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THE USE OF RENEWABLE ENERGY SOURCES IN POLAND AGAINST A EUROPEAN UNION BACKGROUND

Keywords: renewable energy sources, EU energy policy, energy management framework, Europe 2020

ABSTRACT. The purpose of the analysis was to determine the degree of use of renewable energy sources in Poland in comparison to other EU countries. The article presents the degree of use of renewable energy sources in Poland against a background of European Union countries together with the quantitative use of renewable energy sources in Poland, since 2010. Poland, like other EU countries, aims at meeting its obligations towards the energy union policy and achieving the target for energy from renewable sources by 2020, in accordance with the adopted EU strategy "Europe 2020". The results and ways of achieving the goal by Poland were presented, as well as the breakdown of Member State contributions, which are the sum of EU-level goals by 2030. Research was based on secondary data obtained from the EU statistical agency Eurostat. The publication uses, among others: analysis of domestic and foreign literature sources and analysis of secondary data expressed in real values, the results of which are presented in tabular form. For the purposes of this publication, a method of targeted selection of quantitative parameters was used, which will allow an analysis and comparison of the degree of renewable energy development in Poland and the EU. The analyzes covered the years 2010-2017. The analyzes carried out indicate that the slowdown or growth in achieving the goal is largely influenced by current economic development or slowdown, expenditure on supporting renewable energy policy, administrative procedures and current country policy. Trends in the use of renewable energy depend on, among others the above factors.

INTRODUCTION

Renewable energy is at the heart of the Energy Union's priorities. The conclusion of Directive 2009/28 / EC on the promotion of the use of energy from renewable sources (the so-called Red I Directive) was the main element of the Energy Union policy and a key factor to achieving renewable energy targets by 2020 [Gielen et al. 2019]. In 2010, the Europe 2020 strategy for smart, sustainable growth confirmed that the 20% target of reducing energy consumption by 2020 through increased energy efficiency is part of one of the five main goals of this strategy, as coherent and complementary to the EU counteracting policy climate change [Wang et al. 2016]. In October 2014, the European Council set as an indicative target, at an EU level, at least a 27% improvement in energy efficiency in 2030, reserving the possibility of raising this target to 30% [Skoczkowski, Bielecki 2016].

The new framework will build on the progress made by implementing the current directive, including, inter alia, the obligation for Member States to use the 2020 targets

as the basis for respective plans for the next decade. The framework is complemented by other parts of the Clean Energy for All Europeans package.

Poland, in addition to fulfilling its obligations towards EU requirements, conducts and implements national provisions towards RES. The most important challenges of Poland›s energy policy include: ensuring the reliability of fuel and energy supplies, increasing competitiveness of the economy, increasing energy efficiency and minimizing the negative impact of the energy sector on the environment. One of the ways of achieving these goals is to increase the use of renewable energy [Ignarska 2013].

RENEWABLE ENERGY SOURCES IN POLAND

Pro-ecological awareness of society, government and investors, as well as the number of projects undertaken to protect the environment are constantly increasing. The belief that renewable energy is environmentally friendly has spread. In Poland, depending on regional and local conditions, different types of renewable energy sources can be used, i.e. hydropower, wind, geothermal, solar, and biomass, however, the greatest importance has been attributed to the importance and use of biomass, especially from agriculture [Jasiulewicz 2009].

There are several small hydropower plants operating in Poland, which are located on small and medium rivers. Due to unfavorable water and energy conditions in the country, they are not built too often [Warać et al. 2010]. Water energy resources depend on a riverbed decrease and water flows. A reduction in the use of this type of resources is primarily due to the fact that Poland is mostly located in lowland areas, where there is a relatively low amount of rainfall and a high permeability of land. For this reason, only the development of small hydropower plants is noticeable. The mechanical energy of water sets the turbine in motion and is transformed into electricity using an alternator. Power depends on the water flow rate and the amount of water fall and its flow [Kasperek, Wiatkowski 2010].

Small wind farms are more popular. The specificity of wind farms is the need to produce electricity under variable wind speeds. This has a direct impact on the efficiency and level of reliability of wind installations [Paska, Surma 2011]. In Poland, there are suitable conditions for using wind energy on about 1/3 of the country's area. On an area of 60 thousand km^2, the average wind speed exceeds 4 m/s. Outside this area, suitable conditions for the location of wind farms exist on an area of 30,000 km^2. The method of using obtained electricity varies and depends on the specific situation and power generated by a wind turbine [Niemiec et al. 2010].

Heat pumps are also used to heat buildings. The task of heat pumps is to convert energy that comes from renewable sources, such as air, soil or water, into usable heat. Heat pumps can also use the heat coming from waste. Air heat pumps are the cheapest in terms of investment. However, compared to other heat sources, they have a COP of less than 30 to 50%. In addition, they are less energy efficient.

From the ground, however, we can draw the energy of shallow geothermal energy, i.e. stored energy, originating from solar radiation, occuring up to a depth of 350 m. Deeper, lies the energy of the earth›s core, called geothermal energy. Geothermal energy contained in waters, steam and surrounding rocks is also of increasing interest [Kruszewska-Mikucka 2012]. Solar radiation energy can be used in two ways. The first is the direct conversion of solar

radiation energy into thermal energy, the second is photovoltaic, thanks to which it is possible to convert sunlight into electricity. Solar farms currently attract the greatest interest among investors and change in legal regulations are introduced to it [Brasz, Bilbow 2004].

Legal acts regulating the issues of renewable energy in Poland include, among others: the Energy Law Act [OJ 2012.1059, as amended], the Act on biocomponents and liquid biofuels [Journal of Laws 2014.1643, as amended], the Act on renewable energy sources [Journal of Laws 2015.478] and the ordinance of the Minister of the Economy on the detailed scope of obligations to obtain and submit certificates of origin for the redemption, payment of a substitution fee, purchase of electricity and heat generated in renewable energy sources and the obligation to confirm data on the amount of electricity generated in a renewable energy source [OJ 2008.156.969, as amended]. Detailed directions, implementation tools and goals are presented in the document entitled Poland's energy policy until 2030 [Ministry of the Economy 2009]. The share of renewable energy in Poland is about 4.4 GW, including: biomass – 22%, biogas – 4%, solar installations – 0.03%, hydro power plants – 16%, and wind farms – 58% [GUS 2018].

MATERIAL AND RESEARCH METHODS

The purpose of the analysis was to determine the degree of use of renewable energy sources in Poland against a background of other European Union countries in relation to the EU energy policy assumptions by 2020 and 2030.

To achieve the goal mentioned above, the publication uses, among others, an analysis of domestic and foreign literature sources and quantitative data analysis, the results of which are presented in tabular form. Quantitative data comes from Eurostat.

FINDINGS

In order to make quantitative analyzes of the use of renewable energies in Poland, let us examine the objectives that the EU has committed to by 2020:

– reducing greenhouse gas emissions by 20%,
– increasing the share of renewable energy in total energy consumption to 20% (currently this share is 8.5%),
– increasing energy efficiency by 20%.

Thanks to the adoption of the "20-20-20" package, the EU and its members are taking steps towards a more sustainable, secure and more energy-based technology [Kurzak 2010]. Progress reports in the field of renewable energy, published in June 2015, show that Member States [EC 2015a] in achieving the 2020 goals in the field of renewable energy is successive. The structure of obtaining energy from renewable sources for Poland is fundamentally different from the structure of obtaining energy from renewable sources for the EU. This is primarily due to the geographical conditions and resources that are characteristic of our country [Rajchel, Walawender 2018]. Tables 1-4 present quantitative data on electricity production capacity for renewable energy sources and waste, electricity production capacity for combustible fuels by technology and operator, energy efficiency,

Table 1. The share of energy from renewable sources in gross final energy consumption

Countries	Share of energy [%]						
	2010	2011	2012	2013	2014	2015	2016
European Union	13.1	13.4	14.7	15.4	16.2	16.7	17.0
Belgium	5.6	6.3	7.2	7.5	8.0	7.9	8.6
Bulgaria	14.1	14.3	16.0	19.0	18.0	18.2	18.8
Czech Republic	10.5	11.0	12.8	13.9	15.0	15.0	14.9
Denmark	22.1	23.5	25.7	27.4	29.7	31.4	32.6
Germany	11.7	12.5	13.6	13.8	14.4	14.9	14.9
Estonia	24.6	25.4	25.5	25.4	26.2	28.4	28.6
Ireland	5.8	6.6	7.1	7.6	8.7	9.1	9.3
Greece	9.8	10.9	13.5	15.0	15.4	15.4	15.1
Spain	13.8	13.2	14.3	15.3	16.1	16.2	17.4
France	12.7	11.1	13.6	14.2	14.8	15.2	15.9
Croatia	25.1	25.4	26.8	28.0	27.8	29.0	28.3
Italy	13.0	12.9	15.4	16.7	17.1	17.5	17.4
Cyprus	6.0	6.0	6.8	8.1	8.9	9.4	9.3
Latvia	30.4	33.5	35.7	37.0	38.6	37.5	37.1
Lithuania	19.6	19.9	21.4	22.7	23.6	25.8	25.6
Luxembourg	2.9	2.9	3.1	3.5	4.5	5.1	5.4
Hungary	12.7	14.0	15.5	16.2	14.6	14.4	14.3
Malta	1.0	1.8	2.8	3.7	4.7	5.2	6.2
Netherlands	3.9	4.5	4.7	4.7	5.5	5.7	5.9
Austria	29.9	30.1	31.0	32.0	33.2	32.8	33.0
Poland	9.3	10.3	10.9	11.4	11.5	11.7	11.3
Portugal	24.2	24.6	24.6	25.7	27.0	28.0	28.4
Romania	23.1	21.2	22.8	23.9	24.8	24.8	25.0
Slovenia	20.4	20.3	20.8	22.4	21.5	21.9	21.3
Slovakia	9.1	10.3	10.4	10.1	11.7	12.9	12.0
Finland	32.4	32.8	34.4	36.7	38.8	39.3	39.0
Sweden	47.2	48.7	51.1	51.9	52.4	53.6	53.8
Great Britain	3.7	4.2	4.2	5.3	6.5	8.4	9.2
Iceland	70.3	71.5	72.4	71.6	70.5	70.3	72.7
Norway	61.2	63.9	64.2	66.2	68.9	68.7	69.8
Montenegro	40.6	40.6	41.5	43.7	44.1	43.1	41.5
Macedonia	16.5	16.4	18.1	18.5	19.6	19.5	18.0
Albania	31.9	31.2	35.2	33.2	31.5	34.4	37.1
Serbia	19.8	19.1	20.8	21.1	22.9	21.9	21.0
Turkey	14.0	12.8	13.2	13.9	13.6	13.6	13.7
Bosnia and Herzegovina	18.3	17.7	18.7	18.9	19.5	18.5	24.4

Source: own elaboration based on [EUROSTAT 2019a]

Table 2. Dynamics of the share of energy from renewable sources in gross final energy consumption

Countries	Share of energy [%]						
	2011	2012	2013	2014	2015	2016	2017
European Union	102.3	109.7	104.8	105.2	103.1	101.8	102.9
Belgium	112.5	114.3	104.2	106.7	98.8	108.9	105.8
Bulgaria	101.4	111.9	118.8	94.7	101.1	103.3	99.5
Czech Republic	104.8	116.4	108.6	107.9	100.0	99.3	99.3
Denmark	106.3	109.4	106.6	108.4	105.7	103.8	109.8
Germany	106.8	108.8	101.5	104.3	103.5	100.0	104.0
Estonia	103.3	100.4	99.6	103.1	108.4	100.7	102.1
Ireland	113.8	107.6	107.0	114.5	104.6	102.2	115.1
Greece	111.2	123.9	111.1	102.7	100.0	98.1	107.9
Spain	95.7	108.3	107.0	105.2	100.6	107.4	100.6
France	87.4	122.5	104.4	104.2	102.7	104.6	102.5
Croatia	101.2	105.5	104.5	99.3	104.3	97.6	96.5
Italy	99.2	119.4	108.4	102.4	102.3	99.4	105.2
Cyprus	100.0	113.3	119.1	109.9	105.6	98.9	106.5
Latvia	110.2	106.6	103.6	104.3	97.2	98.9	105.1
Lithuania	101.5	107.5	106.1	104.0	109.3	99.2	100.8
Luxembourg	100.0	106.9	112.9	128.6	113.3	105.9	118.5
Hungary	110.2	110.7	104.5	90.1	98.6	99.3	93.0
Malta	180.0	155.6	132.1	127.0	110.6	119.2	116.1
Netherlands	115.4	104.4	100.0	117.0	103.6	103.5	111.9
Austria	100.7	103.0	103.2	103.8	98.8	100.6	98.8
Poland	110.8	105.8	104.6	100.9	101.7	96.6	96.5
Portugal	101.7	100.0	104.5	105.1	103.7	101.4	98.9
Romania	91.8	107.5	104.8	103.8	100.0	100.8	98.0
Slovenia	99.5	102.5	107.7	96.0	101.9	97.3	100.9
Slovakia	113.2	101.0	97.1	115.8	110.3	93.0	95.8
Finland	101.2	104.9	106.7	105.7	101.3	99.2	105.1
Sweden	103.2	104.9	101.6	101.0	102.3	100.4	101.3
Great Britain	113.5	100.0	126.2	122.6	129.2	109.5	110.9
Iceland	101.7	101.3	98.9	98.5	99.7	103.4	98.5
Norway	104.4	100.5	103.1	104.1	99.7	101.6	102.0
Montenegro	100.0	102.2	105.3	100.9	97.7	96.3	96.4
Macedonia	99.4	110.4	102.2	105.9	99.5	92.3	109.4
Albania	97.8	112.8	94.3	94.9	109.2	107.8	93.3
Serbia	96.5	108.9	101.4	108.5	95.6	95.9	98.1
Turkey	91.4	103.1	105.3	97.8	100.0	100.7	96.4
Bosnia and Herzegovina	96.7	105.6	101.1	103.2	94.9	131.9	93.9

Source: own elaboration based on [EUROSTAT 2019a]

Table 3. Energy efficiency against a background of EU countries in 2010-2015

Countries	Efficiency [%]					
	2010	2011	2012	2013	2014	2015
European Union	7.3	7.7	7.7	7.8	8.3	8.3
Belgium	6	6.5	6.8	6.6	7.1	7.1
Bulgaria	2.2	2.0	2.1	2.3	2.2	2.2
Czech Republic	3.4	3.6	3.6	3.6	3.8	4.0
Denmark	12.1	13.2	13.7	14	15	15.4
Germany	7.8	8.5	8.5	8.3	8.8	8.9
Estonia	2.4	2.6	2.7	2.5	2.7	2.8
Ireland	11	12.1	12.3	12.5	13.7	16.4
Greece	7.9	7.4	6.9	7.6	7.6	7.6
Spain	8.3	8.3	8.1	8.6	8.9	8.8
France	7.5	7.9	7.9	7.9	8.3	8.3
Croatia	4.8	4.8	5	5.1	5.3	5.3
Italy	9.0	9.4	9.5	9.7	10.2	10
Cyprus	7.0	7.2	7.5	8.1	7.8	7.9
Latvia	3.8	4.3	4.3	4.5	4.6	4.8
Lithuania	4.1	4.2	4.3	4.8	4.9	4.9
Luxembourg	8.7	9.0	9.2	9.8	10.5	11.0
Hungary	3.7	3.9	4	4.2	4.4	4.3
Malta	7.0	7.1	7.0	8.2	8.8	11.4
Netherlands	7.4	8.0	7.9	8.0	8.5	8.6
Austria	8.7	9.2	9.2	9.1	9.5	9.3
Poland	3.6	3.8	4.0	4.0	4.3	4.4
Portugal	7.4	7.5	7.6	7.5	7.7	7.5
Romania	3.5	3.5	3.7	4.2	4.3	4.5
Slovenia	4.9	5	5	5.1	5.4	5.6
Slovakia	3.8	4	4.2	4.2	4.6	4.7
Finland	5.0	5.4	5.5	5.5	5.4	5.6
Sweden	7.3	7.6	7.6	7.8	8.1	9.0
Great Britain	8.7	9.5	9.4	9.7	10.6	10.7
Iceland	1.9	1.8	1.8	1.8	1.9	2.0
Norway	10.8	12.2	12	11.6	11.9	12.1
Montenegro	2.8	2.8	2.9	3.3	3.4	3.3
Macedonia	2.5	2.4	2.4	2.7	2.9	3.0
Albania	4.2	4.1	4.5	4	4.1	4.5
Serbia	2.0	2.0	2.2	2.2	2.4	2.2
Turkey	5.5	5.7	5.7	6.3	6.4	6.2
Kosovo	1.7	1.8	2.0	2.1	2.2	2.0

Source: own reported data based on [EUROSTAT 2019b]

Table 4. Energy efficiency dynamics in EU countries in 2011-2016

Countries	Efficiency [%]					
	2011	2012	2013	2014	2015	2016
Belgium	108,3	104,6	97,1	107,6	100,0	95,8
Bulgaria	90,9	105,0	109,5	95,7	100,0	109,1
Czech Republic	105,9	100	100	105,6	105,3	105,0
Denmark	109,1	103,8	102,2	107,1	102,7	98,7
Germany	109,0	100,0	97,6	106	101,1	101,1
Estonia	108,3	103,8	92,6	108	103,7	103,6
Ireland	110,0	101,7	101,6	109,6	119,7	98,8
Greece	93,7	93,2	110,1	100,0	100,0	100,0
Spain	100,0	97,6	106,2	103,5	98,9	103,4
France	105,3	100,0	100,0	105,1	100,0	102,4
Croatia	100,0	104,2	102,0	103,9	100,0	101,9
Italy	104,4	101,1	102,1	105,2	98,0	102,0
Cyprus	102,9	104,2	108,0	96,3	101,3	97,5
Latvia	113,2	100,0	104,7	102,2	104,3	102,1
Lithuania	102,4	102,4	111,6	102,1	100,0	100,0
Luxembourg	103,4	102,2	106,5	107,1	104,8	102,7
Hungary	105,4	102,6	105	104,8	97,7	100,0
Malta	101,4	98,6	117,1	107,3	129,5	110,5
Netherlands	108,1	98,8	101,3	106,3	101,2	100,0
Austria	105,7	100,0	98,9	104,4	97,9	101,1
Poland	105,6	105,3	100,0	107,5	102,3	97,7
Portugal	101,4	101,3	98,7	102,7	97,4	100,0
Romania	100,0	105,7	113,5	102,4	104,7	104,4
Slovenia	102,0	100,0	102,0	105,9	103,7	100,0
Slovakia	105,3	105,0	100,0	109,5	102,2	102,1
Finland	108,0	101,9	100,0	98,2	103,7	100,0
Sweden	104,1	100,0	102,6	103,8	111,1	95,6
Great Britain	109,2	98,9	103,2	109,3	100,9	102,8
Iceland	94,7	100,0	100,0	105,6	105,3	115,0
Norway	113,0	98,4	96,7	102,6	101,7	105,8
Montenegro	100,0	103,6	113,8	103,0	97,1	109,1
Macedonia	96,9	100,0	112,5	107,4	103,4	103,3
Albania	97,6	109,8	88,9	102,5	109,8	100,0
Serbia	100,0	110,0	100,0	109,1	91,7	100,0
Turkey	103,6	100,0	110,5	101,6	96,9	96,8
Kosovo	105,9	111,1	105,0	104,8	90,9	100,0

Source: own elaboration based on [EUROSTAT 2019b]

the share of energy from renewable sources in Poland against a background of the EU, and the dynamics of changes in this respect.

According to the presented analyzes, the share of energy from renewable sources in final gross energy consumption, in the European Union, in 2017, increased by 0.5 p.p. year-on-year, to 17.5%. In Poland, since the beginning of implementing the energy policy, the share has increased by an average of 0.5 p.p., although, in 2013, a clear slowdown was observed. In 2015, the European Commission [EC 2015b], in another progress report on the implementation of the directive on the promotion of renewable energy sources, warned two countries, Poland and Hungary, that they may not achieve their renewable energy targets for 2020.

In 2016, a decrease of 0.48 p.p. was recorded, compared to 2015, and a decrease in 2017 by 0.36 p.p. compared to 2016. Sweden is the producer of the cleanest current, where more than half (54.5%) of energy comes from renewable sources. As shown below (Figure 1), Sweden has achieved its target by 2020, exceeding it by 5.5 p.p. Poland, on the other hand, is at the bottom with 10.9%. Poland is 4.1 p.p. away from the 2020 target.

The issue of energy efficiency is treated as a priority in Poland's energy policy until 2030, and progress in this area is key to achieving all of its other objectives. Table 2 presents the dynamics of changes in the share of energy from RES in gross final energy consumption.

Table 3 presents Poland's energy efficiency against a background of EU countries. Given the increase since 2010, Poland is in the middle of the ranking with a score of 0.7 p.p., while the average increase in the presented countries is 1.19 p.p. Greece is the worst in the ranking, with energy efficiency dropping by 0.3 p.p., Ireland is the best with an increase in energy efficiency of 5.2 p.p. The largest dynamics of energy efficiency improvement in 2016, compared with the year 2010, is noticed in countries such as Bulgaria, Malta, Romania and Iceland. A decline in dynamics is clearly noticeable in Belgium. Despite an increase in energy efficiency in Poland, its dynamics definitely slowed down. Trends in energy efficiency are presented in Table 4.

SUMMARY AND CONCLUSIONS

Published data of the Eurostat statistical agency confirm that Poland is moving away from the commitment regarding the share of renewable energy in the national energy mix. The available reports and data analysis show that we may not meet the domestic RES target for 2020. However, over the years Poland has gained experience from RES and changes are taking place towards which trends in the use of renewable energy sources should be shifting. For example, a clear upward trend until 2014 could be observed in the case of the share of energy from renewable energy sources in the overall energy balance in Poland and individual EU countries. However, in subsequent years significant fluctuations are noted.

So, how can the overall observed changes be assessed? They can be explained by a serious inhibition of wind energy development both in Poland and EU countries. Factors are structural and not only related to individual countries. The most positive trends are observed in Scandinavian countries. They can be considered as leaders in the development of renewable energy in Europe. The countries of the former communist bloc still have a lot to catch up on in this respect.

Increasing energy efficiency is, therefore, a complex political, economic and social process, and the right synergy of these three groups of factors is a prerequisite for success. Energy efficiency should be treated as a kind of energy resource [Bielecki, Skoczkowski 2012]. It can be expected that the key to influencing the better use of renewable energy potential are further legal solutions in the EU. Among other areas affecting the development of renewable energy sources in Poland, include: financial support options, legal support regulations, the elimination or minimization of administrative and procedural barriers and other solutions friendly to consumers and entrepreneurs.

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WYKORZYSTANIE ODNAWIALNYCH ŹRÓDEŁ ENERGII W POLSCE NA TLE UNII EUROPEJSKIEJ

Słowa kluczowe: odnawialne źródła energii, polityka energetyczna UE, ramy zarządzania energią, Europa 2020

ABSTRAKT

Celem analizy było określenie stopnia wykorzystania odnawialnych źródeł energii w Polsce na tle pozostałych krajów Unii Europejskiej. W artykule zaprezentowano stopień wykorzystania odnawialnych źródeł energii w Polsce na tle krajów Unii Europejskiej wraz z ilościowym wykorzystaniem OZE w Polsce od 2010 roku. Polska, jak i pozostałe kraje UE, wypełnia zobowiązania względem polityki unii energetycznej oraz realizuje cel w zakresie energii ze źródeł odnawialnych do roku 2020, zgodnie z przyjętą strategią UE „Europa 2020". Przedstawiono wyniki i sposoby osiągania celu przez Polskę, a także omówiono podziały wkładów państw członkowskich, które stanowią sumę celów na poziomie UE do 2030 roku. Badania zostały przeprowadzone na podstawie danych wtórnych pozyskanych z unijnej agencji statystycznej Eurostat. Wykorzystano m.in. analizę źródeł literatury krajowej i zagranicznej oraz analizę danych wtórnych wyrażonych w wartościach realnych, której wyniki zaprezentowano w formie tabelarycznej. Na potrzeby publikacji wykorzystano metodę doboru celowego parametrów ilościowych, które umożliwią dokonania analizy i porównania stopnia rozwoju OZE w Polsce i UE. Analizy objęły lata 2010-2017. Dokonane analizy wskazują, że na spowolnienie lub wzrost w osiąganiu celu wpływ mają w dużym stopniu: aktualny rozwój lub spowolnienie gospodarcze, nakłady na wspieranie polityki OZE, procedury administracyjne oraz aktualna polityka kraju. Tendencje w wykorzystaniu OZE zależą bowiem m.in. od ww. czynników.

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