Institut for Economic Promotion, Austrian Economic Chamber, Vienna, Austria

T.E.I. Thessaloniki Greece

Department of Tourism Management

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THE ROLE OF RENEWABLE ENERGY SOURCES IN REGIONAL TOURISM DEVELOPMENT

Branko Blazevic
University of Rijeka, Rijeka, Croatia[1]

Abstract: In this paper, the author focuses on the fundamental hypothesis that the adoption of a concept of regional sustainable development and the use of renewable energy sources are preconditions to organising an acceptable regional tourism offering based on an eco-philosophy The renewable development of tourism regions is the basic framework for research regarding opportunities for introducing renewable energy sources such as hydro energy, wind power, solar energy, geothermal energy, and biomass energy. The purpose of this paper is to indicate the real opportunities that exist for substituting conventional energy sources with renewable ones and the role of renewables in regional development from economic, environmental and sociological viewpoints.
It should also be noted that renewable energy sources have a strong regional importance and can contribute significantly to local employment.

Key words: renewable energy sources, tourism, sustainable development, regional economy.

INTRODUCTION

Spatial diversity as a platform for regional development demonstrates that, through the essential process of delocalising spatial contents, regions are not marked by rigid boundaries; instead, their demarcation lines must be as pliable as possible. Tourism regions as subsystems of a regional economy operate along the same lines, with emphasis being placed on much higher awareness. This implies the necessity of interregional relationships and delocalisation processes, and treats every tourism region

[1] **Branko Blazevic**, Ph.D., Full Professor, University of Rijeka, Faculty of Tourism and Hospitality Management, Opatija, Croatia.

not only as a mere subsystem of Croatia as a Mediterranean and European tourism region but also as a subsystem of the Croatian economic system. Regional tourism policies require a specific approach within economic policies and, according to the systems theory, they are but a subsystem of national tourism policies and a subsystem of regional economic policies.

The transition process and restructuring of Croatia's economy have the task of generating dynamic growth and development. Obviously, the natural, production and demographic factors existing within a regional spatial structure will have the greatest impact on the creation of a regional offering. When it comes to natural and energy resources, the tourism industry devises its regional offering and exerts the most influence in shaping the regional economic structure and, in turn, in determining and defining tourism regionalisation. Today's new concept of tourism development must be based on market principles, the complementarities of the coast and its hinterland, the principles of environmental equilibrium, the development principles of regions and sub-regions as operational wholes, and ultimately, on tourism regionalisation which plays a vital role in global processes.

Over the past few decades, renewable energy sources (RES) have acquired a growing role in the world's energy product. This is all the more true today, at the beginning of the new millennium. There is no dispute about the ever-greater importance of RES in fields of global climate protection, resource conservation and generally perennial sustainable development. Many studies on the future consumption of energy worldwide focus not only on the need for saving energy but above all on the necessity to increase RES involvement.

1. INTRAREGIONAL AND INTERREGIONAL DEVELOPMENT ISSUES AND RES

Regional problems are naturally of a long-term character, while market mechanisms seek to maximise effects in the shortest time possible (Blazevic 2007, 402).

Tourism regions are good examples of the functioning of the tourism sector that participates in interregional exchange to a much greater extent than other sectors and conveys impulses from the broader marketplace to the regional structure. These impulses are reflected in the development of regional specialisation, labour distribution, bringing about change to the existing regional structure (Magas 2003, 9-14). The ultimate effect of this entire process is the multiplication of regional income and employment.

1.1. Level of RES involvement in physical planning and regional policies

Any intervention in space is carried out in accordance to physical planning documents. The Physical Planning Strategy and the Physical Planning Program of the Republic of Croatia (Vuk 2006, 55) are strategic documents that determine guidelines

for long-term spatial development at the national level, and they are a platform for defining spaces in Croatia.

Rarely are RES exploitation facilities included in spatial plans. Notable in spatial plans for broader areas (spatial plans of counties) is that apart from a general statement in favour of the use of alternative energy sources (with the exception of wind-power installations and small hydropower stations) the possibility of using renewable sources is not even mentioned.

The spatial development plans of counties specifically define areas within which it is not possible to site RES facilities, but only in some plans are the general conditions stipulated for siting small hydropower stations or locations specified for research in siting wind-power installations. Exact conditions and locations are to be specified in lower-level spatial development plans.

Out of 21 county plans, in eight, no mention whatsoever is made of RES; in 13 plans, no RES locations are identified; and in 11 plans, it is stipulated that conditions for siting RES facilities will be determined in plans of more limited spatial levels (towns or municipalities). Only ten plans provide for the possibility of siting all types of RES facilities within a county, while in eight plans, the locations for RES siting have been determined (Vuk 2006, 55)

2. ENERGY-SECTOR DEVELOPMENT STRATEGY OF THE REPUBLIC OF CROATIA

Croatia's Energy-sector Development Strategy covers the period up to the year 2030. This extended period covers present and future technologies, change to relationships and methods in energy management, the time when Croatia is not yet an EU member and the time when it will join the EU. The period to 2010 will differ from the 2010 – 2020 period and even more from the 2020 – 2030 period not only with regard to issues that need to be addressed, but also with regard to how issues will be solved. To many questions, there is no answer today, and it is almost impossible to predict future technological development and the speed at which new technologies will be put to commercial use.

In Croatia's Energy-sector Development Strategy, targets have been set that relate to harmonising sustainable development and the existing energy management system (Strategija energetskog razvitka Republike Hrvatske, 2002)

The Strategy is based on present-day technologies used in the entire process of producing, transforming, transferring, distributing and consuming energy, as well as on the possibilities and characteristics of primary and transformed forms of energy today. The role of fossil fuels will undergo change, and it is not unrealistic to expect that by the middle of the next century end consumers will predominantly be using electrical energy and hydrogen-based energy. The issue of electricity production is a long-term open question to which there is no unambiguous answer today. The scenario of priorities and primary forms for electricity production can be expected to change as

environmental protection becomes more stringent and new technologies come into commercial use. Recognition to this in Croatia's energy development strategy is given through strategic support provided to natural gas in the first 10-year period.

2.1. Development scenarios

There are three scenarios for the development of the energy sector (Strategija energetskog razvitka Republike Hrvatske, 2002):

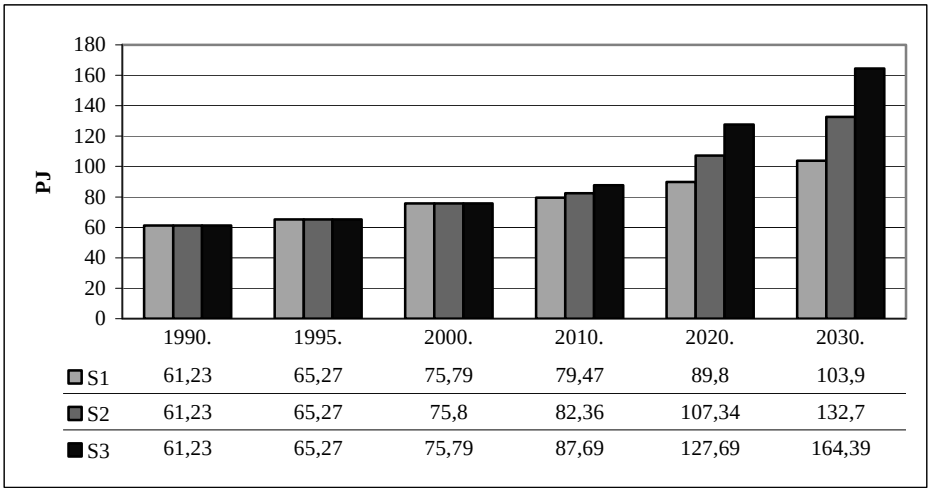
Scenario S1: ***Conventional technologies and no active government measures***. The basic feature of this scenario is that the inclusion of new technologies in the energy system will unfold at a slow pace. The scenario does not provide support to energy efficiency, RES or environmental protection.

Scenario S2: ***New technologies and active government measures.*** This scenario's basic feature is that it implies Croatia's accession to the EU, which should not only bring about good economic effects, but also good effects in the transfer of recent and more efficient technologies.

Scenario S3: ***Explicitly environmental scenario.*** The primary characteristics of this scenario are derived from the assumption that the global greenhouse effect and the concept of sustainable development in the world's energy arena will exert a considerable impact on redirecting and furthering the development of the energy sector.

A fundamental component of sustainable development is its constant concern for greater energy efficiency.

Chart 1. Comparison of energy production from renewable sources



	1990.	1995.	2000.	2010.	2020.	2030.
S1	61,23	65,27	75,79	79,47	89,8	103,9
S2	61,23	65,27	75,8	82,36	107,34	132,7
S3	61,23	65,27	75,79	87,69	127,69	164,39

Source: http://www.nn.hr/clanci/sluzbeno/2002/0839.htm, (30.09.2007)

A fundamental component of sustainable development is its constant concern for greater energy efficiency. The ultimate target of improvement is not to increase an energy system's technical efficiency but rather to enhance the quality and efficiency of the energy services it provides to end consumers. Energy efficiency can help considerably in stabilising the climate and in generally reducing harmful environmental impacts. The consequential energy efficiency policy also leads to creating new jobs, and ultimately to increasing the competitiveness of the entire national economy.

To reach these targets, however, market mechanisms alone will not suffice. There is a need, therefore, for formulating an integrated national strategy with a clear policy, measures and instruments that will ensure the effective implementation of energy efficiency.

2.2. RES potential in Croatia

Croatia has a large but mostly untapped RES potential. This potential primarily refers to wind power, biomass, small water courses and geothermal water; using solar energy to produce electricity is at present too expensive for widespread usage, unlike other resources that are technologically more feasible and commercially acceptable (Table 1).

Table 1 shows that small hydro power plants produce the greatest amount of electricity, and solar energy, the least. According to data from 2005, geothermal energy was not used in electricity production.

Table 1. RES-based electricity production in Croatia in 2005

Source	**Electricity production**
Sun	50.14 MWh
Wind	9.5 GWh
Biomass	10.9 GWh
Small hydro power plants	108.3 GWh
Geothermal	0

Source: Vuk, B., *Energija u Hrvatskoj*, Ministarstvo gospodarstva, rada i poduzetnistva, Zagreb, 2006., 187

2.3. RES development opportunities

RES usage can play a vital role in promoting many of Croatia's objectives. The development of the RES sector could, in the long run, help to (Strategija energetskog razvitka Republike Hrvatske, 2002):

- increase energy efficiency,
- diversify energy production and ensure supply,
- increase domestic production and reduce the import of energy products,

- significantly reduce the environmental impact of the energy sector,
- create new jobs and encourage investment in rural areas, areas of special national concern, coastal areas and the islands.

Care for renewable sources is carried out on the basis of National Energy Programs initiated in 1977 by the Government of the Republic of Croatia, of which the following are especially important to this issue (Strategija energetskog razvitka Republike Hrvatske, 2002):

- **BIOEN** – ***Biomass and Waste-based Energy Program***: By 2020, the production of energy from biomass and waste – for which Croatia possesses real potential – could secure at least 15 percent of the total consumption of primary energy
- **SUNEN** – ***Solar Energy Program***: The program has demonstrated that the use of solar energy in combination with UNP and/or natural gas is an acceptable solution, in terms of technology and the environment, for Croatia's coastal area. By 2020, it is expected that solar energy will meet up to five percent of all non-industrial needs.
- **ENWIND** – ***Wind Power Program***: Wind power, as an environment-friendly and available domestic resource, represents an untapped energy source that could help to meet a part of energy-related needs in Croatia.
- **GEOEN** – ***Geothermal Energy Program***: In exploiting geothermal energy, it is necessary to create conditions that will increase the usage level of geothermal energy in existing facilities. Usage is expected to increase tenfold.
- **MAHE** – ***Small Hydropower Plant Program***: The primary objective is to plan the construction of small hydropower plants and to eliminate all barriers to and ensure all conditions for enlarging the building of small hydropower plants in Croatia.

Use can be made of solar energy available across all continents, as well as of wind power, hydropower, the power of waves and sea currents, biomass that grows anew every year, and geothermal energy. All of this energy amounts to approximately 3,000 times the amount of the world's energy requirements today, and it represents the theoretical potential for RES exploitation. In determining the size of this potential, a number of criteria must be taken into consideration, such as (Potocnik and Lay 2002, 84):

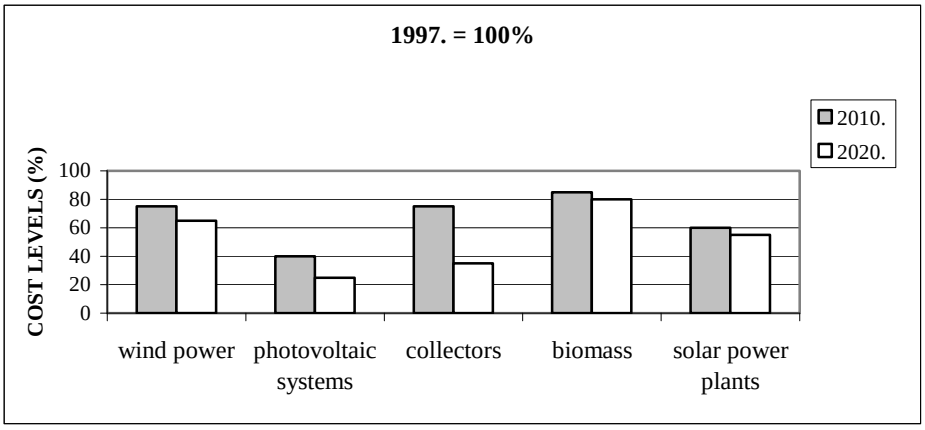
- Efficiency limits, the size of facilities and the technical and development potential of technologies currently available
- Constraints to exploitation due to site dependency (e.g., geothermal energy), limited transportation radius (e.g., biomass), availability of usable areas or competitive forms of energy exploitation (e.g., solar collectors, solar cells)
- Environmental restrictions regarding the open area required (e.g., for wind farms), impact on the water systems (e.g., hydro energy), and the limited possibilities of using biomass.

Because of these reasons, the technical potential of RES is not a readily definable quantity. Nevertheless, it does provide a sure solution for the longer term and points to the great importance that RES will have in the future. For example, renewable energy sources are expected to meet 50 percent or more of the world's energy needs by the mid twenty-first century.

Subject to market expansion and an increase in turnover, today's RES prices could be cut back by 20 percent to 70 percent in the mid term. The greatest potential for reducing electricity prices lies in photovoltaic systems.
The following chart illustrates the potential for reducing RES costs.

Providing the predictions for market and turnover growth come about, the cost of electrical energy from wind farms is expected to drop to 75 percent by 2010; from photovoltaic systems, to 40 percent; from small solar collector systems, to 75 percent; from biomass processing facilities, to 85 percent; and from solar power plants, to 60 percent, as Figure 7 illustrates. Following this and providing these markets remain stable, a further drop in prices can be reckoned with: relative to today's prices, prices after 2020 could drop down to 65 percent for wind power, 25 percent for photovoltaic systems, 35 percent for solar collectors, 80 percent for biomass, and down to 55 percent for solar power plants.

Chart 2. Potential for reducing renewable energy costs



Source: Potocnik, V., Lay, V., 2002, Obnovljivi izvori energije i zastita okolisa u Hrvatskoj, Zagreb, p.87.

Great importance is attributed to RES development and expansion in Europe, in particular, in the EU, because of its role in environmental and climate protection (Kyoto Protocol), ensuring energy supply (reducing energy imports) and providing local employment.

In 2004, renewable energy sources were the third largest producers of electricity after coal and natural gas, but ahead of nuclear energy and oil. Hydro energy accounts for almost 90 percent of electricity produced from renewable energy sources;

biomass, for 6 percent; and solar energy, geothermal energy and wind power together accounting for 4.5 percent.

According to a development scenario (International Energy Agency, 2006) of renewable sources for 2030, RES will play a major role in electricity production. Data indicate that the production of electrical energy from renewable sources will increase from 3,179 TWh u 2004 to 7,775 TWh u 2030. (Table 2).

Table 2. Global increase of renewable sources

	2004	2030
Electricity production (TWh)	**3,179**	**7,775**
Hydro energy	2,810	4,903
Biomass	227	983
Wind power	82	1,440
Solar energy	4	238
Geothermal energy	56	185
Wave energy	< 1	25
Biofuels (Mtoe)	15	147

Source: www.iea.org/textbase/nppdf/free/2006/weo2006.pdf, (30.09.2007)

It follows that the share of renewable sources in the production of electricity in 2030 will amount to an incredible 38 percent, making it the second largest electricity producer after coal. Hydro energy will account for 16 percent of the production of electricity (the same as in 2004); biomass, wind power, solar energy and geothermal energy together, for 10 percent; and biofuels, for as high as 22 percent.

The highest contribution in the production of energy for heating is expected to come from solar collectors, followed by geothermal sources and biomass.

The EU plans to accelerate RES development and expansion. Two EU documents clearly illustrate this (Potocnik and Lay 2002, 92):

- The White Paper on RES Strategy and Action Plan
- The Directive on promoting electricity produced from RES.

These documents set out the targets for the expansion of renewable sources in the EU (Potocnik and Lay 2002, 92):

3. NEGATIVE FEEDBACK AND AUDITING RES IMPACT ON REGIONAL TOURISM DEVELOPMENT

In the feedback system, auditing is only one part of the cycle of Integrated Quality Management (IQM) in a tourist destination that must methodically monitor the elements defined in the planning system. These are prerequisites to a systems understanding of the level and structure of deviations, as the performance indicators of elements defined in the Master Plan of tourism development for a given destination. This is a way of calling attention to problems and pointing to a choice of measures to achieve the goal defined in the Master Plan, that is, to make the tourist trade, in the broadest sense, into a force capable of driving regional economic development.

Indicators result from empirical, quantitative and qualitative measurements based on specified starting points and they serve to assess situations in various areas of tourism development. Sustainable tourism development in a tourism destination calls for establishing and accepting environmental audit indicators (for the systematic auditing of investments in improving the environment) and quality audit indicators (for auditing continuous quality improvement and the effects of TQM). On the global tourist market, the approach to preparing these indicators is based on universally accepted standards of environmental control (ISO 14000ff, EMAS I, EMAS II…), as well as systematic quality improvement standards (ISO 9000ff). The application of these indicators is becoming a valuable, and even compelling, information basis for managing tourism development in tourist destinations.

3.1. Tourism-development indicators and RES

In creating information systems for the needs of tourism management in the destination - information that will be made available within a singular database and that has been gathered by surveying the tourist destination as well as target markets - it is necessary to take into account the themes provided by the WTO classification of indicators of sustainable tourism (Figure).

Databases at the tourist destination level created in this way will become an indispensable information basis in auditing development in accordance with the guidelines for sustainable tourism development. For the management of a tourist destination, this will become the fundamental information resources base for assessing the position of the tourist destination, that is, determining its actual level of development, detecting any deviations from the established model, and making a real evaluation of how far the destination’s current position is from the goal set in the Master Plan.

Figure 1. RES-related sustainable-tourism indicators according to WTO classification

Indicator	
1. Spatial protection *This refers to the level of protection and categorisation of protected areas according to the classification of the International Union for Conservation of Nature and Natural Resources (IUCN).*	**Ecological**
2. Development control *This indicator is used, prior to major projects, to detect whether studies have been conducted on the impact of these projects on the surroundings and the entire environment in accordance with legislation at the national, regional and local levels. The indicator represents responses on a 1 – 5 scale, with "1" signifying the absence of development control.*	**Economic**
3. Planning process *This indicator is also measured on a 1 – 5 scale. The score of "1" indicates that there are no formal, integrated development planning and actions in place (including tourism development planning); as the level of implementation increases, the score ascends to "5".*	**Economic**
4. Critical points of ecosystems *This indicator is based on the fact that the rarer the species of flora or fauna, the more interesting it is likely to be for tourists, and hence, the more vulnerable and exposed to stress it is likely to be. The indicator represents the number of species at risk, and it records the number of species, which have been eradicated (become extinct), preserved or stressed.*	**Ecological**
5. Tourist (consumer) satisfaction *This indicator is obtained by surveying tourists. The first group of questions relates to the quality of the tourism experience and they reflect the conditions at the destination and tourist expectations. The second group of questions focuses on tourists dissatisfied with service quality and the quality of the tourism experience.*	**Economic**
6. Resident satisfaction *This indicator shows the level of satisfaction of residents affected directly or indirectly by tourism development. A questionnaire is used to collect information. In conducting the survey, it is important to obtain a representative sample that will include all members of the local community.*	**Social**
7. Benefits of tourism to the local economy *The purpose of this indicator is to measure the extent to which the local economy is dependent upon tourism (the share of tourism in the economy, based on various indicators). The higher the level of dependence, the greater the risk will be for the economic system relative to fluctuations in the tourist industry.*	**Economic**

Source: prepared after WTO: What Tourism Managers Need to Know: A Practical Guide to the Development and Use of Indicators of Sustainable Tourism, WTO, Madrid, 1996.

The above indicates that only carefully selected indicators can provide an appropriate auditing basis for each implementation stage of the Master Plan of tourism development, following the recommendations of the European Commission and the World Tourism Organisation (WTO). This means that:

a) detecting problems as they emerge will become easier and better, and based on the deviations identified, measures will be taken to have them eliminated;
b) only indicators supporting sustainable development are acceptable; these are indicators capable of identifying constraints and potential opportunities;
c) indicators represent an essential resource base in the decision process of tourist destination management, as they are based on real methodological bases and theoretical and practical knowledge in the field of sustainable tourism development

CONCLUSION

The end of the last century was marked by increased energy consumption, as well as by increased efforts in exploiting new energy sources. In recent years, the use of renewable sources has become a live issue. Although forecasts regarding the use of renewable sources in the future may vary, they all agree that the share of renewables in energy production will continue to grow.

Despite this, however, renewable energy sources are still insufficiently engaged in the overall production of energy. The reason for this can be found in the lack of well-formulated legal frameworks, a lack of credit lines for the installation of production systems based on renewables, etc.

Most advanced countries and even developing countries today have in place programs for exploiting renewable sources, generally as part of their comprehensive environmental protection programs. Croatia is also a part of these efforts through its national programs for the use of renewables. The only way to ensure the best conditions for rapid development is through proper legislation, R&D, and the application of technology.

The natural potential of renewable energy sources is huge; the electrical, thermal or chemical energy that this potential can produce, in technical terms, exceeds by threefold the current consumption of energy worldwide. As early as the middle of this century, renewables are expected to meet 50 percent or more of the world's energy requirements. To accelerate the exploitation of renewables, often cited as a key to combating climate changes, renewable energy sources must be incorporated into all structural plans relating to energy supply and they must be taken into account when making vital investment decisions in the field of energy supply.

On the global tourist market, the approach to preparing these indicators of sustainable tourism development is based on universally accepted standards of environmental control, as well as systematic quality improvement standards. Among these indicators, renewable energy sources are steadily becoming ever more important, and the application of sustainability indicators is becoming an indispensable information basis for managing tourism development in tourist regions.

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