

Overview of the Situation on Photovoltaic Market in Selected Eastern European States

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Abstract

Purpose of this article Purpose is to research situation on photovoltaic markets in Slovenia, Croatia and Hungary. It is focused on market development, market segmentation and product features. Raising trend on photovoltaic markets is expected due to favourable conditions given by states. However, state legislative harms competitive environment. Between customers preferences in product features are big differences.

Scientific aim The aim is to collect and analyze data for fuzzy mathematical model which building up will be output of the dissertation.

Methodology/methods To attain the stated objectives, research based on the collection of primary and secondary data was carried out. Secondary data was obtained from both domestic and foreign literature. Additional information was used from documents from ministries, state institutions and local distributors of electric energy. Primary research was carried out with the employment of qualitative and quantitative methods. From qualitative methods, a structured interview was chosen.

Findings The Balkan states are very different in conditions for installation of photovoltaic systems. The market in Slovenia has consistently growth exponentially. In Croatia it is more in form of step increase. Hungary seems to be the slowest-growing markets due to focus on other sources of energy.

Conclusion Slovenia is the best market for investments into photovoltaic systems from the described states. Slovenia has almost no entry barriers. Croatia stagnates due to the restrictive conditions in the legislation that allows only 1 MWp as an ongrid power. Unfavourable conditions of this market should be changed thanks to new legislation in 2011. Hungarian system, that supports investors with subsidy for technology, will start up this market. These investments will grow mainly thanks to qualified organizations. Thanks to conducted analysis of the data obtained, it is possible to compile fuzzy mathematical model that will be used as managerial tool for investment decision in photovoltaic projects.

Keywords: Feed-in tariff, open-space installation, photovoltaic, performance.

JEL Classification: M21

Introduction

This article deals with economic view on environmental protection. To be more precise, this text concentrates on photovoltaic (hereinafter PV) market and its focus is connected to the article named Overview of the Situation on Photovoltaic Market in Selected Countries that deals with the development and differences of PV markets in Western Europe and the Czech Republic (Pavlíček and Kopřivová, 2010). The purpose of this series of papers is to collect and analyze data for fuzzy mathematical model which building up will be output of the dissertation.

Growing energy demand, drop of fuel supplies and environment pollution are reasons that lead to increased research on new energy production systems (Ulieru, Cepisca, and Ivanovici, 2009). In order to avoid further environmental degradation environmental quality should be considered as a target of economic policy (Ierland, 1991). Almost all over the world people are taking steps to privatize the energy industry and promote environmental friendly technologies (Patlitzianas, Doukas, and Psarras, 2006). The European Union has taken aim to raise the use of renewable energy sources which cut carbon dioxide emissions (Ulieru, 2009).

PV systems belong to sources of renewable energy. PV solutions transform sunlight energy into electric energy and are described by modularity, operating autonomy and long operation period (Ulieru, 2009). Several years ago, potential of PV market was not identified by investors, in other words investors did not see its unique financial properties (Awerbuch, 2000). The market with PV systems increased rapidly by 30% in 2003 and future expansion began to shape (Green, 2004). Total capacity passed over 9 GWp all around the world in 2007. 50% share of this performance belonged to the European Union (Cristian, 2008).

Main goal of this article is to discover current situation and consider possible future development in PV markets in Slovenia, Croatia and Hungary. To meet the main goal, three partial aims are set out. First objective is to investigate market development in the selected areas. Market segmentation is the second. Last point is to illustrate product features.

To set up challenging goals for alternative energy sources given by the European Union support system is to help covering costs that appear with installing and running such systems (Ringel, 2006). The development of the PV market is tied to the support policies executed by national governments and defined in national laws. The correction of such incentive schemes can significantly affect the growth of the PV market in any chosen country (Dusonchet and Telaretti, 2010). These systems are related with administrative and regulatory issues, along with the potential of fraud and mafia involvement. Investors need to be aware of such risk (Wright, 2010). Local support policies in PV solutions of selected countries are described in Market Overview and economic analysis of the support mechanisms that are implemented in these countries was employed.

It is possible to divide customers of PV market into three segments. These are on-grid customers, off-grid customers and specialized producers of electricity. On-grid customers cover residential customers (e.g. home constructions) and industrial customers (e.g. factories) and create 78% of global market. Off-grid customers are mid-size industries (weather stations, semaphores, water stations, etc.). Specialized producers of electricity are “solar farms” and it is predicted that this will be the most important market segment (Cristian, 2008).

1 Research methods

To attain the stated objectives, research based on the collection of primary and secondary data was carried out. Secondary data was obtained from both domestic and foreign literature. Additional information was used from documents from ministries, state institutions and local distributors of electric energy. Primary research was carried out with the employment of qualitative and quantitative methods. From qualitative methods, a structured interview was chosen. This approach was applied among 60 representatives of producers and installation companies and more than 30 investors in order to recognize situation on markets. Personal questionnaire survey was selected to execute quantitative research. This method was aimed on investors and end-users to identify product features. Research process used all logical methods available.

2 Market overview

The selected Balkan states are very different in conditions for installation of PV systems. With respect to this fact, it is necessary to present the selected states individually for the reason of better understanding of the situation on the market.

2.1 Slovenia

Apart from the fact that it is the first independent state after the breakup of Yugoslavia, this country is fully self-sufficient and export-oriented; no matter that Slovenia has approx. 2 million of inhabitants. Despite small area, market with renewable energy sources is rising thanks to a smart system of feed-in tariffs that were introduced on the 1st November 2009. The purpose of feed-in tariffs is to ease meet Slovenia's goal that is to create 25% of renewable sources in electricity generation by 2020 (The European Parliament and the Council of the European Union, 2009). The structure of the system is considered as one of the best comparing to others from the former East Bloc. The system in Slovenia is developing to comparable to northern European countries.

Slovenia has developed its basic feed-in tariff into a system of Advanced Renewable Tariffs that is comparable to program in Germany, France, Spain, and Switzerland. The improved system is enlarged by complete and distinct program of tariffs and subventions. The level of tariffs may remind of rate in European Union.

Government stated feed-in tariffs at the level of 0,3864 €/kW for rooftop installation up to 50kWp and 0,3534 €/kW for the installations bigger then 50kWp installations and on top of that 15% more for integrated roof-top systems. State supports especially "roof-top" systems with power up to 50 kWp. Feed-in tariffs are lowered on price 0,2610 €/kW for projects between 10 MWp and 125MWp. However, feed-in tariffs may be decreased by 14% in 2011 (Gipe, 2010)

There are more than 50 companies operating on the market with PV systems in Slovenia. Situation on the market is changing rapidly due the fact that in average 2 new firms enter to this market every month. None of these companies has privileged position on market and each offers a slightly different product. Structure of market refers to monopolistic

competition. A Slovenian producer, that exists for 4 years and invests big money into promotion, starts dominating above a number of companies. Other firms present mainly Chinese products but recently these are replaced by German companies that offer higher quality products and are able to cover the whole technology.

2.2 Croatia

Location of Croatia is ideal for installation of PV systems. Energy that comes from the sun is on average from 900 W/m² to 1400 W/m². At the same time steady wind helps cooling panels so consequently it increases overall efficiency of these systems. Moreover, costal landscape and islands are not covered with any green vegetation because there is mainly large rocky countryside, and thus it does not lead to devastation of vegetation and occupancy of agriculture areas.

Despite of such favourable conditions for installation of PV systems, Croatian market in fact is closed till the end of the year 2010. Legislation of Croatia allows to install only 1 MWp capacity in years 2009/2010. This restriction put investors into stress. They knew that who installs 1 MWp first, he/she stops connecting to distribution network for the rest of investors. It was connected to the grid only 90kWp till now. But there are installations with a total capacity of ca. 400kWp, where one of them is a 200 kWp installation close to highway from Zagreb to Rijeka, but this one has not been connected to distribution network till nowadays.

Nevertheless, another way of using PV installations was found by a telecommunication company. The installations are used for supplying mobile phones antenna and their monitoring. The company installed PV systems over many Croatian islands and seaside. The third way of using PV installations in Croatia is small island systems with capacity up to 3 kWp for houses and cottages without electricity.

Feed-in tariffs are 3,40 HRK for PV systems up to 10 kWp, 3,00 HRK for installations with capacity from 10 kWp to 30 kWp and 2,10 HRK in case of capacity over 30kWp (Croatian Energy Regulatory Agency, 2010, Energetski institut Hrvoje Požar, 2007. Exchange rate is 1 EUR for 7,344 HRK on the 20th October 2010 (European Central Bank, 2010).

Legislative provisions can be found under: NN 33/07 Regulation on the fees and regulation on minimum share of electricity produced from

renewable energy sources, NN 67/07 Law on electricity market, with additional regulation OG 67/07 Regulation on the usage of renewable energy sources and combined heat production and NN 76/07 Law on urban planning (Slavica, 2009).

For the coming year of 2011, new legislation is planned that should give chance for more installations. Its text has not been disclosed yet. Experts of local conditions speculate on market with capacity bigger than 50 MWp/year and consequently lowering feed-in tariffs. Adoption of the legislation and energy feed-in tariffs will be affected mainly by current economic situation in country. Croatia is still in phase of economic crisis.

This country is not a part of EU which causes a trade barrier because a lot of permissions for connecting and installations are required from local authorities. Such behaviour discourages many investors. Usually it takes 8 months to get all approvals.

2.3 Hungary

Hungary invests into renewable energy sources mainly through EU funds that have promised almost 4,5 milliard EUR by 2013. These subventions are drawn and then redistributed by Ministry of Environment.

Hungary has build up ca. 80 MWp wind power plants around border area with Slovakia and Austria. Money from EU funds is also heavily directed to biomass and geothermal energy for which Hungary offers suitable conditions thanks to many hot springs. Considering these facts, it is logical that PV became a secondary issue although some degree of support was visible.

The whole system is based on state support that pays off 30% to 60% from price of technology to investors. The size of the subsidy is determined by whether the consumer moves from lower to higher energy level thanks to installed technology (there are 5 levels of energy performance from A to E in EU). Financial resources are limited by its fixed amount and therefore the more projects will pass the smaller subsidies can be expected. These subsidies are paid only if the investor is able to prove that the system is installed and functioning.

State support is not guaranteed by law and therefore there is no certainty that if an investor

builds a PV system, he/she will receive the subsidy. Due to this fact the market is divided into two groups of investors:

Group 1– investors who spend money on PV because of their attitude to ecology and so the financial support does not present a motivation for them.

Group 2– investors who speculate if it is possible somehow to ensure that the subsidy will be obtained.

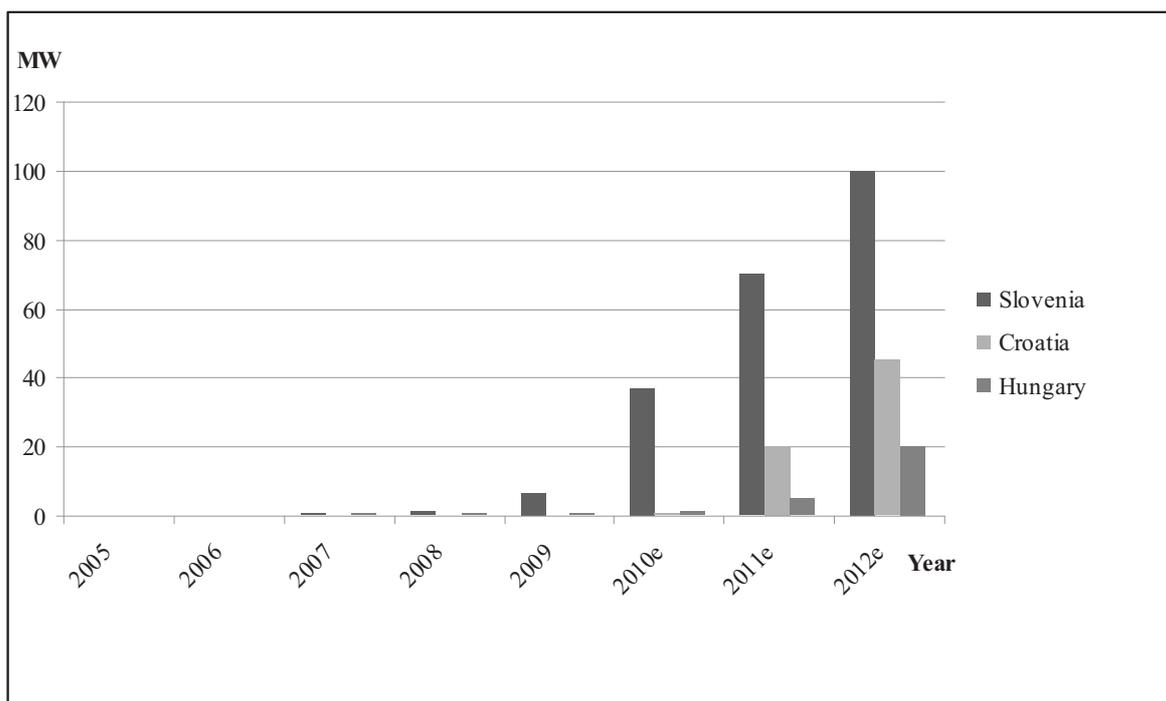
Very interesting and getting popular is the Household system. This system can have max. 50kVA and can only be connected to the low-voltage grid (10kW). In this case there is no permission needed. The new law will change the size to max. 3x16A (11kW) for the Household systems (Ministry of Rural Development, 2007). This law is under construction at this moment, it will most probably be ready by mid 2011.

3 Market development

Market development is monitored in selected countries. Current and probable future market development of selected countries is shown in Graph 1. This development takes regards to current and future feed-in tariffs, demand of inhabitants and possibilities of connections and installations. Graph 1 shows total installed power and the second one demonstrates installed power in individual years.

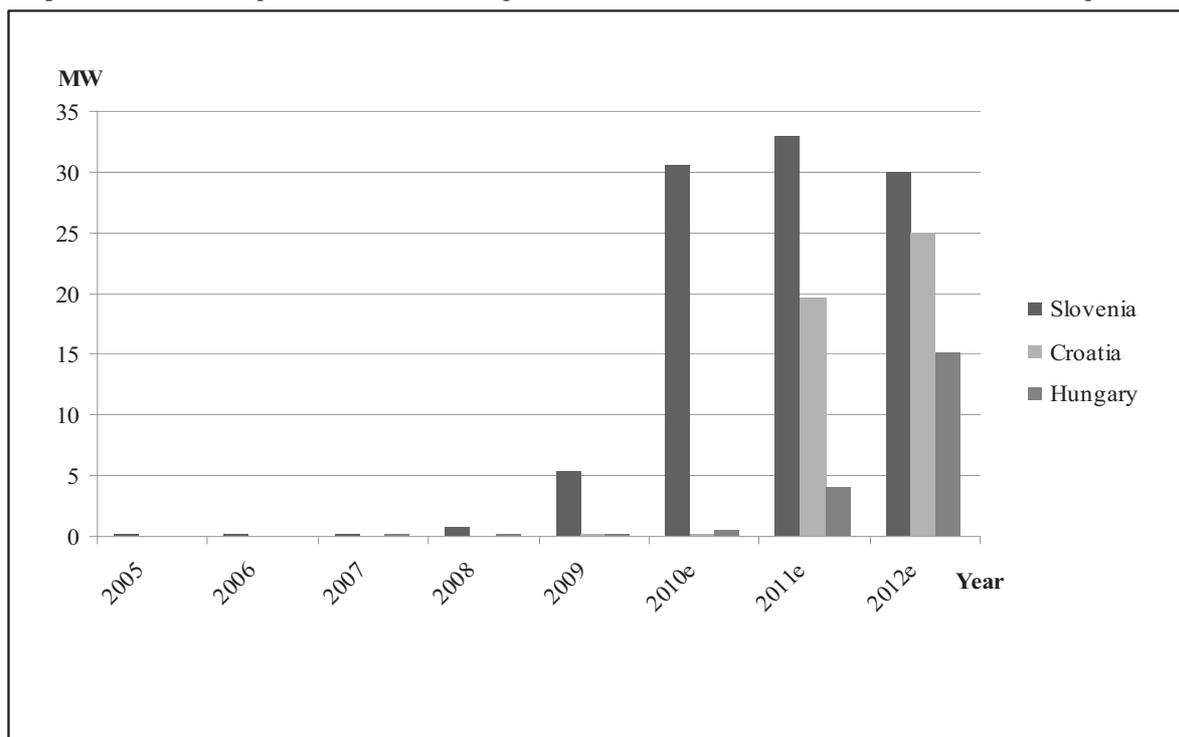
Slovenia is on the first place in using PV among the selected countries. Total power of all installed PV sources reached the value of ca. 6,5 MWp at the end of year 2009. There was 442% rise comparison to 2008 and at the same time this installed PV exceeds other selected countries. This big growth results from smart system of feed-in tariffs that was implemented in that time. Expected increase goes hand in hand with state policy that plans to create 25% of renewable sources in electricity generation by 2020.

Croatian market experienced a growth between years 2008 and 2009. Installed power in 2009 was 0,03 MWp. This is a result of state restriction allowing only such a small power. Future development is very optimistic according to local specialists. It is expected to market capacity of up to 30 MWp/year. Everything depends on approval of amending act by the end of January 2011 and lower feed-in tariffs not more than 7%.



Graph 1 Market development – total installed power¹

Source: Own compilation²



Graph 2 Market development – installed power in individual year

Source: Own compilation

¹ „e“ stands for estimate

² Data may differ by increase due to the time span between asking and completing this research and also because island systems do not need to be registered.

Table 1 Table of values for graph 1

	2005	2006	2007	2008	2009	2010e	2011e	2012e
Slovenia	0,1	0,2	0,4	1,2	6,5	37	70	100
Croatia	0	0	0,01	0,04	0,2	0,4	20	45
Hungary	0,07	0,13	0,3	0,4	0,6	1	5	20

Source: Own compilation

Table 2 Table of values for graph 2

	2005	2006	2007	2008	2009	2010e	2011e	2012e
Slovenia	0,1	0,1	0,2	0,8	5,3	30,5	33	30
Croatia	0	0	0,01	0,03	0,16	0,2	19,6	25
Hungary	0,07	0,06	0,17	0,1	0,2	0,4	4	15

Source: Own compilation

PV systems are not at first position in Hungary due to natural conditions that are more favourable for wind and geothermal energy. Thanks to EU funds, that support PV in Hungary, it seems that investors find new business opportunity no matter if their purposes are only speculative or ecological. So it is obvious that number of PV installations have been significantly growing since the beginning of 2010.

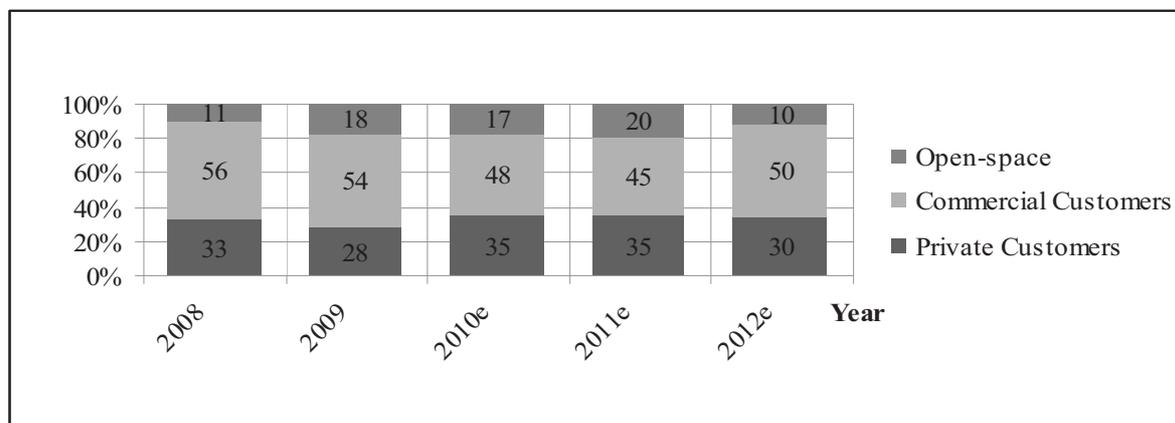
To conclude, the market in Slovenia has consistently growth exponentially, while in Croatia it is more in form of step increase. The prediction of step increase is clearly illustrated on the Graph 3 and Graph 4. The prediction assumes approval of an amendment. Hungary

seems to be the slowest-growing markets due to focus on other sources of energy.

4 Market segmentation

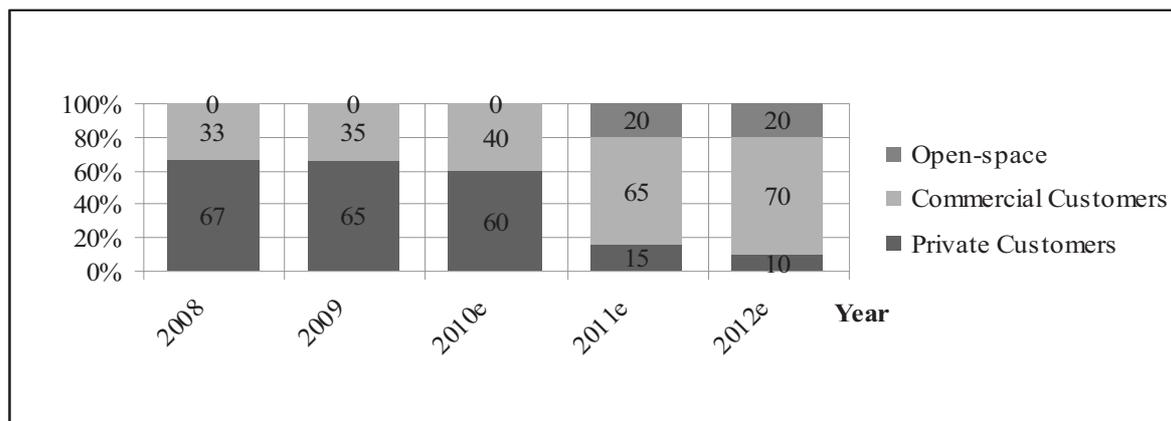
For purposes of this research, the PV market was split up into following segments: private customers, commercial customers and open-space installations. Slovenian, Croatian and Hungarian markets are described in Graph 2.

Slovenia has the most balanced ratio between private and commercial sector. Support of smaller roof-top installations is visible and it motivates investors to install these systems. It leads to decentralizations of power and moreover to better stability of the network.



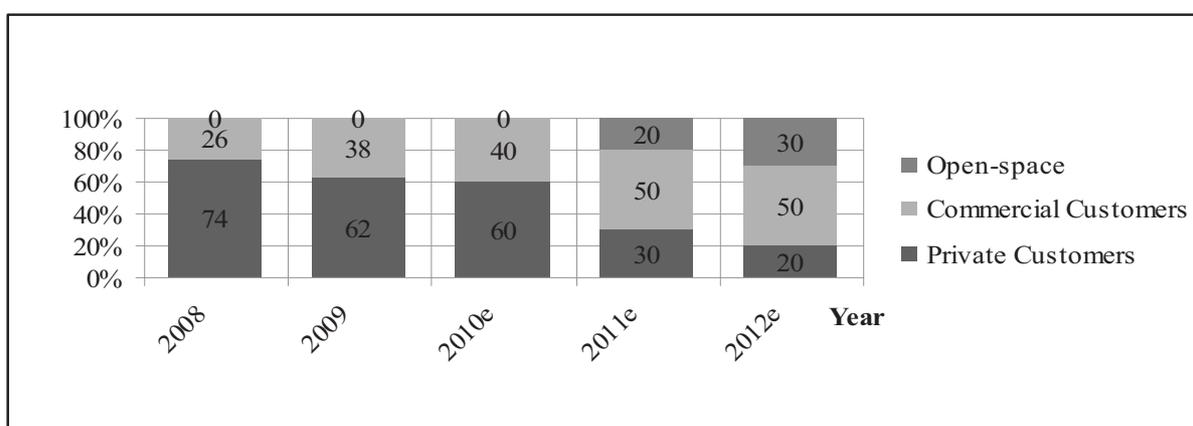
Graph 3 Market segmentation in Slovenia

Source: Own compilation



Graph 4 Market segmentation in Croatia

Source: Own compilation



Graph 5 Market segmentation in Hungary

Source: Own compilation

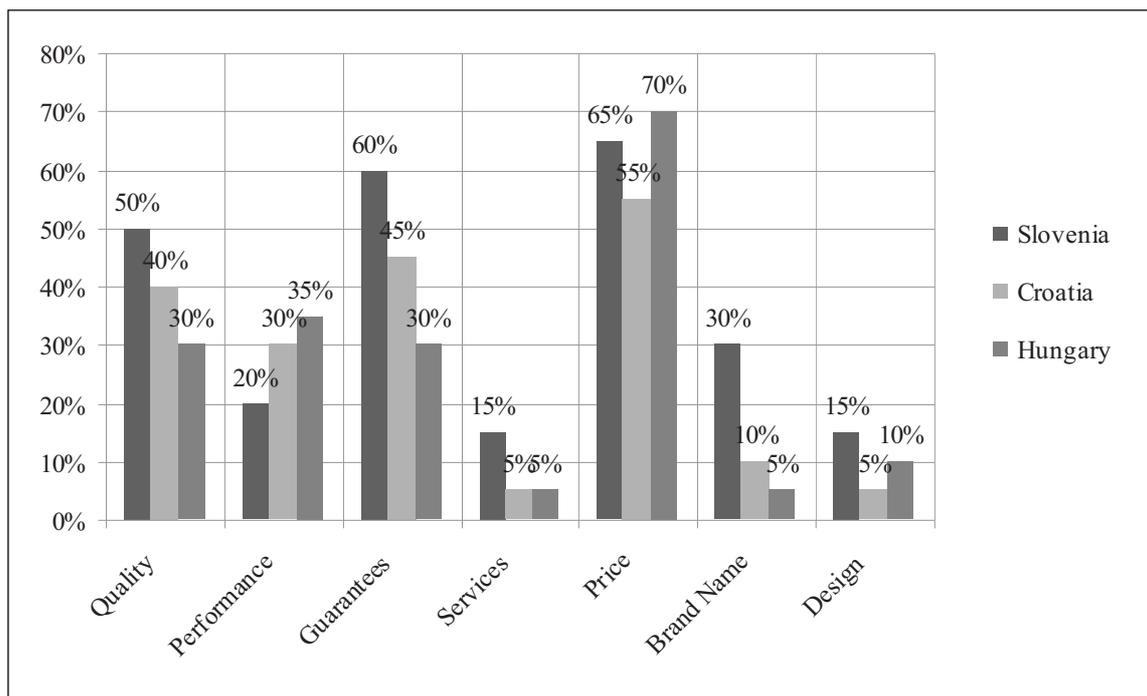
In Croatia, this diagram is affected mainly by prognosis of future installations. The forecast shows a gradual, however, very slow change in this trend especially in comparison to Slovenian PV market. A growth in roof-top installations mainly of businesses and manufacturing companies that have not enough supply of electricity from local distributors is expected.

Hungary is divided between installations on private and corporate buildings now. This reality should be changed with the new year of 2011 thanks to expected changes in perceptions of PV from the state's perspective. In respect to current very slow progress of the changes, it is forecasted that major growth in installations on corporate buildings will occur. Also, the poor economic situation in Hungary and Croatia prevents the progressive development of this sector.

5 Product features

Apart from end-users, individual installing companies are considered as consumers because they operate with these products and have overview about market possibilities. At the same time they know preferences of their end-users. Graph 6 demonstrates the most preferred product features in chosen countries.

From Graph 6 one can easily read the preferences of investors. In Slovenia, investors stress good price the most. Quality and guarantee conditions are the following factors. In contrast, the preferences of Hungarian investors lay in low price. They emphasize the highest possible performance without regard to efficiency. Guarantees and quality of the product have same preferences. Croatian investors also look for good price in respect of guarantees of the manufacturer and the quality of panels. Branded products are mainly asked in Slovenia.



Graph 6 Product features

Source: Own compilation

Croatian end-users demand experiences of the company that carries on the installation, particularly in larger projects that are planned for 2011.

6 Discussion

The market in Slovenia seems fully developed but market structure corresponds to monopolistic competition. This business field is in stage of its biggest development during 2010 and all aspects indicate even bigger expansion in 2011. Although, feed-in tariffs decreased by 14% in 2011 and the 15% subvention for PV integrated systems will be probably stopped in September 2011 with the new legislation. Small investors agree that year 2011 will probably be the best year for PV energy sources. Considering reasonable system of feed-in tariffs, it is highly unlikely that an abrupt turnaround in the perception of this energy source would occur as it happened in the Czech Republic. Thanks to support of "roof-integrated" systems, PV becomes partially a symbol of design and partially successfully developing economy. Feed-in tariffs is reduced by 14% for next year 2011 but due to falling prices of technology, it will not probably affect the amount of investments.

In contrast, Croatian market with PV energy sources is experiencing chaotic situation

this year due to economic crisis. Although there are over 15 companies involved in selling and installing PV modules on the market, none of them is able to sustain on this business area. There are only three companies on the market that trade with PV brought to a successful end and were able to make a reasonable profit. Weakness of Croatian market is that a PV installation may stay off-grid and therefore it is unable to supply electricity to its customers. However, Croatia is currently working on new legislation that should be known next year. It is expected that capacity for these energy sources will be increased, which would lead to an open door for all investors and suppliers of green technologies. According to the information from Ministry of Economy, Labour and Entrepreneurship, it is expected that there will be almost 40 MWp of applications for permission, but it is common that not all of them will be successful due to the capacity of distribution network that is in poor conditions due to the low investments in redevelopment. That is why the estimation 2011e is only almost 20 MWp as it is shown in Graph 2. Moreover, there are also projects with wind energy, biomass and water turbines that take's a piece from requested production of electrical energy from green energy sources.

Hungary is in a phase of slight economic growth after total bankrupt in 2008. There are not so many investors like in other states; nevertheless, there is apparent interest in it in Hungary. It is granted mainly due to the location of the country – there are not mountains for hydro power plants, there are not many windy areas except for the border with Slovakia and Austria. On the other hand, there is plenty of solar irradiance. Average solar irradiance ranges from 1250 kWh/m² to 1500 kWh/m². This important fact makes from Hungary one of the best locations according to average yearly temperature and average solar irradiance. During spring and summer of 2010 government subventions into PV systems were stopped. Now investments into PV installations are on their start again. Companies and investors who are concerned with PV installations expect growth of investments in the next year. Ministry of Environment has ca. 4,5 milliard EUR for investment into green energy. It was planned to invest ca. 250 million EUR into PV power plants. It seems that this trend will continue and investments into PV will increase due to transfer of investments from wind power plant.

Conclusions

It could be said that Slovenia is the best market for investments into PV systems from the above described Balkan states. Slovenia has almost no entry barriers. Market structure is appropriate to monopolistic competition with but one company starts to be dominant. Investments into this business field grow and it is expected to continue in the same trend for

the next year despite of decreased feed-in tariffs by 14%.

Croatian market stagnates due to the restrictive condition in the legislation that allows only 1 MWp as an on-grid power. Moreover, the whole process is accompanied by many applications for permits. Currently feed-in tariffs are very attractive at the value of 0,46 €/kWh for installations with performance up to 10 kWp but nobody gets permissions. On the other hand, PV systems are spread over Croatian islands and seaside where there is no electricity or the capacity of local grid is not able to meet the demand. Unfavourable conditions of this market should be changed thanks to new legislation in 2011. It is expected revitalization of the market. The biggest boom will probably arrive in 2012.

Hungarian system, that supports investors with 30% - 60% subsidy for technology, will start up this market. It is expected that this investments will grow mainly thanks to qualified organizations. Market development predicts meaningful growth in 2012. However, this market will not probably reach the same size as markets in Slovenia or Croatia.

Thanks to conducted analysis of the data obtained, it is possible to compile fuzzy mathematical model that will be used as managerial tool for investment decision in PV projects. Based on gained information, the model is able to calculate height of investment costs, costs of technical documentation, preparation of the project itself and rate of return. At the same time, the information given with regard to the selected country and its political, economic and legislative conditions is taken into account.

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