

POLAND

AUTHORS

Adam Rybka

Faculty of Civil and Environmental Engineering
Rzeszow
University of Technology
E: akbyr@prz.edu.pl

Jan Gorski

Faculty of Energy and Fuels
AGH University of Science and Technology
E: jgorski@agh.edu.pl

Anna Pomykała

Faculty of Civil and Environmental
Engineering,
Rzeszow, University of Technology
E: pomykalcia@gmail.com

Magda Sęp

Faculty of Civil and Environmental
Engineering,
Rzeszow, University of Technology
E: msep@prz.edu.pl

1 OVERVIEW OF THE REGION

Characteristics of the Region

Podkarpackie Province is situated the south-east Poland. There are (as of 2012) 2,128,687 inhabitants living in Podkarpackie which is 5.5% of the whole population in the country. There are 117 people per 1 km² and the Province is seventh in the country as far as the population density is concerned. The geographical area of the region is 17 844 km². The capital is Rzeszow (183 133 inhabitants).¹ Podkarpackie is subdivided into 21 *poviats*.



Figure 1 - Administrative division of Poland

Governance: The Subcarpathian Regional Assembly is the regional legislature of the Province of Podkarpackie. It is a unicameral body consisting of thirty-three councillors elected in free elections for a 4-year term. Members of the Assembly are elected from five districts, and serve four-year terms. Districts do not have the constituencies' formal names. Instead, each constituency has a number and territorial description. The institution is Podkarpacki Voivode (Podkarpacki Province), appointed by the Prime Minister. In the office there are also three delegations: in Krosno, Przemyśl, Tarnobrzeg.

Energy policies are in large part determined by in national bodies, with the local governments implementing them.

Industry in the Podkarpackie Region is characterised by aircraft industry, heavy industry, mining, bus vehicle production and other production sectors. As more than 52% of Podkarpackie Region is covered by forests and 40% are agricultural land, wood processing industry and energy producing industries are important.

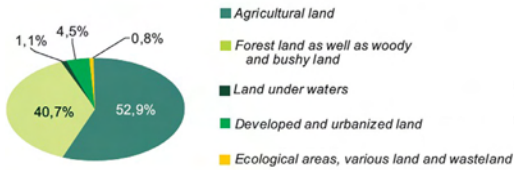


Figure 2 – Structure of the voivodship/provincial area in 2013 (geodestic status as of 1 January)²

The average GDP per capita in 2012 for Podkarpackie Region was €5,952.³ In 2011 the employment rate was registered at 57%.⁴ The issue of fuel poverty is difficult to estimate in Podkarpackie Region, but the five partner countries of the EPEE project have come up with this definition: “Fuel poverty as a household’s difficulty, sometimes even inability, to adequately heat its dwelling at a fair, income indexed price.”⁵ According to KAPE fuel poverty in Subcarpathian region is high and is estimated close to 21.6%, comparing to the whole country – 17% (2011 year)⁶

Energy demand and supply of the Region

In Poland the primary energy consumption in 2012 achieved 1102407.7 GWh. Share of renewable energy in gross final energy consumption in 2011 was 10.4%.⁷

Energy self-sufficiency of Podkarpackie Region in fuel and energy can be defined as the ratio of obtaining to total consumption of primary energy. The share of renewable energy in 2007 was 2%. During the next three years this is expected to quadruple.

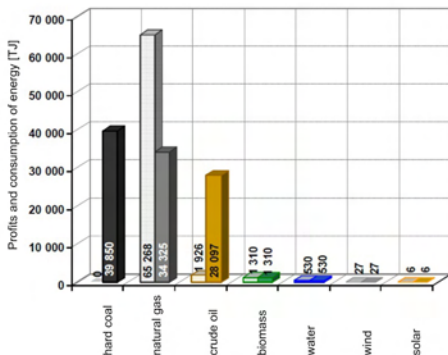


Figure 3 – Energy profits and consumption of energy in Podkarpackie Region 2007⁸

There are no data available for Podkarpackie Region about the total energy consumption (TEC) by sectors, however, the development in Podkarpackie Region may be comparable to the average TEC of the nation.

The level of final energy consumption in Poland tended to increase in years 2000 – 2010. The major change in sectoral structure consisted in shift from industry to transport. The share of industry fell from 32% (2000) to 23% (2010). During this period share of transport increased from 17% to 26%. The agriculture sector recorded a decline and service sector growth of the share. Households remained the biggest consumer with market share of 32%. These changes reflect the development trends of the economy with the increased trade with foreign countries. This resulted in higher energy consumption in transport, and the activities undertaken in the industrial sector (growth of efficiency associated with rising energy prices) and the results of actions taken by public authorities (e.g. pro-efficiency programs targeted to households).

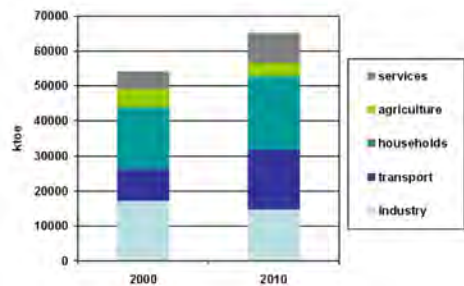


Figure 4 – Total energy consumption by sectors in Poland⁹

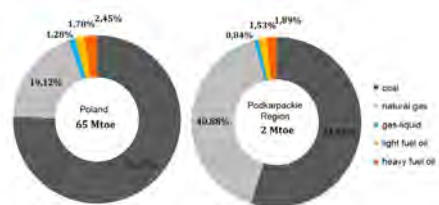


Figure 5 – Total energy consumption (TEC) by fuel in Poland/Podkarpackie Region 2010¹⁰

Share of energy sources for electricity production (%)

Poland is fortunate to possess strong potential renewable energy resources. According to the European Environmental Agency, Poland holds over 3600 TWh (terawatt hours) of commercially exploitable wind power. Poland ranks only behind France, Germany and Spain in biogas potential produced through landfills, sewage, and agricultural residues. Poland’s ample farms and forests offer more unutilised biomass potential than any other EU country. However, currently 57% of electricity in Poland is produced from bituminous coal and 32% from brown coal. Wind and other renewables represent 7% of electricity and 3% of total energy production.

Electricity demand in Poland is steadily rising, and renewables represent the fastest growing source of electrical power. In 2004, wind accounted for just 0.1% of Polish energy production. By 2010, wind power reached the 1% threshold. *Figure 6* illustrates the significant growth of renewable energy in Poland. Wind energy production is decreasing because developers face an array of hurdles that is hindering exploitation of Poland’s wind resources lack of zoning plans, costly ornithological research, existence of secret low altitude military flight routes, payback period is uncertain.¹¹

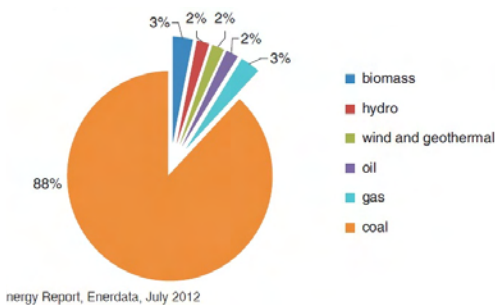


Figure 6 – Structure of electricity in Poland in 2012

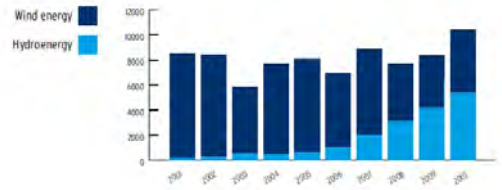


Figure 7 – Growth of electricity production from renewable sources in Poland 1 years 2001 – 2010¹²

Electricity production in Podkarpackie Region can be grouped depending on the generation as illustrated in *Table 1*.

Production GWh (2010)	Poland	Podkarpackie Region
Total Production	157657,6	2662,3
Conventional power station - commercial	152065,0	2541,0
Conventional power station - industrial	7524,0	19,0
Hydropower and renewable energy	10888,8	315,7

Table 1 – Production of electricity by type of power plant in Podkarpackie Region in 2010

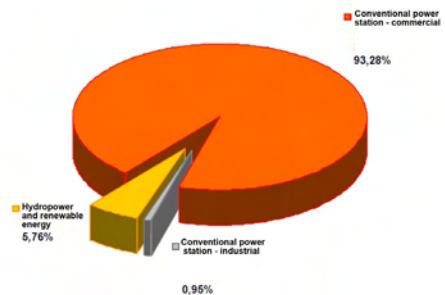


Figure 8 – Energy sources for electricity production Podkarpackie Region 2010¹³

GHG emission factor

Poland emitted 304.7 million tonnes of CO₂ in 2007. The most emissive power sector was coal, which was responsible for the emission of 212.4 million tonnes of CO₂, mainly the burning of oil in transport contributed to the issue of 62.7 million tonnes of CO₂, and natural gas 27.1 million tonnes of CO₂.

In the Podkarpackie Region issued 3567.7 thousand. tonnes of CO₂ (1.6% of national emissions).

Produce of one kWh in Poland obtained at 668 grams of CO₂ emissions. High coefficient of emissivity is a result of structure of the raw materials used in Poland to produce electricity, which is obtained mainly as a result of burning coal with a high index of carbonisation.



Figure 9 – GHG emissions by sectors in Poland (2007)¹⁴

In the Podkarpackie Region there are 82 industrial plants, particularly burdensome for clean air (at 31st December 2007). At the end of 2006, there were 88 plants, which indicates a decreasing number of this type. 64 plants have facilities to reduce pollution dust, 23 have a devices to reduce pollution gas, which means that some plants have both types of devices. According to data from 31st December 2007, emissions stand at 2.7 thousand tons. This fact confirms the significant improvement, as the level of emissions in 2006 amounted to 3.2 thousand tons and 4.3 thousand tons in 2005.

2. CURRENT SITUATION: TARGETS RELATED TO ENERGY POLICY

GHG reduction targets (% and years)

EU assumed that by the year 2020 the share of energy from renewable sources in gross final energy consumption will increase to 20% (for Poland it is 15%).

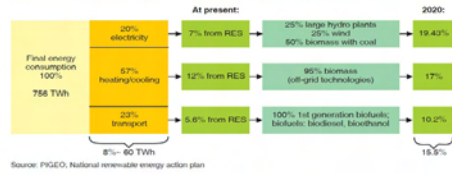


Figure 10 – Share of renewable energy sources (RES) in energy consumption in 2010 and forecast for 2020

Consumption of energy from renewable sources in transport will achieve 10%. GHG reduction targets (% and years) for the EU overall target is a 20% renewable for Energy consumption until 2020 (EU “20-20-20 target”).

Primary energy intensity in Poland fell very rapidly: dropped by 4.2 %/year between 1990 – 2009. That improvement mainly took place between 1990 – 2000 of -4.7%/year.

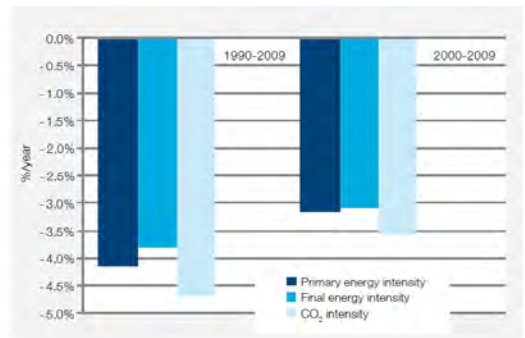


Figure 11 – Energy and CO₂ intensity trends in Poland¹⁵

Poland was, is and will be in the foreseeable future based on coal. The share of coal consumption in fuel consumption for Poland was 75.4% in 2010, and 55% for the Podkarpackie Region. The importance of coal for the Polish economy, of course, stems from having huge deposits of coal. Therefore, Poland is a country with a relatively safe source of energy supply compared to other EU countries. However, the high share of coal in the economy is associated with high CO₂ emissions.¹⁶

Podkarpackie Region participates at many EU structural funds such:

- operational Programme Development of Eastern Poland (OP DEP);¹⁷

- operational Programme ‘Podkarpackie’ a part of European Regional Development Fund (ERDF) (2007– 2013);¹⁸
- ENESCOM – Project financed by IEE program.¹⁹

The expected effects of EU supporting funds can be estimated on the level up to 20 – 30% decreasing the GHG emissions and energy consumption in Poland at the time horizon 2020.

The source of energy data in many cases is different from information gathering systems. This study was based on strategic documents of the region, “Characteristics of energy security in the perspective of the Sub-Carpathian Region for 2020 and 2030”.

Regional targets related to renewable energy

Poland has to raise the share of renewables for gross energy consumption to 15% by 2020. In 2010, this share was calculated as being 9.5%. According to the conditions this level should be achieved by 2014. Several provinces have defined regional targets based on the national target.²⁰

Taking into account the specificity of the region, the following actions are recommended by Podkarpacka Agencja Energetyczna, to improve the energy security of the region:

- carry out activities directed at diversifying sources of energy in a maximum use of their own fuel resources taking into account the possibility of obtaining energy from renewable sources;
- rationally and efficiently use natural gas reserves located in the Podkarpackie Region;
- create favorable conditions for the emergence of intelligent Smart Grid;
- develop infrastructure to generate energy from renewable sources;
- support the implementation of the comprehensive thermal modernisation of buildings located in our region, in order to increase their energy efficiency;
- adapt electricity system to collect energy from renewable sources;
- introduce an energy management system, in particular the implementation plans for heat, electricity and gas fuels including the renewable energy in each municipality of

Podkarpackie Region;

- promote activities in the field of energy efficiency in buildings and promote energy-efficient and passive construction;²¹
- as an important example of impact on the regional approach a Facebook campaign called Krakow Smog Alert was thus launched, and quickly gained city-wide interest and support. Indeed, the overwhelming response in the first few weeks of the campaign created a sense of urgency and political space for local policy makers to seek real solutions for improved air quality in Krakow. It’s official – councillors have banned the use of wood and coal in heating systems in Krakow and across Malopolska Region – one of the most polluted areas of Europe. The likely allocation of EU funds is set to bring about a breakthrough success for a popular and dearly needed campaign for better air quality in Krakow.²² There are also bottom up voluntary schemes that have been implemented at a regional scale. A lot of recently initiatives are proposed by high schools in Podkarpackie Province, for example: Postgraduate studies “Renewable Energy Sources” at the Faculty of Mathematics and Natural Sciences, University of Rzeszow;²³
- postgraduate studies “Audit and certification of energy performance of buildings” at Rzeszow University of Technology,
- full-time studies “Alternative energy sources and processing” and postgraduate studies “Thermo-modernisation and renewable energy sources” at the Faculty of Mechanical Engineering and Aeronautics, Rzeszow University of Technology.²⁴

The actual offer of full-time studies in area of Renewable Energy Resources (OZE) in Poland consists over 30 high-schools in all regions and academic centers in Poland.²⁶ A lot of new clusters have been started in the Podkarpackie Region oriented towards the sustainable development and efficient energy use such presented two examples:

- subcarpathian Renewable Energy Cluster,²⁷
- Malopolska – Podkarpackie Clean Energy Cluster (PKOE).²⁸

Database of Renewable Energy will provide access to extensive and up-to-date information on conventional and, most importantly, innovative energy plants or installations in regions selected as study areas.

Achievement of regional targets

In 2011 the production of energy in the Podkarpackie Region was at 2.876.5 GWh. Production of energy produced from renewable sources was at 319.7 GWh, which accounted for 11.1% of the total volume produced in the Podkarpackie Region. This share was higher than the average share of energy produced from renewable energy sources in total production calculated for the whole country. Detailed data presented in the table below.

Type	Amount	Power (MW)
Producing from biomass	2	1.98
Run-of-the-river hydroelectric plant	13	10.51
Pumped-storage hydroelectric plant	1	168.60
Producing from biogas from sewage treatment plant	8	2.74
Wind power plant on land	24	61.99
Producing from biogas from landfill	3	1.65

Table 2 – The installed capacity of renewable energy sources in Podkarpackie Region (2012)²⁹

Despite the enormous possibilities of using solar energy in Poland, it is a less than 1% in the production of electricity from renewable sources, but in obtaining thermal energy from solar energy is growing steadily, which in 2009 reached the level of 23.2 GWh water and wind energy in 2009: 8550 and 3878 [TJ]. In the Podkarpackie region many important initiatives are being developed green energy systems (in this new 3 large wind farms developed by “Subcarpathian Renewable Energy Cluster”):

- Martifer Renewables and the Ikea Group have today officially opened a 26-MW wind farm in Rymanów, in the Podkarpackie province, south-east Poland;

- The Project: “Installation of renewable energy systems on the public utility buildings and private houses in the Communes which are members of the Union of the Wisłoka River Basin Communes “ within the framework of the Swiss-Polish Cooperation Programme (supported by 465 mln CHF) includes purchase and installation of solar systems both for private and public beneficiaries and purchase and installation of photovoltaic systems for public buildings;³⁰
- City of Rzeszów PRT Project – The project (total investment 55 Million USD) will reduce emissions from automobile traffic, one of the major sources of air pollution in the city. Further goals are the reduction of greenhouse gas emissions consistent with climate change mitigation as well as the costs associated with liquid fuels. The introduction of alternative, less-polluting means of transport that rely in part on renewable energy is a consistent step in Rzeszów’s sustainable development policy implementation. The intention is rapid development and introduction of innovative new technologies together with protection of already highly rated environmental amenities;³¹
- solar installation on the building of a Nursing Home in Rzeszów – 48 kW thermal power, (28 flat-plate collectors, and active area 67.5 square meters);
- the solar installation at the swimming pool in Glogow Mlp – 58 kW, (24 flat-plate collectors, 58 square meters);³²
- new project – solar installation in the indoor swimming pool and outdoor swimming pools system in Mielec – 136 flat collectors, 265 m², 788 000 PLN (85% costs co-financing from the European Regional Development Fund);³³
- installation of photovoltaic facade of administrative buildings Airport “Rzeszów-Jasionka,” along with the installation of a biomass boiler and upgrading the internal electric network.³⁴

The Polish NEEAP states that during the last 20 years, Poland has made significant progress towards energy efficiency. Polish energy efficiency policy includes goals to maintain zero-energy economic growth and to consistently lower the energy consumption of the Polish economy to reach the level of EU-15.

Energy efficiency in the public sector Poland has implemented several measures related to energy efficiency in the public sector, among others, producing an open register of persons authorised to prepare energy performance certificates for buildings. The NEEAP further includes measures to decrease energy consumption in public utility facilities and states that the public sector will play an exemplary role in implementing and promoting nearly zero-energy buildings for public utility facilities.

Further initiatives include:

- Podkarpacka Energy Management Agency Ltd. (PAE) – It is an energy management agency. It is based in a region of agricultural character and has potential for RES and biofuel production. Areas of expertise: Its training courses help people in the region to develop small businesses in RES. It helps citizens to find a way to save energy in their houses by using solar technologies. It also has an information program for clients that want to produce ecologically clean energy;³⁵
- Rzeszow Regional Development Agency (RARR SA) – The RARR SA Agency operates within national and European co-operation networks. It has obtained accreditation with the Polish Agency for the Development of Enterprise as far as training, information, consulting financial as well as pro-innovative services are concerned. It is a member of the National Service System for SME's (KSU) in Poland and the network of the Innovation Relay Centres in Europe;³⁶
- SOLAR-BIN S.A. – Funded in 1990 the Company for Energy-saving Technology Promotion SOLAR-BIN S.A. Company's ambitious aim is activity on the regional market and promotion of modern, energy-saving and environment-saving technologies;³⁷
- Podkarpacka Energy Management Agency (PAE) – The Regional Agency for renewable and efficient energy use. Podkarpacka Energy Agency implements now the project "Database of Renewable Energy Sources in Podkarpackie Region" under the Integrated Regional Operational Programme, Measure 2.6 Regional Innovation Strategies and Transfer of Knowledge. Database of Renewable Energy will provide access to an extensive and up-to-date information

on conventional and, most importantly, unconventional energy plants or installations in regions selected as study areas;³⁸

- Association Horizons - Association "Horizons" works in the area of promotion and implementation of innovation, in the scientists and economical societies for development of the Podkarpackie Region;
- Subcarpathian Renewable Energy Cluster (PKOE) – The PKOE aims at creating networks of cooperation between representatives of regional universities, business support institutions, administrative bodies and entrepreneurs from the renewable energy sector;
- the AGH Educational and Research Laboratory of Renewable Energy Sources and Energy Saving in Miekinia.

Important News: Cracow University of Science and Technology (AGH) received EU grants for two projects, including the largest in its history project - the construction of the Energy Centre. This will be the most modern and largest energy research center in Poland, its creation will cost nearly PLN 190 million, including over PLN 62 million from EU funds.

3. CASE STUDY: BIESZCZADY MOUNTAINS



Figure 10 – Coordinates for Bieszczady Mountains



Figure 11 – Location of the eco-region

This case study was selected to demonstrate how a bottom-up process, driven by a group of communities in South Podkarpackie Region, aimed to develop an eco-region – Local Action Group Green Bieszczady (Stowarzyszenie Lokalna Grupa Działania – “Zielone Bieszczady”). The eco-region programme, initiated in September 2008, was formed by an association of five communities: Czarna, Lutowska, Olszanica, Solina, Ustrzyki Dolne and two organisations: Bieszczady Foundation and Bieszczady District in South Podkarpackie Region.

The region has a total population of 33,000 inhabitants and covers an area of 1417,02 km². The region is characterised by the dominance of agriculture, supplemented by a few food/wood processing and handcraft enterprises and absence of any bigger industries of towns. The settlement pattern is scattered in villages with single family homes prevailing. The region is situated about 16 km from a major center Solina providing all kind of infrastructure. An important center, inside the region itself and to the Podkarpackie capital Rzeszow (101 km away). Traffic infrastructure in terms of public transport is rather poor, individual motorised mobility is common.

It was not Podkarpackie Region regulation, incentives or political framework that fostered or enabled the eco-region plan. The main driver of this initiative has been communities with interrelation ties and a people from Local Action Group, Green Bieszczady. Their basic motivation was to create an eco-region by an awareness of its people, responsibility and collective as well as individual action.

Objectives and methods

The goal of the eco-region goes beyond of what we understand as “Smart energy region”. Eco-region Green Bieszczady is aiming at:

- fostering an eco-friendly circular flow economic model: sustainability and economic viability do not exclude each other;
- attaining renewable energy self-sufficiency;
- seeking eco methods to archive neutrality at local level;
- giving an example to other regions;
- dissemination and exchange of information on initiatives related to the activation of the population in rural areas;
- activation within the framework established support system, business processes related to international economic exchange among business organisations operating in the Podkarpackie Province;
- supporting local businesses operating in the Polish part of the Carpathian Euroregion, with engaging market producers of traditional, regional, local and organic produce and edible forest products;
- creating the conditions for the establishment and development of cooperation between entities in the area of the Project and the European partners, as well as the conditions for the transfer of experience gained by them in the area covered by the project.

The target here is not so much to reduce the emissions of CO₂ but to prevent further increases.. Eco-region has small percentage of industrialisation and the electricity is supplied only by hydroelectric plant. Local business is focused on creating natural and regional products.

Long term focus

The Solina Dam is the largest dam and hydroelectric plant in Poland. It is located in Solina Municipality. Its construction created

the largest artificial lake in Poland - Lake Solina. It has four turbines which were initially capable of generating 136 MW of electricity. Two of the turbines can also reverse flow to store energy to optimise power generation. The installation of new technologies (hydraulic-mechanical-electrical control has been replaced by the electronic memory-programmable digital controller) and the replacement of the old turbines resulted in the dam currently generating 200 MW of electricity. The Solina Dam supplies electricity to all in Bieszczady Mountains area.

The Biosphere Reserve “Eastern Carpathians”, the only tripartite reserve by UNESCO in the world, distinguishes itself by a remarkable variety of natural and cultural treasures. Extensive areas of natural forest and one of the last refuges of wild Carpathian wildlife can be found there, including large predators. Features of the natural environment are combined with a wealth of culture and traditions. For centuries, the region was an area where different cultures, nations and ethnic groups come together: the Vlachs, Lemko, Poles and Slovaks. Today, it is unique landscape allows for the creation of a beautiful wooden architecture, secular and sacred, and agricultural and pastoral traditions. In this small, lost corner of Central and Eastern Europe nature and history of the Eastern Carpathians combines the three neighboring countries, forming the basis of their cooperation and integration as well as an opportunity to develop cross-border initiatives, such as the heritage trail “Green Bicycle – Greenway Eastern Carpathians”.

Among the local initiatives that are implemented in track of the “Green Bicycle - Greenway Eastern Carpathians” are original projects in the field of ecotourism development (creating conditions for the development of water tourism, cycling and horse riding in Bobrka and Lesko). An initiative to promote local crafts (play tradition of weaving in Glade, workshops, artistic ceramics and eco-museum the farm in Jankowce), regional events and fairs (agrotourism fair, Boykos festival) and other interesting initiatives. The construction of such a pathway associated with the need to establish cooperation and simultaneous participation for all municipalities Bieszczady,

has allowed it to create a noticeable because of the tourist product, which may be an international tourist attraction. The Bieszczady Mountain region is interested in establishing cooperation with similar regions in Switzerland.

The concept of the Eco-region is the development of a process towards defined medium-term goals (emission reduction target and CO₂ neutrality). Besides these quantifiable objectives, the region – walking the process path - aims at exploring a more general and complex challenge: an eco-friendly circular flow economic model, unifying sustainability and economic viability.

There are no accurate studies which illustrate emission of CO₂ in the Bieszczady Mountains region. Electricity in the region comes from renewable energy source (hydropower plant). Householders and local businessmen are interested in saving money, water and energy using renewable energy sources (solar panels).

Results

- development of bicycle and foot path (financed by Podkarpackie and EU funds)
- promotion of non-motorised forms of transport and environmentally friendly forms of tourism
- use of local resources (natural, cultural, accommodation and food service and local products)
- providing information and opportunities to better understand the eco-region, its challenges, local initiatives, activities, organisations, etc.
- preserve the landscape and contribute to the protection of natural and cultural heritage
- common projects with retailers: climate friendly shopping
- entire eco-region supplied with 100% CO₂ neutral electricity without additional costs
- construction or energetic improvement of small renewable energy power plants (bioenergy), where technically and economically appropriate.

Outcomes

It can be observed that nearly all central problems related to greenhouse gases emission and core areas of activity in the eco-region correspond to the key aspects that were

also identified at the level of the region of Podkarpackie. Nevertheless, the focuses set reflect the particular local situation in the eco-region. This fact shows that, on the one hand, the eco-region is aware of the interdependency and complexity of emission problems; on the other hand it shows that activity is concentrated on topics that are within the eco-region's scope of action.

On the contrary, a strong focus in this region rich in agricultural surfaces and population is set on agriculture. A definite advantage is the existing "sense of togetherness" and identification in the population of the eco-region. The marketing of the eco-region and its approach outwardly is done quite successfully and additional funding at provincial, national and EU level has been acquired. One of the key aspects of success is the strong involvement of local enterprises. Nearly all firms and tourism enterprises are members of the eco-region – Local Action Group Green Bieszczady. Many of them are active members in terms of active project partner. At the same time, they also take their benefit from the eco-region, as new business ideas and niche products, may be supported and the regional consumption idea as such is promoted.

4. CONCLUSIONS

This case study demonstrates changes that can be made in a coordinated way (on the short term, medium term and long-term) to combat climate change and GHG emissions at small regional level. As in Podkarpackie, there are several regions where communities in vicinity similar characteristics are working together, there is a potential to enlarge the concept to other areas. As the Eco-region Green Bieszczady is working in a specific setting that is characterised by intense human interaction in a relatively small area, any enlargement to the whole of Podkarpackie seems unrealistic. The Eco-region Bieszczady is seeking for exchange on similar approaches and is willing to give an example to other regions.

The eco-region Zielone Bieszczady (Green Bieszczady) is looking to exchange knowledge with other regions. They are partners in

ongoing projects called Alpine-Carpathian Cooperation Bridge (their aim is to promote local entrepreneurs, traditional and ecological products) and Solution (their aim is to further develop approaches of regional energy autonomy on the long term).

5. REFERENCES

<http://www.rzeszow.pl/miasto-rzeszow/dane-statystyczne/rzeszow-w-liczbach> (08.12.2013)

http://www.stat.gov.pl/cps/rde/xbcr/gus/se_efektywnosc_wykorzystania_energii_2000-2011.pdf

http://www.stat.gov.pl/cps/rde/xbcr/gus/RS_rocznik_statystyczny_rp_2012.pdf

http://www.efs.gov.pl/AnalizyRaportyPodsumowania/Documents/Analiza_porownawcza_2012_ost_wersja.pdf

http://www.enescm.org/final_document/Download_PL/CB8-PL-ENSCSOM%20Researches.pdf

<http://monitoruj.podkarpackie.pl/assets/files/bazawiedzy/01.1%20Strategia%20wojew%C3%B3dztwa/Bezpieczenstwo%20energetyczne.pdf>

<http://www.lgd-zielonebieszczady.pl/>

<http://www.esolina.pl/>

<http://www.lutowiska.pl/>

<http://www.czarna.pl/asp/pl>

<http://ustrzyki-dolne.pl/>

<http://www.olszanica.pl/>

5. FOOTNOTES

1. <http://www.rzeszow.pl/miasto-rzeszow/dane-statystyczne/rzeszow-w-liczbach> (08.12.2013)
2. Podkarpackie in figures 2013. Statistical Office in Rzeszów
3. http://www.stat.gov.pl/cps/rde/xbcr/gus/RS_rocznik_statystyczny_rp_2012.pdf
4. http://www.efs.gov.pl/AnalizyRaportyPodsumowania/Documents/Analiza_porownawcza_2012_ost_wersja.pdf
5. www.fuel-poverty.org/files/WP5_D15_EN.pdf
6. www.kape.gov.pl/PL/Projekty/publikacje/EPEE_KAPE_PL_Paris_Final.ppt

- www.stat.gov.pl/cps/rde/xbcr/zg/ASSETS_wskaznik_zagrozenia_ubostwem_2013.pdf
7. http://www.stat.gov.pl/cps/rde/xbcr/gus/ENERGIA_2013.pdf
 8. STRATEGIA ROZWOJU WOJEWÓDZTWA PODKARPACKIEGO
 9. Energy Efficiency Policies and Measures in Poland ODYSSEE MURE 2010
 10. Charakterystyka bezpieczeństwa energetycznego Województwa Podkarpackiego w perspektywie do roku 2020 i 2030.
 11. Liss P., Partner T. Renewable energy in Poland. October 2012
 12. Renewable energy in Poland. RSM Poland KZWS
 13. Charakterystyka bezpieczeństwa energetycznego Województwa Podkarpackiego w perspektywie do roku 2020 i 2030 (Characteristics of energy security in the perspective of the Sub-Carpathian Region for 2020 and 2030)
 14. Wyniki badań projektu ENESCOM dla Województwa Podkarpackiego (The results of Regional Project ENESCOM for Podkarpackie Province)
 15. Poland energy efficiency report.
 17. Charakterystyka bezpieczeństwa energetycznego Województwa Podkarpackiego w perspektywie do roku 2020 i 2030(Characteristics of energy security in the perspective of the Sub-Carpathian Region for 2020 and 2030)
 17. <http://en.parp.gov.pl/index/index/1888>
 18. http://www.funduszeuropejskie.gov.pl/NR/rdonlyres/ABB14F59-4D93-460B-AF0D-07B73E8810AC/39057/Woj_Podkarpackie.pdf
 19. www.enescom.org/final_document/WP2/D2.1_Energy%20report%20on%2020%20regions.pdf
 20. http://www.euractiv.pl/energia-i-srodowisko/spis_linie/odnawialne-roda-energii--szanse-i-koszty-000020
 21. Charakterystyka bezpieczeństwa energetycznego Województwa Podkarpackiego w perspektywie do roku 2020 i 2030 (Characteristics of energy security in the perspective of the Sub-Carpathian Region for 2020 and 2030) [doc&ei=sjbiUsXwL42qhAex5oGoAQ&usg=AFQjCNHLLICmR7CC7V8_hP3KjOvCNU1HQ&bvm=bv.59930103,d.d2k&cad=rja](http://www.energetyka.pl/doc&ei=sjbiUsXwL42qhAex5oGoAQ&usg=AFQjCNHLLICmR7CC7V8_hP3KjOvCNU1HQ&bvm=bv.59930103,d.d2k&cad=rja)
- <http://www.managenergy.net/actors/2859>
<http://www.rarr.rzeszow.pl/en/about-us>
www.solar-bin.pl/?c=mdTresc-cmPokaz-2
<http://www.managenergy.net/actors/2859>

This publication is a section of the book
“Smart Energy Regions”

Published by The Welsh School of
Architecture, Cardiff University,
Bute Building, King Edward VII Avenue,
CARDIFF, CF10 3NB, UK.

Publication date: May, 2014; ISBN: 978-1-899895-14-4.



The COST Action TU1104 Smart Energy Regions brings together over 70 researchers from European institutions to investigate the drivers and barriers that may impact on the large scale implementation of low carbon technologies in the built environment. The book “Smart Energy Regions” is the outcome of the Working Group 1 of the Action and collects analysis and case studies from 26 European countries. For more information about the Action and COST please visit www.smart-er.eu and www.cost.eu.



ESF Provides the COST Office through an EC contract

COST is supported by the EU

RTD Framework Programme



© COST Office, 2014

No permission to reproduce or utilise the contents of this book by any means is necessary, other than in the case of images, diagrams or other material from other copyright holders.

In such cases, permission of the copyright holders is required.

Neither the COST Office nor any person acting on its behalf is responsible for the use which might be made of the information contained in this publication. The COST Office is not responsible for the external websites referred to in this publication.

COST DESCRIPTION

THE ORGANISATION OF COST

COST - European Cooperation in Science and Technology is an intergovernmental framework aimed at facilitating the collaboration and networking of scientists and researchers at European level. It was established in 1971 by 19 member countries and currently includes 35 member countries across Europe, and Israel as a cooperating state.

COST funds pan-European, bottom-up networks of scientists and researchers across all science and technology fields. These networks, called 'COST Actions', promote international coordination of nationally-funded research.

By fostering the networking of researchers at an international level, COST enables breakthrough scientific developments leading to new concepts and products, thereby contributing to strengthening Europe's research and innovation capacities.

COST's mission focuses in particular on:

- building capacity by connecting high quality scientific communities throughout Europe and worldwide;
- providing networking opportunities for early career investigators;
- increasing the impact of research on policy makers, regulatory bodies and national decision makers as well as the private sector.

Through its inclusiveness, COST supports the integration of research communities, leverages national research investments and addresses issues of global relevance.

Every year thousands of European scientists benefit from being involved in COST Actions, allowing the pooling of national research funding to achieve common goals.

As a precursor of advanced multidisciplinary research, COST anticipates and complements the activities of EU Framework Programmes, constituting a "bridge" towards the scientific

communities of emerging countries. In particular, COST Actions are also open to participation by non-European scientists coming from neighbour countries (for example Albania, Algeria, Armenia, Azerbaijan, Belarus, Egypt, Georgia, Jordan, Lebanon, Libya, Moldova, Montenegro, Morocco, the Palestinian Authority, Russia, Syria, Tunisia and Ukraine) and from a number of international partner countries.

COST's budget for networking activities has traditionally been provided by successive EU RTD Framework Programmes. COST is currently executed by the European Science Foundation (ESF) through the COST Office on a mandate by the European Commission, and the framework is governed by a Committee of Senior Officials (CSO) representing all its 35 member countries.

More information about COST is available at www.cost.eu.



This publication is supported by COST.