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Sustainable Development and Tourism. Example of Investments Connected with the Installation of Solar Collectors in Seaside Lodging Facilities

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1. Introduction

Tourism is one of the most dynamically developing sectors of economy, particularly in those states and regions which possess such values that are essential for its development. This concerns seaside areas among others, where almost 25 per cent of lodging facilities in Poland are concentrated. Tourism brings about notable economic benefits both to the local population and to local governments by supplying local budgets with incomes from taxes and local charges. The economic significance for the development of regions has on many occasions been the subject of research by various authors, who demonstrated a multifaceted favourable influence both on economic and social changes. However, tourism also means an exploitation of natural values. A high intensity of the tourist movement exerts an influence on a degradation of these values, and thus it considerably lowers their original value. As a consequence, there arises a question about a sustainable development of those tourism destinations where tourism constitutes an essential economic factor. The intention to balance the dynamic development of lodging facilities and the infrastructure that accompanies local tourist product necessitates search for those solutions which will limit the negative external effects to the environment and will contribute to sustainable development.

As a result of the climate and energy package that was approved in March 2007 by the European Parliament and the leaders of the EU Member States, attention was paid to three main areas owing to which the idea of sustainable development can be pursued. In the package, three basic objectives were presented which refer to a reduction of the emission of greenhouse gases by at least 20% by the year 2020 in comparison with the base year 1990, an increase of the participation of energy from renewable resources in the consumption of final energy up to 20% by the year 2020, including a 10 per cent share of biofuels in the consumption of propellant fuels as compared with the fuel and energy demand forecast. The approval of this policy makes the EU Member States undertake activities aimed an application of new solutions in the area of energy production and management. Renewable energy resources constitute one of those solutions with the aid of which two of the abovementioned goals can be realized.

In connection with the above, the authors of this study accepted as their main objective an analysis of the possibilities to use solar power by those facilities that provide lodging services located in the seaside strip. A hypothesis was accepted according to which an application of zero-emission solutions in the form of solar collectors especially in tourist facilities can be an important factor in the pursuit of the idea of the sustainable development of tourism. An attempt was made to provide answers to a number of questions concerning sustainable development in tourism, the intensity level of tourism movement in seaside communes, the emission of greenhouses gases by tourist facilities and also possibilities to use such energy generating equipment as solar collectors.

2. Idea of sustainable development in tourism

2.1. Sustainable development

The notion of sustainable tourism refers directly to the idea of eco-development or sustainable development. Sustainable development was defined for the first time in a declaration issued by the UN Convention in Stockholm in the year 1972, while the principles of sustainable development were formulated in the year 1987 by the World Commission on Environment and Development in the report entitled “Our Common Future”. In the year 1992 in Rio de Janeiro, during the “Environ-

ment and Development" conference, the majority of the participating states signed a declaration which expressed an obligation to implement the rules of a new social and economic development [45].

Writers generally trace the origins of the term 'sustainable development' back to a 1987 World Commission on Environment and Development report entitled Our Common Future (also known as the Brundtland Report, after the chair of the group commissioned to prepare it), where the term was first used to bring together the apparently disparate concepts of economic development and environmental conservation [14].

The Brundtland Commission Report [44] stated that 'Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs'. M.B. Ekinci stattes that Sustainable development can be defined as; 'sustaining the existence of all living creatures together in harmony and without any threat to each other [12].

The concept of sustainable development is based on four basic principles, namely:

- The principle of environmental sustainability, which provides development to be compatible with the maintenance of vital ecological processes, biological diversity and biological resources,
- Principle of social sustainability, providing development be compatible by traditional values of a community, while adding strengthening of their identity and providing cultural development to be compatible with the cultural values of human community, which also has an impact on the strengthening of their identity,
- The principle of sustainability – economic development to provide a cost effective and resource to be managed in a way they can use and future generations [1].

Sustainable development is determined by four major parameters, as follows: technology development, capital development (development of the banks), social development and protection of the natural environment. Of course, the issue is that all of those 4 parameters must develop in accordance with certain proportions because if one of them dominates over the others, it automatically delays and stops the development (in this case, the general value increase) of the other parameters [29].

The problem of sustainable development translates into a widely understood tourism economy. According to B. Garrod and A. Fyall, the term 'sustainable tourism' is derived from the more general concept of 'sustainable development', the former being a specific term used to denote the application of the latter to the particular context of tourism [14].

Although definitions of both sustainable development and sustainable tourism vary according to the different perspectives of the stakeholders concerned there is now considered to be general agreement on the key principles of sustainable tourism [2].

2.2. Sustainable tourism

The broad concepts of sustainability and sustainable development have been applied to specific sectors of the economy (e.g., tourism) [7]. According to J.M. Rempel, the concept of sustainable development, as applied to tourism, is about an evolving understanding of the complex and dynamic relationships between various parts of the social-ecological system [30].

"Tourism should be developed in a way so that it benefits the local communities, strengthens the local economy, employs the local workforce, and wherever ecologically sustainable, uses local materials, local agricultural products, and traditional skills. Mechanisms, including policies and legislation should be introduced to ensure the flow of benefits to local communities" [16].

The problem of sustainable tourism became the subject of many discussions in the 1990s. Recently, scholars have placed greater focus on the contradictions between the three aspects of sustainable tourism: economic, environmental, and social [34]. As with other subfields of the sustainable development literature, sustainable tourism is an area where the list of existing analyses is long and impressive [5].

Environment-friendly rules including a definition of sustainable tourism were formulated in the year 1996 in the document entitled Agenda 21 for travel and tourism industries: towards environmentally friendly and sustainable development, which was jointly prepared by the World Council of Tourism and the Earth Council. In this document, the sustainable development of tourism is defined as "development which allows the pursuit of the needs of present-day tourists and tourist regions, and at the same time it protects and strengthens the possibilities of future consumers and producers" [25].

The World Tourism Organisation defines sustainable tourism as "Tourism that takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment, and host communities [40]. This definition addresses the three main elements of Sustainability: Economic, Environmental and Social. Thereby, 'Sustainable tourism' signifies a condition of tourism based on the principles of sustainable development, taking "full account of its current and future economic, social and environmental impacts" [39]. Moreover, "Sustainable tourism development meets the needs of present tourists and host regions while protecting and enhancing opportunities for the future. It is envisaged as leading to management of all resources in such away that economic, social and esthetic needs can be fulfilled while maintaining cultural integrity, essential ecological processes, biological diversity and life support systems" [5]. B. Bramwell and B. Lane say that sustainable tourism is a positive approach aimed at reducing the tensions caused by the complex interaction of the tourism industry; tourists, the environment, and the hosts catering for holidaymakers [4]. A wide review of the definitions of sustainable tourism can be found among others in the study by H. Kiryluk, M. Borkowska-Niszczota [21].

According to J. Swarbrooke, sustainable tourism means a maximization of the economic, social, and environmental benefits of tourism, with a simultaneous minimization of costs [35]. B. Bramwell and B. Lane state that sustainable tourism is a positive approach that aims to reduce the tensions between the different elements in a complex tourist system: the tourism industry, the tourists, the environment, and the destination [4].

A review of scientific literature serves to prove that the notion of sustainable tourism is not only essential but it is also compound. This is explained among others by B. Mc Kercher, according to whom: sustainable tourism depends on: (a) meeting the needs of the host population in terms of improved standards of living in the short and long term (b) satisfying the demands of increasing tourist numbers and continuing the attract them to achieve this (c) safeguarding the environment to achieve the two foregoing aims [26].

It can be assumed that sustainable tourism is becoming a conscious and important element of present-day issues connected with tourist

travels. Generally speaking, this notion is connected with a number of more and more popular forms of tourist travels. This concerns the phenomenon of the so-called nature-based tourism. Approximately 10–20% of all international travel is related to nature experiences globally [38]. According to R.J.G. Van den Born, R.H.J. Lenders, W.T. de Groot, and E. Huijsman, 70–90% of people in Western countries claim to value nature-friendly practices [42]. A detailed analysis of the individual forms of sustainable tourism was carried out by F. Kilipiris, S. Zardava, who distinguished the following forms, i.e.: green tourism, alternetive tourism and responsible tourism [20]. The notion of ecotourism is related to the development of sustainable tourism, while ecotourism constitutes the "core" of sustainable tourism [45]. Ecotourism refers to the harmony of ecosystems and the cultural identity of residents. Through its activities, ecotourism provides funds for an effective protection of the values of the cultural and natural heritage. Ecotourism is a form of sustainable tourism, yet not every form of sustainable tourism is equivalent with ecotourism. This is the result of a wide context of sustainable tourism, which is not restricted to ecological objectives only but also includes the economic and social goals of those areas that host tourists, which correspond to the concept of sustainable development [27].

2.3. Indicators of sustainable tourism

In view of the development of research into sustainable tourism, apart from strictly theoretical studies (including discussions concerning basic notions), the issue of proper indicators (meters) that depict the level of the development of sustainable tourism (the so-called sustainable tourism indicators) began to draw more attention on the part of scientists. In recent years there has indeed been significant progress in the definition of indicators for the sustainable management of firms and tourism destinations [10, 11, 23]. The indicators of sustainable tourism are variables that could be measured and monitored for detecting the changing status of a particular phenomenon, and represent tools for gathering new information through which existing information can be filtered. This new body of compressed necessary information facilitates the identification of trends and threats and allows for undertaking the appropriate actions [1].

In spite of such a significant progress in the research into sustainable tourism, „(…) the method of delivering sustainable tourism is not

fully explored and although the concept has been widely endorsed, routes and directions for its practical application remain unclear" [31].

2.4. Negative influence of tourism on natural environment. Example of CO_2 emissions

The current development of tourism is a serious challenge for global climate change mitigation [9]. The tourism industry brings economic benefits to the country, but there are usually energy consumption and carbon dioxide emission associated with it [8]. A tourist not only uses direct energy in the form of petrol, gas and coal, but he (she) also uses indirect energy embodied in consumer goods such as services, food and products [43].

However, it is also likely that tourism development might have indirect effects on climate change through economic growth and energy capacity expansion. For example, an increase of tourism activities creates increased demand for energy at various functions such as transportation, catering, accommodation, and the management of tourist attractions [24].

This problem is very important because as stated by J.W. Lee, T. Brahmasrene, there has not been a time series approach to analyze the relationship among tourism, CO_2 emissions and economic growth for EU countries. This research questions whether tourism induces an increase in the CO_2 emissions and economic growth of the region. The questions are vital to disentangle the effect of tourism on both environment and economic growth in the region, where governments often make legislative responses to current environmental issues [22].

A study commissioned by the United Nations World Tourism Organization (UNWTO, 2008) estimated global tourism-related CO_2 emissions to be roughly 5% of total global emissions [40]. Most of these emissions are generated by the transport of tourists, in particular, air travel. Thus, the contribution of the tourism sector to climate change is on a global level and is substantial [22]. D. Scott et al. (2010) reported that the tourism sector could become a leading global source of greenhouse gases in the future [33]. While 5% of global emissions may appear insignificant when compared to other sectors such as agriculture, tourism is characterized by rapid growth. International tourist arrivals increased from 25 million in 1950 to 534 million in 1995, and 803 million in 2005. In the 2005–2007 period alone, international tourist arrivals grew by 100

million, reaching the 903 million mark. If this trend continues, tourism emissions will increase by over 150% by 2035 [UNWTO, 2008]. This growth in emissions must be considered in the context of emissions reduction targets as outlined by the IPCC (2008), which recommends to reduce global emissions by 50–80% by 2050 [33].

The problem of CO_2 emission emphasized above obviously is not only aspect of the negative environmental impact of tourism. To a significantly greater extent, this sector causes a number of changes, including those in the context of the abuse of water resources or excessive waste emissions [8].

3. Methodology

The research purpose accepted requires in the first order to have the intensity of the tourist movement examined. Seasonal tourist facilities located in those communes that border with the Baltic Sea were selected for purpose of the research. In the next order, an analysis was performed of the level of CO_2 emissions and the consumption of energy and hot water. Those indices which are available in literature were used at this stage. Numerical data concerning the number of lodging places in the seaside communes were obtained from the Bank of Local Data of the Central Statistical Office. In order to determine the consumption of water in the lodging facilities, values were accepted that are compliant with the water consumption standard in Poland, the Ordinance by the Minister of Infrastructure of 14 January 2002 on the determination of average water consumption standards (Journal of Laws No. 8 Item 70); it was accepted that 90% of water consumed is hot water above 40^0C.

The assessment of the determinants of the use of solar energy in tourist facilities was performed based on the average values of daily radiation in the individual months in the Middle and East Europe and the demand for hot water.

4. Lodging facilities in seaside communes

Seaside communes are the most counting tourist destinations in Poland. In the year 2012, the total number of lodging places in those communes was 168.6 thousand. This constitutes 25% of total lodging places in Poland. The communes possess 6.6 thousand of annual lodging

places, which constitutes 15% of total annual lodging places in Poland. In the year 2012, in the communes analyzed, over 14.5 million accommodations (23% on the national scale) were given. The seasonal nature of the tourist movement has an influence on the nature of lodging facilities, which in seaside communes function in the majority of cases in the summer period only. The total number of seasonal lodging places in these communes is ca. 90.1 thousand (cf. Table 1).

Table 1. Characteristics of seasonal lodging facilities in coastal communes
Tabela 1. Charakterystyka sezonowej bazy noclegowej gmin nadmorskich

No.	Type of lodging facilities	Number of seasonal lodging places
1.	Hotels	331
2.	Boarding pensions	1192
3.	Other hotel facilities	1074
4.	Youth hostels	125
5.	School youth hostels	539
6.	Holiday centres	47794
7.	Summer camp centres	6916
8.	Training and holiday centres	4316
9.	Hotels	19
10.	Houses of creative work	135
11.	Complexes of tourist cottage houses	6600
12.	Campsites	10595
13.	Camping grounds	4256
14.	Spa works	778
15.	Remaining non-classified facilities	5477
16.	**Total**	**90147**

From among the tourist facilities analyzed, holiday centres (over 47 thousand places) are characterized by the highest number of seasonal lodging places. Campsites possess a four times smaller number, i.e. over 10 thousand places, and summer camp centres possess almost 7 thousand. There is a low degree of the seasonal nature of accommodation in the case of hotels and spa works, which in the majority of cases function over the whole calendar year.

5. Assessment of CO_2 emissions from tourist facilities

The functioning of lodging facilities requires an involvement of considerable expenditures of energy (Fig. 1). The majority of this energy (61%) is used in the processes of heating, ventilation or air-conditioning. In the further order, energy is used in 21% to heat water and to operate lightning and electric devices (12%). The smallest amount of energy is consumed during the preparation of meals (6%).

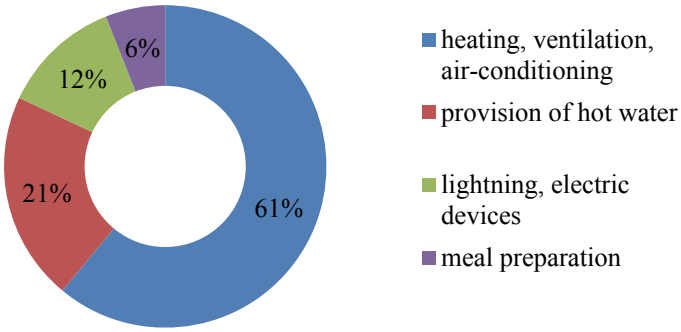

Fig. 1. Structure of energy consumption in hotels [28]
Rys. 1. Struktura zużycia energii w hotelach [28]

Depending on the type of accommodation, different levels are observed of the consumption of energy and CO_2 emissions. The energy consumption values presented by Gössling were accepted for the needs of the analyzes [15]. It results from these that hotels and, in the further order, cottage houses require the highest amounts energy in order to function (cf. Table 2).

The lowest demand occurs in the case of boarding pensions and camping grounds. The values provided here serve the purpose of the determination of CO_2 emissions from lodging facilities located in the seaside communes.

The high consumption of energy occurs as a result of the provision of lodging and gastronomic services. It is estimated that those tourists that visit developing countries consume daily eight times more water than local residents. In the case of hotels, there is a very high demand for

electricity, which in connection with a high consumption of water causes that hotels have the highest negative environmental impact in the group of commercial and service buildings (Table 3).

Table 2. Assessment of average energy consumption and CO_2 emissions by type of accommodation [15]
Tabela 2. Ocena średniego zużycia energii oraz emisji CO_2 według typu bazy noclegowej [15]

No.	Type of lodging facilities	Consumption of energy for one visiting person per day [MJ]	CO_2 emissions for one visiting person [kg CO^2]
1.	Hotels	130	20,6
2.	Camping grounds	50	7,9
3.	Boarding pensions	25	4
4.	Accommodation offered without meals	120	19
5.	Holiday centres	90	14,3
6.	Cottage houses	100	15,9
7.	**Average**	**98**	**15,6**

Table 3. Estimated CO_2 emissions from selected tourist facilities
Tabela 3. Szacowana wielkość emisji CO_2 przez wybrane obiekty turystyczne

No.	Type of lodging facilities	Number of accommodations given within a year	CO_2 emissions per one visiting person [kg/person]	CO_2 emissions within a year [t/year]
1.	Hotel facilities	2339694	20,6	48198
2.	Camping grounds and camping sites	343596	7,9	2714
3.	Complexes of tourist cottage houses	236383	15,9	3758
4.	Other lodging facilities	8593619	15,6	134060
5.	**Total**	**11513292**	**-**	**188731**

The analysis carried out has demonstrated that seaside tourist facilities contribute to CO_2 emissions approximately on the level of 188.7 thousand t/year, out of which hotel facilities emit the smallest amounts, i.e. 2.7 thousand t/year, and the complexes of tourist cottage

houses: 3.8 thousand t/year. Considering the seasonal nature of seaside accommodation, emissions take place mainly in summer months with an intensive tourist movement.

6. Determinants of the use of solar energy in tourist facilities

In the opinion of the Institute for Eco-development, the realization of the guidelines of sustainable development can occur in three ways, i.e.:

- through the greening of travel agencies and other institutions that provide tourist services, which in practice means a change of their image in such a way that they become an evidence of tourism being environment friendly,
- through the greening of the tourist product, which means control of the tourist movement in a given region in such a way so not to abuse natural environment values and resources,
- through the greening of the creation process of the tourist product by orienting it onto sustainable development in the scope of all its segments and elements, starting from transport, accommodation, catering to various additional services [19].

In the last case, the methods can be used of the reduction of environmental pollution, which is generated as a result of the creation and consumption of the tourist product. In a holistic model of sustainable tourism, on the level of tourist reception, environment friendly energy economy is mentioned [37]. This includes typical activities connected with the operation of the tourist movement, such as the provision of lodging, catering or transport services. Connections need to be considered of tourism with the other fields of the regional economy including farming, forestry, public utilities and communication, where solutions from the scope of renewable energy resources are also used.

A renewable energy source is a source that utilizes the energy of wind, solar radiation, geothermal, marine waves, currents and outflows, river gradients and energy acquired from biomass, landfill biogas and also biogas generated in the processes of sewage discharge or purification waste, or decomposition of plant and animal remnants stored

[41].The basic feature of renewable energy resources is that energy is acquired from natural and permanently repeated natural processes [13]. This is the primary difference in relation to traditional non-renewable energy sources in the form of fossil fuels, such as hard bituminous coal, brown coal or petroleum, which in the process of combustion provide large quantities of greenhouse gases that are released into the atmosphere. In sustainable development, particular attention is paid to the accumulation of pollutants, which are mainly generated in highly urbanized and industrialized areas. This also concerns those tourist regions which accept large numbers of visiting people over a short period of time, which involves a high energy demand.

One of the possibilities in the area of renewable energy resources is the use of solar energy mainly by tourist facilities that provide their services in the summer season. According to Tańczuk and Zając, the annual density of solar radiation in Poland on a horizontal surface fluctuates within the range of 950–1250 kWh/m^2 (Table 4), while the average insolation is 1.6 thousand of hours per year [36]. Moreover, in the calendar year, meteorological conditions are characterized by a very uneven annual layout of insolation (Fig. 2). The highest insolation (80%) coincides with six months of the spring and summer season from the beginning of April to the end of September. The time of solar operation lengthens up to 16 hours/day in summer, while in winter it shortens to 8 hours/day. These conditions are favourable for the installation of solar systems in those seaside tourist facilities where the highest numbers of visitors are observed in summer months.

Solar radiation is characterized by a spatial diversification. In this respect, it also diversifies Polish regions. Its highest values occur in the seaside strip and in the eastern part of Poland. When accepting the average annual density of solar radiation, 1.07 thousand kWh with no heat losses can be theoretically obtained from one square meter in the seaside strip. The average operational efficiency of flat solar collectors is an annual average of 55 per cent (the maximum is ca. 80%), which to a certain extent will reduce this amount of energy to the level of 592 kWh. Therefore, it can be accepted that 1 m² of a solar collector allows a saving of 592 kWh of energy. Depending on the technology used, the installation of solar collectors involves savings.

Table 4. Potential useful energy of solar radiation in kWh/m^2 per annum in selected regions in Poland [36]
Tabela 4. Potencjalna energia użyteczna promieniowania słonecznego w kWh/m^2/rok w wyróżnionych rejonach Polski [36]

No.	Region	Year (I–XII)	Summer half year	Summer season	Winter half year
1.	Seaside strip	1076	881	497	195
2.	Eastern part of Poland	1081	821	461	260
3.	Central part of Poland	985	785	449	200
4.	Western part of Poland with the upper drainage basin of the Odra River	985	785	438	204
5.	Southern part of Poland	962	682	373	280
6.	South-west part of Poland including Sudety with Tuchowo	950	712	393	238

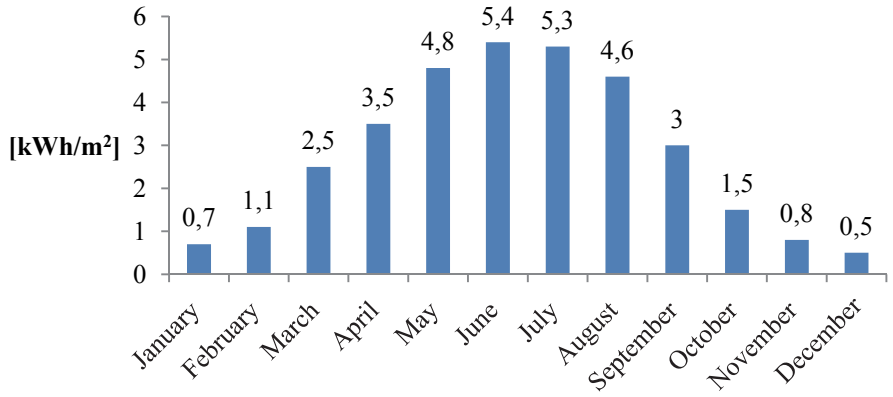

Fig. 2. Daily radiation in individual months in Central and Eastern Europe [18]
Rys. 2. Promieniowanie dzienne w poszczególnych miesiącach w Europie Środkowo-Wschodniej [18]

Due to the spatially and temporarily diversified level of solar radiation, different productivity of liquid collectors (cf. Table 5) is obtained. The density of solar radiation on the surface of the collector is decisive for the possibility to heat water. For example, with the radiation density of 6kWh/m^2, 1.02 thousand dm^3 of hot water with the temperature of 40^{0}C

can be obtained. If we wish to obtain a higher temperature with the same radiation intensity, we will heat a smaller quantity of water.

Table 5. Efficiency of liquid collectors according to the daily dose of solar radiation [6]
Tabela 5. Wydajność kolektorów cieczowych w zależności od dziennej dawki napromieniowania słonecznego [6]

No.	Temperature of heated water in ^{o}C	Quantity of water in dm^3 within a day from 10 m^2 of collectors with daytime solar radiation dose being		
		3,0 kWh/m^2	4,5kWh/m^2	6,0 kWh/m^2
1.	40	330	660	1020
2.	50	150	340	550
3.	60	60	170	330
4.	70	20	80	190

The determinants concerning the use of solar energy in tourist facilities can be referred to the intensity of radiation in the individual months and in connection with the seasonal nature of tourism. The abovementioned phenomena are coincident as regards values. The highest solar radiation occurs simultaneously with a high energy demand, which results from the tourist movement intensity. Taking into consideration only the aspect of the reduction of CO_2 emissions without an analysis of the economic profitability of the investment, collectors can be used in seasonal tourist facilities to heat water.

The seasonal nature of the tourist movement may result in a diversification of the costs of energy producing installations. With variable solar radiation, in order to obtain the same energy production effectiveness in March as in June, July or August, the surface of collectors needs to be increased from 10 m^2 to 30 m^2. This involves a significant increase of the costs of the installation. Hence, the use of collectors in seasonal facilities will enable a decrease of the investment costs.

To assess the quantity of water which is consumed in lodging facilities situated in the seaside communes, Polish water consumption standards were used [32]. According to these standards, the consumption of water for one lodging place in a hotel is an average of 150 dm^3, while for camping sites and complexes of cottage houses this is 100 dm^3.

Table 6. Estimated area of solar collectors in relation to energy demand in summer months
Tabela 6. Szacunkowa powierzchnia kolektorów słonecznych względem zapotrzebowania na energię w miesiącach letnich

No.	Type of lodging facilities	Number of seasonal lodging places	Consumption of hot water[a]		Surface of collectors in m^2 [b]	
			dm^3/one person per day	m^3/day	July	August
1.	Hotels	331	150	45	50	66
2.	Boarding pensions	1192	150	161	179	239
3.	Other hotel facilities	1074	150	145	161	215
4.	Youth hostels	125	110	12	14	18
5.	School youth hostels	539	110	53	59	79
6.	Holiday centres	47794	150	6452	7161	9564
7.	Summer camp centres	6916	150	933	1036	1384
8.	Training and holiday centres	4316	150	582	647	864
9.	Hostels	19	110	2	2	3
10.	Houses of creative work	135	150	18	20	27
11.	Complexes of tourist cottage houses	6600	100	594	659	880
12.	Camping sites	10595	100	954	1058	1413
13.	Camping grounds	4256	33	126	140	187
14.	Spa works	778	150	105	117	156

[a] Values were accepted in accordance with the Polish water consumption standards, the Ordinance by the Minister of Infrastructure of 14 January 2002 on the determination of average water consumption standards (Journal of Laws No. 8 Item 70); it was accepted that hot water above 40^0C constitutes 90% of water consumed.
[b] Total daily radiation was accepted in July to be 5.3 kWh/m^2 and in August on the level of 4.6 kWh/m^2 [6]

The highest daily consumption of water in seaside communes occurs in holiday centres (6.4 thousand m^3) in the further order in camping sites (954 m^3), summer camp centres (954 m^3) and also in the complexes of tourist cottage houses (594 m^3) and training and holiday centres (582 m^3); cf. Table 6.

Assuming that the seaside tourist facilities analyzed function in summer months, i.e. in July and August (months with a great density of solar radiation) and are fully booked, the daily demand for hot water will be 10.2 thousand m^3. The highest daily consumption of hot water will be in holiday centres (6.4 thousand m^3), camping sites (954 m^3) and summer camp centres (933 m^3).

To heat this quantity of water (i.e. 10.2 thousand m^3) in July, with the daily radiation of 5.3 kWh/m^2, ca. 113 thousand m^2 of collectors is needed; in March, with the solar radiation of 2.5 kWh/m^2, the area of 308.6 thousand m^2 is required, that is almost three times as much. Tourist facilities have an opportunity to participate in sustainable development through the use of solar collectors, which will allow to acquire 21% of energy required for them to function, and to heat water.

7. Summary

1. The sustainable tourism is direct linked with the idea of eco-development or sustainable development; hence, apart from economic and social issues, it is equally focused on the problems of environmental protection including the emission of greenhouse gases. Those living services which are offered by lodging facilities require a high involvement of energy; thus, search for innovative solutions oriented onto low emissions of greenhouse gases in connection with energy production is important.
2. Accommodation facilities in Poland are characterized by a great concentration of lodging services. This particularly concerns the seaside strip, where 25% of lodging places are located on the national scale. Apart from this, seaside regions are mainly visited in summer months, i.e. in July and August. This causes a high intensity of the tourist movement and an energy demand over a relatively short period of time.
3. The use of energy in tourist facilities is diversified in relation to the facility type and the type of the services provided. The highest consumption of energy occurs in hotel facilities, while the smallest consumption is in the case of camping sites and camping grounds. This translates into CO_2 emissions related to the production of energy for the needs of tourists. It was estimated that the total CO_2 emissions in lodging facilities in seaside communes within a year amount to 188.7 thousand tones.
4. Hot water is one of the main factors that determine energy demand in lodging facilities. Solar collectors can be used to heat this water. The analysis carried out has demonstrated that in the case of seasonal facilities, the highest efficiency of the equipment and the greatest effectiveness of heat production is obtained in relation to the surface of collectors.

5. Investments connected with the installation of solar collectors may have a good impact on energy savings and they will contribute to reductions of CO_2 emissions in tourist regions. This constitutes an essential contribution to the sustainable development of tourism and also to the sustainable development of the region.

The analysis included in this article may constitute an introduction to wider research to take into consideration national and international aspects, for an example aspects all the Baltic countries. In the first case, research could cover comprehensive effects of the phenomenon analyzed, also in the context of the energy balance of Poland.

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Rozwój zrównoważony a turystyka. Przykład inwestycji związanych z instalacją kolektorów słonecznych w nadmorskich obiektach noclegowych

Streszczenie

Autorzy niniejszego opracowania przyjęli za cel główny analizę możliwości wykorzystania energii słonecznej przez obiekty świadczące usługi noclegowe zlokalizowane w pasie nadmorskim. Przyjęto hipotezę, która zakłada, iż zastosowanie bezemisyjnych rozwiązań w postaci kolektorów słonecznych szczególnie w obiektach turystycznych może być ważnym czynnikiem realizacji idei rozwoju zrównoważonego turystyki. Na potrzeby weryfikacji hipotezy podjęto próbę odpowiedzi na szereg pytań dotyczących istoty zrównoważonego rozwoju w turystyce, poziomu natężenia ruchu turystycznego w gminach nadmorskich, emisji gazów cieplarnianych przez obiekty turystyczne, a także możliwości wykorzystania urządzeń do produkcji energii takich, jak kolektory słoneczne.

Przyjęty cel badawczy wymagał w pierwszej kolejności zbadania natężenia ruchu turystycznego. Do badań wybrano turystyczne obiekty sezonowe zlokalizowane w gminach graniczących z Morzem Bałtyckim. W następnej kolejności wykonano analizę wielkość emisji CO_2 oraz zużycia energii i ciepłej wody. Na tym etapie wykorzystano wskaźniki dostępne w literaturze. Dane liczbowe dotyczące liczby miejsc noclegowych w gminach nadmorskich pozyskano z Banku Danych Lokalnych Głównego Urzędu Statystycznego. Do określenia zużycia wody w obiektach noclegowych przyjęto wartości zgodnie normą zużycia wody w Polsce, Rozporządzenie Ministra Infrastruktury z dnia 14 stycznia 2002 r. w sprawie określenia przeciętnych norm zużycia wody (Dz. U. Nr 8, poz. 70); przyjęto, iż 90% zużytej wody, to woda ciepła powyżej 40°C.

Ocenę uwarunkowań wykorzystania energii słonecznej w obiektach turystycznych wykonano w oparciu o średnie wartości promieniowania dziennego w poszczególnych miesiącach w Europie Środkowo-Wschodniej oraz zapotrzebowania na ciepłą wodę użytkową.

Przeprowadzone badania pozwoliły na sformułowanie następujących wniosków.

1. Turystyka zrównoważona nawiązuje bezpośrednio do idei ekorozwoju lub rozwoju zrównoważonego stąd koncentruje się równorzędnie obok spraw gospodarczych i społecznych również na problemach ochrony środowiska, w tym emisji gazów cieplarnianych. Usługi bytowe, które oferują obiekty noclegowe wymagają dużego zaangażowania energii stąd ważnym jest poszukiwanie innowacyjnych rozwiązań ukierunkowanych na niskoemisyjność gazów cieplarnianych przy produkcji energii.

2. Baza noclegowa w Polsce charakteryzuje się dużą koncentracją usług noclegowych, co szczególnie dotyczy pasa nadmorskiego, w którym zlokalizowane jest 25% miejsc noclegowych w skali kraju. Dodatkowo regiony nadmorskie są głównie odwiedzane w miesiącach letnich, tj. lipcu oraz sierpniu, co powoduje duże natężenie ruchu turystycznego i zapotrzebowania na energię w relatywnie krótkim czasie.
3. Wykorzystanie energii w obiektach turystycznych jest zróżnicowane ze względu na typ obiektu i rodzaj świadczonych usług. Najwyższe zużycie energii występuje w obiektach hotelarskich, natomiast najmniejsze w przypadku kempingów i pól namiotowych. Przekłada się to na emisję CO_2, która powstaje przy produkcji energii na potrzeby obsługi turystów. Oszacowano, iż łączna emisja CO_2 w obiektach noclegowych gmin nadmorskich w przeciągu roku wynosi 188,7 tys. ton.
4. Jednym z głównych czynników determinujących zapotrzebowanie na energię o obiektach noclegowych jest ciepła woda użytkowa. Do podgrzewania tej wody można zastosować kolektory słoneczne. Przeprowadzona analiza wykazała, iż w przypadku obiektów sezonowych uzyskuje się najwyższą sprawność urządzenia i efektywność produkcji ciepła w stosunku do powierzchni kolektorów.
5. Inwestycje związane z instalacją kolektorów słonecznych mogą wpłynąć na oszczędności energii oraz ograniczą emisję CO_2 w regionach turystycznych, co stanowi istotny wkład w rozwój zrównoważony turystyki, jak również rozwój zrównoważony regionu.

Zawarta w niniejszym artykule analiza może stanowić wstęp do szerszych badań, uwzględniających aspekt krajowy oraz międzynarodowy, przykładowo odnoszący się do wszystkich krajów bałtyckich. W przypadku tego pierwszego, badania mogłyby się odnosić do kompleksowych następstw analizowanego zjawiska, m.in. w kontekście bilansu energetycznego Polski.

Słowa kluczowe:
turystyka, rozwój zrównoważony, turystyka zrównoważona, kolektory słoneczne

Keywords:
tourism, sustainable development, sustainable tourism, solar collectors