STATUS AND COMPARISON OF RENEWABLE ENERGY SUPPORT SYSTEMS IN CROATIA AND SOME NEIGHBOURING EU COUNTRIES (SLOVENIA, HUNGARY, ROMANIA AND BULGARIA)

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Contents

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INTRODUCTION

European Union (EU) is dedicated to sustainable development, mostly because of reducing CO_2 emissions, but also in order to decrease import dependency and price fluctuations of energy sources (oil, gas, etc.). One of the methods of reaching these goals is to increase the share of renewables within total energy mix. Therefore, a number of directives and policies have been created in the EU to implement and support renewable energy.

Each EU member state has obliged to increase the share of renewables within its own energy generation mix, and also set the target share of renewables within the total consumption in 2010 and 2020. The ultimate EU goal in 2020 is to fulfill the so called „20-20“ concept – 20% increase in using renewables and 20% reduction of greenhouse gas emissions.

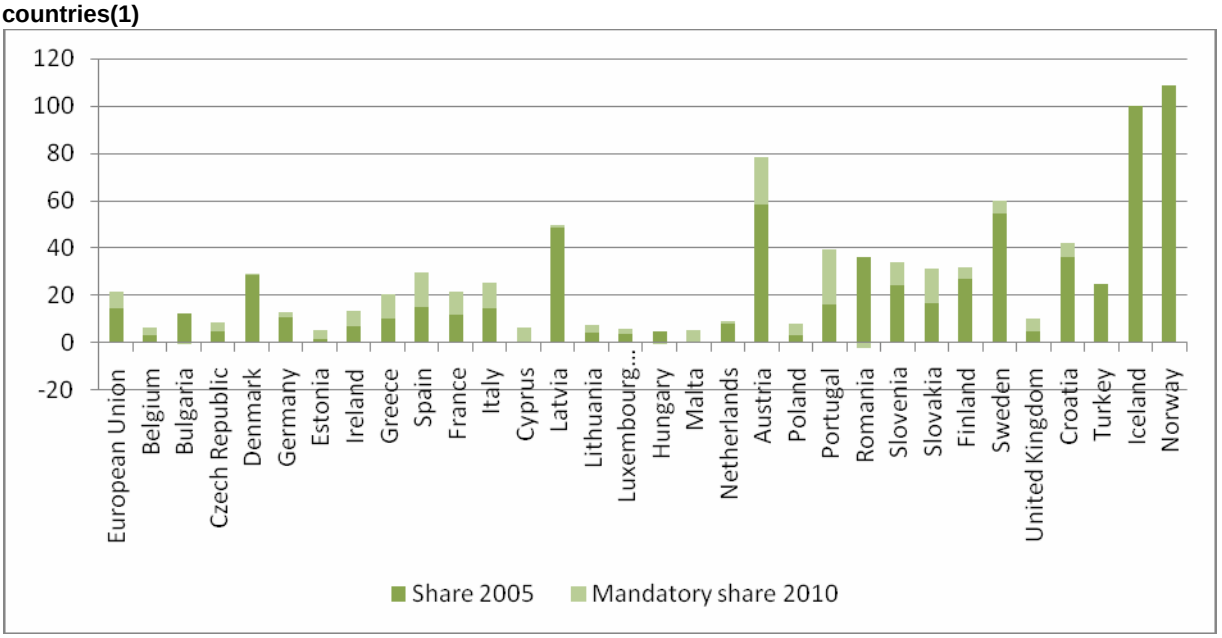
Introducing economic instruments to support investments in renewable energy has become essential for EU member states in order to reach their targets. Some countries selected the system of privileged purchase prices, so called feed-in tariffs, where there is a set price for purchasing electricity from each renewable source and others introduced the tradable green certificates (TGC) system in combination with mandatory quota, where each producer for each MWh of renewable electricity produced receives a green certificate with which he can then trade on the market, so every producer or utility can reach mandatory share set by the state.

The objective of this paper is to give an overview and comparison of renewable energy policies and support mechanisms introduced in Hungary, Slovenia, Romania, Bulgaria and Croatia. Countries were selected on two different levels: Hungary and Slovenia as Croatian EU neighbours, with similar natural and geographical resources and Romania and Bulgaria as new EU member states, as Croatia will soon join EU, so it can learn from their experiences. Other countries, such as Bosnia and Herzegovina, Serbia, Montenegro and Macedonia will not be a part of this paper, because they still haven't introduced energy policies, so the comparisons were not possible.

RES STATUS BY COUNTRY

Each EU country has set its own mandatory share of renewables in total consumption that it needs to reach until 2010. The Figure 1 gives an overview of RES shares for each EU country in 2005, as well as their mandatory share for 2010.

Figure 1 – Overview of RES shares in 2005 and mandatory RES shares for 2010 for EU and candidate countries(1)

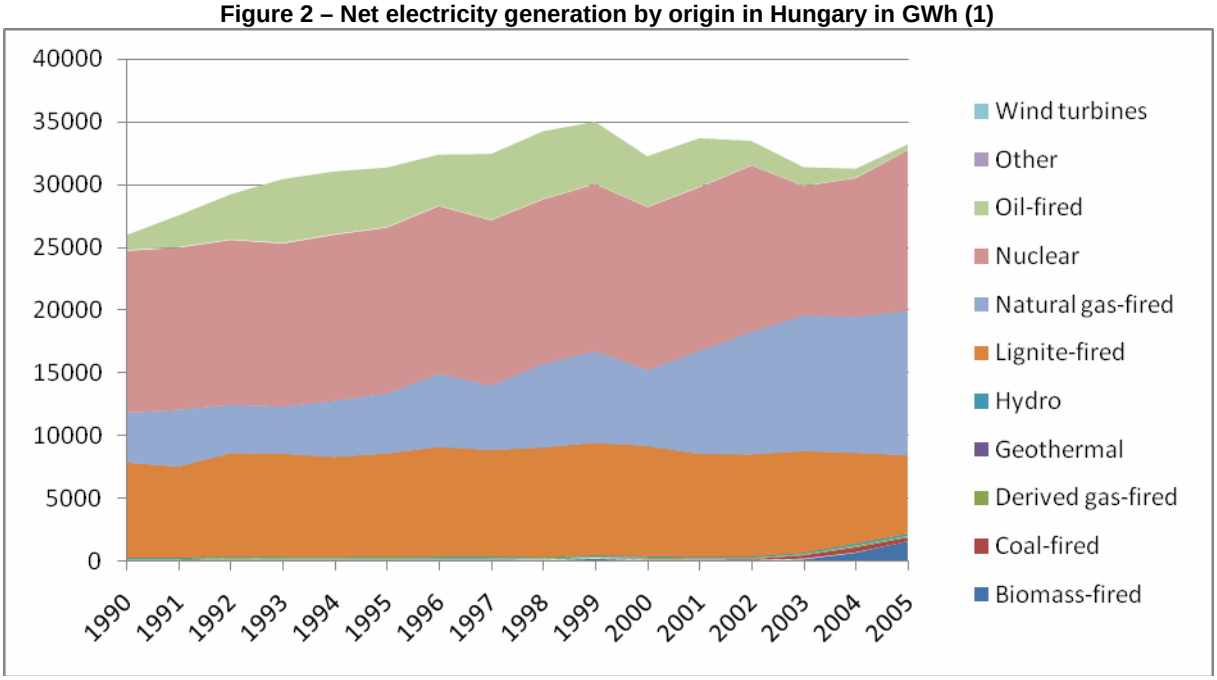


Mandatory shares here include large hydro electricity, although most of energy policies introduced by EU countries do not have specific support system for that type of electricity generation, because of maturity and competitiveness of the technology with traditional technologies.

Hungary

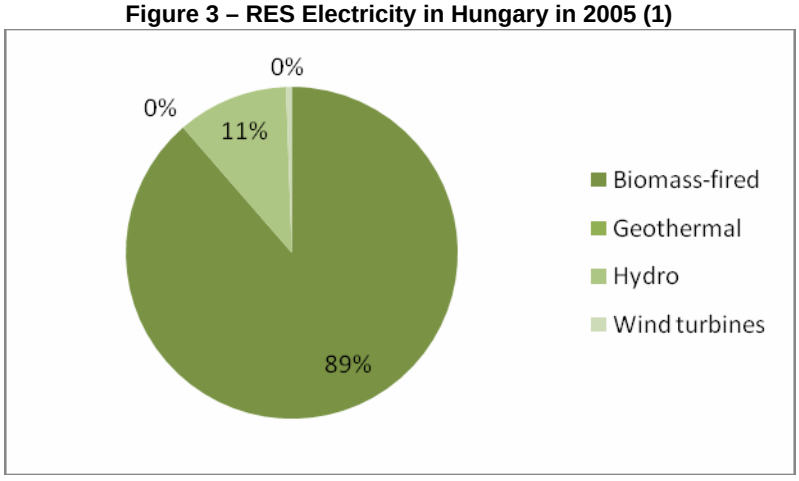
The largest portion of electricity in Hungary is still generated by nuclear power from its four nuclear reactors in Paks built during 1980's. Natural gas-fired power plants started growing rapidly as secondary reserve gas turbines in Liter and Sajosoged started with operation in 1998, while oil and lignite-powered power plants start to lose their importance.

Figure 2 – Net electricity generation by origin in Hungary in GWh (1)



In renewables, biomass has by far the largest share, and it is still growing, mostly because of excellent geographical conditions and conversion of old coal-fired power plants to biomass (and gas) plants. From 1997 until 2004, the average annual growth for biomass was 116%. Further development of hydropower is limited, because of lack of natural resources and other sources – wind, photovoltaic and geothermal – are still constrained by the administration, although a feed-in supporting system exists. (2)

Figure 3 – RES Electricity in Hungary in 2005 (1)



The most specific situation is present on the wind market, since wind power capacity has been limited to 330 MW in 2010, because of grid constraints. All of this capacity has already been taken, so no new licenses will be granted until enhancments to the grid have been

made. According to estimates of Emerging Energy Research (3), Hungarian wind power market will add over 200 MW through 2010, closing the year with 267 MW installed, which brings the country under the capacity limit. The same source estimates aditional 300 MW until 2015, which would mean an annual growth rate of 60 MW. Developers were forced to reduce project size in order that all fully permitted projects actually come to life by 2010. Maximum project size is expected around 25 MW. (3)

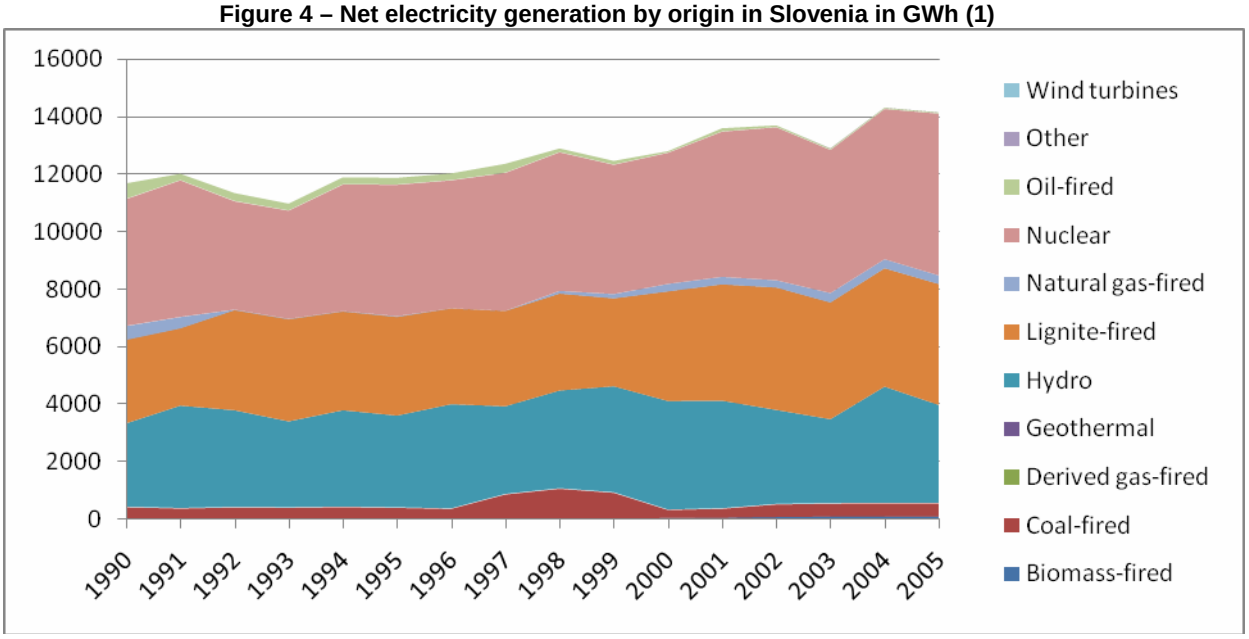
Photovoltaics are not widely used in Hungary, as solar energy is mostly expolited for heating purposes in solar collectors. In 2003 total installed photovoltaic capacity in Hungary was 100 kW, and in 2005 it grew to 155 kW (4), which was still quite insignificant. However, in 2005 worldwide photovoltaic manufacturer Sanyo started with production of HIT (Heterojunction with Intrinsic Thin-layer) cells in Hungary, mostly for export to Germany and surrounding countries. Expected annual production of HIT panels is 50 MW, with an objective of expansion to 100 MW in near future. (5) Also, the 100 kW barrier for PV systems was removed, so they can now also receive feed-in tariffs, which could lead to stronger growth of this industry.

Feed-in tariff system was introduced in 2005, when technology-specific tariffs were published. Tariffs are valid for the entire lifetime of the project. Hungarian government has also introduced the Energy Act (in 2001, ammended in 2004), where it states that it can, in the future, set a green certificate supporting scheme introduction date. After that start date, the feed-in tariff system will not be applied anymore. (2)

Slovenia

Electricity generation in Slovenia is almost equally distributed to nuclear power (50% of NPP Krško, co-owned with Croatia), lignite-fired power plants (largest Slovenian TPP – Šoštanj, net capacity 683 MW and TPP Trbovlje, 125 MW) and hydropower (eight HPPs on Drava river and others on Soča river).

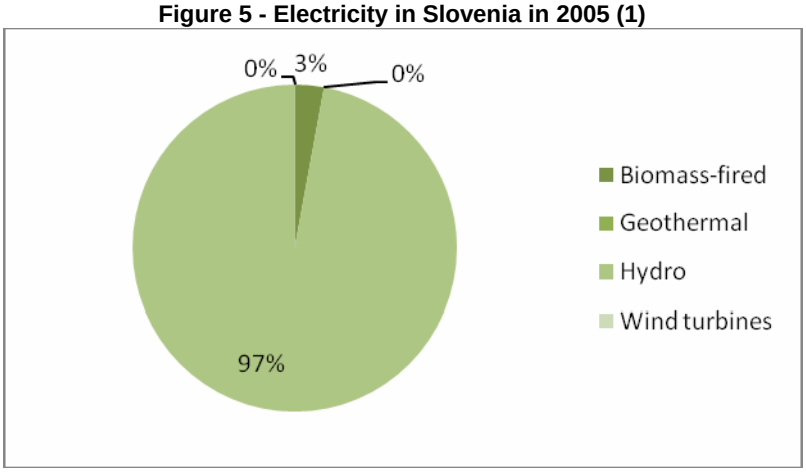
Figure 4 – Net electricity generation by origin in Slovenia in GWh (1)



Hydropower holds the largest share of renewable electricity in Slovenia (97%) and the other (3%) is held by biomass. Hydropower lies mostly on old hydro power plants, which are planned for refurbishment within Slovenian renewable energy strategy. Potential for biomass is quite high, taking into consideration that 54% of total Slovenian land is covered with forests. Photovoltaics are still installed only on experimental basis. (6) The growth of photovoltaics, according to Warsaw University of Technology (4) was from 51 kW installed in 2003 to 200 kW in 2005.

Currently, there is no existing wind capacity in Slovenia. The first wind project to be comissioned in 2008 is a 28 MW power plant at Volovja Reber. According to EER, an average growth of 10 MW per year is expected from 2009 until 2015, with total wind capacity in 2015 of 98 MW. (3)

Figure 5 - Electricity in Slovenia in 2005 (1)



Slovenia has introduced energy policy, which is consisted of two measures: feed-in tariffs and investment subsidies. Feed-in policy is made in a way that producers can choose between fixed feed-in tariffs or premium feed-in tariffs from the network operators. The purchase contract is then valid for 10 years. Subsidies and loans with lower interest rates are also available and they cover up to 40% of investment cost. Investments in rural areas with no possibility of connection to the electricity network are eligible to apply for an additional 20% subsidy. (6)

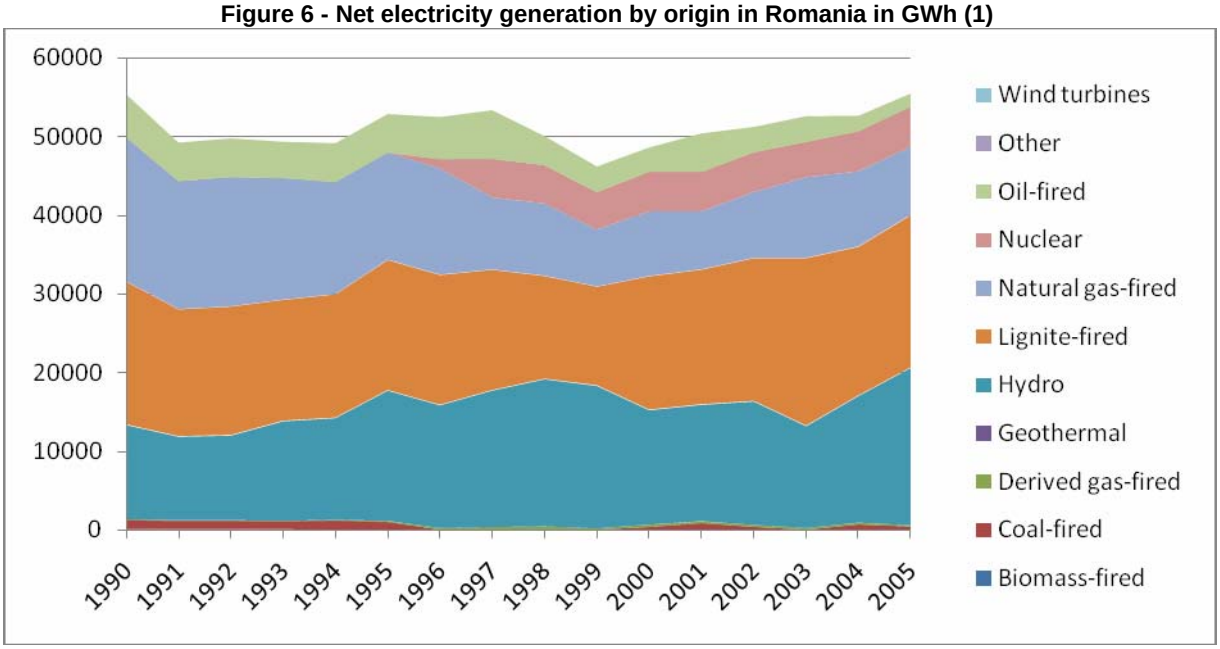
Romania

Romanian energy mix is quite diverse – most of electricity generation comes from hydroenergy and lignite-fired power plants, but also nuclear and natural gas-fired power plants are quite significant.

Large scale hydro power plants are very significant for total Romanian electricity production and also represent the vast majority of renewable energy (there is also a very small amount of biomass and wind electricity, but less than 1%). Romania has great potential for further development of small-scale hydropower (6 TWh smaller than 10MW), but this potential still hasn't been fully utilized (growth rate between 1997 and 2004 was only 5% annually). Biomass is the main renewable energy heating source in Romania (7), but wider use in electricity generation has not yet been started.

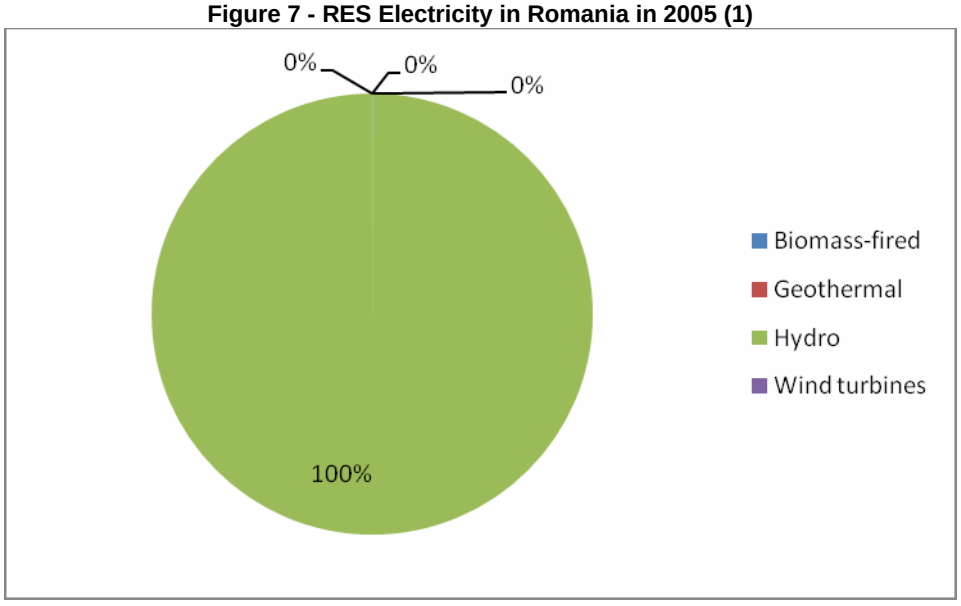
In 2007 there was only 1 MW of wind capacity installed in Romania. According to (3) Romania is forecasted to add nearly 400 MW thorugh 2015, which means average annual growth of 25 MW. With that growth, Romania is expected to reach its wind objectives for 2010 (120 MW) and 2015 (400 MW). There are several wind projects in development, out of which the 30 MW Constanta project is expected to start in 2009, and 20 to 25 MW Tulcea project in 2010. (3)

Figure 6 - Net electricity generation by origin in Romania in GWh (1)



Differently from most EU member states, Romania has in 2004 introduced tradable green certificate (TGC) support system in combination with mandatory quota. The mandatory quota will increase from 0.7% in 2005 to 8.3% in 2010. TGCs are issued to electricity production from wind, solar, biomass or hydro power generated in plants with less than 10 MW capacity. (7) Between November 2005 and February 2006 there were 7183 green certificates issued to the renewable electricity producers in 2005. Green certificates can be traded in the market, as well as bilaterally between companies. (8)

Figure 7 - RES Electricity in Romania in 2005 (1)

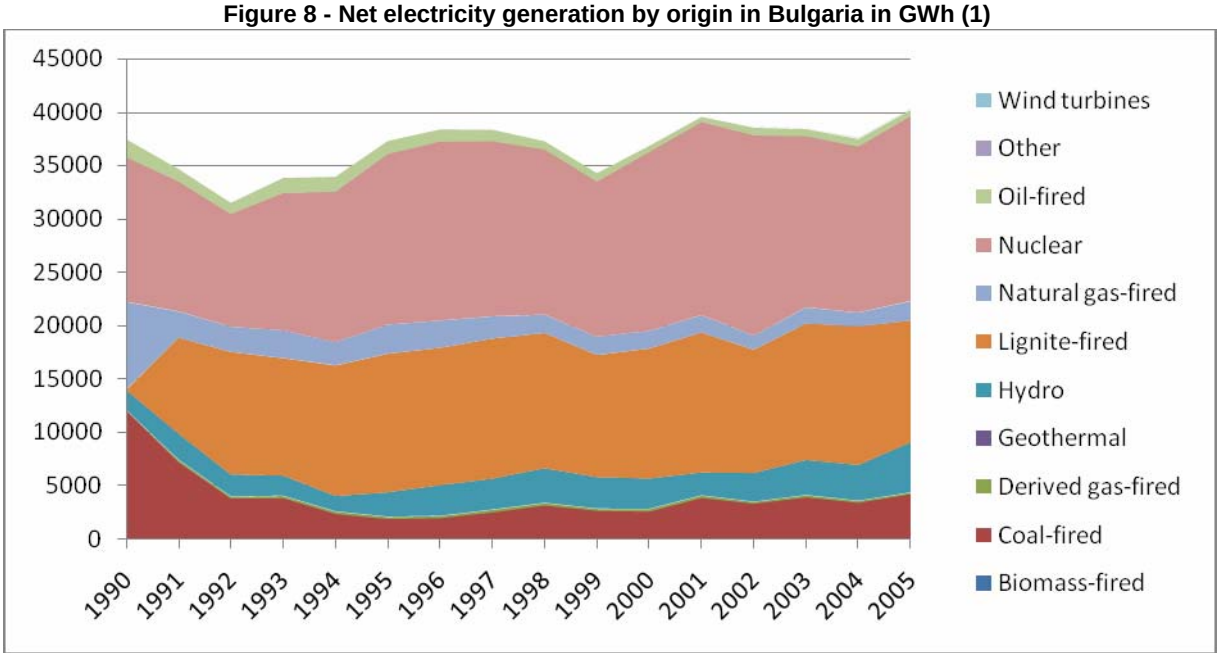


Current value of TGCs is lower than in western EU markets (3). TGC prices are limited by the government, because of a rather small number of renewable electricity generators in the country, so the minimum price is set to 24 €/MWh and maximum to 42 €/MWh. (8) However, there is still interest in investing into wind sector, but only if developers suceed in penetrating the country's energy production sector which is still largely controlled by the state. (3)

Bulgaria

Bulgarian electricity generation is mostly polarized between two technologies – nuclear and lignite-fired power plants. There are also smaller amounts of hydro, natural gas-fired and coal-fired power plants.

Figure 8 - Net electricity generation by origin in Bulgaria in GWh (1)



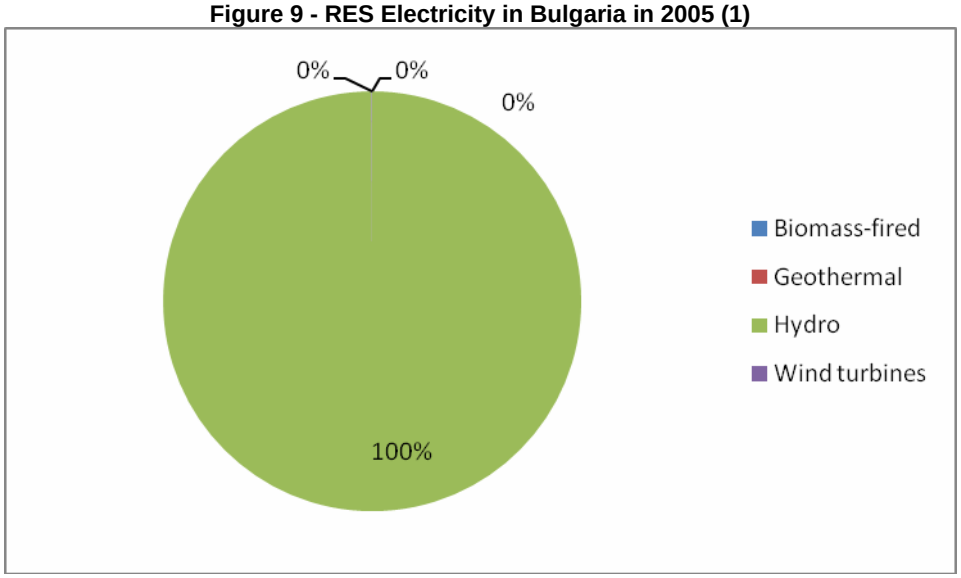
In terms of renewable electricity, hydropower is the main source, especially large scale hydro power plants. However, the potential for large hydro utilization is already fully expolited, so no further development is expected. Small scale hydro has shown annual growth rate of 20% between 1997 and 2004, and it is still developing. Since 60% of the country is agricultural area, and 30% are forests, there is quite a big potential for biomass usage. Potential for geothermal electricity is around 200 MWe, and solar energy could be used in southern and eastern Bulgaria. (9)

The Bulgarian wind market is currently fragmented, with mostly single turbine projects. One of the largest projects to be implemented in Bulgaria is 170 MW project of a local developer, which is planned for completion in phases, from 2008 to 2012. Bulgaria is expected to grow from 30 MW installed in the end of 2006 to 485 at the end of 2015, which means average annual growth of 40 MW. (3)

Bulgaria has introduced a feed-in tariff system, which will be applied only for projects built by 2010. However, prolongation is expected after this period. (3) The tariffs should be at least 80% of the average selling price of electricity to households in the previous year. In the 2007 proposal for amendments to the Energy Act it is suggested that the entire renewable electricity amount from all electricity producers that enter the market until December 31st

2010 shall be bought at preferential prices (tariffs). The tariffs will then be paid for 12 years from the beginning of project life, and there is a specific regulation on the tariffs to be issued by Energy Regulator. (8)

Figure 9 - RES Electricity in Bulgaria in 2005 (1)



Additionally, specific regulation has been passed to define criteria and rules for certifying the origin of renewable electricity. Energy Regulator is responsible for issuing the certificates. (8) There were plans to introduce green certificate system from 2007, but it was decided to have the feed-in tariff system, at least until 2010, when new energy policy should be introduced.

Croatia

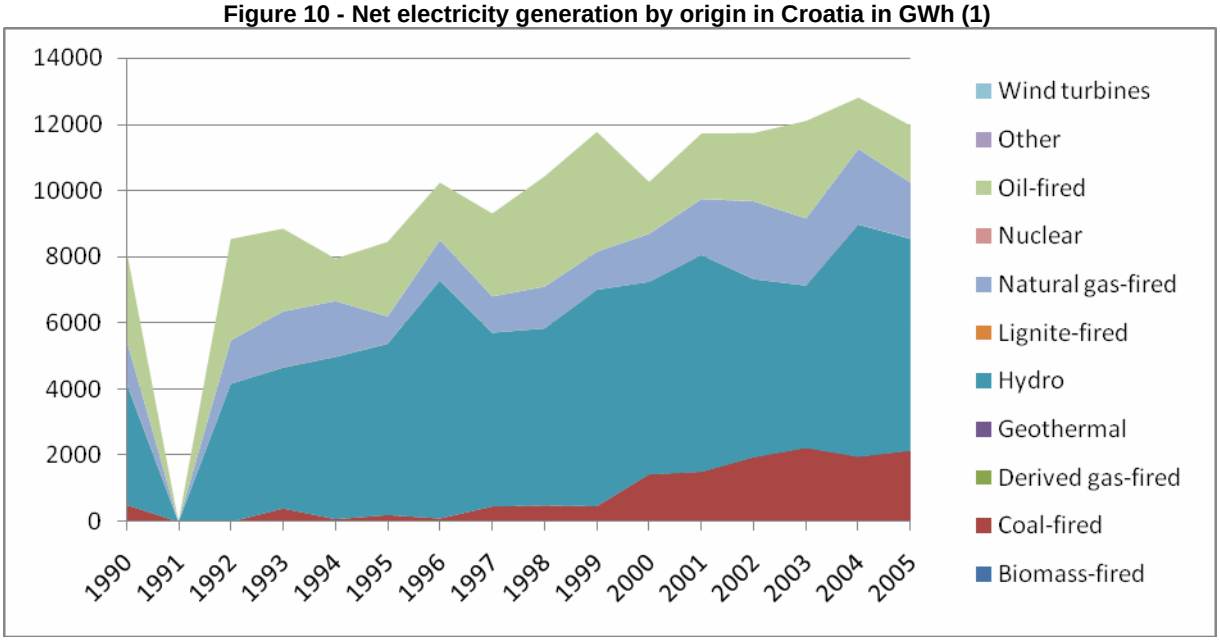
Croatia produces most of electricity from hydropower, but fossil fules, such as coal, oil and natural gas are still quite significant in the portfolio. The data is taken from the same source (1) as for the other countries, for comparison purposes, although newer data is also available. Nuclear electricity from NPP Krško, shared 50-50% with Slovenia is not included in the graph, although it contributes by 17% in Croatian electricity generation mix.

In 2005, the only renewable electricity source Croatia had were large scale hydro power plants, and several small hydro plants (below 10 MWe), which did not contribute significantly. Currently, there are two wind farms installed in Croatia – WPP Ravne on the island of Pag (56 MW) and WPP Trtar Krtolin (11, 2 MW) close to Šibenik. Croatia has a quite good wind potential, especially in southern mountainous area, and there are already plans for more than 1500 MW of wind farms. However, total wind power than can be absorbed into the Croatian power system is highly dependant on grid conditions and is currently restricted to 360 MW for total Croatia. This limit is expected to increase, as grid is extended and projects are implemented. Imposing a limit of 360 MW has led to high insecurity among wind project developers, as some of them were not allowed to build the full capacity planned in their projects.

Croatia also has a significant biomass potential, especially in wood biomass exploitation, since 37% of Croatian land is covered with forests. There are also two geothermal projects planned in northern Croatia – 2 MWe Lunjkovec-Kutnjak near the city of Koprivnica and probably 4 MWe Velika Ciglena near the city of Bjelovar. These projects aren't meant to be

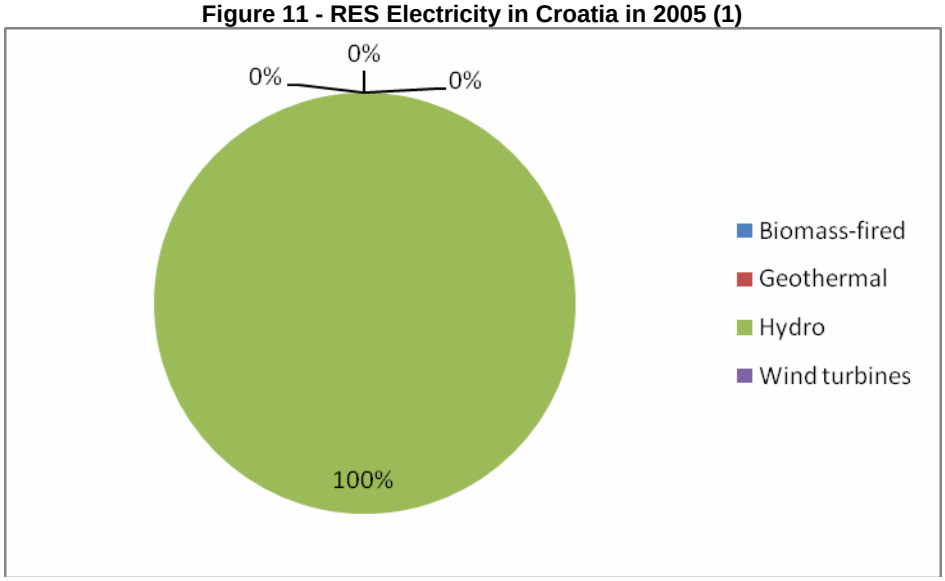
used only for electricity generation, but are planned as multi-purpose projects (heating of nearby places, production of flowers, vegetables, fish, opening of touristic spa centre etc.). Solar energy also has high potential, especially at southern areas, and currently is used for spatial and water heating. Photovoltaics are still not widely used, and are not expected to grow significantly, since new renewable policy sets the limit of 1 MW of PV installed in the entire Croatia in 2010 to be included in the incentive system.

Figure 10 - Net electricity generation by origin in Croatia in GWh (1)



In March and July 2007, Croatia has introduced the feed-in tariff system for support of renewable electricity generation. Tariffs are determined by technology, are valid for 12 years and are adjusted every year according to average small goods' price coefficient, as well as dependant of the share of domestic component within the project. Croatia also has a specific clause in energy policy, which states that renewable electricity will be supported only until the share of 5,8% in total electricity consumption in 2010 (which would be around 1100 GWh) is reached.

Figure 11 - RES Electricity in Croatia in 2005 (1)



CROSS COMPARISONS AMONG COUNTRIES

Share of renewables within total electricity generation

In the beginning of this document, the graphic representation was given of shares of RES electricity within total energy consumption in 2005 and mandatory shares for 2010 (Figure 1). Since in this document there are five countries described in depth, Table 1 is given in order to compare mandatory shares of those countries set for 2010 with renewable electricity shares in previous years.

Table 1 – Share of RES electricity within total electricity consumption in 2005, and mandatory share for 2010 for selected countries (1)

Country/Share (%)	2010	2005	2004	2003
EU27	21	14	13.9	12.9
Bulgaria	11	11.8	8.9	7.8
Hungary	3.6	4.6	2.3	0.9
Romania	33	35.8	29.9	24.3
Slovenia	33.6	24.2	29.1	22
Croatia	5,8*	36.1	41	29.4

* does not include large hydro

From Table 1 it is visible that most of the countries are on track with increasing their share of renewable electricity.

Hungary has already in 2005 exceeded its objective for 2010. The key reason of such a big jump from 2,3% in 2004 to 4,6% in 2005 is increase in electricity generation from biomass for almost 1.000 GWh. In 2004, in Hungarian city of Pecs, a cogeneration wood-biomass power plant with total installed capacity of 182 MWe of power and 313 MWth of heat, was built by converting an old coal-fired facility. This power plant was previously in the ownerhip of PannonPower Holding, and was recently (January 2007) aquired by Dalkia, subsidiary of EDF. (10)

In other countries, the situation is quite different. There was no increase in renewable generation capacity (Table 2) and the volatility of renewable generation is caused mainly by hydrology conditions. When the hydrology was good, the share of renewable electricity generation was increased, and when the weather is drier, the share of decreases.

Table 2 – RES installed capacity (MW) in selected countries in 2004 and 2005 (1)

Installed capacity (MW)	Country	2004	2005	Difference 2005 - 2004
Hydro power stations	Bulgaria	2567	2567	0
	Hungary	49	49	0
	Romania	6279	6289	10
	Slovenia	974	979	5
	Croatia	2083	2060	-23
Wood / wood wastes	Bulgaria	0	0	0
	Hungary	189	337	148

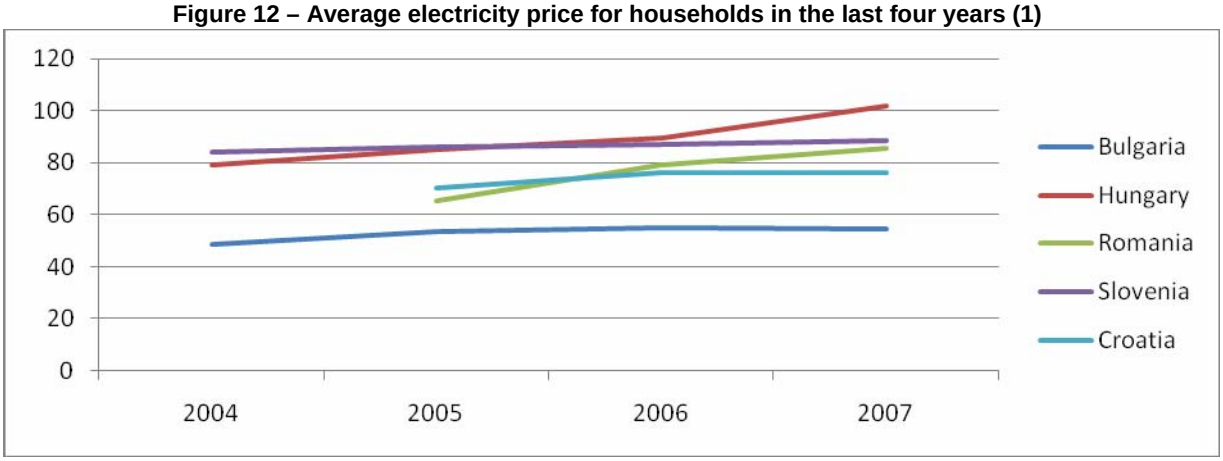
	Romania	0	0	0
	Slovenia	13	13	0
	Croatia	0	0	0

Installed capacity in other renewable sources, apart from hydro and wood biomass, was either non existant, or it did not change between 2004 and 2005.

Electricity price and feed-in tariffs

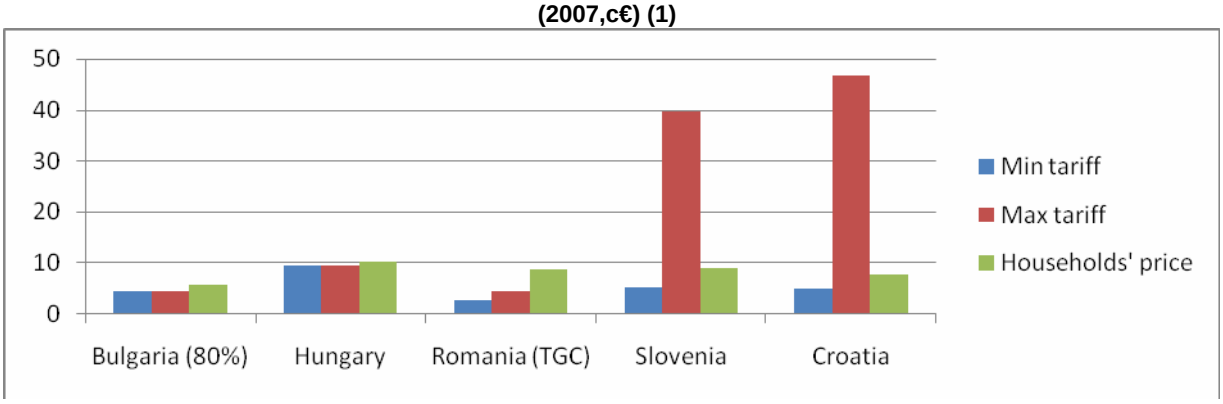
The cost of supporting renewable electricity is in the end paid by electricity consumers. This chapter will provide a comparison of average electricity prices paid by households by country and respective guaranteed tariffs.

Figure 12 – Average electricity price for households in the last four years (1)



As it is visible on Figure 12, electricity prices are the highest in Slovenia nad Hungary, that are already considered the most developed out of these countries. In Romania, electricity prices have grown rapidly in only three years, while Croatia still holds a constant, as well as Bulgaria, which has the lowest electricity prices among these countries.

Figure 13 – Comparison of min and max feed-in tariffs (TGCs) and electricity prices for households, (2007,c€) (1)



In Bulgaria, the tariff is set to 80% of average households' electricity price and in Romania the green certificate system is in place. Hungary has equal prices for all technologies, and Slovenia and Croatia have very high ranges, because of setting the tariffs for each technology separately.

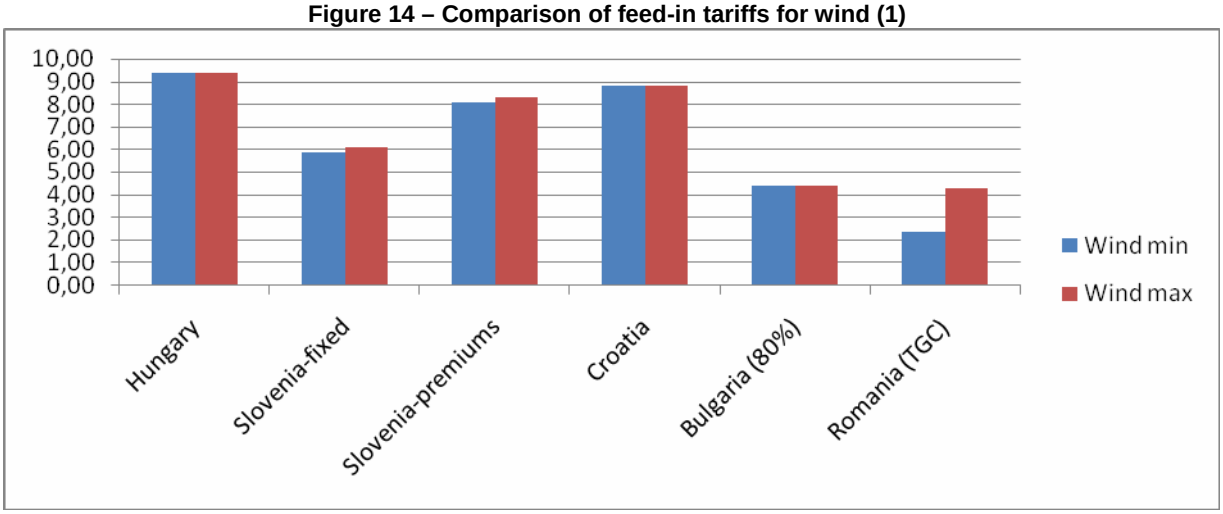
Figure 13 serves good for general comparison between countries, but it is necessary to go more in depth and compare the tariffs by technology to get a better view of differences among countries.

Feed-in tariffs by technology

As said in the chapter before, it is necessary to compare the feed-in tariffs by technology in order to get a better view of the strength of support in each of the countries.

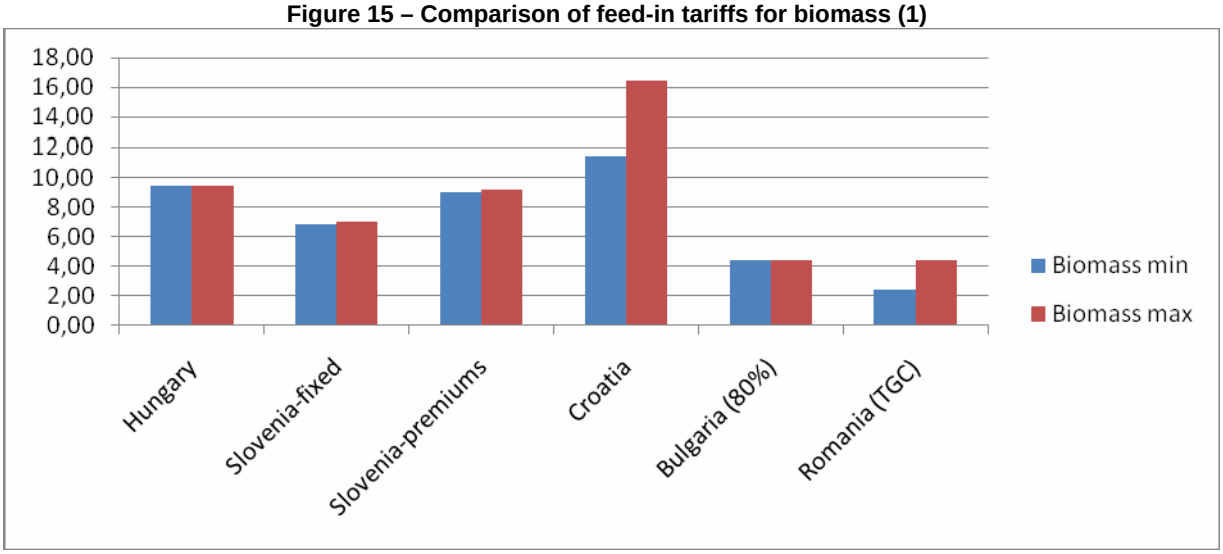
The highest level of support for wind can be found in Hungary and Croatia. For Hungary it is a quite reasonable level of price considering the electricity price paid by consumers, while in Croatia the tariff is set to be almost 30% higher than price of electricity paid by households. If the level of the tariff would be the only investment criteria for potential investors, these two countries would be first to invest to. However, taking into consideration the size of the country (market) and wind potential, investments may turn in another direction.

Figure 14 – Comparison of feed-in tariffs for wind (1)



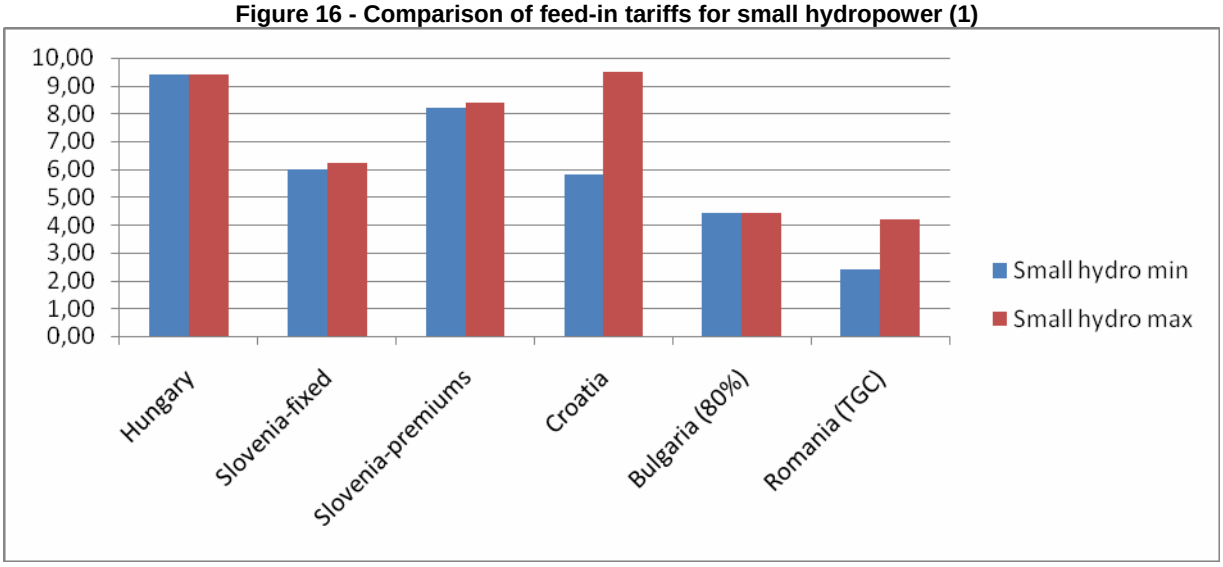
For biomass, Croatia has by far the highest guaranteed tariff, which opens possibilities for future investors. In Croatia there is still enough fuel available (wood, agricultural residues, etc.), but it is very locally limited, so there is still a lot of work to be done to enable the full expolitation of the potential. On the contrary, Bulgarian tariff is quite low, which could possibly pose a threat in development of biomass projects, regardless of its big potential.

Figure 15 – Comparison of feed-in tariffs for biomass (1)



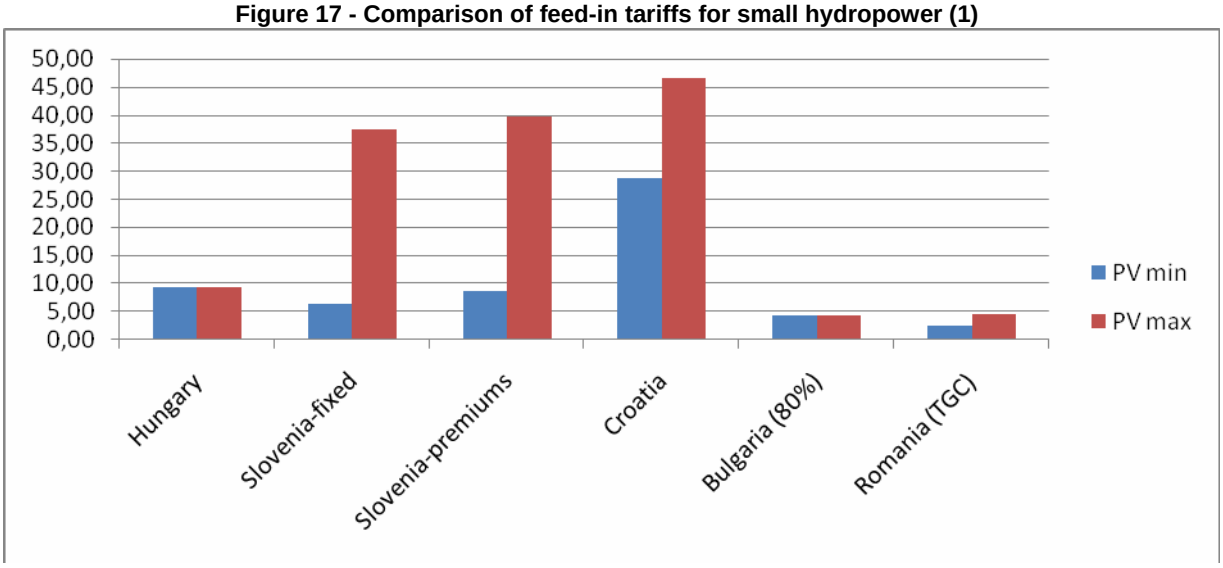
Hungary has the highest level of support for small hydro projects, most probably because of natural limitation of the source. Croatia has the highest range of tariffs, which depend highly on the annual electricity generation. Romania shows the lowest level of support, while also having the highest potential for growth in this area.

Figure 16 - Comparison of feed-in tariffs for small hydropower (1)



Croatia is the absoulte leader in the level of support for photovoltaics. However, Croatia has set a limitation for installed capacity to 1 MW in the entire country, so this makes good investment only for smaller units (i.e. households, office buildings, etc.). Among other countries, Slovenia excells with its tariffs and looks as a very good investment opportunity, of course, if the natural resource is extensive enough.

Figure 17 - Comparison of feed-in tariffs for small hydropower (1)



Other sources, such as biogas and geothermal power are not expected to have high capacities and the tariffs for both technologies are the highest in Croatia.

As a conclusion it may be said that, if investors would look only in the level of the tariff, Croatia is the best country to invest to in biomass and wind, while investments in photovoltaics and hydropower from the tariff point of view are the best to be made in Slovenia.

CONCLUSION

Renewable energy policy has been adopted in all of the selected countries. Hungary and Croatia adopted the „classical“ feed-in tariff system, which is present in most of EU countries, while others decided to try with different systems: Romania has chosen green certificate system – market-oriented, but still rather complicated, Bulgaria has set purchasing price to 80% of average household tariff – as Croatia had before the introduction of new tariff system, and Slovenia introduced a feed-in system that is based on the selection of fixed or premium tariffs (currenntly also present in Spain). The benefits of the introduced systems are still not shown in the available data set. However, natural resources as well as the level of tariffs attract investors to these countries, which will in the end lead to increasing the share of renewables in total electricity consumption – the ultimate goal of the renewable energy policy.

Attractiveness from the investor's point of view can be assessed based on different aspects. First of all, it is the size of the market. Romania is the largest country among these and has a lot of potential for exploitation of renewables. However, the green certificate system introduced may show some initial problems in adoption, which leads to investment insecurity. On the other hand, Slovenia, the smallest one, has reasonably high tariffs and well resolved policy, but the resources here are not abundant.

Slovenia and Hungary most probably present the lowest risk in investment – they have already adopted EU legislations and policies and there is quite enough resources to meet the targets they proposed. Croatia still has some issues to resolve in terms of legislation and procedures and may become less attractive for investors if they will not be promptly resolved. Also, the limitation of 360 MW of wind power poses a threat for potential investors. Bulgaria has introduced a rather simple system, but it may not be a payout for investors, since other countries have higher tariffs then household price. Romania showed the most ambition by introducing the green certificate system, which is completely market-oriented and rather complicated in realization. The size of the green certificate market will be of crucial importance, because it can influence both prices and security of investments. However, the limits set for the green certificate prices bring a level of security for potential investors.

The situation in these countries, in terms of renewable energy policy, is moving to positive direction. The objectives for the future are likely to be fullfiled and the other countries, which still have not set their own renewable energy policies, such as Serbia, Bosnia, Macedonia or Montenegro, need to continue to work on this type of legislation in order to benefit from renewable energy key characteristics: security of supply, diversification of energy supply and also ecological reasons.

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