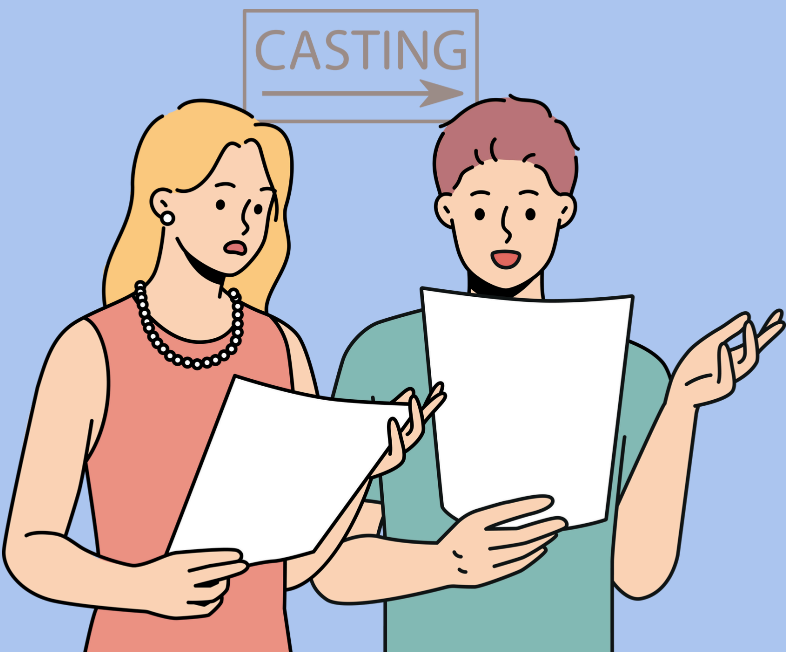
SCENARIO "CLIMATE IN OUR HANDS: HOW SCIENCE INFLUENCES ENVIRONMENTAL PROTECTION ACTIONS"



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1. Introduction

Welcome to the training dedicated to one of the most pressing challenges of our time—climate change and environmental protection. The title, "Climate in Our Hands," is not accidental. It highlights the key role that each of us can and should play in shaping the future of our planet. The world we live in is changing rapidly, and the human impact on the climate is becoming increasingly visible.

The goal of this training is to understand how science and climate change research can translate into real actions that each of us can take to protect the environment. We will analyze how scientific knowledge shapes climate policy, influences everyday decisions, and motivates pro-environmental initiatives. We will address questions such as which actions are most effective and what steps we should take to minimize our negative impact on the planet.

We will also learn about the importance of critical thinking, particularly in the context of climate misinformation, and how to utilize creativity in service of environmental protection.

During this training, we will also explore examples of ecological initiatives that bring tangible benefits to the climate. We will discuss how changes in our daily lives can contribute to global transformations and how we can become ambassadors of change within our communities.

This training is not only an opportunity to gain knowledge but also to inspire and reflect on our role in protecting the Earth. We believe that after completing it, each participant will be able to consciously and effectively act for the climate—because the future of our planet lies in our hands.

As part of the prepared educational scenario, a variety of tools and materials are available that can be adapted to meet the needs of your participants and the training objectives.

2. Resources Available in This Training Scenario

Self-Assessment test for participant knowledge and skills (Pre-training)

This test allows participants to assess their knowledge and skills level before starting the training. It can be used to identify areas requiring special attention during the course.

Module Scenario for Educators, Including Learning Outcomes and Validation Criteria

The scenario contains detailed guidelines for conducting the modules, including defined learning outcomes and validation criteria to help assess participant progress. Some learning outcomes are pre-defined to facilitate planning and conducting the sessions.

Multimedia Presentation

The prepared multimedia presentation visually supports content delivery during the training. It can be used to illustrate key issues, making it easier for participants to absorb information.

Three Podcasts

Podcasts can be used as supplementary educational materials that participants can listen to before or after the sessions. These are short recordings discussing key issues related to green competencies and critical thinking.

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Five Quizzes/Tests/Comics

These tools can be used as assessment tools at various stages of the training, as well as a way to check how well participants have understood the discussed content and to support discussion.

Ten Exercises/Tasks

Exercises and tasks are a crucial element of active learning. They are designed to engage participants, foster the development of critical thinking skills, and provide practical applications of the acquired knowledge in the context of real-world environmental issues.

Process Verification Scenario with a Final Test

This scenario includes a description of the final evaluation process, including an assessment test and guidelines for educators on checking results and providing feedback. This is a key element in verifying participants' learning outcomes and assessing their progress.

Each of the above tools can be flexibly adapted to the structure and dynamics of the training, allowing for customization to meet the group's needs and achieve the educational goals. We encourage you to make full use of the available resources to effectively support the learning process and develop participants' competencies in sustainable development and ecology.

We believe that this program will not only enhance participants' competencies but also contribute to greater awareness and engagement in green transformation processes, positively influencing their future work in the field of sustainable development.

We invite you to explore the full scenario and wish you fruitful work with your participants!

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MODULE I
THE BASICS OF GLOBAL WARMING

The objective of this module is to familiarize participants with the fundamental concepts related to global warming and to present the mechanisms that shape and influence climate change. Participants will understand how their daily actions can either decrease or increase the effects of global warming, as well as what steps they can take to mitigate it.

Learning Outcomes:

- Participants will have a solid theoretical foundation regarding global warming, including knowledge of key concepts such as the greenhouse effect, greenhouse gas emissions, and climate change
- They will learn about the main sources of greenhouse gas emissions
- They will be able to analyze the factors contributing to global warming and understand its short- and long-term impacts on various aspects of life on Earth
- They will gain awareness of their own impact on the climate and understand how their individual actions can contribute to combating global warming
- Participants will be able to effectively communicate to others what global warming is, its consequences, and the importance of taking action for climate protection

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Validation Criteria

- Participants should be able to define global warming, identify its causes, describe the mechanism of global warming, and explain its effects. They should understand the relationships between human activity and the climate, as well as identify the primary sources of greenhouse gases.

Questions the trainer may ask during the module discussion

- What do you think global warming is?
- What are the causes of global warming?
- How does it affect the climate and the world around us?
- Do you observe any effects of global warming in your immediate environment?
- In your opinion, is global warming a serious problem or an issue exaggerated by the media and corporations looking to profit from it?

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Content for trainers to use during the training:

→ Radiation and energy absorption

All processes that occur on Earth's surface require energy, just as the activities performed by our bodies (such as chewing, breathing, or physical activity) do.

This energy does not come from the Earth's internal system but is instead supplied to the Earth's surface from outside and then distributed among different organisms and systems. For instance, plants use this energy to create chemical compounds that form their stems, leaves, etc. Oceans also absorb this energy, impacting water temperature.

The primary source of energy for processes occurring on Earth's surface is solar radiation (the Sun).

→ Energy balance, greenhouse effect

Solar energy reaching the Earth's surface is absorbed (e.g., by the oceans), and this absorption increases the energy and, consequently, the Earth's surface temperature.

The Earth's energy balance is a vital phenomenon related to energy supply from sources like the Sun. Some of the sunlight reaching Earth is absorbed (e.g., by plants for chemical processes mentioned earlier), but some is not absorbed and is reflected back into space. The energy balance involves the equilibrium between the amount of energy delivered to Earth and the amount emitted and reflected.

The Earth's energy balance determines the average surface temperature. If it is zero, the temperature remains unchanged. If positive, the planet warms.

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The Earth's energy balance determines the average surface temperature. If the balance is zero, the temperature remains unchanged. If positive, the planet warms.

The energy balance, along with the amount of energy delivered, reflected, and emitted, is connected to another concept—the greenhouse effect. This is a complex process occurring in the atmosphere. In simple terms, certain gases present in the upper layers of the atmosphere have properties that enable them to retain some of the solar radiation reflected from the Earth's surface, preventing it from escaping the planet. This is the greenhouse effect. In itself, it is not a negative phenomenon. We need to retain some solar radiation to maintain an optimal temperature for life on Earth. However, if the amount of these gases with specific properties (known as greenhouse gases, with the most well-known example being carbon dioxide, CO_2) increases, then too much solar energy will remain on Earth. This ultimately disrupts the energy balance and raises the temperature.

Another source of energy on Earth is geothermal heat from the planet's interior. However, it is negligibly small compared to the amount of energy received from the Sun, so we typically exclude it from our considerations.

The Earth's average surface temperature depends on factors such as:

- the amount of radiation absorbed or reflected by the Earth's surface,
- the amount and types of greenhouse gases.

The issue of greenhouse gases pertains to how much energy is retained by the atmosphere and how much escapes (is radiated) into space. The more greenhouse gases in the atmosphere, the more energy is retained. The type of gas also matters, as different gases have varying capacities to trap energy (for example, methane, though less abundant, has a greater ability to trap energy than carbon dioxide; methane is 23 times more potent as a greenhouse gas than carbon dioxide).

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Water vapor, which forms clouds, is also a greenhouse gas.

While an excess of greenhouse gases is harmful to Earth's climate, a balanced presence in the atmosphere is essential for sustaining life (in appropriate amounts, of course!). Without greenhouse gases, virtually all heat would escape (or be radiated) into space, leading to a drop in the Earth's surface temperature.

Definition of Albedo:

When discussing the absorption and reflection of radiation, it is important to understand albedo—a parameter that indicates a surface's ability to reflect solar radiation. As mentioned earlier, some of the solar radiation reaching the Earth's surface is reflected back toward the atmosphere and beyond our planet.

However, this does not occur evenly, as different surfaces have varying reflective abilities (measured by the albedo coefficient).

A simple example is the color of shirts worn on warm sunny days: **which shirt would make you feel hotter—a black one or a white one?**

You would feel warmer in a **black shirt because black absorbs more solar radiation than white.**

Similarly, with the Earth's surface, darker areas typically absorb more radiation than lighter ones.

Ice has a high albedo—it reflects a large portion of incoming solar radiation. Water, on the other hand, has a low albedo and absorbs most of the solar radiation that hits it. Therefore, as more glaciers and ice sheets melt, the ocean surface area increases, leading to more absorbed energy.

All the above information should be considered when studying the Earth's energy balance—namely, the amount of solar radiation absorbed and reflected, albedo, and the greenhouse effect.

An increase in greenhouse gases leads to more energy being trapped on Earth, which disrupts the energy balance.

This increase in retained energy results in a rise in average temperatures. As temperatures rise, glaciers and ice sheets melt. The melting of ice reduces the surface area that efficiently reflects solar radiation (such as ice, glaciers, and ice sheets), leading to more energy being retained on Earth—thus, returning to the starting point.

The increase in greenhouse gases causes more energy to be trapped on Earth, disturbing the energy balance.

Climate Tipping Points

A tipping point is a threshold beyond which the equilibrium state of a system changes.

In the Earth's climate system, a tipping point is a threshold whose crossing may lead to significant, possibly irreversible, climate change.

This concept is often associated with positive feedback loops. By introducing changes to the system (e.g., adding extra energy), we may trigger self-reinforcing processes, much like in a positive feedback loop, setting off a cycle that cannot be halted or reversed.

Examples of elements susceptible to such tipping points include ice sheets over the Arctic, Greenland, and both Western and Eastern Antarctica. Rising global temperatures cause these ice sheets to melt, subsequently raising sea and ocean levels.

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Other examples of climate tipping points include:

- Thawing of permafrost in Siberia,
- Droughts, deforestation, and fires in the Amazon rainforest,
- Weakening of Atlantic Ocean currents,
- Destruction of coniferous forests in temperate climates,
- Destruction of the Great Barrier Reef.

Scientific Evidence of Climate Change

The concentrations of carbon dioxide, methane, and nitrous oxide in the atmosphere have significantly increased since the onset of the industrial revolution. For example, the average concentration of carbon dioxide measured at the Mauna Loa Observatory in Hawaii rose from 316 parts per million (ppm) in 1959 (the first full year of available data) to over 411 ppm in 2019. This rate of increase has been observed at numerous stations globally.

Since pre-industrial times, atmospheric CO2 concentration has risen by over 40%, methane by over 150%, and nitrous oxide by about 20%. More than half of the increase in CO2 has occurred since 1970. The rise in concentrations of all three gases contributes to global warming, with CO2 being the most significant driver.

Scientists have examined greenhouse gases in the context of historical records. Analysis of air trapped in ice accumulating over time in Antarctica reveals that CO2 concentration began to rise significantly in the 19th century, maintaining levels between 260 and 280 ppm for the preceding 10,000 years. Ice core data going back 800,000 years show CO2 levels fluctuating between 170 and 300 ppm across several ice age cycles, with no recorded levels above 300 ppm until the past 200 years. Measurements of carbon isotopes in the modern atmosphere indicate a clear addition of “old” carbon from fossil fuel combustion (as opposed to “new” carbon from living systems). Additionally, human activities (excluding land-use changes) currently emit an estimated 10 billion tons of carbon annually, primarily from fossil fuel burning, which is more than sufficient to explain the observed increase in concentration. This evidence strongly indicates that the elevated CO2 levels in our atmosphere result from human activities.

Estimating the global increase in average surface air temperature requires a thorough analysis of millions of measurements from around the world, including from land stations, ships, and satellites. Despite the complexities of synthesizing this data, many independent teams have separately and unanimously concluded that the average global surface air temperature has risen by about 1°C since 1900. While there are pauses and accelerations within this warming trend, each of the past four decades has been warmer than any other decade in the instrumental record since 1850. To examine temperatures before accurate thermometers became widely available, scientists reconstruct temperatures using climate-sensitive proxies in materials such as tree rings, ice cores, and marine sediments.

Comparisons of thermometer records with these proxies suggest that the period from the early 1980s onward has been the warmest 40-year span in at least eight centuries, with global temperatures now approaching peak levels last seen between 5,000 and 10,000 years ago during the warmest part of our current interglacial period. In recent years, numerous other impacts related to warming have become apparent. The summer Arctic Sea ice cover has dramatically shrunk. Ocean heat content has increased. Since 1901, the global mean sea level has risen by approximately 16 cm, due to both thermal expansion of warmer ocean waters and the addition of meltwater from glaciers and ice sheets on land. Warming and precipitation changes are altering the geographic range and lifecycle timing of many plant and animal species. In addition to climate impacts, some of the excess atmospheric CO_2 is absorbed by the ocean, changing its chemical composition (leading to ocean acidification).

Based on the physics of the amount of energy absorbed and emitted by CO_2, doubling the atmospheric CO_2 concentration from pre-industrial levels (to around 560 ppm) would, by itself, result in a global average temperature increase of about 1°C. However, the entire climate system is more complex; warming leads to additional effects (feedbacks) that can either amplify or reduce the initial warming.

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The most significant feedbacks involve different forms of water. A warmer atmosphere generally holds more water vapor, which is a potent greenhouse gas, causing further warming; its short atmospheric lifespan means its levels largely follow temperature increases. Thus, water vapor is considered an amplifier rather than a driver of climate change. Higher temperatures in polar regions melt sea ice and reduce seasonal snow cover, exposing darker ocean and land surfaces that can absorb more heat, leading to further warming. Another significant, though uncertain, feedback involves changes in clouds. Together, warming and increased water vapor may lead to either an increase or decrease in cloud cover, which can either amplify or mitigate temperature change, depending on changes in the clouds' horizontal extent, height, and properties. Recent scientific assessments suggest that the overall net global effect of cloud changes likely reinforces warming.

The ocean moderates climate change. While the ocean is a massive heat reservoir, it is challenging to heat its entire depth because warm water tends to remain near the surface. Consequently, the transfer of heat to the ocean depths is slow; it varies year-to-year and decade-to-decade and helps determine the rate of surface warming. Subsurface ocean observations were limited before about 1970, but since then, warming of the upper 700 meters (2,300 feet) is clearly evident, and deeper warming has been observed since around 1990. Surface temperatures and precipitation in most regions differ significantly from the global average due to geographic location, particularly latitude and continental positioning. Average temperatures, precipitation, and extreme values (which generally have the most significant impacts on natural systems and human infrastructure) are also strongly influenced by local wind patterns. Estimating feedback effects, warming rates, and regional climate changes requires sophisticated models. Although these models vary in their projections for expected additional warming, they all agree that the net effect of feedbacks overall is to amplify warming.

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Sources of greenhouse gas emissions

In discussions about climate change, we focus on carbon dioxide (CO_2)—the most dominant greenhouse gas produced by burning fossil fuels, industrial production, and land-use change. But CO_2 is not the only greenhouse gas driving global climate change. There are many others—methane, nitrous oxide, and trace gases such as the "F-gases"—that have contributed significant warming to date.

Total greenhouse gas emissions are the sum of emissions of different gases: carbon dioxide, methane, nitrous oxide and smaller trace gases such as hydrofluorocarbons (HFCs) and sulfur hexafluoride (SF_6). Current research results indicate that carbon dioxide emissions are about 75%, methane emissions are about 20% and nitrous oxide emissions are about 5% of the total greenhouse gas emissions.

Methane

Agriculture, fossil fuel production, and waste management are the main sources of methane emissions. Livestock (ruminants—cattle, goats, and sheep) produce methane through a process called "enteric fermentation." Rice farming produces methane—waterlogged rice fields provide an ideal environment for microbes to produce methane through a process called "methanogenesis." Biomass combustion: Methane is produced by incomplete combustion during large-scale burning of forest, savanna, and agricultural waste. Waste: The decomposition of organic waste in landfills produces methane. Fossil fuel production: Methane can be released during oil and gas extraction—a category often referred to as "fugitive emissions."

Methane is a much more potent greenhouse gas than CO_2 in terms of "warming potential." Over a 100-year timescale, and without taking climate feedbacks into account, one ton of methane would cause 28 times more warming than one ton of CO_2. This means that despite its small mass emissions of greenhouse gases, methane has been responsible for about a quarter of the radiative forcing since 1750.

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Methane is a very "short-lived" greenhouse gas. This means that once it accumulates in the atmosphere, it is removed relatively quickly - on a scale of several decades, unlike CO_2, which can remain in the atmosphere for centuries or even thousands of years.

The average "lifetime" of methane in the atmosphere is about 12 years. This means that reducing methane emissions quickly results in a reduction in its concentration in the atmosphere. This would reduce its warming effects. Therefore, solving the problem of methane emissions can be an effective and rapid way to mitigate some of the effects of climate change - over a period of decades.

Nitrous oxide (N_2O)

Most of our nitrous oxide emissions come from agriculture: N_2O is created when we apply nitrogen fertiliser to the soil. Nitrous oxide is produced by microbes in almost all soils. However, applying nitrogen fertiliser makes it easier for microbes to take up nitrogen, which can be converted to N_2O – this is because not all the nutrients applied are taken up by crops. Nitrous oxide is not only created by applying synthetic nitrogen fertiliser; the same processes occur when we use organic fertilisers such as animal manure.

Nitrous oxide is a much more potent greenhouse gas than CO_2 in terms of "warming potential." Over a 100-year timescale, and without taking climate feedbacks into account, one ton of nitrous oxide would cause 265 times more warming than one ton of CO_2.

The average "lifetime" of nitrous oxide in the atmosphere is about 121 years. This is typically shorter than CO_2 (which can persist for centuries or even thousands of years), but longer than methane (which has an average lifetime of 12 years).

Carbon dioxide emissions, mostly from the burning of fossil fuels, have increased dramatically since the beginning of the industrial revolution. Most of the world's greenhouse gas emissions come from a relatively small number of countries. China, the United States, and the European Union are the three largest emitters in absolute terms. Greenhouse gas emissions per capita are highest in the United States and Russia.

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Carbon dioxide emissions have increased rapidly over the past 70 years. However, they are expected to remain stable, albeit at very high levels, in the coming decades. Emission reductions in developed economies are expected to offset increases in carbon dioxide emissions in developing countries.

Other greenhouse gases (i.e. methane, nitrous oxide and fluorinated gases) are expected to increase by 30 percent over the next three decades.

After presenting the theory of greenhouse gas emissions, the presenter moves on to discuss the sources and magnitude of greenhouse gas emissions.

Sources of greenhouse gases:

1. Energy (electricity, heat and transport): 73.2% including at least:
A) Energy consumption in industry: 24.2%
B) Transport: 16,2%

- Road transport (11,9%)
- Aviation (1,9%)
- Maritime transport (1,7%)
- College (0,4%)
- Pipelines (0,3%)

C) Energy consumption in building: 17,5%

- Residential buildings (10,9%)
- Commercial buildings (6,6%)

2. Direct industrial processes: 5,2%
A) Cement (3%):
B) Chemicals and petrochemicals (2,2%)

3. Waste: 3,2%

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4. Agriculture, forestry and land use: 18,4%

A) Grasses (0,1%): As grasses degrade, these soils can lose carbon, turning into carbon dioxide in the process

B) Crops (1,4%)

C) Deforestation (2,2%)

D) Crop burning (3,5%): Burning crop residues—the leftover vegetation from crops like rice, wheat, sugarcane, and other crops—releases carbon dioxide, nitrogen oxide, and methane. Farmers often burn crop residues to prepare the land for replanting crops

E) Rice (1,3%): Flooded rice fields produce methane in a process called “anaerobic digestion.” Organic matter in the soil is converted to methane due to the low-oxygen environment in waterlogged rice fields. 1.3% may sound like a lot, but it’s important to put it in context: rice accounts for about one-fifth of the world’s calorie supply and is a staple crop for billions of people around the world

F) Agricultural soils (4,1%): Nitrous oxide—a potent greenhouse gas—forms when synthetic nitrogen fertilizers are applied to the soil.

G) Livestock and manure (5.8%): Animals (mainly ruminants such as cattle and sheep) produce greenhouse gases in a process known as "enteric fermentation." When microbes in their digestive systems break down food, they generate methane as a byproduct. This means that beef and lamb tend to have a large carbon footprint, and eating less of these foods is an effective way to reduce emissions in one’s diet.

Nitrous oxide and methane can also be produced from the decomposition of animal manure under low-oxygen conditions. This often occurs when a large number of animals are managed in a confined area (such as dairy farms, beef cattle farms, and pig and poultry farms), where manure is typically stored in large piles or removed in lagoons and other types of manure management systems.

MODULE II
SCIENCE IN THE SERVICE OD CLIMATE

This module discusses examples of new technologies and their role in environmental protection. The types of technologies are divided into three groups: those that focus on identifying problems, those aimed at stopping damage, and those that concentrate on regeneration and reversing the damage done. Additionally, participants will familiarize themselves with examples of extreme weather events.

Learning Outcomes

Participants will:

- Understand the role of science in combating the effects of climate change.
- Learn about key scientific achievements in environmental protection.
- Be aware of the interdisciplinary nature of climate research.
- Get acquainted with examples of extreme weather events.

Validation Criteria

Participants should be able to explain the role of science in environmental protection and provide examples of scientific achievements in this area.

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Questions that the instructor may ask during the module:

- Can you provide examples of new technologies that support humanity in combating climate change?
- Do you believe that new technologies are crucial from the perspective of actions aimed at environmental protection?
- What environmental problem should new technologies focus on?

Content that the instructor may convey during the module:

→ New Technologies to Combat Climate Change

Technology creators are finding intriguing ways to halt and reverse carbon dioxide emissions while preventing further harm to the planet.

Scientists are tackling climate change in many inventive ways. New technologies facilitate the identification of emission sources, halt further damage through increased energy efficiency and lower-carbon alternatives to fossil fuels, and even remove excess greenhouse gases from the atmosphere. Many of these approaches are far from routine. For example, scientists are exploring the possibility of launching a massive sunshade into space to block a small but critical amount of solar radiation. If this technology works, the theory suggests it could be sufficient to counteract the effects of global warming.

In another innovative experiment, scientists have released salt aerosols into the atmosphere to alter the composition of clouds over the Earth’s oceans, reflecting some solar energy back into space.

It seems that no promising idea is beyond reach.

1. Identifying Problems

The first step in fixing something is determining where it is broken. We know what the problem is: excessive greenhouse gas emissions that are raising global temperatures; however, an essential issue is identifying where these emissions come from.

Identifying Global Emission Hotspots Using Machine Learning-Based Satellites

In March, the Environmental Defense Fund (EDF) launched MethaneSAT, a satellite that tracks methane emissions, an even more potent greenhouse gas than carbon dioxide. Data from this satellite is expected to be available by the end of 2024. This data, combined with Google’s artificial intelligence and infrastructure mapping, will help better understand how to mitigate methane emissions, particularly those from oil and gas infrastructure.

Detecting Emissions in the Global Supply Chain Using Artificial Intelligence

Companies producing and processing oil, gas, minerals, and other raw materials are responsible for half of the world’s greenhouse gas (GHG) emissions. Climate TRACE is a Google-funded nonprofit organization that tracks and analyzes carbon dioxide (CO_2) emissions from power plants, factories, controlled burns, cargo ships, and other anthropogenic sources using satellite imagery, infrared imaging, and nitrogen oxide sensors. The nonprofit aims to analyze this information using machine learning to create a publicly accessible source of real-time emissions data. Governments and other groups worldwide could use these independently collected data to detect illegal polluters, verify compliance with international climate change agreements, and manage carbon dioxide emissions trading markets. Climate TRACE has published a database of 352 million greenhouse gas sources.

Measuring Digital Carbon Footprint

The digitization of the economy helps the environment by reducing greenhouse gas emissions. However, its impact still needs to be measured. The production of computer devices, the raw materials used, and the energy consumed contribute to the so-called digital carbon footprint, which accounted for 2% of total global emissions in 2015 and 4% in 2020, according to Enel, an energy company currently focusing on green energy. To measure the digital carbon footprint of organizations, the Greenly app allows companies across all industries to do just that.

Monitoring the carbon footprint is particularly important as the increase in AI usage leads to a massive rise in electricity and water consumption in the data centers powering AI. It is estimated that within just a few years, energy consumption associated with AI will be comparable to that of a country like Argentina, according to data scientist Alex de Vries, whose analysis was published in The New York Times.

2. Stopping Further Harm

When you know that something you're doing creates a problem, the next step is to do something differently. In relation to climate change, this means developing energy sources that emit lower levels of carbon dioxide and finding more efficient ways to use the energy generated.

Low-carbon energy is all around us, and scientists are finding inventive ways to harness it:

Reducing and Reusing Food Waste

According to estimates by the United Nations, an astonishing one-third of the food produced is wasted or lost. This is particularly tragic considering that 800 million people worldwide do not have enough food, according to data from the UN World Food Programme. At the same time, agriculture and food production are among the main contributors to greenhouse gas emissions. In fact, rotting food in landfills contributes to 10% of global greenhouse gas emissions, according to UN data.

New digital technologies, including digital twins, can help reduce food waste by monitoring and modeling food freshness, extending shelf life, and selling food at attractive prices just before expiration through apps. For example, Freshspire uses cloud computing to reduce food waste at the production level by providing order management, supplier management, and data analytics solutions that connect small and medium-sized farms with grocery stores, restaurants, nonprofits, and other customers to sell food that might otherwise be wasted. Meanwhile, an academic-technology partnership at Princeton University has resulted in wireless technology used to sort the quality of fruits to reduce the number of fruits going to landfills.

Composting food waste when it reaches a point of spoilage and turning it into plant feed is a fairly straightforward solution that avoids sending food to landfills. Many startups, including Full Harvest, Hungry Harvest, and Imperfect Produce, are implementing technology aimed at improving the appearance of produce to meet consumer expectations, helping to avoid their waste solely for cosmetic reasons.

Agricultural waste can also be used for other purposes. For example, Strawcture Eco converts agricultural by-products into sustainable building materials.

Solar-Powered Fabric

What if you could charge your phone or laptop while wearing a shirt? A new polymer that collects solar energy can be applied to textiles, creating the possibility of producing shirts, pants, and other clothing that can serve as mobile power sources.

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Water Drops

There are many promising achievements in harvesting energy from raindrops. Scientists from the City University of Hong Kong have developed a generator that can convert rain (or a leaky faucet) into 140 volts of energy per drop—enough for one drop to briefly light 100 small LED bulbs. Scientists from China and the UK have developed a technique to harvest low-speed wind energy using anchored ionic droplets. This method—utilizing winds that are too weak to drive a turbine—could be used to power small electronic devices.

Researchers in Florida are testing how well turbines anchored 80 feet below the ocean's surface can capture the steady flow of the Gulf. A new 4D printed generator shows potential for drawing even greater power from droplets of water or other liquids.

Tidal Energy

Tidal energy production has the potential to deliver vast amounts of clean energy by utilizing predictable tidal currents through methods such as tidal streams, barrages, and tidal lagoons. This technology is still in its infancy, with the first projects planned in the United States, in Washington State and Maine. The city of Liverpool in England has announced plans to build the world's largest tidal energy generator on the Mersey River; it could power over a million homes for 120 years or more.

Wave Energy

Wave energy converters could collect 29,500 terawatt-hours of renewable electricity from the ocean each year. This technology is making a comeback after a major project failure in 2008. The turbulent waters off Aguçadoura in northern Portugal still provide an ideal testing ground for new wave energy converters, and the Swedish company CorPower Ocean has just completed testing its new 60-foot C4 buoy generator for commercial scale. Portugal is also home to another promising wave energy technology called Wave Roller. Experiments with wave energy in the USA have been limited, citing high costs. California authorities have mandated state agencies to investigate the technology and submit a report on its feasibility by 2025.

Utilizing Marine Creatures that Store Carbon

Researchers from Ohio State University are part of a research team focusing on viral species in the world's oceans to identify those most likely to combat climate change by helping to capture carbon dioxide in seawater.

Wind Generators

Energy-generating brakes are known to anyone who drives an electric or hybrid car. What about installing them in other devices that frequently stop—such as elevators? The new generation of elevator technology includes regenerative drives that generate energy while lowering elevators, especially when they are loaded with heavy weights, according to Propmodo. Regenerative drives can recover up to 30% of the total energy consumption of the elevator. The Empire State Building in New York was one of the first examples of this technology, and as of 2022, it claims to host “the largest wireless battery management system in the world.”

Other Innovative Technologies and Efficiency Boosters

To reduce our dependence on fossil fuels, we also need to increase energy efficiency. In this regard, new achievements are also promising:

Transparent Wood

Well-designed windows help regulate the temperature of a building and energy consumption, but conventional glass production is heavy in terms of carbon dioxide emissions. Transparent wood, a new material made almost entirely from fast-growing balsa trees, is a sustainable alternative that is also five times more thermally efficient than glass. Its application in mobile phones is also anticipated.

Energy-Efficient Programming

Web designers are exploring ways to shorten load times and make websites less energy-consuming and more sustainable through techniques such as optimized resource usage, cloud storage, caching, mobile design, and carbon-neutral hosting. Broader efforts are also underway to make software engineering more sustainable through energy efficiency, hardware efficiency, and carbon-conscious computing.

Mitigating Inefficiencies in Buildings Using Sensors, Analytics, and Artificial Intelligence

For years, facility managers have relied on data analysis and sensors to promote energy efficiency. Now, artificial intelligence is entering the scene, revolutionizing the way facility managers approach decision-making and operational processes. For example, AI can analyze historical energy consumption patterns to identify areas of waste and recommend energy-saving measures and proactive asset management. Additionally, deploying AI/machine learning on large datasets generated by the Industrial Internet of Things (IIoT) sensors allows for much quicker insights.

3. Regeneration: Reversing Existing Damages

Given the rapid decline of key indicators of the health of our planet, typical sustainability efforts focused on reducing emissions and waste in our economic system are foundational. Furthermore, it is necessary to implement systems that reverse damages, alongside business operations that heal and regenerate our natural resources, such as:

Carbon Capture and Utilization

Direct air capture technology is a form of carbon removal that extracts CO_2 from the ambient or stationary air. The separated CO_2 can then be permanently stored deep underground or converted into products—an example of the circular economy principle of finding uses for waste and by-products.

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Biochar for Soil Renewal

Produced by heating wood and other biomass at high temperatures without oxygen, biochar is becoming increasingly popular as a means of carbon sequestration—removing carbon from the atmosphere by locking it in solid forms. When mixed with soil, biochar enhances its fertility and capacity to absorb greenhouse gas emissions. There are many promising agricultural applications, as well as a market for selling biochar carbon credits to corporations.

Alternative Uses of Fungi

In response to the plague of packaging materials, such as styrofoam peanuts, mushroom-based alternatives made from organic plant waste, like hemp and corn husks, offer a safe and compostable home alternative to plastic foams. Besides packaging, fungi are entering the scene as meat alternatives and as a means of cleaning up oil spills—essentially, magical mushrooms.

Regenerative Agriculture

It is essential for farming practices to go beyond sustainability and heal the land, preparing it for a resurgence. While achieving carbon neutrality involves balancing emissions with removals, regenerative practices actively contribute to carbon sequestration and storage in the soil. The "clean positive" effect is the active reduction of carbon dioxide levels in the atmosphere and the reversal of climate change. Private equity firms are investing in regenerative agriculture ventures.

3D Printed Coral Reefs

Researchers from the University of Texas, funded by a National Science Foundation (NSF) grant, aim to build 3D-printed artificial reefs that replicate Roman concrete, which has proven exceptionally resilient to seawater. Another 3D coral reef project in Florida involved sinking 25 concrete modules to the seabed, creating new marine ecosystems at depths of 60 to 90 feet.

The climate crisis remains urgent and inevitable, but it can still be addressed. These are just a few technological innovations that give us hope to move beyond mere disaster prevention and build a world that is more sustainable.

New opportunities, ideas, and technologies continue to emerge; the world needs a combination of approaches that are tested, refined, and implemented to combat global warming.

After discussing the issues of inventions, the facilitator proceeds to present examples of extreme weather events and their consequences.

Extreme Weather Events

Recent scientific analyses indicate that approximately 80% of extreme weather events are caused by human activities. Scientists also estimate that the emerging phenomena of extreme heat are 93% driven by human activities, while for precipitation and flooding, this percentage is 56%. In the case of droughts and the wildfires they cause, the figure is 68%.

Examples:

Heat Waves: In July 2023, extreme heat waves occurred in several parts of the Northern Hemisphere, including the southwestern United States and Mexico, southern Europe, and China. On July 16, temperatures exceeded 50°C in Death Valley in the USA and northwestern China. Records were also set at many other weather stations in China, and the all-time high record in China was broken in Sanbao on July 16. In Europe, the hottest day on record occurred in Catalonia, while other parts of Spain recorded their highest daily minimum temperatures. In the United States, some areas in Nevada, Colorado, and New Mexico recorded all-time high temperatures, while parts of Arizona, particularly in the Cayman Islands, experienced record high nighttime temperatures in Phoenix, Arizona, which also recorded the longest stretch of temperatures not dropping below 32.2°C. Several deaths due to heat have been confirmed in the USA, including migrants at the border with Mexico. In Mexico alone, over 200 people died due to the heat. Spain, Italy, Greece, Cyprus, Algeria, and China also reported deaths due to heat, as well as a significant increase in hospitalizations due to heat-related illnesses. A large portion of the population in Italy and Spain, as well as over 100 million residents of the southern United States, were under heat alerts. In all three regions, energy demand surged, negatively impacting many important crops, including olive oil in Spain and cotton in China.

Precipitation and Flooding: Between April 24 and May 4, 2024, over 420 mm of rain fell in the southernmost state of Brazil, Rio Grande do Sul, affecting more than 90% of the state with flooding. The floods forced the displacement of over 80,000 people, injured more than 150,000, and as of May 29, there were 169 fatalities, with 44 people still considered missing (Governo do Estado de Rio Grande do Sul, 2024). There were also disruptions in the provision of essential services, resulting in 418,200 households losing power and over a million households without water. Dozens of municipalities lost telephone and internet services.

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Droughts and Fires: It is estimated that so far this year, fires have burned over 1.3 million hectares of the Pantanal, the largest tropical wetland in the world and the largest biodiversity hotspot. Although the peak of the fire season typically occurs in August and September, June 2024 was exceptional – it is estimated that around 440,000 hectares burned in just one month, significantly exceeding the previous June maximum of 257,000 hectares and far surpassing the monthly average of about 8,300 hectares. The Brazilian Pantanal, located on the border with Bolivia and Paraguay, encompasses over 15 million hectares. The wetlands are seasonally flooded from November to April and then dry out during the dry season from May to October. It supports a vast range of unique species, is home to many indigenous groups, provides essential ecosystem services for the surrounding area, and offers livelihoods for tens of thousands of farmers, ranchers, and fishermen while being a huge carbon dioxide reservoir. Indigenous and traditional communities are among the most affected by the fires, as traditional lands are destroyed, cultural practices are disrupted, and people are displaced. Economic activities such as tourism and agriculture are also threatened, causing crop losses and the death of livestock. Fires have also killed countless wild animals and birds, destroyed vital habitats, and severely disrupted the lives of animals that managed to escape as food and water became increasingly scarce.

MODULE III
CRITICAL AND CREATIVE THINKING

In this module, participants will develop critical thinking and creativity skills. Examples of climate misinformation will be presented, and participants will learn about the role of creativity in environmental protection through practical applications.

Learning Outcomes

Participants will learn what climate misinformation is and explore how to use creativity in environmental protection.

Validation Criteria

- Participants will be able to identify climate misinformation on the internet and apply creativity in environmental protection

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Questions the facilitator might ask during the module:

- Have you ever encountered false information about the climate being spread on the Internet?
- How can you tell if an article and the information it contains are not credible?
- Do you think there is a lot of content online that is not entirely true regarding climate change and environmental protection?
- Do you believe that the spread of misinformation primarily stems from ignorance, or do specific interest groups play a role in it? Who do you think is behind such articles?

Content That the Facilitator May Convey During the Module:

Climate misinformation refers to deceptive or misleading content that:

- Undermines the existence or effects of climate change, the unequivocal impact of human activity on climate change, and the need for urgent action in accordance with the scientific consensus and the goals of the Paris Climate Agreement.
- Misrepresents scientific data, including by omission or selective presentation, to undermine trust in climate science, institutions, experts, and climate solutions.
- Falsely promotes efforts as supporting climate goals that actually contribute to global warming or contradict the scientific consensus on mitigating climate change or adaptation.

This definition was developed by Climate Action Against Misinformation.

Often, when people hear the term "climate misinformation," they think of climate change denial, which claims that climate change is not real or not caused by humans. But that is just one form of climate misinformation. Increasingly, those who disrupt the climate discussion use "distraction and delay" tactics to hinder and postpone action. These narratives are subtler but no less harmful: they do not deny the existence of climate warming but instead attack measures to combat the crisis, question the integrity of climatologists, and argue that environmentalists are alarmists. You may have heard some of these narratives: "Renewable energy doesn't work," "Environmentalists are hysterical," "Net Zero harms the economy."

These false statements have consequences. Research shows that climate misinformation is a major factor contributing to societal polarization regarding the climate crisis and shapes public attitudes toward climate science. Individuals exposed to such misinformation are less likely to support climate change mitigation policies, making it difficult for decision-makers to take significant climate actions.

Every lie, distortion, and conspiracy theory about climate change obstructs meaningful climate action — which constitutes a collective effort requiring our agreement on a set of basic facts. The current strategy of the fossil fuel industry involves encouraging misunderstandings about these facts to support divisions. Research has shown that this tactic works, contributing to numerous negative phenomena from political inaction to the rejection of climate mitigation policies. This is, of course, what the fossil fuel industry anticipated. The dissemination of misinformation on social media is simply a mutation of what has been done offline for decades. It is also a page straight from the tobacco industry playbook. A comprehensive report from 2020 on climate misinformation cited a phrase from a tobacco industry director’s memo explaining how the same tactic was applied during decades of attempts by that industry to suppress the impact of research linking cigarettes to cancer: “Our product is doubt, as it is the best way to compete with the ‘fact’ that exists in the public’s consciousness. It is also a way to create controversy.”

Fossil fuel companies, other major polluters, and their allies have spent hundreds of millions of dollars disseminating false and misleading content on social media. One analysis found that the 16 largest polluting companies in the world were responsible for posting over 1,700 such ads on Facebook in 2021. Collectively, these ads garnered around 150 million views, and the platform earned nearly $5 million from them.

Clean energy is a favorite target for these dubious social media merchants of the 21st century. For example, the Texas Public Policy Foundation, a think tank heavily linked to the oil and gas industry, has engaged in regional conflicts over wind energy, producing YouTube videos portraying these battles as clashes between local small businesses and international clean energy companies.
In 2023, ExxonMobil paid for at least 350 ads aimed at influencing proposed legislation in New York State that would phase out natural gas in new buildings.

Knowing that users are much more likely to trust political information that appears to come from grassroots organizations rather than information that can easily be identified as corporate ads, oil and gas companies have become adept at creating front groups that look, sound, and act like nationwide collections of “concerned” citizens. Climate misinformation has even been incorporated into marketing plans to help persuade the public to continue using fossil fuels. Gas industry trade groups are actually paying influencers on Instagram — often young women who are very popular among foodies and cooking enthusiasts — to discuss the benefits of cooking on gas stoves compared to electric ones, attempting to make the burning of this particular fossil fuel seem like a necessary condition for successful recipes. Many of these general messages are often reinforced by the largest individual purveyors of misinformation online, some of whom receive funding from fossil fuel interest groups.

Scientists from Indiana University have identified three distinct but interrelated types of behavior that they believe "make the social media ecosystem susceptible to both intentional and accidental misinformation." Cognitive biases are systematic errors in thinking that arise from our tendency to use mental shortcuts. Social bias is the tendency to trust information coming from people you know (or identify with) over information from other sources. Algorithmic bias is a consequence of the social media platforms themselves: sites like Facebook and Platform "X" tailor the content you see each day based on what they think you will react to most passionately — regardless of whether your reaction is joy, sympathy, or anger. Together, this is essentially a recipe for discourse disaster.

Cognitive bias means that we are much more likely to believe — and share — information that seems true to us without taking the time to verify whether it is indeed true. Social bias means we are even more likely to believe and share this information if it has reached us through someone in our social (or ideological) circle. And algorithmic bias means that once we like and share that piece of possibly true, or possibly false, information, we will see a lot more posts in the same vein. Add to that a small but significant dopamine rush that people experience when others like and/or share their posts, and you basically have a machine built for unfettered, unfiltered messaging. If you are the director of oil and gas or an analyst on a consulting team tasked with undermining clean energy, you couldn't devise a better way to spread information and entrench it.

How to Deal with Misinformation, Particularly on the Internet:

- **Approach Headlines with Skepticism.** Fake news often has catchy headlines written in all caps and exclamation marks. If shocking claims in the headline sound unbelievable, they probably are.
- **Examine the URL Carefully.** A fake or similar URL can be a warning sign of fake news. Many fake news sites mimic authentic news sources by making slight changes to the URL. You can visit the site to compare the URL with trusted sources.
- **Investigate the Source.** Ensure that the story is written by a source you trust and that has a reputation for accuracy. If the story comes from an unknown organization, check their “About Us” section to learn more.
- **Watch for Unusual Formatting.** Many fake news sites contain spelling errors or awkward layouts. Read carefully if you notice these signs.
- **Pay Attention to Images.** Fake news often includes manipulated images or videos. Sometimes, a photo may be authentic but taken out of context. You can search for the image or photo to see where it originated.
- **Check Dates.** Fake news may contain timelines that don't make sense or changed dates of events.
- **Verify Evidence**. Check the author's sources to confirm their accuracy. A lack of evidence or reliance on anonymous experts may indicate fake news.
- **Review Other Reports.** If no other news source is reporting the same story, it may indicate that it is fake. If the story is reported by multiple trusted sources, it is more likely to be true.
- **Determine if the Information Was Intended as a Joke.** Sometimes, fake news can be difficult to distinguish from humor or satire.
- **Think Critically.** Some stories are deliberately false. Only share news that you know is reliable.

MODULE IV
PROJECT WORKSHOPS – CREATING SOLUTION

Module 4 provides an introduction to what local sustainability initiatives are, their benefits, the challenges they face, and the key strategies for these initiatives. It also covers what a project is and the stages involved in planning and implementing it.

Learning Outcomes

Participants will understand what local sustainability initiatives are, as well as learn about the stages and tools needed for planning and implementing a climate protection project within their local community

Validation Criteria

Participants should be able to describe local sustainability initiatives and be capable of planning and implementing a climate protection project within a local community

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Questions the facilitator might ask the participants:

- What do you think a project is? What characterizes it?
- What is project management?
- What potential benefits do you see in planning and carrying out a project?

Content the Facilitator Can Share During the Module:

Organizing Local Sustainability Initiatives
Community-led sustainability initiatives are essential for several reasons. First, they promote local ownership and responsibility, encouraging individuals and groups to take proactive steps toward sustainability. Second, they can be tailored to the specific needs and contexts of a community, ensuring that interventions are relevant and effective. Third, community-driven initiatives often utilize local knowledge and resources, making them more resilient and adaptive. Finally, these initiatives can serve as models for broader policy and practice, demonstrating innovative approaches to sustainable development that can be scaled and replicated.

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Definition and Key Characteristics

Community-driven sustainability initiatives are grassroots efforts by local communities to implement practices and promote sustainable development. These initiatives can take various forms, including renewable energy projects, energy efficiency programs, sustainable transport schemes, waste reduction efforts, and educational and community engagement activities.

Key characteristics of community-led initiatives include:

- **Local Ownership**: Initiatives are led and managed by community members, which enhances a sense of ownership and responsibility.
- **Inclusivity**: Efforts aim to engage a diverse range of stakeholders, ensuring that all community members have a voice and can contribute.
- **Flexibility**: Initiatives are tailored to the specific needs, contexts, and resources of the community, allowing for adaptive and responsive approaches.
- **Collaboration**: Partnerships with governments, businesses, non-profits, and other organizations increase the initiatives' effectiveness and reach.
- **Innovation**: Communities often employ creative and innovative solutions to meet local challenges and opportunities

Community Engagement Benefits

Involving the community in sustainability initiatives offers numerous benefits, including:

- **Empowerment:** Involving community members in decision-making and actions gives them a sense of control over their environmental impact and reinforces a sense of agency.
- **Local Relevance:** Initiatives are tailored to address specific community needs and circumstances, making them more effective and meaningful.
- **Resource Efficiency:** Using local knowledge, skills, and resources enhances the efficiency and sustainability of initiatives.
- **Behavioral Change:** Community-led actions can drive behavioral change by raising awareness, providing education, and creating social norms around sustainability.
- **Social Cohesion:** Working together towards shared goals strengthens social bonds and fosters a sense of community.

Challenges and Limitations

Despite their potential, community-led sustainability and environmental initiatives face several challenges and limitations, including:

- **Resource Constraints:** Limited funding, technical expertise, and human resources can hinder the scale and impact of initiatives.
- **Resistance to Change:** Overcoming resistance and apathy among community members can be difficult, especially when initiatives require significant lifestyle changes.
- **Political and Regulatory Barriers:** Navigating complex political and regulatory environments can be an obstacle for implementing and scaling initiatives.
- **Inclusion and Equity:** Ensuring that initiatives are inclusive and equitable, and that all community members can participate and benefit, is essential but can be challenging to achieve.

Key strategies for successful community-led environmental initiatives

Building Awareness and Community Engagement

Raising awareness and engaging the community are key to the success of carbon reduction initiatives. Strategies include:

- **Education and Outreach:** Conduct workshops, seminars, and information sessions to educate community members about climate change and the benefits of reducing carbon emissions.
- **Media and Communication:** Use local media, social media, and newsletters to spread information and keep the community informed.
- **Incentives and Rewards:** Offer incentives, such as discounts or recognition programs, to encourage participation and reward contributions.

Utilizing Local Knowledge and Resources

Leveraging local knowledge and resources enhances the relevance and sustainability of initiatives. Strategies include:

- **Participatory Planning:** Involve community members in the planning and decision-making process to ensure initiatives meet local needs and priorities.
- **Local Expertise:** Utilize the skills and expertise of local residents, businesses, and organizations to implement projects.
- **Resource Mapping:** Identify and utilize local resources, such as renewable energy potential, local materials, and existing infrastructure.

Collaborating with Governments and Organizations

Partnerships with governments, businesses, non-profits, and other organizations can amplify the impact and reach of community-led initiatives. Strategies include:

- **Policy Advocacy:** Work with local authorities to develop supportive policies, regulations, and incentives for carbon reduction.
- **Public-Private Partnerships:** Collaborate with businesses to leverage resources, expertise, and networks for sustainability projects.
- **NGO Support:** Partner with non-profit and community organizations to access funding, technical assistance, and capacity-building support.

Leveraging Technology and Innovation

Using technology and innovation can enhance the efficiency and effectiveness of carbon reduction efforts. Strategies include:

- **Renewable Energy Technologies:** Implement solar, wind, and other renewable energy technologies to reduce reliance on fossil fuels.
- **Smart Systems:** Deploy smart grids, energy management systems, and IoT solutions to optimize energy use and reduce emissions.
- **Digital Platforms:** Use digital platforms and tools for monitoring, reporting, and engaging the community in sustainability initiatives.

Ensuring Sustainable Financing and Resources
Securing sustainable financing and resources is crucial for the long-term success of initiatives. Strategies include:

- **Diverse Funding Sources:** Access various funding sources, such as grants, donations, crowdfunding, and income-generating activities.
- **Financial Planning:** Develop robust financial plans and budgets to ensure efficient resource use and long-term financial stability.
- **Resource Efficiency**: Implementing cost-effective measures and practices to maximize the impact of available resources

Community engagement is essential for achieving meaningful environmental protection outcomes. Community-led initiatives reinforce local ownership and responsibility, leverage local knowledge and resources, and drive behavior change and social cohesion.

The future of community-led sustainability initiatives is promising, with emerging trends and innovations offering new opportunities for impact. By utilizing digital tools, building strong partnerships, and ensuring inclusivity and equity, communities can play a key role in addressing the global challenge of climate change and creating a sustainable future for all.

Planning and Implementing a Climate Protection Project in the Local Community

Elements of Project Definition:

- **Unique –** A project is not a routine activity; each one has its specific conditions, goals, and challenges. In other words, no two projects are identical, which makes their implementation more challenging and demanding.
- **Time-bound –** Projects have a defined beginning and end. This means they continue until the set goals are achieved or the project is abandoned for various reasons. The duration of a project can be short, as in the case of organizing a birthday party, or relatively long, such as the launch of a new product by a corporation.
- **Undertaking –** This is a deliberate, organized effort that involves coordinated actions and the use of various resources.
- **Serving a specific goal –** A project is aimed at achieving a specific result or creating new value. Implementing a project means focusing on this specific goal and taking actions to achieve it. As mentioned before, this can be a business, personal, social, or other type of goal.

After explaining the basic concepts, the instructor clarifies what project management entails.
Following that, they explain the concept of a project plan, its components, and emphasize its importance and the benefits that come from it in terms of implementing the project.

Benefits of Implementing an Action Plan:

- **Greater transparency –** An action plan provides a clear and concise overview of the project, including its objectives, assumptions, tasks, and schedule. This enables everyone involved in the project to easily understand what needs to be done and when. This increased visibility and transparency can help improve communication and collaboration and can also aid in early identification and mitigation of risks.

- **Increased efficiency and productivity –** An action plan can help improve efficiency and productivity by breaking the project down into smaller, more manageable tasks. This facilitates tracking progress and identifying areas where improvements can be made. Additionally, an action plan can help ensure effective resource allocation and timely task completion.

- **Reduced risk of project failure –** By clearly defining the project's goals and assumptions, an action plan can help reduce the risk of project failure. This is because it makes it easier to identify and mitigate risks early on. Furthermore, an action plan can help ensure that the project is completed on time and within budget.

- **Improved decision-making –** An action plan can help streamline the decision-making process by providing a framework for evaluating options and making informed choices. This is because the action plan clearly outlines the project's goals and assumptions, as well as the related tasks and schedule. It facilitates evaluating the impact of different decisions on the project and selecting the option that is most likely to yield the desired results.

- **Increased team morale and motivation –** An action plan can help boost team morale and motivation by providing a sense of purpose and direction. This is because the action plan clearly defines the project's goals and assumptions, as well as the associated tasks and schedule. It can help keep team members focused and motivated and can also foster a sense of shared responsibility for the project.

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The presenter explains what the SMART goal-setting methodology is. He discusses its individual components and then explains how to establish specific, measurable, achievable, relevant, and time-bound goals using the SMART criteria.

At this point, it is essential to discuss each component of the SMART methodology, using the following examples:

1. Specific
Example: "I will disseminate the budget report."

2. Measurable
Using the "Measurable" SMART criteria: "I will disseminate a budget report that shows our department's current expenses."

3. Achievable
Using the "Achievable" SMART criteria: "I will disseminate a budget report that shows our department's current expenses compared to our allocated annual budget and highlight areas where we are exceeding expenses."

4. Relevant
Using the "Relevant" SMART criteria: "I will disseminate a budget report that shows our department's current expenses compared to our allocated annual budget and highlight areas where we are exceeding expenses. Based on our current expenses, I will provide suggestions on how to cut costs to stay within budget."

5. Time-bound
Using the "Time-bound" SMART criteria: "Each month this year, I will disseminate a budget report that shows our department's current expenses compared to the allocated annual budget and highlight areas where we are exceeding expenses. Based on our current expenses, I will provide suggestions on how to cut costs to stay within budget."

After discussing the SMART criteria, the presenter introduces the topic of prioritizing individual goals.

He explains to the participants that to prioritize SMART goals, four criteria should be considered:

- **Urgency –** This refers to how quickly a task needs to be completed, based on deadlines, dependencies, or risks.
- **Significance –** Importance refers to the degree of alignment of the task with the formulated initiative goal.
- **Effort –** Effort relates to the amount of time, resources, and energy required to achieve the task.
- **Impact –** Impact refers to the value that the task creates for your organization, clients, or stakeholders.

The presenter then discusses the most common tool that can help in prioritizing SMART goals, known as the Eisenhower Matrix, which divides tasks into four quadrants based on the two criteria mentioned above: urgency and significance

First Quadrant: Important and Urgent (tasks that need to be completed immediately) – Tasks placed in this quadrant should be completed as soon as possible. These are usually last-minute requests arising from unforeseen circumstances. Essentially, these tasks should be completed immediately or by the end of the day. Examples include replacing a sick coworker or dealing with an unexpected emergency, such as a disruption in the supply chain.

Second Quadrant: Important but Not Urgent (tasks to be scheduled for later) – This quadrant contains long-term goals and tasks that are important but do not have a specific deadline, allowing them to be completed later. This category includes obtaining professional qualifications or planning long-term business goals, such as budget reduction.

Third Quadrant: Urgent but Not Important (tasks that can be delegated to others) – These tasks should be completed immediately, but they are not significant enough to require your attention, meaning they can be assigned to other team members. This category includes routine tasks or lengthy meetings and phone calls conducted without a clear purpose.

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Fourth Quadrant: Not Important and Not Urgent (tasks that should be ignored) – These tasks are merely distractions and should be avoided. In many cases, you can simply ignore or cancel them. This refers to situations such as social meetings or overly long coffee breaks.

In the next stage, the presenter describes what a project schedule is and its purpose. He also discusses the tools used to create it and explains the role and importance of milestones in project scheduling.

When discussing the project schedule, it is essential to introduce and explain the functioning of the basic and most commonly used tool for creating schedules, which is the Gantt chart.

MODULE I

Exercise 1: Understanding Global Warming

This exercise allows participants to understand what global warming is and the factors that influence it.

Learning outcomes supported by the exercise

Participants are able to independently define the concept of global warming, considering its key aspects.

Participants understand the causes of global warming, such as greenhouse gas emissions, and can explain them.

Validation Criteria

- Definitions created by participants include key elements of global warming, such as the increase in Earth's temperature, causes (e.g., greenhouse gas emissions), and possible effects.
- Definitions are understandable, coherent, and reflect current knowledge about global warming.
- After completing the exercise, participants can indicate how their understanding of global warming has changed during the exercise.
- Participants can identify the differences between their initial definitions and the definition developed in pairs, and understand what influenced these changes.
- This exercise is an integral part of Module 1, supporting its educational goals by applying the acquired knowledge in real-world professional contexts

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Exercise 2

This exercise allows for the analysis and conclusion of the causes of global warming by identifying arguments for and against the impact of human activity on global warming and developing an individual stance on the subject.

Learning Outcomes

Participants can critically analyze a variety of arguments regarding the causes of global warming, including those that support human impact and those that question it.

Participants understand the complexity of the debate on global warming and can identify common points between both sides of the dispute.

Participants can present their stance on global warming, justifying it with credible information and conclusions drawn from the discussion.

Validation Criteria

- The table created by each pair contains well-formulated arguments for and against the impact of human activity on global warming.
- The table identifies facts that both sides agree on, demonstrating that participants understood the different perspectives.

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Exercise 3

This exercise aims to develop the skills of analyzing and synthesizing information regarding the impact of carbon dioxide on global warming through the analysis of data from graphs.

Learning Outcomes

Participants can interpret data from graphs related to percentage changes in carbon dioxide levels in the atmosphere and average global temperatures.

Participants are able to compare data from different historical periods and identify trends.

Participants understand how the increase in carbon dioxide in the atmosphere can influence the rise in global temperatures.

Participants can identify a potential relationship between the increase in CO_2 concentration and the rise in temperature based on the data.

Validation Criteria

- Participants can accurately specify the difference in average temperatures and the percentage increase in CO_2 in the atmosphere during the discussed periods
- Participants correctly identify and describe the relationship between the increase in carbon dioxide and the rise in average global temperature, indicating a possible causal relationship
- Participants can combine data from both graphs and formulate a coherent conclusion.

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MODULE III: Critical and Creative Thinking

Exercise 4: Climate Disinformation

This exercise is an ideal complement to Module 3, as it teaches participants how to distinguish credible information from climate disinformation by analyzing real articles on climate change.

Learning outcomes supported by the exercise

Participants can differentiate between information based on scientific evidence and information that may be manipulative or false.

Participants learn to assess the credibility of sources and authorities cited in articles.

Participants can identify rhetorical techniques used to persuade the audience toward a particular narrative.

Validation Criteria

- Participants correctly indicate which article is based on scientifically confirmed information and which may contain elements of disinformation
- Participants accurately identify rhetorical techniques and potentially misleading elements in the article considered less credible
- Participants make an accurate assessment of the credibility of the information sources and scientific authorities cited in the articles
- Participants consider the context of publication in their analysis, such as the editorial outlet in which the article appeared and any potential conflicts of interest of the author

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Exercise 5: The Impact of Critical Thinking on the Development of Green Technologies

This exercise integrates creativity with climate protection, highlighting how it can be useful and necessary in the field of environmental protection, which directly supports the educational objectives of Module 3.

Learning outcomes supported by the exercise

Participants will learn to think outside the box by creating visually appealing and functional clothing designs from waste materials.

They will understand the significance of reusing waste in fashion and its impact on environmental protection.

Validation Criteria

- Participants present original and creative ideas for using materials designated for disposal
- Participants' projects incorporate key elements such as form, color, durability, practicality, and visual appeal
- Participants demonstrate an understanding of the role of creativity in environmental protection

MODULE IV

Exercises 6-10

Exercises 6 to 10 are planned to teach the gradual development of a project plan aimed at solving an environmental problem in the local community. Working in groups, participants will identify local environmental issues, define project goals, assess resources and threats, select key actions, and plan the project implementation schedule.

Learning Outcomes

Participants will learn to recognize and analyze environmental issues in their community.

Participants will acquire the skill to create a project structure, including defining goals, actions, and a schedule.

Participants will learn to evaluate available resources and identify potential threats and ways to mitigate them.

Participants will learn to generate realistic and effective solutions for local environmental problems.

Validation Criteria

- **Accuracy of Problem Identification**: Assessment of how accurately participants identified and described the local environmental problem and its causes and effects (Exercise 6).
- **Clarity and Precision of Project Goals**: Assessment of whether the project goals are clearly defined, realistic, and consistent with the identified problem (Exercise 7).

- **Selection and Assessment of Actions**: Assessment of the relevance and feasibility of the selected actions and their potential to achieve the project goal (Exercise 8)
- **Complexity of Analysis**: Assessment of the completeness of the information and the quality of sources and support identified by the participants (Exercise 9)
- **Realism of the Schedule**: Assessment of how realistic and well-organized the action schedule, allocation of responsibilities, and resources are (Exercise 10)

SUMMARY

Scientific discoveries not only help us understand the scale of the problem but also indicate specific solutions that can be implemented at both the global and individual levels. Each of us, using scientific knowledge, can contribute to building a more sustainable future.

The training "Climate in Our Hands: How Science Influences Environmental Protection Actions" focused on the role of science in the fight against climate change and environmental protection.

During the training, we discussed how scientific research provides key insights into the causes and effects of climate change. Thanks to this research, it is possible to develop effective environmental strategies and policies based on solid, verified evidence. The training highlighted how technological innovations, inspired by scientific discoveries, support sustainable development through the advancement of renewable energy, sustainable agriculture, and efficient resource management methods.

In summary, the training demonstrated that science is fundamental in the fight against the climate crisis. Basing actions on reliable scientific research allows for effective and responsible decisions in favor of environmental protection and inspires the introduction of innovations that can help build a sustainable future for us all.

Every participant who successfully completes the training will receive a Certificate of Completion. This certificate will serve as formal confirmation of the skills and knowledge acquired, which are essential for effective action in the field of environmental protection.

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CERTIFICATE

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Participant's Name

has completed the training titled

"Development of Green Competencies and Critical Thinking."

The training took place on: ....

Date of training: ....

- An overview of the causes of climate change and their impact on the environment.
- Analysis and evaluation of climate protection methods based on scientific evidence.
- Development of individual projects or initiatives aimed at environmental protection and the promotion of sustainable development.
- Collaboration in groups to solve environmental problems.
- Utilization of critical thinking skills to assess the credibility of climate information sources.

The aim of the training was to equip participants with practical tools and knowledge necessary for effective action towards sustainable development and environmental protection.

This certificate was issued by:

Organizer's Name
Position
Organization/Company

....

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