

I. MODULE

General Information on Climate Changes

Module 1. General Information on Climate Changes

"Every action we take affects our environment, it's up to us to decide what impact we want to have"

Jane Goodall

The most important topic in the world today is the topic of **climate change**.

The huge fires that are happening more and more often in the world, the floods that are taking everything before them, as well as the hot summers and mild winters, clearly indicate the fact that the climate of our planet is changing.

Through this training, we will try to answer some of the most frequently asked questions about climate change and help you understand them better, as well as enrich your knowledge on this topic and try to train you in the easiest way to convince people. from your environment that something important is happening.

What is climate?

What is climate and what is weather?

What we hear daily as a weather forecast is simply WEATHER. What is the temperature outside, is it rainy, is it windy, or rather what are the current weather conditions prevailing in a certain area, for example on a certain day of the week in Skopje.

Weather and weather forecast are very important for our daily life, in terms of what the current weather is like and what the forecast is for the rest of the day, we make a decision about how we will dress and whether we should take an umbrella with us.

Climate, on the other hand, is the average weather over a longer period of time, for example over a period of 50 years. If we plan, for example, to raise an apple orchard, we need to know what kind of climate prevails in a certain area where we plan production, in the coming years. So, in relation to those data, we make a decision whether the climate is suitable for a suitable type of production or not.

What is climate change? What is global warming?

Climate change is a long-term change in the climatic conditions of our planet.

Global warming, on the other hand, can be understood as part of climate change.

Scientists have long noticed that the temperature of our planet has been rising for the last 140 years, and during the 80s of the last century this topic became relevant in the general public, so in a way, it can be said that "**global warming**" becomes a popular topic. However, as time passed, it became increasingly clear that the rise in temperature was accompanied by other consequences, such as changes in the amount and intensity of rains, river overflows and catastrophic floods, more extreme events - devastating storm winds, tornadoes and rising sea levels.

Because of all this, we are increasingly talking about climate change as a broader term that includes an increase in the earth's temperature, along with numerous other consequences that follow that change.

Why is the earth's temperature rising? What is the greenhouse effect?

The Earth is a specific and unique place in our solar system where life is possible.

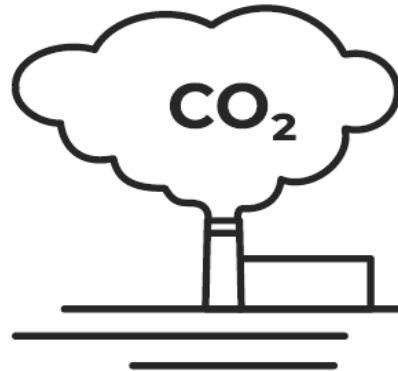
The main reason for this is the appropriate distance of the planet from the sun and our greenhouse effect atmosphere.

Simply put, the greenhouse effect is what makes the earth warm. This effect is of particular importance for planet Earth, because without atmospheric gases that retain heat from the sun, our planet would be a very cold place with an average temperature of -18 degrees Celsius.

The gases that make this possible are called **greenhouse gases**, which essentially retain some of the energy coming from the sun that the earth's surface absorbs and later slowly releases back into the atmosphere.

In order to better understand this process, it is best to compare greenhouse gases to a tent wrapped around the planet that does not allow heat to escape.

The concentration (amount) of these gases in the atmosphere in the last 140 years began to increase rapidly and therefore the temperature began to rise. In other words, "the blanket around our planet is getting thicker and retaining more and more heat."



Picture 1: Gases from fossil fuels

Source: <https://unsplash.com/>

Why is the concentration (amount) of greenhouse gases in the atmosphere increasing?

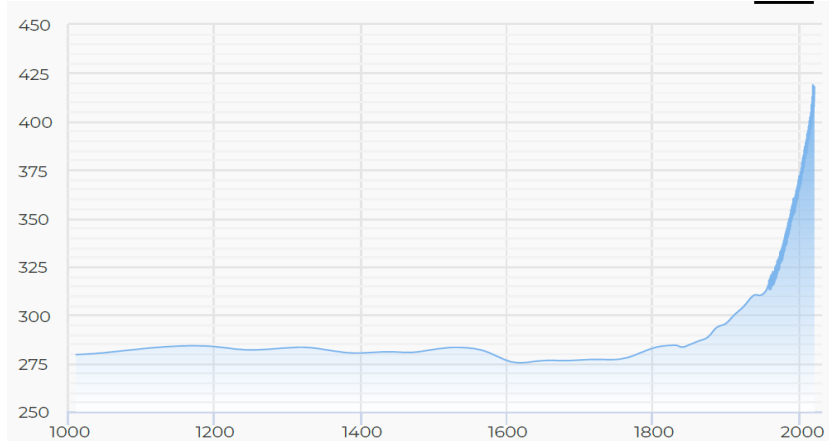
The main reason why this is happening is because we are burning more and more fossil fuels (coal, oil and gas) which release huge amounts of carbon dioxide into the atmosphere.

By burning these fuels, carbon dioxide (CO₂), the most important gas that causes the greenhouse effect, is released into the atmosphere. One of the basic problems with carbon dioxide is that once it enters the atmosphere it is very difficult to leave it, it is even considered that even though it was released into the atmosphere hundreds of years ago, it is still there.

In the past 140 years, humanity has burned huge amounts of fossil fuels, which were the basic source of providing energy for the development of civilization.

The electricity for our homes, the cars we drive, the appliances we use every day came about as a result of energy from fossil fuels.

In fact, we have burned so many fossil fuels that in just 140 years the concentration of carbon dioxide in the atmosphere has increased by as much as 43%, and the higher its concentration, the greater the possibility of "trapping" energy in the atmosphere and **increasing the temperature.**



Graphics: Concentration of CO2 in the atmosphere from 1010 to the present

How much have the temperatures increased so far?

How much will they grow in the future?

The average surface temperature of our planet has increased by a little more than 1 degree Celsius since 1880. Although it may sound like a little, the consequences are still visible. It is enough to look at the weather in our country.

The summers are getting hotter and the high temperatures persist until the end of October. Winters, on the other hand, are becoming milder and snow is becoming less common.

If this trend of burning fossil fuels continues and if people continue to behave recklessly, the earth will continue to warm and by the end of this century the temperature could increase by about 3.5 degrees Celsius, and further up to over 5 degrees.

Scientists warn that this can be very dangerous and will dramatically change the conditions for life on our planet. That's why we need to do everything to prevent further **warming of the planet.**



Picture 2: Global Warming

Source: <https://unsplash.com/>

Why should warming by 3.5-5 degrees worry us?

The average temperature of our planet is about 15 degrees Celsius, but it has not always been like that. About 15 thousand years ago there was an ice age on the earth. Most of Europe and North America were under ice, including all of Scandinavia and most of Great Britain.

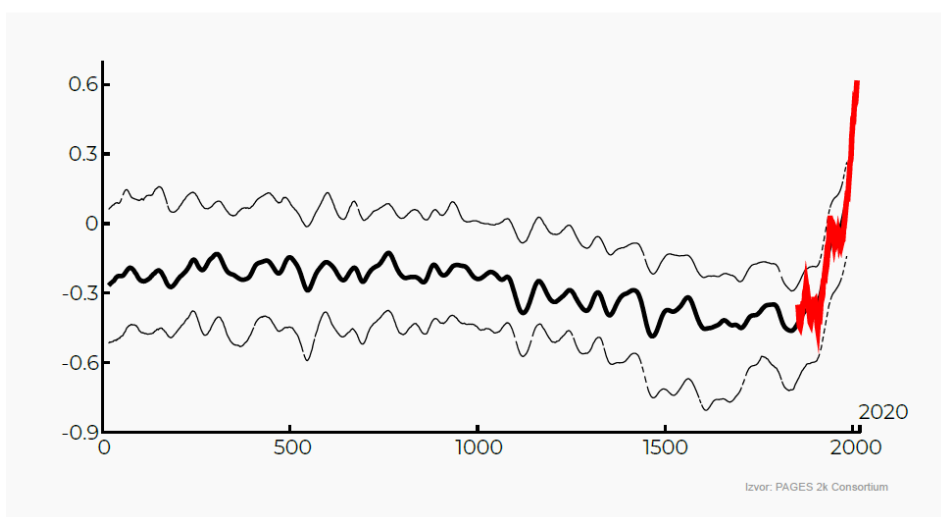
The temperature at that time was about 4 degrees Celsius lower than today.



Picture 3: Earth in the Ice Age

Source: <https://unsplash.com/>

Then, over a period of several thousand years, the world warmed up and conditions were created that enabled our ancestors to build a great civilization, of which we ourselves are a part. If we allow the temperature to rise by 5 degrees, most of our planet will become an inhospitable place for life, and in Macedonia the snow would completely stop falling, even on the mountains.



Graphics: Deviation of the average global temperature in the last 2000 years in relation to the values for the period from 1961 to 1990

Measurements after 1850 are marked in red, while estimates based on intermediate data are shown in black.

According to scientists, any warming of more than 2 degrees can be very dangerous, and **it would be best if we stop at 1.5 degrees**, because anything beyond that brings serious consequences.

Just as an example, if the temperature were to rise by 2 degrees, most of the coral reefs on Earth would be destroyed.

Scientists have been pointing out the problem of heating for a long time. Towards the end of the 19th century, Svante Arrhenius published a paper entitled "Effects of Carbonic Acid in the Air on the Temperature of the Earth's Surface" in which he calculated how much the temperature of our planet would increase if the concentration of carbon dioxide in the air increased.

In 1896, Guy Callendar presented his paper "Artificial Production of Carbon Dioxide and Its Influence on Climate" in which the first published data showed that the burning of fossil fuels by humans was beginning to change the earth's climate.

A lot of time has passed since then. Technological advances and years of research have greatly advanced our understanding of these problems and their possible consequences. So yes, today scientists can predict with great certainty how the climate will change in the future.

What are the possible consequences?

When we talk about the possible consequences of global warming, the first thing we should know is that their weight directly depends on **how long we will continue to burn fossil fuels, that is, how much the temperature of our planet will increase**.

If we manage to stop the warming of the planet by less than 1.5 degrees, most of the possible consequences we are talking about will be prevented.

How is the earth's climate changing?

Increase in temperature

We have already mentioned that our planet is "well on track" to warm by about 3.5 degrees Celsius by the end of this century. But what exactly does that mean? Will it be 23.5 degrees instead of 20 degrees in spring?

Climate is the average weather over a longer period, while current weather conditions are what we see as a weather forecast and are variable.

If the earth were to warm by about 3.5 degrees, it would mean that hellishly hot summers would become a "normal" thing that we would have to live with.

In general, the likelihood of "extreme events" would increase, such as days with very high temperatures or heat waves that would last longer and be more intense.

It would not only affect human health, but also agricultural production, animal health and many other aspects of daily life.

The other seasons would also be warmer, and episodes of extremely high temperatures in autumn and winter would greatly disrupt natural processes and lead to enormous damage.

Melting of polar ice caps and glaciers

Large parts of our planet are covered with ice all year round. North Pole, South Pole, Greenland or high mountain glaciers. All these ice surfaces are very, very important and make up a delicate system on planet Earth.

As the temperature rises, due to an increase in the concentration of greenhouse gases in the atmosphere, the ice cover of the planet decreases.

Huge ice sheets in Antarctica are becoming unstable and there is a real danger of their separation from the Continent, which would mean their irreversible loss and accelerated melting in the coming period.

The Arctic Ocean has been losing its ice for the last 40 years. Scientists predict that there is a huge chance that this ocean will be completely thawed during the summer months of the year in the coming decades.



Picture 4: Consequences of accelerated melting of polar ice caps and glaciers

Source: <https://unsplash.com/>

The ice is not only melting at the North and South Poles, if the warming is not stopped, the same fate awaits the glaciers of the high mountains, which are also rapidly disappearing.

Many ecological communities depend heavily directly on the water that melts from glaciers, and the changes that occur can cause them serious problems.

In the near future, the rapid melting of glaciers may cause **possible floods and river overflows**, and until they disappear forever, many areas, especially in South America and South Asia, could have a problem with drinking water supplies.

Rising sea and ocean levels

All the ice that melts eventually ends up in the seas and oceans, and this will lead to a rise in the world's sea levels.

There is enough ice in the Antarctic ice sheet alone to raise global sea levels by 60 meters. Fortunately sea levels are not rising that fast. The current estimate is that even under the worst case scenario, sea levels will rise by a little less than 1 meter by 2100.

A huge part of the population lives in coastal cities. As many as three quarters of large cities are located by the sea, and some of the most important cities, such as New York, Shanghai, Melbourne and Tokyo, are directly threatened by the eventual increase in sea levels.



Picture 5: Expected floods from climate change

Source: <https://unsplash.com/>

Although 1 meter does not sound like a lot, even in such a situation, a large part of the cities will be in serious danger of flooding, and the consequences will be even more dramatic for small island states that are already preparing plans for population relocation.

The sea level is rising not only because of the melting of the ice, but also because of the thermal expansion of the water. As the atmosphere heats up, the seas and oceans also heat up, and as heated bodies have the ability to expand, the heated water occupies a larger area and **the sea level rises**.

Strong tropical storms

The warming of the waters not only leads to a global increase in the level of the seas, but also causes the effect of "propellant fuel" for strong and destructive typhoons and hurricanes.

In recent years, we have witnessed strong storms that have caused human suffering and enormous material damage. Hurricane Dorian, for example, which devastated the Bahamas, left more than 70,000 people homeless, while Cyclone Idai, which hit southeastern Africa, killed more than 1,300 people.

Rising sea levels further increase the effects of storms, because the range of storm surges that cause flooding and human suffering is greater.



Picture 6: Severe storms

Source: <https://unsplash.com/>

Amounts of rain

The climate is a complex system and all the changes described so far will have a huge impact on the **total amount of rain**.

It is still difficult for scientists to give an accurate estimate of how the total amounts of rain will move in different parts of the planet, but one thing they have noticed is that in the future there will be less rain in areas that are already dry, while humid regions will expect more rain.

A warm climate, on the other hand, will also change the way rain falls.

The trend is already being observed that larger amounts of rain fall in a much shorter time. More and more often we receive information that in just a few days amounts of rain have fallen that usually fall in a few months. On the other hand, the periods of time without rain are getting longer.

In the future, such developments will be more frequent.



Picture 7: Flooding

Source: <https://unsplash.com/>

Increasing acidity (acidification) of the oceans

By burning fossil fuels, humans release huge amounts of carbon dioxide into the atmosphere and thus heat the Earth. However, not all amounts of carbon dioxide remain in the atmosphere, a part ends up in the oceans.

Part of the carbon dioxide from the atmosphere dissolves in the oceans and thus **Carbonic acid** is created.

As huge amounts of this gas are released into the atmosphere every year, in the oceans, in the last 140 years, so much Carbonic acid has been created that **the total acidity of the oceans (ph value) has started to change**.

Acidic waters directly threaten the survival of certain species, which have calcium-carbonate armor around their bodies, because this element dissolves in an acidic environment.

At the same time, such conditions are not suitable for the survival of some species of Plankton, which is a basic source in the food chain in the seas and oceans. A reduced concentration of plankton can seriously disturb the balance in aquatic ecosystems and further threaten the survival of some marine species



Picture 8: Consequences of ocean acidification

Source: <https://unsplash.com/>

What can we do to prevent this?

All the possible consequences that have been discussed so far sound very dangerous, but the good news is that most of them can still be prevented.

The most important thing we as a civilization can do is to start using renewable energy sources as soon as possible and stop burning fossil fuels IMMEDIATELY.

That means, as soon as possible, we should stop burning, first of all, **COAL**, as a fossil fuel for obtaining electricity, and start producing it from the sun, wind and water.



Picture 9: Renewable energy sources

Source: <https://unsplash.com/>

Also, as far as transportation is concerned, we need to start using electric vehicles as soon as possible, instead of those that move with the help of internal combustion engines and use engines that run on oil or gasoline.

Of course, let's charge the batteries of electric vehicles with **renewable energy sources**.

Fossil fuels also still find enormous use in industrial production processes. So it is necessary to find new technologies that will enable us to supply the necessary energy for industrial production processes in other, alternative ways.

As we can conclude FOSSIL FUELS are by far the "most important" part of this story, but they are not the only one.

It is also very important to protect and preserve **FORESTS**, because they help us a lot to extract carbon dioxide from the atmosphere. It is no coincidence that it is said that trees and forests are the "lungs" of planet Earth and we should not only preserve them but also intensively restore them.



Picture 10: Dense forests

Source: <https://unsplash.com/>

We have to find ways to make **more use of arable agricultural land and to produce food in sustainable ways**, and it is especially important to use less meat in our diet in the future because animal husbandry also has a significant impact on the emission of greenhouse gases.

You may have noticed that we have mentioned the words "an hour sooner" in several places in this section of the text.

The reason for this is that the speed of action is too important for these issues and the faster we react, the simpler and easier we will solve the problem that threatens us

How much have we done so far?

Unfortunately, still NOT enough.

If everyone in the world respects the promises and plans to prevent climate change, our planet would warm by 2.8 degrees by the end of this century.

That's a lot more than the 2 degrees Celsius limit that should NOT be exceeded, and even more than the 1.5 degrees that should be our goal, especially if we want to reliably solve the problem.

The problem is that not everyone adheres to the promises made and the plans they have adopted and our main task should be to constantly remind them of that and not let them forget it.

However, much has been done so far!

Ten years ago, the situation looked much worse than it does now, and if the picture today looked like it did then, we would certainly be talking today that by the end of this century the planet would have warmed by more than 4 degrees.

For the last ten years, **CLIMATE CHANGE** and the solutions that are being taken have been the MAIN TOPIC of conversation in most forums, meetings and tribunes all over the world.

In 2015, all countries in the world have agreed that Climate Change is a problem that requires URGENT action, and that is why the Paris Agreement was signed, with which everyone undertakes to do everything in their power to keep the Earth's warming below 2 degrees Celsius.

From all this we can conclude that we are still moving in the right direction, but that we are still not doing it fast enough.

Can we speed things up?

Of course we can! The main reason for this is that the development of technology in recent years is going really fast.

The price of electricity produced from renewable energy sources has been reduced several times, so that in some parts of the world the price of electricity produced from renewable sources is much cheaper than the price of electricity produced from fossil fuels.

This, unfortunately, does not mean that the production of electricity from fossil fuels will be completely overcome and that we can fully rely on alternative ways of production.

There are still many challenges ahead of us in that direction. First of all, in connection with the storage of electricity produced from renewable sources.

However, many things are already known and we know in which direction we need to move until the complete rejection of coal as by far the worst option for electricity generation in the years ahead.

Even the storage of electricity, as the biggest challenge for the production of "clean" energy, is becoming more efficient and cheaper, and it is more than certain that this trend will continue in the future.

The main reason for this is the increasingly rapid development of technology in the production of electric cars.

Electric cars are increasingly conquering the market, so that in the Scandinavian countries they are already dominant compared to conventional cars.

The car giant Tesla is a leading company in this direction. And more and more car manufacturing companies are joining this production trend.



Picture 11: Electric car

Source: <https://unsplash.com/>

The rapid development of technology should go hand in hand with new policies, such as bans on diesel vehicles, the introduction of high taxes on carbon dioxide emissions and clear deadlines for the complete rejection of coal as an energy source.

So, the development of technology, on the one hand, and restrictive policies, on the other hand, should give clear directions in which direction the world will have to move and ensure even faster and greater progress.

For now, industrial processes are still lagging behind in this "green" direction, and here even more progress is needed in the coming years, so that we could fully respond to the challenge.

CLIMATE CHANGE is a systemic issue and it will be necessary for virtually everyone in the world to agree and take joint and decisive action in order to successfully solve the problem.

But that does not mean that we, as individuals, cannot do anything in this regard. On the contrary.

As we have seen so far, the climate of our planet is not a simple matter at all. To begin with, it is necessary to first educate everyone about the climate change that is happening in order to better understand the problem we are facing.

Once we understand what climate change is, we need to make people around us aware of the problem, so that as many people as possible are aware.

When we succeed in that, all of us together will be able to put pressure on the state to start adopting policies and strategies so that the entire economy turns in the direction of the development of renewable energy sources.

We also need to change our own habits, drive cars less and walk and ride bicycles more. To make our homes energy efficient and to use less energy in daily living.

Let's support companies that are trying to reduce their impact on climate change and thus send a clear signal to everyone that they need to start changing and adapting to new trends.

The most important thing is to understand that each of us can be actively involved in solving this problem together with millions of other people from all over the world.

We should not be just observers, but we should be actively involved in offering solutions that will make some kind of contribution to solving the problem.

- If we are good at writing, we should write about climate change and inform people.
- If you are a lawyer, you should get involved in drafting legal solutions for a "green future".
- If you are artists, offer creative solutions that will reach the general public.
- If you are involved in the economy, offer solutions on how to get renewable energy sources.
- If you are involved in marketing, work on popularizing this topic.
- All scientists, engineers, programmers, can find and offer a million different ways to apply their knowledge and skills in finding solutions to prevent climate change.

We could go on and on, because climate change is a very broad area and really everyone can get involved in their own way and make a significant contribution.

And the best thing is that if we are successful in that, we will not only leave a better place for future generations to live in, but also a better and more developed society.



Picture 12: The Earth
Source: <https://pixabay.com/>

What is the current situation?

Some scientists believe that it will be inherently difficult, if not impossible, to keep the warming of the planet below 1.5 degrees, which is considered the "comfort zone".

The limit of 2 degrees is still achievable, but in order to achieve it, our efforts in finding new technological solutions and new political solutions that will "hold" the course towards a green transition of the world will have to increase significantly.

We all have a lot of work ahead of us but we hope to succeed in our intentions, we just need a little more help.



Picture 13: The Earth on the palm

Source: <https://pixabay.com/>

