CLIMATE CHANGE AND THE USE OF RENEWABLE ENERGY SOURCES IN EUROPE

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***Abstract**: This paper presents a brief overview of research on climate change on Earth, as well as a fact-based scenario that predicts climate change in the future. The aim of this paper is to show the impact of climate change on the planet, in order for humankind to prepare in time to adapt and mitigate the consequences of this phenomenon. The paper method includes the collection and analysis of contemporary relevant data and literature in the field of global climate change. Majority of phenomena contributing to climate change can be attributed to human activities that have endangered environmental security. Further on the paper presents research data considering the use of renewable energy sources in Europe, which has a very significant role in reduction of carbon dioxide (CO2) emissions into the atmosphere, which represent an important part of European Union (EU) policy. Also, this paper presents the share of renewable energy sources in final energy consumption, as well as electricity and traffic consumption. It is important to point out that climate change requires adaptation by overall society in order to successfully overcome all the consequences of this global problem. It is absolutely necessary to actively consider the environmental problems at the national and global level in order to find ways to solve them.*
***Keywords**: climate change, human activities, environment, Europe, renewable energy sources*

INTRODUCTION

As well as the economic growth, the protection of environment is equally important, and we are witnessing a growing interest in the efficient use of natural resources and environmental protection. Efforts are being made to harmonize economic and environmental interests and to find more adequate instruments for encouraging sustainable social development (Petrović-Randjelović et al., 2020).

The impact of climate change on our planet is quite noticeable. It is believed that climate change will cause the greatest damage to developing countries, because they do not have enough financial and technical resources to adapt to some natural disasters, such as floods or droughts.

Humankind do not only feel environmental change, but humankind also creates it. Excessive exploitation of resources in the industrialized world and unsustainable economic policies have led to many factors that generate global climate change (Beniston, 2010). There are opportunities to adapt to climate change. Implementation of strict mitigation measures can ensure that the impact of climate change remains under control and our future more certain (Veljković et al. 2016).

The best assessment in terms of global warming was given by the Intergovernmental Panel on Climate Change (https://www.ipcc.ch/site/assets/uploads/2018/02/ar4_syr_full_report.pdf), which predicts that future warming will increase between 1.8-4.0°C. The increase in temperature can lead to large-scale consequences, especially when it comes to the most vulnerable groups, the poorest inhabitants of the planet. Therefore, if there is an additional increase in temperature, intensification of harmful effects can be expected, so there is a logical growing concern regarding possible changes in the distribution of precipitation and water availability, which directly affect the food supply. It is also clear that rising sea levels are threatening millions of people, especially those living in island nations, as well as numerous economic centres located in areas near the sea.

Global average air temperature shows that until 2007 it was 0.8°C higher than in the pre-industrial period (from 1850 to 1899), while for the mainland the average was 1.0°C. The growth rate of average global temperature has increased from 0.1°C per decade, in the past 100 years to 0.2°C per decade. Estimates of global warming projects further increase in average temperature (Popović et al., 2009).

Observation of the European global average temperature shows that Europe has warmed significantly more than the average. Until 2007, the average annual temperature for the European continental area was 1.2°C higher than in the pre-industrial period, while for the combined area of sea and land it was 1.0°C higher. The projections of the annual temperature (obtained based on forcing climate models according to different scenarios of climate change) are that the temperatures will increase further, 1.0-5.5°C. During the winter, the greatest warming is expected in Eastern and Northern Europe, and during the summer in Mediterranean and Southwestern Europe (Popović et al., 2009).

The intensity of extreme rains has increased in Europe over the last fifty years, even in areas with reduced medium rainfall such as Central Europe and the Mediterranean (an increase in the frequency of heavy rainfall is projected for Europe as a whole). It is also projected that the length and frequency of droughts will increase, especially in southern and south-eastern Europe.

However, there are opinions among scientists that the climate has always changed and that it is a part of natural cyclical behaviour that has happened on several occasions in the past. The sun is the source of life on Earth and the driver of almost all processes that take place in the atmosphere. It is believed that the Sun creates a greater amount of energy, and the consequence of this is an increase in temperature on Earth.

Climate change is already happening, and man cannot completely prevent it, but he can mitigate it. What a person can do is to increase energy efficiency, to use more renewable energy sources, to apply recycling processes and use clean technologies. Renewable energy technologies also provide a unique opportunity to limit carbon emissions without compromising access to energy, which has significant implications for slowing climate change (UNDP, 2013).

Therefore, in order to maintain the optimal conditions on Earth, which enable the survival and development of living beings, it is necessary to harmonize the interests between present and future generations. Use of natural resources must be driven on the principles of equality between input and output.

CLIMATE CHANGE AND RENEWABLE ENERGY IN THE EU

The use of renewable energy sources is a key to climate solution. Energy use is changing rapidly. An increasing shift to renewables is needed, however, it must happen faster, not only in electricity production, but in heating, buildings, and transport, in order to stop the rise in global temperatures.

Renewable energy sources could supply four-fifths of the world's electricity by 2050, which will significantly reduce carbon emissions and help mitigate climate change. Solar energy, wind energy, water, biofuels are a key part of actions to promote and use renewable energy today and in the future. Climate change, high fossil fuel prices, and energy security concerns underscore the urgent need for a faster transition to a clean energy system.

The Intergovernmental Panel on Climate Change emphasizes that renewable energy sources should increase greatly in all sectors of the

economy in today's conditions with 14% of total energy. They need to have a further growth trend that will reach a value of about 40% in 2030. At the same time, energy from non-renewable sources should be decisively replaced, which would reduce carbon dioxide emissions and reduce air pollution, which aims to mitigate and slow down climate change. The growth of renewable energy sources can also stimulate employment, through the creation of new jobs in new "green" technologies.

The EU reached a share of 22.1% in its gross final consumption of energy from renewable sources in 2020, which is significantly higher than in 2004, when consumption from renewable energy sources was 9.6%. Table 1 shows the latest available data on the share of renewable energy sources in gross final energy consumption.

Table 1. *The share of renewables in gross final energy consumption in the EU and other countries in Europe in 2020*

	Share of renewables in gross final energy consumption (%)		**Share of energy from renewable sources in gross electricity consumption (%)**		**Share of energy from renewable sources in traffic (%)**	
	Years					
Countries	**2004**	**2020**	**2004**	**2020**	**2004**	**2020**
1. Belgium	1,9	13,0	1,7	25,1	0.6	11,0
2. Bulgaria	9,2	23,3	8,4	23,6	1,0	9,1
3. Czech Republic	6,8	17,3	3,7	14,8	1,2	9,4
4. Denmark	14,8	31,6	23,8	65,3	0,4	9,6
5. Germany	6,2	19,3	9,4	44,7	2,1	9,9
6. Estonia	18,4	30,2	0,5	29,2	0,2	12,2
7. Ireland	2,4	16,2	6,0	39,1	0,0	10,2
8. Greece	7,2	21,7	7,8	35,9	0,1	5,3
9. Spain	8,3	21,2	19,0	42,9	1,0	9,5
10. France	9,3	19,1	13,8	24,8	0,8	9,2
11. Croatia	23,4	31,0	35,0	53,8	1,0	6,6
12. Italy	6,3	20,4	16,1	38,1	1,2	10,7
13. Cyprus	3,1	16,9	0,0	12,0	0,0	7,4
14. Latvia	32,8	42,1	46,0	53,4	2,1	6,7
15. Lithuania	17,2	26,8	3,6	20,2	0,4	5,5

16. Luxemburg	0,9	11,7	2,8	13,9	0,1	12,6
17. Hungary	4,4	13,9	2,2	11,9	1,0	11,6
18. Malta	0,1	10,7	0,0	9,5	0,0	10,6
19. Netherlands	2,0	14,0	4,4	26,4	0,5	12,6
20. Austria	22,6	36,5	61,6	78,2	4,5	10,3
21. Poland	6,9	16,1	2,0	16,2	1,6	6,6
22. Portugal	19,2	34,0	27,4	58,0	0,4	9,7
23. Romania	16,8	24,5	28,4	43,4	1,8	8,5
24. Slovenia	18,4	25,0	29,3	35,1	0,9	10,9
25. Slovakia	6,4	17,3	15,4	23,1	1,5	9,3
26. Finland	29,2	43,8	26,7	39,6	1,0	13,4
27. Sweden	38,4	60,1	51,2	74,5	6,3	31,9
European Union	**9,6**	**22,1**	**15,9**	**37,5**	**1,4**	**10,2**
28. Island	58,9	83,7	93,1	102,7	0,0	12,0
29. Norway	58,4	77,4	98,0	113,8	3,1	28,7
30. Montenegro	/	43,8	/	61,5	/	0,6
31. Serbia	12,7	26,3	18,5	30,7	0,5	1,2
32. Bosnia and Herzegovina	20,2	/	40,3	/	/	/
33. Albania	29,6	45,0	70	100	0,1	0,3
34. North Macedonia	15,7	19,2	14,5	23,4	0,2	0,1

Source:
https://ec.europa.eu/eurostat/databrowser/view/NRG_IND_REN__custom_2394713/default/table?lang=en (29th March 2022)

A comparison in years 2004 and 2020 in the European countries shows an increase in energy consumption from renewable sources in gross final energy consumption. Sweden has more than half of its energy from renewable sources in its gross final energy consumption as a member of the EU (60%) among the member states in 2020. Then come Finland (44%) and Latvia (42%). At the opposite end of the scale, Malta (11%), Luxembourg (12%) and Belgium (13%) have the lowest share of renewable energy sources. Iceland (83.7%) and Norway (77.4%) have the highest consumption of energy from renewable sources in their gross final consumption in Europe (Europe Strategy, 2020).

If we look at the highest consumption of energy from renewable sources in its gross final consumption in Serbia and its surroundings during 2020, we notice that its consumption is only higher than in North Macedonia, while in 2004 Serbia had the lowest consumption in the region.

When it comes to the consumption of electricity from renewable sources, the leading role among EU member states, over 70% of the consumed electricity in 2020 produced from renewable sources, have Austria (78.2%) and Sweden (74.5%). Renewable electricity consumption was also high in Denmark (65.3%), Portugal (58%) and Latvia (53.4%), which accounted for more than half of the electricity consumed. On the other hand, there are EU member states whose share of electricity from renewable sources was below 15%, such as Malta (9.5%), Hungary (11.9%), Cyprus (12.0%), Luxembourg (13.9%) and the Czech Republic (14.8%). EFTA countries Norway and Iceland produced more electricity from renewable sources than they consumed in 2020, leading to a share of more than 100%.

When considering the consumption of renewable energy sources (including liquid biofuels, hydrogen, biomethane, "green" electricity, etc.) in transport, the EU's goal was to have a 10.0% share of renewable energy consumption in transport in 2020 (transport Among the EU Member States, the share of renewable energy in fuel consumption in transport ranged from a high of 31.9% in Sweden, 13.4% in Finland and 12.6% in the Netherlands and Luxembourg up to 7% or less in Greece (5.3%), Lithuania (5.5%), Poland (6.6%) and Croatia (6.6%). EFTA country Norway also reported a high share of renewable energy in transport fuel consumption (28.7%).

Based on the 2008 initiative, the EU adopted a climate and energy package (Decision No 1600/2002/EC) aimed at increasing renewable energy sources; the goal for 2020 was the use of renewable energy sources of 20% of total energy consumption. Also, the goal was for 20% of the share in energy consumption to be obtained from renewable sources, while renewable sources should also make up 10% of the share of fuel used in the transport sector by the same date (Nikolić et al., 2012).

The EU goal known as the "20-20-20" sets three key targets: a 20% reduction in greenhouse gas emissions comparing to levels from 1990's; increasing the share of energy consumption from renewable sources to 20% and increasing energy efficiency by 20%. All these measures represent an integrated approach to climate and energy policy aimed at combating climate change, increasing the EU's energy security and strengthening its competitiveness (Todić, 2011).

CONCLUSION

Unfortunately, the relationship between man and nature nowadays is not in accordance with its basic laws, which means that there are numerous factors that endanger the environment. Today, climate change is recognized as one of the biggest and most serious challenges for the planet, because there is scientific evidence that the high concentrations of gases in the atmosphere, which cause the greenhouse effect, are the reason for global warming. Climate change occurs exclusively as a result of human influence on the planet. The consequences of climate change are visible and serious, which is why serious measures must be taken to address and prevent them. It is necessary to adapt to the changes in the energy sense, which means switching to renewable energy sources. Sweden uses the most renewable energy in its gross final consumption among EU members (60%), while the EU average is 22.1%. Of all European countries in 2020, Iceland (83.7%) and Norway (77.4%) used renewables the most in gross final consumption. In terms of electricity consumption from renewable sources, the leading countries in Europe are Austria (78.2%) and Sweden (74.5%). When it comes to the use of renewable energy sources in transport, the leading countries are Sweden (31.9%), Finland (13.4%), the Netherlands (12.6%) and Luxembourg (12.6%).

What all the countries of the world need to do, when it comes to the problem related to climate change, is constant education and raising public awareness about this problem and insisting on energy conservation, regardless of the activity. International researchers emphasize that the impact of climate change will be more progressive in the future, but it is not possible to say with certainty to what extent. It is necessary to reduce the emission of harmful gases that cause global warming as soon as possible and to adapt to current and future changes. Since climate change is a global problem, it is necessary to find an adequate solution at the global level.

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