Economic Possibilities and Management of Solar Energy Use in Tourism

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ABSTRACT
Due to its geographical position and its climate conditions, Croatia as a tourism destination has numerous and completely untapped potentials in solar energy application. Every tourism coastal and island settlement could resolve their key issues in hotels, private accommodation, and other tourism bearers by applying the district heating/cooling systems. Specific condition along the Adriatic Coast should be indicated, with increase in energy security representing an important tourism factor. Authors' research, undertaken among the management of the Kvarner tourism destination, shows only 36% of hotels apply mostly one form of renewable energy source - solar energy, converting it into thermal energy for domestic hot water and heating systems, and seldom use photovoltaic systems for conversion into electric energy. Analysis of survey results of hotel management shows 64% of hotels use no forms of renewable energy sources, nor plan to apply them. The analysis results clearly indicate Croatian numerous benefits and opportunities for significant increase in use of renewable sources, particularly in camping tourism. Its efficacy depends on overcoming both the perceived and well-known barriers, and particularly on weak but in the future indispensable connection of all relevant policies – energy, industrial, agricultural, tourism, environmental protection, construction and areal planning – in order to ensure conditions for sustainable development, with renewable energy sources forming its essential part.

KEYWORDS: *energy independence, green camps, management, solar energy, support mechanism, tourism.*

JEL CLASSIFICATION: *L83, O10, O13, M10.*

INTRODUCTION

Solar energy is applied in electric energy production, in heating, and even in areal cooling. Its benefits are expressed in energy independence, environmental protection, and savings. Specific condition of the Adriatic coast of the Republic of Croatia, with its increase in energy security is extremely important for tourism. Summer peak load can be significantly reduced by use of solar energy in preparation of hot water.

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In order to assess the meaning of RES within the contemporary tourism management, recent secondary dates are presented which were applied for the purpose of comparison of the value of solar energy of Croatia with other parts of Europe. In the development of problems within the paper, the historical approach method was applied in order to indicate the importance of solar energy within the contemporary management of tourism companies.

In tourism industry, RES technologies are applied in obtaining thermal energy for hotel heating, water heating, and cooking. Obtaining thermal energy from solar energy is relatively old, but commercially viable way of use of this renewable source. Regarding the large consumption and the constant need for hot water, this technology has been applied in tourism. When using conventional energy sources, water heating represents by 12% of total consumption i.e. of energy costs of an average hotel. Eastern Adriatic coast and islands have almost all natural requirements to obtain highest ecological and energy standards. Therefore is troubling that neither energy nor renewable energy sources are mentioned in the strategy of Croatian Tourism Development by 2010.

Authors' research was undertaken among the management of the tourism destination of Kvarner in December of 2007, by collecting data on a sample of 11 hotels in the immediate tourism destinations of Lovran, Opatija, and Rijeka. The research was undertaken by method of interviewing, with questionnaires consisting in both open-ended and closed-ended questions. The obtained results are presented in the paper, indicating RES benefits for hotels, i.e. conversion of solar energy into thermal energy suitable for consumable hot water and heating. The method of interviewing was applied in testing the conversion of photovoltaic system into electric energy.

Camping sites represent the most suitable places for solar energy conversion for preparation of consumable hot water. Not only the need for hot water and sun energy availability overlap perfectly – from May to October, 75% of the annual insulation is obtained – but as a rule, camp owners and tourists in camping sites are interested in the environment and its preservation.

In spite of this, use of solar energy in camping places represents an exception, even in Mediterranean countries with a large number of sunny days as is the case in the Republic of Croatia. Solar energy must not be imported and does not pollute the environment, and therefore directly contributes to the preservation of environment and mitigates climate changes, at the same time increasing energy independence of the particular region. However, financial savings in energy costs are also important, as after the return on initial investment, heat production of solar systems becomes extremely convenient. A camping site with quality solar water-heating system equipment has all the prerogatives for a sustainable tourism form. In addition, use of solar energy in camps can often be used for promotional purposes as „green camps“, with its growing importance within the tourism market in attracting more tourists. Untouched environment and the opportunity to prove their respect for the environment give to camps clear competitive advantage – it facilitates the selection of a „green camp“.

Various environmental and security solutions increase production costs and, in case of no financial support from state and/or institutional systems, no increase in use of renewable energy can be expected. Thus all the activities are left to active enthusiasm of few individuals, whose share in total energy consumption is unfortunately negligible. There are

various forms of financial incentives which vary from country to country. For example, it can be mention: tax incentives, guaranteed purchase rates, fixed awards, green certificates, investment incentives, etc. Analysis results clearly indicate numerous advantages and opportunities for significant increase in use of renewable sources in Croatia. Success depends on overcoming the perceived and well-known barriers, particularly related to the poor but in the future necessary cooperation of all relevant policies – energy, industry, agriculture, tourism, environmental protection, building, and areal planning – in order to ensure the conditions for sustainable development, with renewable energy sources as its integral part. Through its energy strategy, Croatia should fully choose to use renewable energy sources in accordance with the principles of sustainable development.

1. POSSIBILITIES OF SOLAR ENERGY USE IN TOURISM

As natural resources are scarce in some countries, the low ratio of production to total energy supply will remain a challenge as economies and energy-intensive lifestyles need to be fuelled. This furthermore leads to high energy and emissions intensity per capita and thus increases Europe's environmental footprint. However, due to relatively 'clean' electricity and heat generation, and measures to reduce pollution of air and water, Western Europe scores well in environmental impact mitigation for the most part (World Energy Council, 2012). Due to its geographical position and climate, Croatia, as a tourist destination, has countless and quite untapped potential for the application of solar energy. Within the present structure of primary energy consumption in Croatia, 50% is represented by fossil fuels, 25% by gas, 21% by renewable energy sources, and approx. 4% by imported sources (coal, nuclear energy) (Labudović, 2002).

Within the overall consumption of Croatian household, electrical energy prevails by 40%, mostly consumed in thermal purposes (i.e. in hot water and heating). By 30% of Croatian households are situated on the coastline, in the hinterland, and on the islands, where the replacement of fossil fuels by solar energy is economically viable even today, particularly for all low-temperature applications: DHW, space heating, swimming pools, greenhouses, etc. Hybrid solar power plants are definitely a prospect for the application of solar energy (using solar energy and gas) in every Croatian tourism settlement on the coastline and on the islands, as precisely district heating and cooling could resolve the key problems in hotels and their managements, private accommodation, and other tourism bearers within the particular areas. The largest share in solar photovoltaic system for direct transformation of solar energy into electric energy is applied in Germany. The good example is represented by the German city of Freiburg, with solar energy as the main energy source. In such an environment Hotel Victoria (Hotel Victoria, $^{2012)}$ was developed – the most environmentally friendly private hotel in the world: hotel supplied by electric energy produced with no adverse effects on environment and therefore considered the „zero emission" hotel.

Solar energy is used for electric energy production, for heating, and even for space cooling, with benefits in energy independence, environmental preservation, and savings. Situation becomes particularly specific along the Adriatic coast, with extreme importance of energy security growth for tourism. Summer loads can be significantly reduced by use of solar energy in preparation of hot water consumption. In tourism industry, RES technology is applied in obtaining thermal energy for hotel heating, water heating, and cooking. Hot water generating from solar energy represents relatively old, but commercially cost-effective process in use of this renewable source. Due to large consumption and constant

need for hot water, this technology is applied in tourism. If conventional energy sources are used, water heating represents by 12% of overall consumption, i.e. of energy cost of an average hotel (Hrastnik et al., 2006).

Given this as well as the fact that water solar collectors have technical lifetime of over 20 years with relatively little maintenance, they are more profitable than photovoltaic panels and are therefore more applicable. Besides water heating, solar energy can also be applied for space heating. The difference between water heating and space heating consists in the surface of solar collectors. Solar heating energy can also be used for some similar needs, like swimming pool water heating. Successful project in swimming pool water heating has been undertaken in Glamsbjerg, Denmark in 1989 (UNEP, 2003). Comparison of costs of introduction and maintenance of the given system with the costs of energy derived from classical sources for swimming pool heating resulted in cost effective system after only 5 years of use, not taking into account positive environmental effects with no greenhouse gasses emission and other potential pollutants. Both Adriatic coastline and islands have almost all natural requirements for achieving the highest environmental and energy standards. It is therefore concerning that in the Strategy of Development of Croatian Tourism by 2010 no concept of energy and of renewable energy sources are mentioned (Ministry of Tourism, Republic of Croatia, 2010). Within the Master plan and within the Strategy of Development of Tourism of the Republic of Croatia by 2020, which is currently at the stage of public debate, green is mentioned as the philosophy of action **(**Ministry of Tourism, Republic of Croatia, 2012**).** This way of thinking must also change the philosophy of previous modes towards the sustainable one.

1.1 Possibilities of solar energy use in hotels

Philosophy of all highly developed societies tends towards complete independence on energy resources that are found elsewhere, while refusing unnecessary costs higher than really needed. Although Croatia is increasingly feeling the spirit of a new civilization, awareness of a brand new relationship towards energy and energy resources is far from the needed. Not to use solar energy in housing, in construction of hotel & tourism and sports & recreation objects, particularly within the area of coastal counties, is at the minimum extend unreasonable and irresponsible. Only by passive use of solar energy, hotels could save half the current cost of heating. (Unlike the active application of solar energy by thermal and photovoltaic transponders, the passive application of solar energy is based on derived construction elements and materials which should be optimally and on only aesthetically designed and functionally interlinked.)

If active solar systems were used to meet the remaining 50% of energy needs, which is actually possible by 80% (Labudović, 2002) within the coastal area, the present heating energy and DHW consumption could drop to only 10%. Hotels that are not open yearlong, cannot justify the installation of sophisticated solar boilers and must therefore seek for other solar solutions which do not require significant investments. In winter period, with a number of solar hours lower than in June and July due to shorter and cloudier days, solar collectors can produce just enough DHW for „winter guests“, while the existing conventional system will take care of heating, which will also ensure savings in fossil fuels. Hotel and catering complexes, large sports & recreation centers, greenhouses, and numerous other larger objects could solve the heating, DHW, and cooling problems based on solar boilers using liquid petroleum gas (LPG) as backup fuel. Use of solar energy in

combination with LPG and/or natural gas (or hydrogen) is technically and ecologically acceptable for the Croatian coastal area. A hybrid combination of solar energy, wind energy, and LPG can also contribute both to solving the energy infrastructure on islands and to driving the development of traditional island activities by engaging local resources in accordance with the strategic guidelines for the development of Croatian islands (Fond za zaštitu okoliša i energetsku učinkovitost, 2004). Today, we have green field tourism settlements which can be geometrically and architecturally shaped in order to obtain full autonomy by use of passive and active solar energy converters, particularly in summer months when most of the tourism activity is obtained (Labudović, 2002). Ecological solar tourism settlements necessarily represent ecological and tourism needs. Solar settlement should blend into the environment and use locally obtainable natural materials. It should also solve the wastewater problem in a satisfactory way. For instance, watering ornamental plants by use of purified water is recommended, particularly during the summer period. In order to determine the use of energy efficient technologies, the Fund for Environmental Protection and Energy Efficiency has in 2006 conducted energy audits in 124 hotels. Among those, only eight of them disposed of solar collectors, six of which related to water heating only, and only the remaining two had collectors for heating. Energy costs amount to 3-6% of overall hotel labor costs. Audit results indicate low level of use in energy efficient technology and renewable energy sources in Croatian hotels (Šćulac Domac, 2008). However, positive examples in solar technology use can be observed, so solar systems, six 1000l water-heaters for hot water and heating, with preparations to use gas as the alternative to electric energy have been installed in two 3* and 4* hotels in Starigrad. Although for this purpose the free credit was obtained from the Fund, the investment has still not paid off. Energy costs have dropped by 55%, and even some new projects in environmental protection have been implemented (Ranogajec, 2008). Guests often agree to higher service costs if environmental protection is at stake, but implementation of renewable energy sources also requires considerable financial means, which requires the necessary support of the relevant Ministry and other institutions (Ranogajec, 2008). Authors' research was undertaken within the tourist destination of Kvarner in December 2007, by data collecting on survey research of management on the sample of 11 hotels within narrower tourist destinations of Lovran, Opatija, and Rijeka. The results showed 36% of hotels used RES in mostly one of its components, i.e. solar energy, in conversion into thermal energy for DHW and heating, and rarely used photovoltaic systems for conversion into electric energy. 64% of hotels neither used any form of RES, nor had intention to implement them (Krstinić Nižić, 2008). The worrying attitude of managements must be accentuated, while the reasons for such a response can possibly be found in additional financial expenses and human effort required to introduce any changes, including new technologies. The reasons for such a great indifference of management can be located in insufficient education of management, but also of the entire local community, thus including tourist destinations, on the advantages and benefits obtained by renewable energy sources.

An example of good practice is represented by the international project of Solcamp, financed by the European Commission within the framework of the project „Intelligent Energy Europe Program"(IEE). The project was financially supported by the Fund for Environmental Protection and Energetic Efficiency and by the Ministry of Environmental Protection, Spatial Planning and Construction, while the principled support was obtained by the Ministry of Economy, Labor and Entrepreneurship. (Project is coordinated by the German Society for Solar Energy (DGS – DeutscheGesellschaft fur Sonnenenergie). The

whole project has been implemented by 15 partner companies in cooperation of 8 European countries: Germany (BVCD, Valentin, DGS, ISH), Poland (ECBREC), Austria (ESV), Slovenia (ITI iApE), Italy (AGIRE, PEPS, ESCOS, APEA), Spain (DEPAEX), Portugal (ARECBA) and Croatia (DOOR). The goal of the project is to meet, promote, and encourage the use of solar thermal equipment in tourist camping sites of Croatia and other countries where the project is implemented (SOLCAMP, 2011).

Croatian partner in the project is the Society for Sustainable Development (http://www.mojaenergija.hr, 2011). SSD is a nongovernmental non-profitable organization established by the multidisciplinary group of experts – engineers, economists, experts in environmental protection, sociologists, and others – committed to sustainable development. Its mission is to promote sustainable development in all segments of society, particularly in energy. Geographical location of Croatia and its mild climate ensure optimal conditions for solar energy use, which is particularly applicable on coastal area and islands, where almost all the Croatian tourist camping sites are situated.

Table 1 indicates comparison of incident solar energy on optimally tilted surface for various parts of Croatia and Europe (Pašičko & Rodik, 2007).

Table 1. Comparison of Incident Solar Energy on Optimally Tilted Surface, Various Parts of Croatia and Europe

Location	Annual Average, Daily Incident Energy (gWh/m^2d)
Croatia, South Adriatic	5.0 – 5.2
Croatia, North Adriatic	4.5 – 4.6
Croatia, Continental part	3.4 – 4.2
Central Europe	3.2 – 3.3
North Europe	2.8 – 3.0
South Europe	4.4 – 5.6

Source: Pašičko & Rodik (2007), p. 7.

Table 1 shows incident solar energy in Croatia, by 70% higher than in most Central European and Northern European countries, while the South of Dalmatia is equal to Spain and Greece. Southern Adriatic has over 2500 hours of sunshine annually, while Hvar and Vis, for instance, have more than 2700 hours of sunshine annually (Pašičko & Rodik, 2007).

1.2 Possibilities of solar energy use in camping sites

Camping sites represent most appropriate places for solar energy use for DHW (Energy Institute Hrvoje Požar, 2012). The need for hot water and viability of solar energy not only overlap – between May and October by 75% of annual insolation is obtained – but both managements and tourists in camps are as a rule interested in environment and its preservation. In spite of this, use of solar energy in camping sites represents an exception rather than a rule – even in Mediterranean countries with a large number of solar days and high insolation, as is the case of the Republic of Croatia. Solar energy must not be imported and does not pollute the environment, and therefore directly contributes to environmental preservation and mitigates climate changes, while the energy independence of the region

grows. However, financial savings are also important for energy, as after the return of initial investment thermal production of the solar system becomes very affordable. Camp with the quality equipment for solar energy use for DHW has all the prerogatives to be included into the sustainable form of tourism. Nevertheless, use of solar energy in camps is often applied in promoting purposes – „green camps", with growing importance in the tourist market, and attracting more guests. Undisturbed environment and the possibility to prove the respect for the environment provide the clear advantage over the competition – and facilitate the choice of „green camps"(http://www.mint.hr/UserDocsImages/081010-kamping-zakljuc.pdf, 2012). A large number of guests in camps give the additional importance to the choice of camps. According to the Croatian Camping Association data, 500 camping sites are active in Croatia, with the total capacity of 200,000 persons. Tourists in camps make up 22% of the total number of tourists, with 29% of stays. Through their own positive experience in solar energy use for DHW, awareness of the role of renewable energy is changing, together with the care for environmental protection. Croatian data indicate low quality and poor maintenance as main objections of guests in Croatian camps. Tourists are increasingly looking for camping sites of medium and high quality, with natural advantages and attractions of the location in line with the care for the environment.
Activities undertaken within the Solcamp project are the following: (www.mojaenergija.hr/ index.php/me/.../opis_projekta%20SolCamp.pdf, 2011)

a) Manual „Solar thermal systems for camps"

The manual contains all the information necessary to learn for use of solar thermal energy, peculiarities, advantages, and applicability in camps. The manual is distributed to the interested camp owners and solar system designers.

Example and analysis of hot water consumption in campsite in South Adriatic, Orebić (from the Manual):

- Hot water consumption: 20 l per person daily (50^{o}C), shower, sink, washstand,
- Campsite capacity: 200 persons,
- Required amount of hot water at maximum occupancy: approx. 4000 l/day,
- Additional DHW heating: boiler with fuel oil,
- Investment into solar heating system: 134,370.00 hrk,
- Estimated annual saving: 14,000 hrk/yearly, according to the additional energy price (current fuel oil price: 4.5hrk/l),
- Simple investment payback period: 9 – 10 years,
- Ecological contribution in CO_2 emission savings: 8,566.7 kg/annually.

b) Computer programming software „T* Solcamp"

The computer simulation software T*Solcamp, translated into Croatian and adopted to the Croatian climate conditions, enables the designer located in the camp to determine the equipment for solar thermal energy use (collector area, volume of containers) depending on specific needs and on the location of the campsite.

c) Training day for designers

The purpose of the training is to familiarize interested designers with new technologies currently available on the market, installing, and applying the software tools „T*Solcamp". Upon completion of the training designers are verified as „Sol camp designers" and available for the determination of the required equipment in campsites interested in participating in the project.

a) Camp survey on solar energy use for DWH

So far, 20 camp surveys were undertaken within the project. Among them, only 6 camps were medium sized and small (less than 200 places for tents, bungalows, or camping trailers), while all the others were large camps. Significantly, by 89% of surveyed campsites plan the renovation of water heating systems and are interested in investments into solar thermal systems.

b) Lectures

Lectures have been given for camping site owners, in order to inform them about advantages in solar thermal system, and about independent information on prices and viability of the system. Indirect benefits have also been presented in promoting possibilities and attracting ecologically conscious guests, as positive example to other camping sites, etc. Although not available in Croatia, special emphasis was given to the possibilities of co-financing and project financing by competent institutions and banks.

In Germany, approx. 150 camping sites were surveyed within the Solcamp project. Of this number, as many as 100 camps have evinced interest for investment into solar thermal system, while 50 of them had already a solar system installed or showed no interest in the project. To inform camping site owners about the benefits of solar thermal energy for their camping sites several regional workshops have been performed, organized in cooperation with national or regional camping associations. In addition, information flyers have been distributed to the camping site owners, including the offer and benefits of solarsystems. These flyers did not contain detailed technical informati on but promote the good reasons for using solar energy and raise some indirect benefits obtainable by use of solar thermal system in camping sites, i.e. to attract ecologically aware guests. After the owners of camping sites, another large target group for solar thermal system producers is the group of home owners.

Namely, the project will try to attract home owners to use solar energy and thus contribute to environmental protection.

2. SOLAR ENERGY USE IN EU

Solar energy represents the renewable and unlimited energy source from which, both directly or indirectly, derive most of all other energy sources on Earth. In the narrow sense, solar energy implies the amount of energy transferred by solar radiation, expressed in joules (J). In its original form, solar energy is mostly used to convert into thermal energy for DHW systems and heating (in European countries mostly as additional energy), and in solar power plants, while the photovoltaic systems are used to convert into electric energy (http://www.energetika-net.hr/skola/oie/sunceva-energija, 2012**.)** Solar systems represent thermal sources for heating and DHW systems, which use the radiant heat from the Sun, i.e. solar energy**.** Solar heating systems are mostly used as additional thermal sources, while the basic ones are gas, oil, and electric boilers. Solar energy use as basic thermal energy sources is rare and limited to areas with sufficient amount of solar radiation throughout the year, with favorable climate conditions and a short heating season. Such solar systems are therefore mostly used for DHW preparation.

Solar photovoltaic transducers are applied in direct conversion of (solar) light into electric energy, performed as photovoltaic cells which can be made of (Labudović, 2002):

- monocrystalline and multicrystalline silicon,

- amorphous silicon,
- Cadmium-telluride and copper-indium-disellenide.

Individual photovoltaic cells can be connected in series, parallel, or by combination of both methods into larger photovoltaic modules. Photovoltaic systems represent an integrated set of photovoltaic modules and other components, designed to transfer solar energy directly into final electric energy which may provide work of a number of DC and/or AC loads, independently or together with the reserve source.

Solar energy can be used actively and passively. Unlike the active application, which is implemented by thermal and photovoltaic transducers, passive application of solar energy represents direct use of transferred solar energy, by corresponding construction of buildings. Geometric shape, size and height of buildings, thermal capacity of individual walls and rooms, glazing, physical properties of building and constructive materials, have considerable impact on the overall energy consumption throughout the year.

Table 2. Electricity production from solar photovoltaic power in European Union in 2010 and 2011 (GWh)

	2010	2011
Germany	11,683.0	19,000.0
Italy	1,905.7	10,730.0
Spain	6,412.6	7,912.0
Czech Republic	615.7	2,118.0
France	677.0	1,800.0
Belgium	560.0	1,282.1
Greece	142.0	544.0
Slovakia	170.0	400.0
Portugal	213.0	265.0
United Kingdom	33.2	259.0
Austria	89.0	162.8
Bulgaria	15.0	120.0
Netherlands	60.0	86.0
Slovenia	13.0	60.0
Luxembourg	21.0	21.0
Malta	5.7	17.5
Sweden	8.6	15.0
Denmark	6.0	12.0
Cyprus	5.6	12.0
Finland	4.3	8.0
Hungary	1.0	3.3
Romania	1.0	2.0
Poland	1.7	1.7
Ireland	0.4	0.5
Lithuania	0.1	0.1
Estonia	0.1	0.1
European Union	**22,644.7**	**44,832.0**

Source: EurObserv'ER (2012)

If the production of electric energy from photovoltaic power by nation is observed, we notice that the leading three positions are occupied by Germany, Italy, and Spain, which confirms visible progress in member countries which have been making efforts in renewable sources by means of regulations i.e. legislation.

For the European Union, continuous growth in installed photovoltaic cells (in GWp) GWp and MWp – gigavatpeak and megavatpeak are measures for output energy and are mostly used in photovoltaic solar devices, http://en.wikipedia.org/wiki/Kilowatt-peak, 2012.) has been recorded in the period 2005 - 2011, namely annually by approx. 40%. Such a large share can be attributed to the developed legislation and other efforts which, beside the states themselves, were invested also by regional energy agencies.

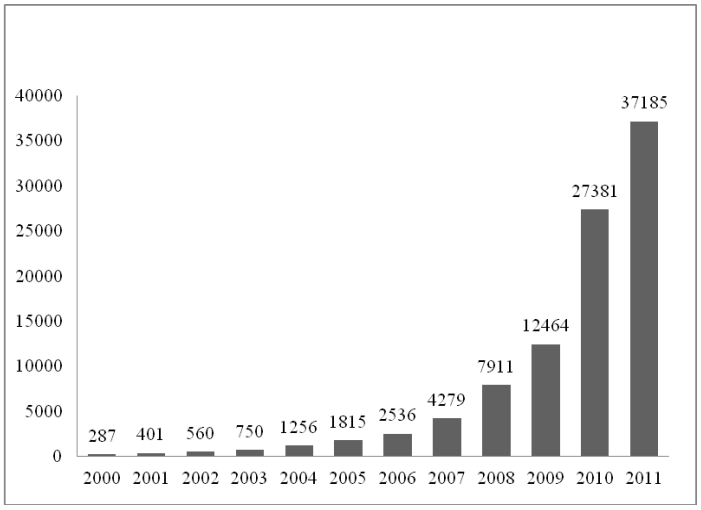

Figure 1. Global solar cell production, 2000 to 2011 (MWp)
Source: EurObserv'ER (2012)

Figure 1 indicates constant growth in production of solar cells: in 2011, production amounts to 37 GWp, which forms additional growth by 36%. According to the projections, the trend will continue and the production capacity will increase to 69 GWp in 2012 (http://www.eurobserv-er.org/pdf/photovoltaic_2012.pdf, 2012).

The market in photovoltaic systems has showed strength growth recently, which will surely continue in the future years. By 2009, almost 23 GW of photovoltaic systems have been installed in the world. Of all world regions, Europe represents the leader in installation of photovoltaic systems with 16 GW and almost 70% of overall installed systems, followed by Japan with 2,6 GW, USA with 1,6 GW, with the remaining part related to the rest of the world. In 2009, the ratio of Europe in the photovoltaic systems amounted to 78%, followed by USA and Japan by 7% each, and by South Korea and China with 2%, while the remaining 4% was related to the rest of the world. According to the European Solar Thermal Industry Federation (ESTIF), the total of 2.969,994 m² of solar cells (both plate and vacuum) were installed in EU countries and Switzerland in 2007, and approx. 4.762,798 m² were installed in 2008, which represents the growth in approx. 60%. (Majdandžić et al., 2013).

Geographical position of Croatia guarantees high potential in solar energy usability. Contemporary technology development level in solar energy use indicates remarkable value when converted into thermal energy, especially in Southern Europe, and cost of direct conversion into electric energy should in the future become even lower.

CONCLUSIONS

State incentives for energy obtained from renewable sources are the result of environmental concern, requests for security in energy supply, and of needs for more independence in the import of fuel. As already known, renewable sources also have a great disadvantage: the cost of energy produced from renewable sources is still mostly higher than the cost of energy obtained from conventional plants. But ecological and social advantages in use of renewable sources indicate that their use, although still more expensive than the use of conventional energy, brings multiple benefits – both on the global and on national and regional levels. Consequently, developed countries tend to encourage their use by use of various mechanisms. As energy markets in a large number of developed countries are nowadays liberalized, the attitude prevails that the supporting mechanism should not be in conflict with the market mechanisms, and its application should not cause market distortions.

A number of factors can improve the use of renewable sources, but seemingly not one particular represents the key to success, which is determined by their interweaving and complementation. However, there are unavoidable elements of the renewable source development strategy which, if systematically applied, guarantee the success.

The following can definitely be stated:

- political support
- appropriate legislation
- incentive tax policy
- financial support
- administrative support
- support of technological development, and
- promotion of renewable sources by education.

In most European Union member countries, governments have set goals in use of renewable sources, and have therefore issued the minimum share of renewable sources in consumed energy – i.e. the renewable source quota. In order to succeed in fulfilling these demanding objectives, various support mechanisms for renewable sources are foreseen. At the moment, harmonization of the support system has been established on the level of the European Union. According to the European Directive 2001/77/EC on promotion of renewable energy sources, national legislations and bylaws must be harmonized with the Directive, i.e. the legal-institutional analysis must be regulated. It is most important to prescribe the incentive methodology in order to allow for greater participation of renewable energy sources in overall energy balance. By the adoption of bylaws, the applicable incentive mechanisms will be clearly defined. In this way, both the existing and the future project will approach the implementation, thereby considerably using renewable sources, and Croatia would approach the target EU objectives in renewable energy sources use by 2050. RES issues are related to principal questions (energy security, energy efficiency, market model, public services, sustainable development, etc.) and to operational issues

(model of incentive system in RES production, green certificates, diversification of risk between producers and buyers, etc.). The stated questions should be involved in actions of national regulatory authorities (regulators in energy sectors), particularly from the aspect of the possible contribution to safety in energy supply.

The following renewable energy sources are particularly interesting for Croatian tourism: solar thermal and photovoltaic system, wooden biomass, biogas and bio fuels, thermal pump, ground collectors, and passive solar architecture. As additional solutions, various forms of smaller wind turbines, collateral thermal energy and process condensate, biomass use in thermal energy for space heating and DWH (particularly in the mountain areas and rural tourism forms) could be stated.

Analysis results clearly state Croatian innumerable advantages and possibilities in considerable growth in renewable source use. Success depends on overcoming the perceived and well known barriers, in particular those relating to weak but in the future indispensable connection of all relevant policies – energy, industry, agriculture, tourism, environmental protection – in order to ensure conditions for sustainable development, with renewable energy sources forming its indispensable part. In its energy strategy, Croatia should fully decide for use of renewable energy sources in accordance with the principles of sustainable development.

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