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Article

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Economic and Environmental Studies (E&ES)

Provided in Cooperation with:

Opole University

Suggested Citation: Gołuszka, Agnieszka; Gollinger-Tarajko, Marta (2016) : Local sustainable development activities through the example of the Sucha Beskidzka district, Economic and Environmental Studies (E&ES), ISSN 2081-8319, Opole University, Faculty of Economics, Opole, Vol. 16, Iss. 4, pp. 577-590

This Version is available at:

<https://hdl.handle.net/10419/178935>

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Local sustainable development activities through the example of the Sucha Beskidzka district

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Abstract: The presented Sucha Beskidzka district situated in the małopolskie voivodeship (province) is an example of many different projects implemented for the benefit of inhabitants: installation of solar collectors, thermal modernization of public facilities, construction of modern waste screening plant as well as initiatives for natural values protection and promoting “small homeland”. The aim of this paper is to present how the sustainable development goals can be achieved at local level bringing ecological, economic and social effects. A financial and economic analysis and environmental effects of completed projects lead to conclusions the activities implemented by the district undoubtedly improved the quality of life in the local community. Reducing emissions of harmful substances into the air fosters both population health and preservation of valuable natural areas in the district such as the Natura 2000 area covering the Babia Góra National Park. The use of renewable energy sources brings not only reduced heating costs but also lowered energy consumption. These activities had also a social dimension. The implementation of the programs undoubtedly increased ecological awareness among local community – the need to take care of the nearest environment and the sense of regional identity among citizens.

Key words: sustainable development, local activities, quality of life improvement, renewable energy sources, Sucha Beskidzka district

JEL codes: Q42, Q59

1. Introduction

The problems of the contemporary world cause that the concept of sustainable development is still valid although the declaration of the United Nations Environment Programme (UNEP) was adopted in 1987, i.e. almost thirty years ago. An economic model in this declaration assumes conscious shaping of relationships between economic growth, care of the environment and human

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health. The term “sustainable development” is present also in Polish legal regulations and is defined as a social and economic development that integrates political, economic and social activities to meet the needs of the present generation and future generations while maintaining natural equilibrium and continuity of basic natural processes (Environmental Protection Act 2000). This concept is universal both at global (international), national and local community levels.

The next motto: “Thing globally, act locally” originated in 1992 in Rio de Janeiro during the United Nations conference on environment and development underlines the significance of local initiatives for sustainable development of global economy. The aim of this meeting was to develop guidelines for environment protection activities and behaviours. The summit resulted in such documents as Rio Declaration consisting of 27 principles intended to guide countries in sustainable development. The next document was Agenda 21 the scope of actions for sustainable development to be executed at global, national and local levels in the 21st century. The task were set forth to reduce greenhouse gas emissions that cause climate change. The most important is minimising air pollution with harmful substances. The last declaration refers to forests and its values introduced into social life, supporting tradition and eco-development (Ignatowicz, 2015: 223-236). The presented tasks defined the direction of sustainable development that should be started from local activities. Sustainable development strategies are quite commonly used by various social organizations, business environments, corporations and enterprises that implement innovative technologies, thus enhancing environmental quality and human health. Sustainable development applies also to individual responsibility for decision making in everyday life having an impact on shaping and development of our nearest environment, e.g. waste management in households, water savings, selecting ecological heating systems, reducing excessive consumption, and the sense of regional identity with a small homeland.

The Sucha Beskidzka district is an example of local initiatives for sustainable development and completed projects were aimed at human health protection and the preservation of valuable natural areas. In several years a number of important projects was completed, while taking into account local problems, in particular disastrous air pollution. One of such undertakings was to increase the use of renewable energy resources and to improve air quality in the NATURA 2000 areas. More than 2300 solar collector kits were installed in individual buildings and in 5 public facilities. Also thermal modernization of public facility complexes was carried out and the waste

screening plant was modernized and equipped with modern equipment and solutions based on contemporary standards (District Office in Sucha Beskidzka, 2015).

2. The subject and area of the study

The subject of this study is environmental projects completed in the Sucha Beskidzka district to improve environmental quality, especially atmospheric air pollution and to gain measurable benefits due to energy savings and reduced building heating costs for thermal energy provision.

The completed projects were assessed for achieving the assumptions of sustainable development in terms of ecological, economic and social effects achieved.

The assessment was made based on the data submitted by the Sucha Beskidzka district, including the degree of environmental pollution, financial and economic calculations and economic and environmental analysis of the investment projects.

2.1. Characteristics of the Sucha Beskidzka district

The Sucha Beskidzka district is located in the Western Beskids and is a typical mountainous area. Forests occupy more than 50 % of its area. Mountain ranges running across the district belong to the Żywiec Beskids. The Babia Góra massif distinguishes itself with Babia Góra, the highest peak in the Żywiec Beskids that stands 1724.6 m above sea level. Tourist attractions in the district are beautiful landscapes. The area is attractive to tourists – they do mountain walking, skiing and mountain biking (Listwan et al., 2002: 7-11). There are valuable natural areas in this region. The Babia Góra National Park is located in its southwestern part, in the Zawoja Commune. Natural values of the Babia Góra National Park are highly appreciated not only in Poland, but also abroad. The Babia Góra National Park was established in 1954. In 1977 the Park acquired the status Biosphere Reserve conferred upon by the UNESCO International Coordinating Council, thus was included in the “Man and Biosphere” programme. Scientific research is conducted here (Ptaszycka-Jackowska et al., 2002: 156-159).

The Sucha Beskidzka district as a self-government unit contains nine communes, including two towns, one municipality and 6 rural communes. The district covers an area of 686 km², i.e. about 4.5 % of the total area of Małopolskie voivodeship. The population reached 84,142, population density is 123 people per sq km. According to the Statistical Office in Kraków (2015)

64 % of population is in working age, 45.2% professionally active citizens work in agriculture, 25.0 % in industry and construction industry, 8.9% in service sector, and 8.9% in financial sector.

2.2 Environmental issues in the Sucha Beskidzka district

According to the Voivodeship Environmental Protection Inspectorate in Kraków, there is rather poor air quality in the Sucha Beskidzka district – especially in compact development areas and in urban areas. Air pollution shows an increasing tendency for many years. The primary source of pollution is low-height emissions from individual domestic coal-fired furnaces and plants and workshops situated in the district. The largest exceedances are observed in the heating season. The use of fossil fuels for heating does not meet environmental protection requirements and is the main cause of harmful pollution. Generally, furnaces and chimneys are not equipped with mechanisms or filters that could reduce dust and gas emissions. Pollution issues result often from ignorance of citizens who heat their houses by using waste materials or low-grade coal. Undoubtedly, an economic factor plays an important role. Both coal-fired boilers and electrical heating are highly unprofitable from the financial point of view. In addition, the situation is getting worse due to automotive exhaust emission (Skorut et al., 2008: 57).

The main substances polluting the local environment are sulphur dioxide and suspended particulate matter PM 10 as well fine solids such as ash, soot and asbestos.

In 2014 the concentration of sulphur dioxide in the Sucha Beskidzka district exceeded $17 \mu\text{g}/\text{m}^3$ – the largest value in małopolskie voivodeship. The town of Sucha Beskidzka belongs to locations of highest atmospheric air pollution. The primary substances emitted into the atmosphere include carbon dioxide, nitrogen oxides, sulphur oxides and ozone. Measurements made by Voivodeship Environmental Protection Inspectorate in Kraków evidently indicate severe levels of air pollution in the Sucha Beskidzka district. The district area was classified by the Voivodeship Environmental Protection Inspectorate in Kraków as zone C, that indicates air pollutant concentrations significantly exceeding the allowable levels (Pająk et al., 2015: 20). Due to the fact, that the Sucha Beskidzka district is not an industrial area and environmental pollution results from burning coal and other power fuels in ovens for heating apartments and water preheating – mainly in citizen's private houses – actions were undertaken to reduce atmospheric air pollution. Elimination or reduction of hazardous substances has a significant effect on human health and improvement of everyday living conditions for the Sucha Beskidzka district communities. For low

earnings of people living in the Sucha Beskidzka district, introducing alternative cheaper sources of domestic hot water acquisition was of utmost importance.

3. Environmental quality improvement projects in the Sucha Beskidzka district

3.1 Installation of solar collectors

The programme for increasing the use of renewable energy sources and improving air quality in the NATURA 2000 areas – the Sucha Beskidzka district was started from activities related to completion of the project in 2007. Although the work within the framework of the project was completed in August 2013, the project monitoring will be continued by December 2018. The project entailed the purchase of solar collector systems and their installation on individual houses and public facilities. Acquiring funds for financing the project was an important issue. Collector installation and system replacement were financed by donors. The four financing sources were gained: donations from the Swiss-Polish Cooperation Programme; National Environmental Protection and Water Management Fund in Warsaw; Voivodeship Environmental Protection and Water Management Fund in Kraków and their own contribution of the inhabitants of the district at amount of about 16 % of the entire investment amount. The cost of all project-related operations was 32.5 million PLN. The cost of single solar collector system was 12,000 PLN.

Total surface area of all collectors installed in the Sucha Beskidzka district is 15,076 m², that corresponds to total output power of 12.59 MW. In turn, total capacity of tanks used in solar installations is 725,900 litres. The installed devices include flat solar collectors most often roof-mounted ones, water heaters and pump and conductor units.

2,349 installations were mounted on private houses – residential houses and on 5 public facilities: District Hospital, 2 Nursing Homes, School Complex and Indoor Swimming Pool. 11,534 inhabitants of the Sucha Beskidzka district participated in the program. (District Office in Sucha Beskidzka, 2015).

3.2 Thermal modernization

The project entitled “Improving energy efficiency of facilities in the Sucha Beskidzka district” was initiated in 2008 and was completed successfully in 2013. Within the framework of the project 10

buildings were thermally modernized and opened for public use. These facilities are managed and maintained by the district self-government. The scope of the project included installing wall and ceiling insulation, replacing doors and windows. Also radiators with thermostats were replaced, and in some houses coal-fired boilers were replaced with natural gas-fired ones. The total cost of the project was 5,266,348.00 PLN. The project was financed from the three sources: donations from the National Environmental Protection and Water Management Fund in Warsaw, low-interest loan granted by the National Environmental Protection and Water Management Fund in Warsaw and a loan granted by the Voivodeship Environmental Protection and Water Management Fund in Kraków. Environmental Protection and Water Management Fund in Kraków awarded a donation for this purpose. The remaining amount was supplemented from the district budget (District Office in Sucha Beskidzka, 2015).

3.3 Modernization of municipal waste screening plant

In 2003 in Sucha Beskidzka the waste screening plant and municipal waste landfill were launched. At the end of 2013 and the beginning of 2014 the work on “Modernization of Municipal Waste Screening Plant and Landfill Site in Sucha Beskidzka” was started and completed in November 2014. A modern mechanical biological waste treatment system was purchased. Modern composters for biodegradable waste were installed. The aim of this project was to establish a waste management system adopted to legal requirements and an effective screening plant capable to automatic processing of municipal waste at amount of 30,000 tonnes annually. The modernized screening plant can manage waste generated in southern region of the Małopolskie Voivodeship by 150,000 inhabitants according to the Małopolskie Voivodeship Waste Management Plan. Due to new solutions only 38 % of waste will be deposited in the landfill, while the remaining 62 % will be recycled or recovered. Within the framework of the program an action entitled “SEGREGATE TO SAVE THE EARTH”. Its goal was to make the inhabitants aware of the importance of waste segregation. Segregated waste materials were exchanged for tree seedlings – 1,500 tree seedlings were handed out (Modernization of District Municipal Waste Screening Plant and Landfill Site in Sucha Beskidzka, 2015).

The above mentioned project was initiated and completed by the Association of Municipalities of the Upper Skawa Basin Świnna Poręba – an organization bringing together four communes of the Sucha Beskidzka district.

The cost of this investment project was 10,102,888.10 PLN. A donation from the Cohesion Fund at amount of 73.93 % of the total project price was granted. The remaining amounts were gained from a loan granted by the Voivodeship Environmental Protection and Water management Fund in Kraków and own funds (Association of municipalities of the Upper Skawa Basin, 2015).

3.4 Development of sustainable tourism

The Babia Góra National Park belongs to the most valuable district natural areas. For such important and valuable region the Association of Babia Góra Municipalities was established in 1995. This was initiated by self-government activists. At present the organization brings together 14 communities from the districts of Sucha Beskidzka, Nowy Targ, Wadowice and Żywiec. They cover 1,038.9 km² – including 604.8 km² of the Sucha Beskidzka district. The association collaborates with 11 Slovak municipalities. The association is governed by the Circle of Highland Landholders – Management and Council of the Elders – representatives of individual municipalities. The association works to develop social and economic system based on its own values. Besides working for sustainable economy and protection of natural and recreational values in the Babia Góra area, the aim of the association is preserving and developing national heritage and promoting “small homelands” (Leśniakiewicz, 2015: 3-9). Natural values of the Sucha Beskidzka district cause that this area is an attractive place for tourists. There are many hiking trails and increasing number of biking trails as well as expanding tourist accommodation capacity. Preservation of valuable natural areas is the highest priority for self-government units. To achieve social goals, educational trips and ecological competitions are organized. It is also planned to establish the “Leskowiec” beech forest reserve.

4. The results of projects completed in the Sucha Beskidzka district

The largest challenge facing self-government units and inhabitants of the Sucha Beskidzka district is improvement of environmental quality, especially atmospheric air. This translates directly into human health. There are many valuable natural areas in the region that should be protected and maintained for future generations. The district authorities and inhabitants are aware of it and bring together in associations and other social organizations to strive for funds necessary for completing projects in compliance with sustainable development, as mentioned above. The projects completed

in the Sucha Beskidzka district in recent years brought measurable effects. Some of them are presented below.

4.1 Environmental effects

The primary source of atmospheric air pollution in the Sucha Beskidzka district is low-height emission, especially in the heating season. The methods of house heating before commencing the project for increasing the use of renewable energy sources are presented in Table below.

Table 1 Energy sources used for house heating in the Sucha Beskidzka district in 2008

Item	Energy source	Share [%]
1.	Hard coal-fired boilers	60%
2.	Electrical heaters	35%
3.	Natural gas-fired heaters	4%
4.	Heating oil-fired devices	1%

Source: Author's own elaboration based on: materials published by the Sucha Beskidzka District Environmental Protection Department, 2015.

It follows from the table presented above that hard coal had the largest share of 60% in house heating. This was very disadvantageous to the environment, since this raw material contains sulphur, oxygen, nitrogen and hydrogen. When burning oxides of these elements are formed and solid waste such as ash, slag and dust. In turn, solar collector systems are fully safe and have no adverse environmental impact. They are fully environmentally friendly and emit no substances toxic to the environment.

Table 2 lists harmful substances emitted to the atmosphere before installing solar collectors and emission levels after installation.

Table 2 Reduction of harmful substance emissions

Pollution in Mg/year	Dust	SO ₂	NO ₂	CO	CO ₂
Emissions before installing solar collectors	10.5414	25.9293	3.2414	107.6435	3,180.6387
Emissions after collector installation	0.0007	0.6205	0.1460	0.1825	18.81
Reduction	10.5407	25.3088	3.0954	107.4610	3,161.8287

Source: Author's own elaboration based on: materials published by the Sucha Beskidzka District Environmental Protection Department, 2015.

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After installation of solar collectors dust and carbon oxide emissions were almost completely eliminated. Sulphur dioxide emission was reduced by about 98 %, while nitrogen dioxide emissions were reduced by about 95%. These data clearly reflect ecological advantages from the use of solar energy.

Thermal modernization of buildings was aimed, besides financial profits – reduction of harmful substance emissions into the air due to firing boilers to obtain domestic hot water or building heating. Table 3 presents reduction of carbon dioxide emissions during one year due to thermal modernization investments.

Table 3 Reduction of carbon dioxide emissions during one year after thermal modernization

Energy carrier	Emissions before modernization [mgCO ₂ /year]	Emissions after modernization [mgCO ₂ /year]	Emissions reduction [mgCO ₂ /year]
Heating	1,143.35	550.62	592.7
Heat for domestic hot water	112.83	103.99	8.5
Total	1255,83	654,60	601,2
Emission reduction rounded to full tonne [mgCO ₂ /year]			601
Percentage reduction			48 %

Source: Author's own elaboration based on: materials published by the Sucha Beskidzka District Environmental Protection Department, 2015.

Environmental advantages resulting from waste utilization in the modern waste screening plant are important from ecological point of view.

4.2. Economic and financial effects

Completion of the projects presented above required quite high financial expenditures. Nevertheless, it is possible to evaluate profits these investments will bring in the future.

The District Office commissioned a financial and economic analysis of the programme for increasing the use of renewable energy sources. Savings resulting from using renewable sources were calculated. A continuous rise of fossil fuel prices, oil, coal, natural gas and electricity is observed. It should be noted that solar energy is delivered free of charge and without intermediaries. Therefore, the cost of hot domestic water heating will be reduced even to zero

during summers, and by 30% in winters. It is estimated that bills paid in the winter season may be lower at least by one third (Skorut et al., 2008: 60).

Annual savings resulting from supplying hot domestic water from solar collectors expressed in PLN are presented in table below.

Table 4. Savings from preparation of hot domestic water.

Primary energy source	Energy production replaced with solar collectors [GJ/year]	[PLN/GJ]	Annual savings [PLN]
Coal-fired boilers	29,912	38.73	1,158,527.03
Electricity	696	161.27	112,241.23
Natural gas-fired boilers	1,618	60.85	98,457.35
Oil-fired boilers	1,391	98.35	136,811.96
Wood-fired boilers	2,087	44.68	93 240,34
TOTAL			1,599,281,87

Source: Author's own elaboration based on: Solarsystem sc. 2010.

As follows from Table 4 financial savings from replacing conventional boilers with solar collectors reach 1,599,281. 87 PLN yearly (Skorut et al., 2008). For such not large district this is a significant amount. This not the only savings – also means for environmental charges will be saved. From economic point of view the large convenience of solar installations is that they require no power supply, thus the need of fuel storage is eliminated.

Yearly environmental and financial benefits are presented in Table 5.

Table 5. Savings from pollution reduction.

Air pollution reduction	mg	PLN/mg	Annual savings [PLN]
CO ₂	3 137.88	0.36	1,119.56
SO ₂	26.05	636.27	16,576.36
NO _x	2.15	636.27	1,370.22
Pyly	16.74	428.78	7,177.37
CO	162.10	152.15	24,662.78
Sadza	4.03	177.05	712.78
BAP (Benzo[a]pyrene)	0.03	45,516.15	1,465.60
TOTAL			53,084,67

Source: Author's own elaboration based on: Solarsystem sc. 2010.

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Annual savings resulting from lack of environmental charges are 53,084.67 PLN. The figures presented above show measurable profits of the project.

Also for the thermal modernization project it is possible to calculate a profitable economic effect. An analysis of 10 modernized facilities in terms of heat savings was carried out. The results are presented in Table 6.

Table 6. Total heat demand for 10 facilities before and after thermal modernization.

Energy demand characteristics	Before modernization	After modernization	Heat savings
Building heating [GJ/year]	16, 647.52	8,345.98	8,301.54
Hot domestic water production [GJ/year]	1,557.16	1,479.04	78.12
Sum of heating + hot domestic water [GJ/year]	18, 204.68	9,825.02	8,379.66
Sum of heating and water [MWh/year]	5,056.86	2,729.17	2,327.68
Energy saving due to thermal modernization [MWh/year]			2,327.68
Annual energy savings in PLN			439,965.08

Source: Author's own elaboration based on: materials published by the Sucha Beskidzka District Environmental Protection Department, 2015.

Despite of a high project cost, annual energy saving are significant. An analysis does not consider continuously increasing prices of electricity and fossil fuels. Taking such costs into account for many years would bring much more profitable effects of the project.

4.3. Social effect

Each of completed projects required the commitments not only their initiators or local authorities, but was addressed directly to inhabitants. Thus, the project itself contributed to an increase of environmental awareness among local communities. The activities connected with the programme for increasing the use of renewable energy sources and improving air quality in the Natura 2000 areas in the Sucha Beskidzka district bring an excellent opportunity for promoting and understanding environmental protection solutions and improving environmental behaviour among inhabitants. When conducting the projects a number of meetings with self-government activists and inhabitants were arranged. Websites containing all project details were created. Children and

adolescents were involved by introducing educational paths, organizing educational competitions or trips, for example to newly modernized waste screening plant or to the Babia Góra National Park. Such activities have an influence on changing social behaviour and increase awareness of responsibility for the environment and concern of the region, i.e. “small homeland”.

Natural values of the Sucha Beskidzka district cause that this an attractive place for tourists. Ecotourism becomes more and more popular among tourists, mainly young people. Promoting such ways of spending time may be profitable both for district budget and people who want to spend time actively in the region of attractive natural values (Łabaja 2009: 21-44). Booth local authorities and inhabitants strive for enabling as more people as possible to visit the Babia Góra area. Tourism increases profits for the region, however economic items should be equal to environmental protection, security and maintaining social order. This guarantees regional sustainable development of the region.

5. Conclusion

1. The concept of sustainable development is a challenge facing today societies targeted at providing good life conditions while keeping an equilibrium between economic growth and maintaining biodiversity, social equality and abundance of resources for future generations.
2. This is an universal idea both at global-international, national and local community levels. International organizations emphasize the significance of local initiatives for sustainable development of world economy according to the rule: “think globally, act locally”.
3. The Sucha Beskidzka district is an example how the sustainable development goals can be achieved at local level. The activities undertaken by local authorities in favour of citizens – installation of solar collectors, public facility thermal modernization and construction of modern waste screening plant, initiatives for preserving region natural values and promoting “small homelands” brought measurable ecological, economic and social effects.
4. Environmental advantages related to good practices in the Sucha Beskidzka district include at first place reduction of gas and dust emissions polluting the air in the region, having an essential impact on human health and improving everyday living conditions, and reducing the greenhouse effect on a global scale.

5. The inhabitants of the Sucha Beskidzka district were interested particularly in modern environmentally friendly solutions and technologies. Their implementation not only improves an image of the site and pollution reduction, but also brings measurable benefits, e.g. reduction of heat energy costs or reduction of heat losses, waste management systems reducing environmental load.
6. A financial and economic analysis commissioned by the district authorities for programmes for increasing share of renewable energy sources and thermal modernization indicated an advantageous economic effect. The savings resulting from insulating the buildings and replacing conventional coal-fired boilers with solar collectors – especially at continuous rise of fossil fuel prices and low people earnings - were of great importance.
7. Local inhabitants attach a great importance to their culture and tradition. They take care of the Babia Góra environment as they highly identify themselves with their roots. Project preparation and completion was an opportunity for promoting the region, responsibility for and care of the region, “small homeland”. This made the inhabitants aware of environmental protection and making everyday decisions having an impact on shaping and developing the nearest environment.

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Działania lokalne w realizacji zrównoważonego rozwoju na przykładzie powiatu suskiego.

Streszczenie

Przedstawiony powiat suski położony w województwie małopolskim jest przykładem realizacji różnorodnych projektów służących mieszkańcom: montaż kolektorów słonecznych, termomodernizacja budynków użyteczności publicznej oraz budowa nowoczesnej sortowni śmieci, a także inicjatyw na rzecz ochrony walorów przyrodniczych regionu i promowania „małej ojczyzny”. Celem artykułu było zaprezentowanie w jaki sposób na szczeblach lokalnych można realizować cele zrównoważonego rozwoju osiągając efekty ekologiczne, ekonomiczne i społeczne. Analiza finansowo-ekonomiczna i efektów ekologicznych zrealizowanych projektów pozwala na stwierdzenie, że podejmowane przez powiat działania niewątpliwie wpłynęły na poprawę jakości życia ludności zamieszkującej powiat. Ograniczenie emisji szkodliwych substancji do powietrza atmosferycznego sprzyja zarówno zdrowiu mieszkańców jak i ochronie obszarów cennych przyrodniczo występujących na terenie powiatu: m. in. obszar Natura 2000 obejmujący Babiogórski Park Narodowy. Wykorzystanie odnawialnych źródeł energii to oszczędność kosztów ogrzewania oraz zmniejszenie zużycia energii. Działania te miały również wymiar społeczny. Po wprowadzeniu programów niewątpliwie zwiększyła się również świadomość ekologiczna miejscowej ludności - potrzeba dbałości o najbliższe środowisko naturalne oraz poczucie tożsamości regionalnej mieszkańców powiatu.

Słowa kluczowe: zrównoważony rozwój, lokalne działania, poprawa jakości życia, odnawialne źródła energii, powiat suski.