New Global Learning

Environment and Climate Change

“Someday, perhaps not long from now, the inhabitants of a warmer, more dangerous and biologically smaller planet than the one I lived on will probably wonder what you and I were thinking, or if we were even using our brains.” John Steinbeck

Global warming is something that almost everybody is familiar with, however, the majority of us don’t know what it is. Some might not believe it, some might be overwhelmed, others depressed and others just do not care. Many questions are asked, but not enough are answered. Global warming is omnipresent yet so many people still haven’t realised it.

If you would go on a street and ask some stranger what global warming is, he would probably respond, however if you would ask him what are the impacts the chances of a relevant answer are pretty small. One of the biggest problems is that people don’t know how global warming affects them. Moreover, scientists are confused sometimes too. This is reflected in the debate community as well. Nobody will argue that climate change is happening and is bad, debaters will fight at their best, but often they struggle to present real situations, impacts and everyday life situations.

This module aims to show you the rawest form of climate change, to take you to areas where scientists just started to discover new threats and challenges. The module will bring many examples from various geographical locations, cultures and ecosystems. It will also try to show some light at the end of a tunnel, and light up faith in science. Global warming is an area of facts. Facts are easily refuted by other facts, but if you lack them, this module will provide some exercises to do that.

Key issues

The module will cover the following areas and questions

- What is global warming? How can we identify it?
- What are the possible scenarios? What is most dangerous about global warming?
- Is there something that is not caused by global warming? What has global warming already caused? Why should people in developed countries care?
- What is the cascade effect of global warming? What is climate migration and who does it affect?
- How does global warming affect plants? What do higher temperatures mean for agriculture?
- What is the role of ecosystems? How are they affected? What is going to happen if climate change destroys them?
- How do we fight climate change? What tools can politicians use?
- What is geoengineering? Does it have the potential to save us?
- Why is it so hard to fight climate change? Is really the feedback loop such a huge problem?

Key concepts

Global warming - Global warming is **the long-term warming of the planet's overall temperature**. Though this warming trend has been going on for a long time, its pace has significantly increased in the last hundred years due to the burning of fossil fuels. As the human population has increased, so has the volume of fossil fuels burned.

Climate - Climate is **the long-term pattern of weather in a particular area.** That means, we can say that the climate during winter in central Europe is cold, with snowing, temperatures below zero etc.

Weather - the state of the air and atmosphere at a particular time and place. Simply if you look out of the window you can tell what's the weather, but you can not say that is the climate of that region.

Ecology - is the study of the relationships between living organisms, including humans, and their physical environment; it seeks to understand the vital connections between plants and animals and the world around them.

Ecosystem - is a geographic area where plants, animals, and other organisms, as well as weather and landscape, work together to form a bubble of life. The world is composed of millions of these ecosystems which together form the biosphere.

Feedback loop - describes the interconnection in nature. Ecosystems are incredibly connected, and if we cause something in one, it might completely destroy the other or it will cause it to thrive. This mechanism describes what would happen if bees go extinct. We know that we would lose around 50% of all crops, but what else will happen has not been discovered yet. This mechanism is insanely complex, because nobody knows what could happen if icebergs in Nepal melt etc. This is probably the biggest challenge for scientists, to discover these interconnections.

What is global warming?

Since the Industrial Revolution, the global annual temperature has increased in total by a little more than 1 degree Celsius. Between 1880—the year that accurate record keeping began—and 1980, it rose on average by 0.07 degrees Celsius every 10 years. Since 1981, however, the rate of increase has more than doubled: For the last 40 years, we've seen the global annual temperature rise by 0.18 degrees Celsius per decade.

The result? A planet that has never been hotter. Nine of the 10 warmest years since 1880 have occurred since 2005—and the 5 warmest years on record have all occurred since 2015.

Global warming occurs when carbon dioxide (CO_2) and other air pollutants like methane collect in the atmosphere and absorb sunlight and solar radiation that have bounced off the earth's surface, respectively they are blocking it to get away. Normally this radiation would escape into space, but these pollutants, which can last for years to centuries in the atmosphere, trap the heat and cause the planet to get hotter.

These heat-trapping pollutants—specifically carbon dioxide, methane, nitrous oxide, water vapour, and synthetic fluorinated gases—are known as greenhouse gases(GHG), and their impact is called the **greenhouse effect**.

Though natural cycles and fluctuations have caused the earth's climate to change several times over the last 800,000 years, our current era of global warming is directly attributable to human activity—specifically to our burning of fossil fuels such as coal, oil, gasoline, and natural gas, which results in the greenhouse effect.

Worldwide the most emissions are caused by energy use (41,7%), transportation (16,2%) and agriculture (18,4%)

Possible scenarios

Big parts of science are predictions. They form how the world will look like, or at least where the resources will be allocated. Unfortunately it is difficult to make an accurate one. In the context of global warming there can be found hundreds of predictions, some of which are more optimistic while others are predicting a cruel and slow death without chance for salvation. One is clear, they all end by the year 2050 or 2100.

Those two were notselected randomly, they set up the boundaries for mankind. Both of them are connected to different temperatures. Let's briefly show some of them

Increase by 2°C

Predictions say that 400 million people would lose access to water. Majority of the icebergs would melt. In India heat waves would be 32* stronger, they would last 5* longer and thread 93* more people. Such an increase would decrease the harvest of crops by 20%, which would cause even bigger problems if the population grows.

Increase by 3°C would cause permanent drought in Europe and would prolong the dry period in South America to 18 months. The impact for the majority of ecosystems would be fatal and the majority of these regions wouldn't have livable conditions.

All of this seems so unreal, that people tend not to believe it, which goes hand in hand with another factor. These semi-fatal or deadly impacts will appear mostly around the year 2100,

that's where studies end their predictions, because we will either solve climate change or suffocate. The feeling of remoteness makes people think it is not their problem, which leads to low incentive to fight climate change and invest money into it. Which sets up the first barrier for fighting global warming.

Global warming and nature

Nature is the first and only line of defence against fatal impacts on humans. It evolves and adapts fast, but sometimes it is not able to catch up with the speed of emissions emitted. This part focuses on how global warming amplifies catastrophes and how they have severe consequences.

Catastrophes are getting into our life more frequently and with bigger intensity. It is one of very few direct impacts of global warming. Climate change in itself does not cause them, but it amplifies their effect. In the past humans categorised catastrophes by years, meaning some were centennial floods, others the quincentennial flood, however in the past few years we can spot that it has stopped working. In the USA there were three hurricanes marked as five-hundred-thousand-year-old just in this century.

Temperatures during heat waves are getting almost up to 50°C. Most recent heat wave in India and Pakistan had a chain effect on the whole world. If you google how many people died due to heat during this period you would be probably surprised that it was “just” 90 people. It is important to see that these deaths were directly marked as “caused by heatwave” by a doctor, but in fact many more people died and will die due to long term consequences. In such an environment, when the body is exposed to high temperature the body stress increases, which can cause other diseases to occur since body immunity is weakened. This is the most evident part of a heat wave, but what has been before and after is the important part that can show us why global warming is such a problem. It all started with reduced rainfall (India 71%, Pakistan 62%) which set up ideal conditions for massive and long lasting heat waves. Increased temperatures plus lacking water had dropped yield by 15-30%(India produces 12,5% of world grain production), which is certainly a problem, considering world production of grain has already suffered from the Ukrainian war.

The Government of India wanted to increase grain export in order to fill the gap made by missing Ukrainian grain, however suddenly they haven’t had enough for themself. World market was already lacking food supplies yet the climate change pushed even more.

The same year in China massive rainfall started floods which caused 30 millions acres couldn't be planted and many more were devastated. Overall causing 20% crop yield decrease. This has started “the crop cascade”. At this point the whole world was starting to get affected, wheat prices have spiked. African countries such as Kenya, Somalia, Ethiopia which are heavily dependent on Russian-Ukrainian wheat (by 40%) have struggled to cover food demand, and the number of people facing extreme hunger has doubled to 23 millions.

The more wheat was lacking the more countries had implemented wheat export bans, which meant less when available on market, thus prices going even higher, and less accessible for poor countries. By that time European and American citizens had also faced the cruelty of global warming, because bread prices went up by 18%. In combination with rising food prices, families were forced to reduce their non-food spendings. Afterwards scientists tried to quantify how much human carbon activity contributed towards this event. It was the early, prolonged and dry heat that made this event stand out as distinct from heatwaves occurring earlier this century.

Calculations say that human induced emissions increased the probability of such an event 30 times. Another prediction says that by 2050 heat waves will directly kill 255 000 people. This example shows…

While it already might seem very tragic, so far we just traced one strain of the cascade. To make matters even worse, high temperatures during heat waves had affected icebergs in Indian-Pakistani mountains like Krakoram, Hindukush or Himalaya. Melting of icebergs happened at worst time possible, because it was monsoon period which already inflict floods in Pakistan, however this year it was supported by additional water from melting icebergs. Again just amplification happened and Pakistan has its biggest floods in history, which has cause over 1,700 direct deaths and financial damage 15,2 bn dollars. Another 16,3 billion dollars are estimated to be needed for reconstruction. In total the cost will be around 10% of Pakistani GDP (348,3 billions), which is definitely a significant amount of money.

Moreover this only covers spendings to get back to status before, however more investments and innovations are needed in order to prevent similar events in future, as they are more likely to occur more often. Another 8 millions of people are struggling due to lost homes, work etc. Their are facing health and food crisis, which makes them extremely vulnerable stakeholders.

The more CO_2 mankind emits, the worse the effects will be. Another study predicts that if temperature is increased by 1.5°C, damages from floods would increase by 160-240%. For Pakistan it would be absolutely devastating.

Icebergs play a significant role in the climate change game. They are allocated all over the world, however majority can be found on North and South pole. Because of their white colour heat is not fully absorbed, moreover the majority is reflected back to atmosphere and space, so it can’t contribute to warming. This ability is called the albedo effect, without it our planet would be totally different. Albedo effect is a good guy, nevertheless humans created bad guy to fight back, the greenhouse effect. In fact it has existed long time before humans appeared, but we slightly improved it.

However this bad guy causes that icebergs melt. Melting has triple effect. First is obvious, see level raise, which is going to be covered later. Secondly in the ice are huge reservoirs of

methane which would be released. If Arctic starts to melt it will likely release 100 billions tons of CO2, which is equivalent to one half of emissionsemitted from industrialization to present. The second half would be added by the third effect, due to lost albedo effect heat absorbed would increase thus worsening GHG effect.

Some of the stated above is irreversible and marks a red line in our efforts fighting climate change. Moreover, the feedback loop is waiting and will reveal its secrets later, because we are unable to fully predict what will happen under different scenarios.

Debate exercise

The text above tries to demonstrate that things are incredibly connected and that events on one side of the world might easily affect the other one. Debaters often don't realise these connections and struggle in explaining how something affects someone, a typical question "Why should Europeans care about heat waves in India?". Hopefully that is already clear, however many more events can happen.

In this exercise debaters should brainstorm and develop ideas how the following events can affect something in another place. Later research can be done to prove or dispute their analysis.

Events:

Fish are unable to reproduce at Great barrier reef

Global warming and agriculture

Planting, breeding and harvesting are all present for hundreds of years, yet they face challenges like never before. Weather is more unstable and extreme, critical resources like water and nutrients are becoming more rare. Plants, animals and especially humans have to adapt to survive.

Everyone with basic knowledge of biology knows that plants consume CO2 and produce oxygen, we call it photosynthesis. Photosynthesis is what makes our planet livable due to it, the atmosphere was created and is maintained. The problem is that it requires certain conditions. Firstly plenty of water is needed, if the supply is low, the plant will start conserving it more, that means it will stop opening its pores, so water doesn't evaporate via them. Less pore opening means less CO2 can get into a plant, thus being transformed into sugar, body mass or something else. This is called CO2 fixation and it is one of the main mechanisms of how CO2 gets out of the atmosphere. Higher temperatures have a similar effect, plants make thicker leaves as a protection from evaporation. Calculations say that this would add 6,39 billion metric tons of CO2 into the atmosphere each year, which is

equivalent to over a half of the emissions of China, which is the biggest polluter. Another factor that affects plant functions is concentration of CO2. Intuitively higher concentration means higher photosynthesis, however as always it is not that linear. Photosynthesis will grow to some extent, however there is a limitation of CO2 concentration which makes it more effective, after reaching this limit, efficiency does not increase anymore. Second factor is photosynthetic acclimation. This describes that some plants will reduce their increased photosynthesis after being exposed to higher levels of CO2 after some time. It does not happen to all plants, plus photosynthesis will still remain at least a bit higher then with lower CO2 level. However this indicates that plants won't adapt as humans would need, and aren't the great saviours that we are looking for.

Second devastating effect will mostly affect regions like middle Africa where temperatures are already high. Plants that will grow in this area will display higher production of sugar when exposed to high temperatures. They will contain less nutrients essential for humans. Estimates are that 150 million people in the developing world will face a shortage of nutrients.

As less and less areas will be suitable for growing plants, the intuitive response would be to move fields more north where the climate will be similar to the one where plants grow nowadays. Explicitly moving farms from Czechia into Sweden etc. At the first sight it may seem like a genial idea, because the temperatures will most likely be ideal, plus there are plenty of water resources (at least so far). The problem is soil. Areas where wheat grows right now had thousands of years to develop nutrient-rich soil, by decomposition of plant matter. In mild climates 1 cm of fertile soils take 200-400 yers to be created. For growing plants you need several centimetres, so it would take ages for the field to be fertile. Conclusion is that plant production won't be able to move, so it has to adapt.

Climate change and politics

"Politicians, please be brave and resist the temptation of lobbyists."

Responsibility, no one wants to take it, yet everybody would like to have someone with it. Politics is an inseparable part of global climate change, politicians are those who make policies that will affect our lives and future of our planet. They weigh between popularity and responsibility for climate change.

Political involvement is divided into two fields, domestic which is about implementing certain policies and international, where they create vision and world-plan–fighting- climate change. Regarding domestic policies they are often facing hard decisions whether to implement policy and lose some voters or not. People are the ones that will decide if the planet survives or not. So far it seems that the majority of people in developed countries haven't realised

how serious it is. Long term impacts are too farto be taken into account by common people. Short term impacts like catastrophes are mostly happening far away or we have enough resources to quickly recover after it. However, something has already been done, and many things are being implemented. In the following section two main mechanisms that are used to fight carbon emissions will be described.

Carbon credit system is well known in Europe, however it has been emerging in China, India and other countries. The main idea is the creation of a carbon market, where all emissions are counted at the beginning. The amount of CO2 produced is then transformed into emission allowances which are proportionally given to companies. However some of them are left to be auctioned, so the prices go higher and polluting gets more expensive. These companies can then emit only as many CO2 as the allowances allow them. If they need to emit more, they need to buy an allowance from which they do not emit that much. This way companies that reduce their carbon footprint can gain money as a reward, while polluters have to pay more. This itself wouldn't reduce CO2 net emissions, for that reason the panel/committee that distributes allowances reduces their amount each year. Due to that every year less and less emissions occur and we can spot an overall decrease.

This is an effective way of reduction, however it is rather slow and presents several disadvantages. Companies which are under this system are losing competitive advantage towards those who are outside of it, because their expenses for production are significantly lower. This can be easily combated within the system by implementing a carbon border. Carbon border forces producers which aren't under the credit system to pay for the CO2 emitted when importing into the carbon market. The price is determined by the price of allowances. Earned money is then used for green transformation. However when firms inside the carbon market want to export out of it, they still need to pay allowances, but they compete with other companies that do not have to, which sets their products at significantly higher price.

We are again getting to the point where people will decide about our climate. They are either going to buy cheap but heavy-polluting products or they have to pay more for something more sustainable.

Second most common policy is carbon tax. The implementation is significantly easier than creating a carbon market, that is probably the reason why over 60 countries implemented this system. The basic mechanism is built on pricing every ton of CO2 emitted by price tag, producers then have to explicitly state how much CO2 has been emitted during the production process and they pay the required amount of money.

This system also presents several problems. Main problem is that overall CO2 production is not being lowered, because nobody can say stop emitting at some level, you just have to pay more money. In comparison with which credit system you also can't give them less

allowances, so they can still remain on the same level.Carbon tax is often improved as progressive taxation. Simply the price for each ton of CO2 isn't the same, the more you produce the more expensive it gets.

Exercise: Debating the opposition to a carbon tax Cheat

sheet and set-up:

Opposition to a Carbon Tax: Key Actors and Arguments

1. The Energy Industry (Fossil Fuels)
Argument: Increased operational costs and reduced competitiveness due to higher taxes on carbon emissions.

Counterargument: A carbon tax incentivizes innovation in clean energy, potentially leading to long-term benefits for the industry through investment in sustainable energy sources.

2. Consumers and General Public
Argument: Concerns over increased prices for energy and goods, disproportionately affecting lower-income households.

Counterargument: Revenue from a carbon tax could be redistributed to mitigate the impact on consumers, especially vulnerable populations, through rebates or by funding public services.

3. Certain Governments and Political Leaders
Argument: Fear of economic disadvantage relative to countries without a carbon tax, leading to job losses and industry relocation.

Counterargument: International cooperation and border adjustments can level the playing field, while investment in green technology can create jobs and lead to economic diversification.

4. Small and Medium Enterprises (SMEs)
Argument: Disproportionate impact due to thinner profit margins and less flexibility to absorb or pass on additional costs.

Counterargument: Exemptions, lower rates for SMEs, or assistance programs can help mitigate the impact, encouraging SMEs to innovate and become more energy-efficient.

Exercise Structure

Preparation: create 5 sides. 1 side is in favour of a carbon tax, 4 sides take the roles assigned above. They are asked to prepare opening statements (5 mins), a rebuttal round against what they heard (4 minutes), and closing statemens (2 mins).

Opening Statements

Each side presents their main arguments, laying out why they believe the opposition to a carbon tax is justified or misguided.

Rebuttal Round

Participants address the opposing side's arguments, using data, examples, and strategic counterpoints to strengthen their position.

Question and Answer (Q&A)

Teams or individuals ask each other questions, challenging them to defend their stance and think critically about their arguments' implications.

Closing Statements

Summarize the key points made during the debate, emphasizing the strength of the arguments and the importance of considering diverse perspectives.

Case Study: The Contradictions of Energy Politics in China

China’s energy politics are just both by opponents and proponents of decisive action on climate change. The country still brings coal and gas plants online, but is also the world leader in solar panel installation. How can this contradiction be explained?

Economic Growth vs. Environmental Sustainability

Economic Growth Imperative: China's rapid industrialization and urbanization over the past few decades have been heavily reliant on coal, the most carbon-intensive fossil fuel. Coal accounts for a significant portion of China's energy mix, powering its economy to become the second-largest in the world. This reliance on coal has resulted in severe environmental degradation and health issues due to air pollution.

Push for Environmental Sustainability: In response to domestic and international pressure, China has made substantial investments in renewable energy sources such as wind, solar, and hydroelectric power. It leads the world in renewable energy production and investment, aiming to peak carbon emissions before 2030 and achieve carbon neutrality by 2060. However, the continued expansion of coal power in some regions highlights the ongoing struggle between economic objectives and environmental commitments.

Innovation vs. Legacy Systems

Innovation in Green Technology: China is at the forefront of green technology, including electric vehicles (EVs), battery storage, and renewable energy technologies. These sectors have received significant state support, showcasing China's potential to lead a global energy transition.

Struggle with Legacy Systems: Despite these advancements, China's energy sector is still dominated by state-owned enterprises (SOEs) with vested interests in traditional energy sources. These legacy systems and their associated bureaucracies often resist change, slowing the transition to cleaner energy sources.

Geopolitical Strategy

Energy Imports and Security: China's energy strategy is also influenced by its need to secure stable energy imports, particularly oil and gas, from politically volatile regions. This dependency has shaped its foreign policy and investment strategies, including the Belt and Road Initiative (BRI), which seeks to secure energy resources and routes globally.

Exporting Energy Technology: As part of its geopolitical strategy, China exports its renewable energy technology and infrastructure development capabilities. This not only opens new markets for Chinese companies but also increases its influence in the global energy landscape.