 Euro	
Private Funding		Public Funding	
1.500.000 Euro		1.500.000 Euro	
Equity	Commercial loan	Structural Fund	Other grants
1.500.000 Euro	- Euro	1.500.000 Euro	- Euro
Project life time		15 Years	

5.2.3 Economic Analysis

Table 5.3: Economic analysis of Energy Action 1 – Biogas Plant in Niedoradz

Investment costs [thous. EUR]	3.000
Investment subsidy from SF / CF [thous. EUR]	1.500
Economic lifetime [years]	15
Discount rate	5%
Combined rate of increase of prices	2,0%
Net Present Value (NPV) [thous. EUR]	4.782
Internal Rate of Return (IRR)	37,2%
Profitability indicator (PI)	159%
Simple payback [years]	2,9
Real (discounted) payback [years]	3,0

5.3 Step 4: Positive effects in view to overall energy vision

Various groups of interest will be affected by the realization of the project. First of all, the municipality of Nowa Sol and its community will solve two environmental problems at one time. On the one hand, they will significantly reduce the amount of deposited municipal waste and thus extend its longevity. Moreover, they can recover the energy “hidden” in waste which would otherwise get lost in the waste stream. On the other hand, through replacing of one coal-fired boiler in the municipal boiler house with a gasifier equipped with complex flue gas purification system, the emissions of sulphur dioxide will be avoided. As a result the quality of ambient air will certainly improve in the town of Nowa Sol. Furthermore, ca. 6.500 t fossil fuels in the form of coal might be saved by using alternative fuels made of waste.

As for the socio-economic benefits of the investment, 6 to 8 permanent jobs will be created as a result of the fuel switch. This fact has an essential meaning for the region characterized by a very high unemployment rate.

Finally, a successful implementation of the project concerning an alternative solution for waste disposal might be seen as a milestone in terms of waste and energy management in Polish municipalities. The topic regarding energy recovery from waste is still relatively new and hardly developed in Poland and the approach of local communities is usually mistrustful and skeptical. Overcoming this reluctance and convincing the authority to introduce such measures will be seen as a great success and a chance for the future development of investments in this sector. Approval of the community for waste-to-energy-related projects may trigger further realization of similar projects which might be in the end regarded as highly beneficial for the region.

5.4 Step 5: Cooperation scheme

Since there is no bundling foreseen within the project, no particular co-operation schemes need to be developed.

5.5 Step 6: Strategy for financing Energy Actions by Structural Funds

The total investment costs are estimated for ca. 3 Mio Euro. Similarly to the preceding project European Structural Funds enable designing of the realistic project budget. The contribution from the EU funding will probably account for ca. 50% of the total project value, since

Due to the strong emphasis on the increase in the innovation potential in the financing period 2007-2013 priority will be given to projects implementing new and clean technologies. As the gasification process might be regarded a technical novelty in the field of environmental protection infrastructure at least on the regional and probably also on the national level, the prerequisites for the support within the EU Funds seem to be complied with.

Two basic co-financing opportunities can be considered by the owner of the boiler house in Nowa Sol – both concerning the support for private sector. On the national level the project could be co-financed with the use of Operational Programme “Innovative Economy” within the priority axis

Provided that for some reason (i.e. not exceeding the minimal requested value of the project) the action would not be qualified for support within the nationally coordinated programme project developer may apply for funding to the Regional OP where second priority axis is addressed to the entrepreneurs who intend to carry out some innovative projects in versatile branches. The expected level of subsidy will similarly account for ca. 50% since the beneficiary is a private investor.

In case a Private Public Partnership were to be established between the EC Opole managing the boiler house and the municipality of Nowa Sol, there might be an additional source of support available to such a beneficiary, which is II priority in the framework of the Operational Programme “Infrastructure and Environment” that deals with investments in waste management sector. The suggested project perfectly fits into the objectives of the priority axis which predominantly aims at reducing the quantity of municipal waste disposed of on landfills. By separation of various fractions of waste and their appropriate use (among others gasification of the combustible fraction) the expected effect can successfully be achieved, which makes the action very promising in terms of fund raising.

In case when the eligibility criteria (i.e. regarding project size) should not be met, project developer can always resort to the regional funding sources. Measure 3.1 Environmental infrastructure of the ROP provides financing options for investments concerning among others combustion-related technologies for waste disposal, however, only to beneficiaries from the public sector or performing typical public services. It must be noted that the form of PPP is very complicated from the legal point of view and therefore rarely used by the beneficiaries.

6. Energy Action 4 – Refurbishment of municipal buildings, Nowa Sól County

6.1 Step 1: Technical pre-feasibility

6.1.1 Detailed technical project description

The Action Bundle consists of 3 individual projects of a very similar character. Energy efficiency measures are to be implemented in three municipal buildings owned by the Nowa Sol County: Complex of Secondary Schools, Social Care Centre and Town Hall in Nowa Sol. These are the last three buildings managed by the county which remained unrefurbished and had been constructed dozens of years ago using an obsolete technology with a very high energy demand. In the recent years most of the public buildings in Nowa Sol have already been refurbished and thus the energy consumption has slightly decreased.

In the framework of the project complex renovation work will be conducted in the refurbished buildings. External walls and ceilings will be insulated with the 12cm-thick layer of styropore which will then be plastered. Special anti-humidity protective measures to prevent the walls from the negative impact of water. Moreover, the old, single-glass and wooden-framed windows will be replaced by double-glass windows made of PCV. Similarly all external doors will be either replaced with new better isolating ones or sealed in order to prevent heat losses. Obsolete central heating system together with the radiators will be replaced with new ones. Besides, in case of some buildings additional construction works will be carried out: modernization of the electricity system, renovation of roof structure etc. In each case standard building materials will be used. The main contractor will be selected in a procedure of a public tender.

The adopted technical measures will lead to substantial savings in heat consumption in particular buildings (up to 45%) which are presented in the table below:

Expected energy savings for the Complex of Secondary Schools:

Current annual heat consumption	1.091.430 MJ
Expected annual heat consumption after refurbishment	742.170 MJ
Resulted savings in energy use	349.260 MJ

Expected energy savings for the Social Care Centre:

Current annual heat consumption	3.447.920 MJ
Expected annual heat consumption after refurbishment	2.068.750 MJ
Resulted savings in energy use	1.379.170 MJ

Expected energy savings for the Town Hall:

Current annual heat consumption	1.398.807 MJ
Expected annual heat consumption after refurbishment	769.350 MJ
Resulted savings in energy use	629.457 MJ

All three buildings are equipped with their own boilers fired with gas from the local network. Taking into account current gas prices of ca. 17,50 Euro per MJ the expected annual savings in the operational costs will altogether reach ca. 41.000 Euro, which accounts for ca. 40% of the today's heating costs,

6.2 Step 3: Financial analysis

6.2.1 Investment Cost

- Equipment and material costs: 3.400.000 €
- Taxes: 70.000 €
- Engineering and managing the project completion (including project preparation costs): 530.000 €
- Other costs: 250.000 €

6.2.2 Financial Engineering

Table 6.1: Energy Action 4 – Refurbishment of municipal buildings, Nowa Sól County

		Total investment	
		4.250.000 Euro	
Private Funding		Public Funding	
508.000 Euro		3.742.000 Euro	
Equity	Commercial loan	Structural Fund	Other grants
508.000 Euro	Euro	3.612.000 Euro	130.000 Euro
Project life time		35 Years	

6.2.3 Economic Analysis

Table 6.2: Economic analysis of Energy Action 4 – Refurbishment of municipal buildings

Investment costs [thous. EUR]	4.250
Investment subsidy from SF / CF [thous. EUR]	3.742
Economic lifetime [years]	35
Discount rate	5%
Combined rate of increase of prices	2,0%
Net Present Value (NPV) [thous. EUR]	229
Internal Rate of Return (IRR)	7,9%
Profitability indicator (PI)	5%
Simple payback [years]	14,9
Real (discounted) payback [years]	20,0

6.3 Step 4: Positive effects in view to overall energy vision

The energy efficiency measures are the most desirable energy-related projects aiming at better energy management. While on the one hand new and innovative renewable energy sources are taken into operation to produce “green energy”, it is on the other hand crucial to promote certain patterns of behavior in the society that will lead to overall lower energy consumption. The primary objective of the sustainable energy management is to maximize the energy savings in the economy. Therefore, public bodies should be the pioneers giving Best Practise examples to other members of the local community.

Project carried out in Nowa Sol is intended to be promoted and disseminated among the neighbouring communities where energy efficiency measures haven't been undertaken so far. It will thus hopefully be multiplied in order to further reduce the energy demand and the corresponding heat costs in the other buildings. Since individuals play an important role in this respect, it is very important to attract their attention with this project. Therefore, it would be recommendable to combine the project with some accompanying events concerning ways how to save energy in the household sector. This sort of education campaign is planned to be realized by the Polish Ecological Club.

As a result of the above mentioned investments an increase in the energy efficiency can be observed. This in turn will lead to substantial savings on conventional fuel (gas) which has been used for heating up till now. It has been estimated that the amount of necessary natural

gas can be reduced by over 75.000 m³ after the fuel switch. Furthermore, the emissions of carbon dioxide will consequently be reduced by ca. 140.000 t.

6.4 Step 5: Cooperation scheme

The single investments have been bundled in one large project to make it easier to apply for any sort of public funding (especially for the EU Structural Funds). However, the main reason are not the hardly achievable eligibility criteria within the particular priority axes (since in case of the Regional Operational Programme it is rather improbable that any project size down-limits will be fixed), but purely formal and technical simplification of the whole application procedure in case of one project comparing to three independent projects. On the other hand, provided that 3 single applications have been submitted, there is always a relatively higher probability that at least one of the projects will get the support. This issue will ultimately be decided as soon as detailed guidelines for financing from the resources of the EU Structural Funds will be published.

6.5 Step 6: Strategy for financing Energy Actions by Structural Funds

Energy efficiency projects are one of the most essential priority areas regarding the support for energy-related projects, for they have crucial meaning to the overall objectives of the sustainable energy management. As the beneficiary are the authorities of the County and the size of the projects is medium the suitable financing scheme can be found in the Regional Operational Programme in the already mentioned measure 3.2 focused on subsidizing all sorts of investments in the sector of renewables and energy efficiency. In case of Nowa Sol county it is highly probable that the level of available co-financing will reach even 85% of total eligible costs.

Some additional financial support can be applied for from the ECOFUND – an association subsidizing investments in the field of renewable energy sources (a. o. also refurbishment projects). The financial resources come from the Polish national debt towards some European countries which decided to devote the corresponding sums of money from debt for financing projects regarding environmental protection. However, the level of the subsidy reaches in this case maximum ca. 130.000 Euro.

The precise and final financing structure will be fixed no sooner than the detailed guidelines for European Funds will be released in Poland.

7. Conclusion and Outlook

To sum up, Nowa Sol County offers a sufficient potential to develop the sector of renewable energy. Due to the specific characteristics of the region the most recommendable source of renewable energy is biomass in various forms. Furthermore, the most prospective directions for the development are: use of agricultural residues for heat and electricity production, gasification of combustible and calorific organic waste, solar heat collectors, energy crops' plantations. Other types of RES-technologies are rather not recommendable either due to very high investment costs (i.e. photovoltaic panels) or to the unfavourable conditions and lack of appropriate resources and (wind and hydro power, wooden biomass from the forestry or wood processing industry).

The first initiatives have already been undertaken in the region. Municipality Nowa Sol supplies some of their buildings with heat produced from the biomass, mainly in the form of energy crops from the own willow plantation as well as from other energy plants. The authorities of Nowa Sol County, on the other hand, implemented the energy efficiency measures in several public buildings. Wooden pellets were manufactured from saw dust, however, due to the shortages and unavailability of raw material an innovative concept is seriously considered, to start production of pellets from alternative input material which are mainly by-products from agriculture as well as energy crops. Those actions as Best Practise examples have created a good basis and starting point for future developments in this field.

After the Master Plan for Nowa Sol County has been elaborated in detail and the "Energy for Cohesion" project has been finalised, the local stakeholders intend to continue the actions started in the framework of the programme. The comprehensive feasibility studies will be performed for the selected actions and the European Structural Funds will be applied for in order to assure the financial stability of the project.

With the serious involvement of local authorities, private sector as well as obtaining of required co-financing the actions proposed in the Master Plan could highly probably be implemented in the target region. The significant role of the project "Energy for Cohesion" for the acceleration and intensification of development in the RES sector cannot be overestimated. The actions initiated within the programme have contributed enormously to the popularization of renewables in the region and managed to get local stakeholders from various groups of interest together for the common sake. Thanks to those pioneer initiatives renewables might become a crucial element of the local and regional planning processes and an integral part of development and energy-related policies. Moreover, the level of social awareness regarding the RES issues has risen due to the events carried out in the framework of the E4C project. In the end, supported by the local environmental NGOs

renewable sources of energy might turn out to be successful sustainable solutions in the energy sector, which will help the regional entities to fulfil the appropriate legal regulations.

Annex 1: Energy 4 Cohesion Poster

Annex 2: Energy 4 Cohesion Project Presentation