

THE USE OF THE RENEWABLE ENERGIES IN THE VISEGRAD GROUP AND ROMANIA

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Abstract: *The purpose of our research is to compare the use of renewable energy sources in the Visegrad Group (Poland, Czechia, Hungary and Slovakia) and Romania. The widespread renewable energies are solar, wind, hydropower and biomass energy. We chose these countries because they had similar fate and presents. I was wondered whether they can catch up Western Europe in the use of the renewables. In the 20th century, these countries had enough resources without the renewables. However, the spreading of the renewables have begun in these century, and its spreading accelerated after the joining to the European Union. The Middle European countries have begun use the renewables earlier, and they utilized their possibilities but for nowadays Romania has become a significant factor in the European renewable energy production, tight behind the Western members. In this region the most important renewable energy resources are the hydropower and the biomass energy. In the examined countries some hydropower plants were built a hundred years ago and these power plants rather count as industrial monuments than real factors in the energy sector. Some of the countries use the biomass energy more, mainly for heating, these countries are Hungary and Czechia. Other countries like Slovakia trust in their rapid rivers to produce electric power. And there is Romania which country benefits both. It is welcomed that other renewables like wind and solar energy began to add to the examined countries' energy sector. From the database of Eurostat, we made some ratios to compare the countries with each other and the European average production. With means we could measure the share of the renewables in the whole national production in average, and the deviations for each country. Finally we made a possible forecast for the increasing of the renewables in the examined countries.*

Keywords: *renewable; energy; Visegrad; Romania; EU directive; 2020.*

JEL Classification: *O13.*

Introduction

First of all we would like to introduce the renewable energies in general. Renewables are the ones, which can be used and they can reproduce themselves within a human lifespan. We can divide these into two groups according their consumption. Into the first group belonging the wind and the solar energy. These type of energies are constantly useable, especially the solar energy, which come from the Sun anytime. The other group is the stock typed renewables, with the biomass, the hydropower for example. These type of energy can exhaust if we consume them reckless, but with responsible management they can be sustainable. (Bulla, 2011)

The first great power to introduce the renewables into its policy was the European Union. According to Câmpenau and Pencea (2014) the Union's attitude towards the renewables was influenced by four big global occasions. Two out of these four was fairly recent. One of these was the global depression between 2007 and 2010. By this time the Union tried to decrease its dependency on foreign energy resources, and invested in newer and more effective technologies including renewable energy sources. The other one was the recognition that our continent failed to keep pace in economic growth with the United States, Japan and China. The non-renewable coal is still the primary resource of these countries especially of China because of its low price. This state questioned the short term benefit of the renewables. (Câmpenau and Pencea, 2014)

Nonetheless the European Union is the pioneer of the sustainable economy with low greenhouse gas emission. The EU has its directive which targets 20% of the final energy consumption from renewable sources by 2020. This is the *Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC*. To achieve this, each EU member country had to mark a national target, which they thought they could reach by 2020 and these national targets are in each country's national energy plan. These plans include sectorial targets for electricity, heating and cooling, and transport too. A mandatory 10 % minimum target to be achieved by all Member States for the share of biofuels in transport by 2020. That is how the national targets ranging from Malta's 10% to Sweden's 48%. But this developing will not be stop in 2020. By 2030, the EU targets the renewables at least 27% of final energy consumption. This will make the EU global leader in the use of renewable energies. (European Parliament et al., 2009 and European Commission et. al., 2017)

The examined area for us is some Middle European countries such as Poland, Czechia, Slovakia, Hungary and Romania. They have very different climate and geographical conditions so they cannot use renewables in the same way. But now we can focus on some similarities. Each country has some of Europe's great rivers such as the Danube (Slovakia, Hungary and Romania), the Vistula (Poland) and the Elbe (Czechia). Most of their area belong to the humid continental climate excluding the highest mountains and the coastal territories. Each country have fairly developed economy including their agriculture and forestry which produce the biomass energy. From global view, only hydropower, solar energy, wind power and biomass energy have enough importance to influence the national energy consumptions. In our case Romania has highly developed hydropower industry and rapidly increasing solar and wind energy sector. Romania has high mountains, those are where the rapid rivers have their sources. Thanks to this Romania's electricity production is granted from renewable energies with the share of 43% in 2016. (From which hydropower has 31%, wind has 10% and solar has 1% share) (Dragomir et. al., 2016)

Slovakia has the highest peaks among these countries so it is unequivocal, that this country has great hydropower industry too. In 2016, renewables granted the 25% of the Slovakian electricity production (From which hydropower has 17%, solar energy has 2% and biomass energy has 6% share). We can see that hydropower, solar energy and wind energy can be used primarily in electricity production, while the other three countries have lack of these energies. They use mostly biomass energy which can be used in heating and transporting. Hungary has the lowest renewable ration in electricity sector. It is only 11%, from which the biomass has 7%, the

hydropower and the solar energy have 1-1% and the wind energy has 2% share. It is almost the same in Czechia. Renewable energies have the share of 12% from the Czech electricity production, with 6% of biomass, 3% of solar energy, 2% of hydropower and 1% of wind energy. Poland is one of the biggest biomass energy consumer in the Union. Although it does not mean that biomass is only used for producing electricity. Only 14% of Poland's electricity production comes from renewables (From which wind energy has 8%, biomass has 5% and hydropower has 1% share) (International Energy Agency 2017a, 2017b, 2017c, 2017d)

The purpose of our research is to compare the use of renewable energy sources in the Visegrad Group and Romania. We chose these countries because they had similar fate and presents. We was wondered whether they can catch up Western Europe in the use of the renewables.

Methods

Our method's basis was the reports and timeline data from Eurostat and European Environment Agency. With these and some other sources such as national energy plans and European scientific literature we gained the important data for compare the use of the renewable energies in the examined countries, and forecast whether they can succeed the national target by 2020 or not.

The comparing ratios make easier to notice the difference and similarities between the examined countries. Then we examined the growth rate in each country and the 2020 targets. The examined countries compared in their national plans to the 2005 data and we compared this to the last public data, which is 2016. So the 2016 and the targeted 2020 data are divided by the 2005 data.

And last the timeline data were represented in a graph, which indicates each country's trending lines to forecast the growth.

Results

Without research, the winner amongst these countries is Romania. It has the highest percentage of renewable energies in heating, electricity and the overall consumption. Romania take advantage of its decent opportunities. Romania has the highest 2020 target and back to 2005 had the highest percentage too. In Table 1 you can see the growth rate of the share of the renewables in each examined country.

Table 1: Growth rate of the share of renewable energy in gross final energy consumption from 2005

Country	2016 ratio	2020 target ratio
Poland	1.57	2.08
Czechia	2.44	2.21
Slovakia	1.79	2.09
Hungary	3.30	3.40
Romania	1.44	1.38

Source: Own editing based on National renewable energy action plans

We can clearly see, that Romania and Czechia has surpassed their targets by 2016. Romania's low ratio numbers have a simple explanation: as we mentioned above, it had the highest percentage of the renewable sources in the final energy

consumption. So it had the first place among the former Soviet ally countries. Romania stands on a higher level in renewable energy than the other examined countries. It has the lowest growth rate but we have to bear in mind that it had way higher base in 2005 than the others. Czechia and Hungary started from the lowest level that is why they have the highest growth rate. Poland is currently the farthest from its target. In Table 2 you can see the share of the renewable energies in gross final energy consumption by sector in each country in 2016.

Table 2: Share of the renewable energies in gross final energy consumption by sector in 2016 (%)

Sector	Poland	Czechia	Slovakia	Hungary	Romania	EU-28 av.
Electricity	13.4	13.6	22.5	7.2	42.7	29.6
Heating	14.7	19.9	9.9	20.8	26.9	19.1
Transport	3.9	6.4	7.5	7.4	6.2	7.1
Total cons.	11.3	14.9	12.0	14.2	25.0	17.0

Source: Own editing based on Eurostat data

This table highlights that Romania is leader among these countries and Poland is the tail-ender. Only in transport use do not have Romania the lead. We can clearly see that the hydropower countries (Slovakia and Romania) have the higher percentage in electricity production. Among the high Carpathian Mountains originate fast flowing rivers, and the Danube is touching Slovakia and Romania border, this river is Europe's second longest river with great hydropower potential. Romania has the biggest hydropower plant in Europe called the Iron Gates, and it is shared with Serbia.

Slovakia had its great international hydropower plant with Hungary called the Gabčíkovo-Nagymaros Waterworks, but only the Slovak part was built, because Hungary tried to terminate the project due to environmental causes.

Hungary, Romania and Poland have great plains with decent agriculture. The agricultural by-product makes up a significant proportion of the biomass resources. As we mentioned above biomass energy is primarily used by heating. In some cases renewed thermal power plants use biomass to substitute the peat and lignite which have low energy density. The other big source of the biomass energy is the forestry. In this area Hungary has the lowest percentage of forests, the others are near to the European average. Firewood is often used by communal heating. You can see that the biomass countries have higher percentages in heating than the European average.

The renewables in transporting have nearly the same numbers as the European average excluding Poland. According to the 2020 directive 10 % minimum target to be achieved by all EU member states for the share of biofuels in transport. This target currently is not surpassed by any of the examined country.

In the next part of the results we made some forecast whether the countries can achieve their targets or not. For the easier visibility we divided the countries into two graphs. For Figure 1 was chosen Romania and Poland because they have bigger economy and are more populated than the other three. In Figure 1 you can see the share of renewable energy in gross final energy consumption in Romania and Poland.

As you can see both countries had nearly constant growth of renewables. According to their national energy plan, Romania's 2020 target is the 24% share. It was mentioned earlier, that Romania has the lowest target compare to the 2005 base year. However, Romania's 2005 data (17.4%) is still higher than the other countries' 2020 target. In the graph you can see that Romania reached the 25% in 2015. With this growth rate Romania can reach 26% or 27% share.

Poland has a slower growth than Romania. The Polish target is the second lowest comparing to the 2005 base (7.2%). Poland has targeted the 15% by 2020, but in this rate of growth cannot be achievable. Poland energy sector based on coal, which price remained relatively low, and it prevents the relevant renewable energy investments in Poland.

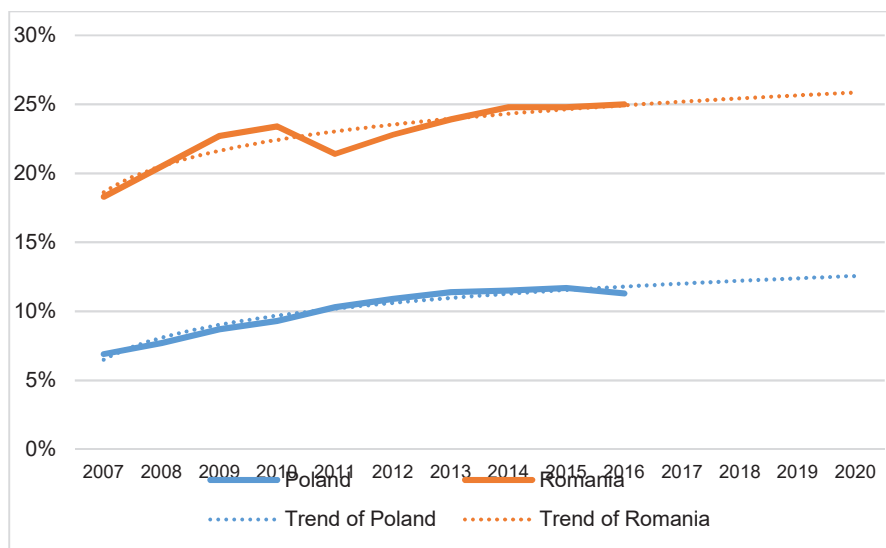


Figure 1: Share of renewable energy in gross final energy consumption in Romania and Poland

Source: Own editing based on Eurostat data

In Figure 2 you can see the share of renewable energy in gross final energy consumption in the rest of the countries. As we mentioned earlier Hungary and Czechia had the lowest percentage in 2005 (Hungary had 4.3% and Czechia had 6.1%) so they had the biggest growth through these years. Hungary has targeted nearly 14.5% and they achieved it in 2013 but they had a throwback and dropped to around 14%, but with this growth rate they can achieve again the target and can reach even higher percentages by 2020. It depends on the agricultural yield because most of the biomass energy comes from agricultural by-products.

Czechia had more balanced growth than Hungary. The Czech target is to reach 13.5% share of renewable energies. As you can see they have surpassed their target in 2013 and unlike Hungary they managed to keep their result. The Czech growth rate predicts that this country can reach 16% by 2020. Slovakia had an average base percentage (6.7%) in 2005 among these countries. They targeted 14% by 2020, the Slovak renewable sharing in not as billowy as the Hungarian, but as constant as the Czech, it is located between these two. The Slovak growth rate is not enough to

reach their target by 2020, they can reach a whole percentage less share for the renewables only about 13%.

Excluding Romania, each country has very simple energy sector with a dominant energy resource. In Poland and Czechia it is the coal with over 50% share. In Slovakia and Hungary it is the nuclear energy with over 50% share. It is dangerous depending on one kind of resource because it makes the country's economy vulnerable.

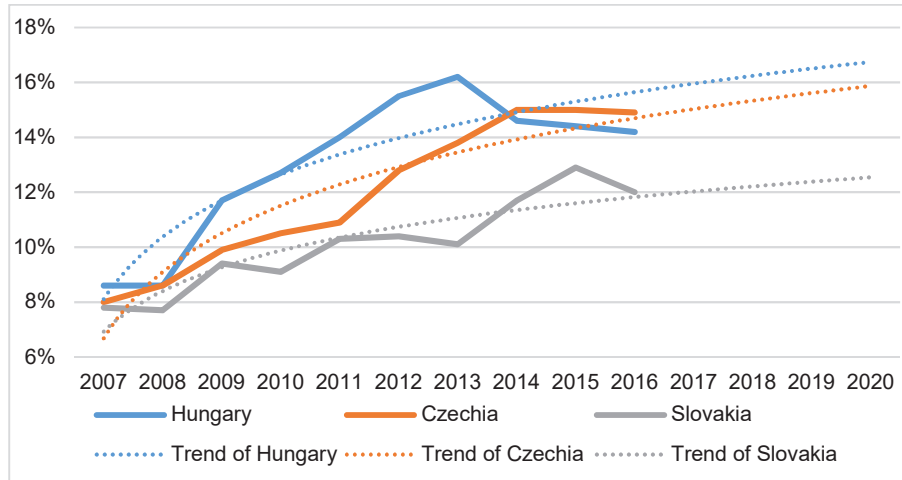


Figure 2: Share of renewable energy in gross final energy consumption in Hungary, Czechia and Slovakia

Source: Own editing based on Eurostat data

Conclusion

We examined the use of the renewable energies in the Visegrad countries and Romania. The European Union wants to reach its 20% target by 2020. Its goal is constantly meet some barriers, such as economic depression which prevented the renewable energy investments and so the lowered fossil fuel prices what obstruct the research too. Nonetheless the EU set newer goals by 2030. The examined countries want to keep up with the EU directive so they achieved big developing in the use of renewable energies.

The leader amongst these countries is Romania with no doubt. Their renewable share increased by 1.4 times by 2016 and their 2005 base year is bigger percentage than the other countries 2020 targets. This country has reliable and sufficiently diverse energy sector. They use hydropower, wind energy, solar energy to produce electricity and biomass energy for the heating. Romania is the only examined country which has more than one sector with higher percentage share of renewables than the EU average. These sectors are electricity and heating.

Czechia is the other country which reached its 2020 target, and still has growing potential. Its electric sector relies a bit on biomass energy, hydropower and solar energy. Czechia uses renewable energy for heating higher percentage than the EU average. The Czech renewable share in the in gross final energy consumption increased by 2.44 by 2016.

Hungary has a special case. It reached their target in 2013, but by 2016 it dropped below the target. The Hungarian energy sector had the lowest percentage share of the renewables, but it increased by 3.3 times. The Hungarian energy sector's most relevant renewable energy is the biomass energy. They use in both electricity production and heating. Just like Romania and Czechia, Hungary has higher share of renewables in heating than the EU average.

Slovakia has the third highest growth rate, although this is not enough to achieve its target by 2020. Slovakia primarily use renewable energies to produce electricity. The Slovak electricity sector relies on its hydropower plants and biomass energy. With this electricity sector Slovakia is near at the EU average in renewable energies in the electricity production.

Poland has the second lowest growth rate after Romania, but the Poles do not have a high base year like Romania. Poland was overtaken by Czechia, Slovakia and Hungary, despite Poland had the second highest percentage in 2005. With this growth rate the Poles cannot achieve their target by 2020.

In the end it is needed to mention that these countries excluding Romania is still below the EU average and they have to invest more on renewable energy using technologies if they do not want to fall behind in the EU. Romania is a good example for the other four countries how to take advantage of the climate and geographical conditions. They have different conditions but each country can find the segment from the Romanian renewable sector which suits to them and they can learn about it.

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