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‘THE VALUE OF THE SUSTAINABLE CONSTRUCTION IN THE EUROPEAN GREEN DEAL AND THE CIRCULAR ECONOMY’

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1- INTRODUCTION:

I keep pleasant memories from the childhood that I spent during summer holidays at my grandparents' house, near Cáceres, Spain.

July and August were hot and dry months when temperatures could reach easily 40°C at midday and sometimes around 25°C at night. However, my grandparents' small house, which was built around 1930s, kept a steady temperature around 20°C all day and did not require any mechanical system of cooling (or heating in winters).

My parents lived in the same village, but in a flat which was built in the 1980s. The atmosphere inside was uncomfortable due to the high temperature. Later they had to install an air conditioning system to make it cooler, but not all rooms got to reduce their high temperature.

It was difficult for me to understand the difference in comfort between my grandparents and my parents' houses. The latter was built recently, with supposedly modern construction techniques instead of the traditional thick walls. Moreover, my parents' house needed the assistance of installations such as air conditioning systems during the hot months, which consumed more energy, and a boiler for winters to heat the rooms, which produced more greenhouse gas (GHG) emissions.

If my parents' flat was built 50 years later, why did it consume more energy and produce more GHG emissions to make it comfortable? For me it was not a lack of progress, but directly a backward movement.

This feeling that I still keep is not just a personal experience or consideration. Data and scientific research support this thought. Currently, the construction sector and buildings' lifecycle are responsible for around 40% of all energy

consumed and all GHG emissions and 33% of all water consumed and all waste generated.¹

I studied architecture, among other reasons, to revert this trend in the construction sector and the buildings' lifecycle.

However, as long as I was studying, I noticed that a particular person, family or community could develop a sustainable project which would even be a near zero energy building (NZEB) (i.e. a building with high energy performance that requires a low amount of energy and, at the same time, this energy comes from renewable sources produced on-site or nearby), but the global negative trends will keep the same.

Therefore, the challenge that I consider most difficult is to establish a common regulated framework where sustainable construction standards are applied not only at local or regional levels, but worldwide. It has no sense to foster sustainability in certain projects if the rest continue to apply the current linear model of “*take-make-dispose*”. In the same way, it is welcome, but not enough, that a group of countries lead the change to a circular economy when other states and whole continents continue to overproduce GHG emissions.

The European Union, greatly through its European Green Deal, is promoting a new economy based on a circular model which main goal is to become climate-neutral by 2050. Nevertheless, regarding the current trends of energy consumption and GHG emissions of the construction sector and buildings' lifecycle, the EU will not achieve its goal without integrating these sectors as a cornerstone of its ambitious plan.

¹ European Commission. Circular economy. Level(s). European framework for sustainable buildings. DG Environment of the European Commission. 2021. [Online] Available from: https://ec.europa.eu/environment/topics/circular-economy/levels_en

Based on the previous information, the hypothesis of the Master's Thesis deals with determine the value or contribution of the sustainable construction to the European Green Deal and the circular economy.

The goal of the Master's Thesis is to demonstrate that the hypothesis is correct. A research process, as objective as possible, will be developed. The conclusions of that research should be identical to the ones that any other researcher would reach if he or she considered the same hypothesis and followed the same methodology.

The methodology will be based on analysing each of the following three main topics (among others issues that will help to contextualise the whole work) and establishing relations between them: climate change data; responses to the climate change through sustainability policies (the EU environmental policy, the VIII Environment Action Programme, the European Green Deal and the circular economy) and the sustainable construction.

The relations between points 1 and 2 will be based on proposals and solutions to fight climate change and move to an economic model based on sustainability and circularity.

The relationship between points 2 and 3 focuses on establishing the contribution that the sustainable construction may play in those environmental and sustainable policies.

In order to demonstrate that the hypothesis is correct, it will be stated in which areas the construction plays an essential role for the goals of the European Green Deal and the circular economy and how much it can contribute to achieve them.

The main sources will come from the Kyoto Protocol, the Paris Agreement, United Nations 2030 Agenda for sustainable development, the EU environmental policy, its Environment Action Programmes (EAP), the policies that arise from the European Green Deal and the circular economy models of the European Union, especially the European Commission.

Those policies constitute the avant-garde in terms of sustainability.

Regarding construction, a wider variety of sources will be required as the knowledge is not concentrated in few organisations. The lack of international regulations in this sector make it difficult to select reliable data so specific policies developed at local and regional level will be used, as at those levels there are indeed examples of good practices in terms of sustainable constructions and near zero energy buildings.

2- CONTEXT.

2.1- Climate change. State of play.

The Copernicus Climate Change Service (C3S) is one of the six information services provided by the Copernicus Earth Observation Programme of the EU.²

It provides society authoritative information about climate change in Europe and the rest of the world. It offers free and open access to climate data and tools based on the best available science. Copernicus relies on climate research developed within the World Climate Research Programme (WCRP)³ and the information it provides is based on requirements defined by the Global Climate Observing System (GCOS).⁴

On 8th January 2021, the C3S published that the year 2020 has been the warmest in Europe since there are records (1850) and the second warmest globally, after 2016.⁵ Concretely, the year 2020 has been 0.4°C warmer than 2019, the previous warmest year in Europe. The C3S's has also reported the next globally data:

- CO2 concentrations in the atmosphere have continued to rise at a rate of approximately 2'3 parts per million (ppm)/year in 2020, reaching a maximum of 413 ppm during May 2020.
- The last six years have been the warmest six in record.

² The Copernicus Climate Change Service (C3S) (2021). European Centre for Medium-Range Weather Forecasts (ECMWF). European Commission. [Online] Available from: <https://climate.copernicus.eu/about-us>

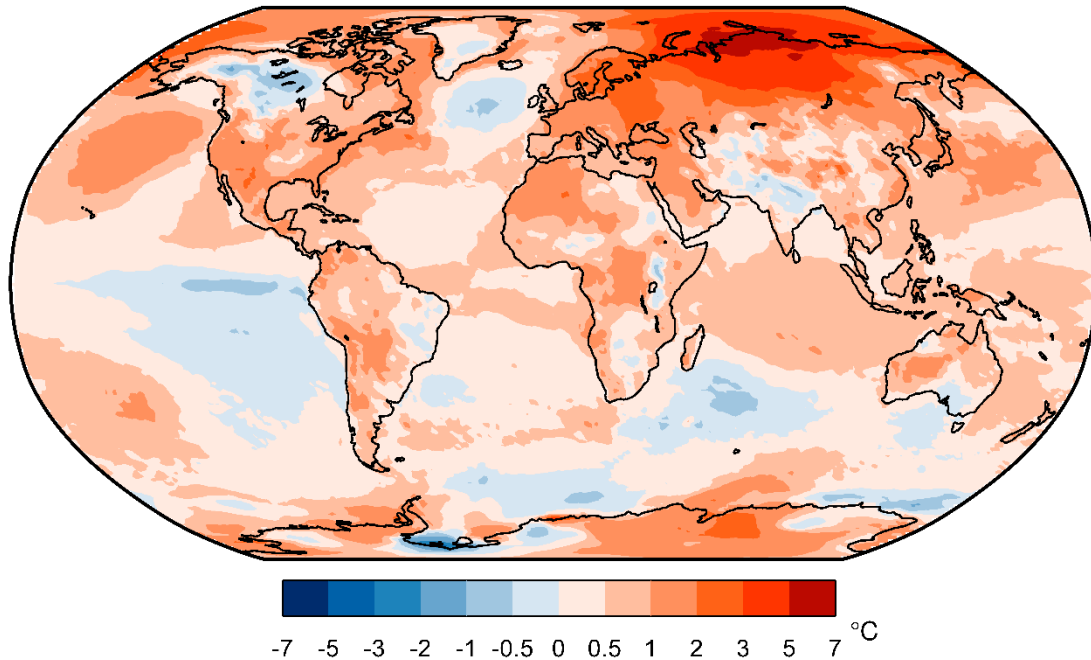
³ The World Climate Research Programme (WCRP) (2021). [Online] Available from: <https://www.wcrp-climate.org/about-wcrp/wcrp-overview>

⁴ The Global Climate Observing System (GCOS) (2021). [Online] Available from: <https://gcos.wmo.int/en/about>

⁵ The Copernicus Climate Change Service (C3S) (2021). Press releases: '2020 warmest year on record for Europe; globally, 2020 ties with 2016 for warmest year recorded'. 8th January 2021. European Centre for Medium-Range Weather Forecasts (ECMWF). European Commission. [Online] Available from: <https://climate.copernicus.eu/2020-warmest-year-record-europe-globally-2020-ties-2016-warmest-year-recorded>

- 2020 was 0.6°C warmer than the standard 1981-2010 reference period and around 1.25°C above the 1850-1900 pre-industrial period. ^{Figure 1}

Figure 1 - Temperature difference 2020 and 1981-2010 average.



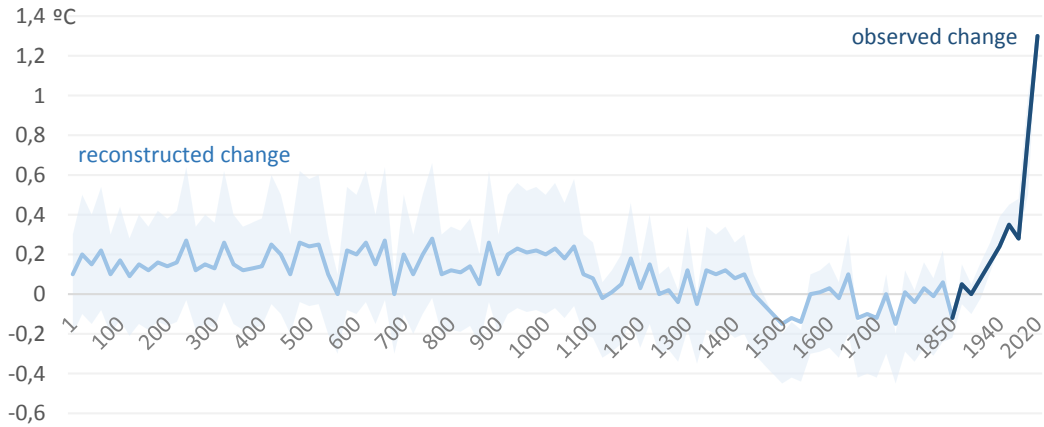
Source figure 1 - NASA Science. (2021). Carbon Dioxide. Global Climate Change Home. (2021). [Online] Available from: <https://climate.nasa.gov/vital-signs/carbon-dioxide/>

And in Europe:

- 2020 has been 1.6°C warmer than the 1981-2010 reference period.
- The Arctic and northern Siberia concentrated the largest annual temperature deviation from the 1981-2010 average, reaching to over 6°C above average.

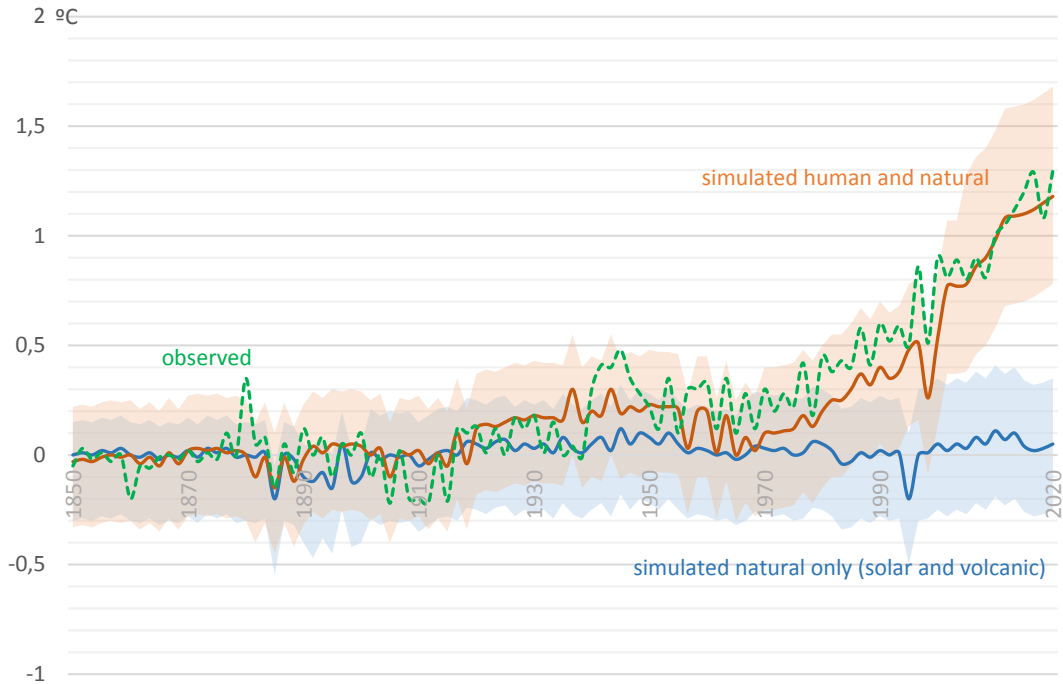
Critics could argue how much of this temperature rise is due to human activities, i.e. the release of GHG emissions that come from productive activities, and how much depend on natural processes. Although it is difficult to determine the exact contribution of human artificial activities to the global warming, scientists have agreed that human influence has warmed the climate at an unprecedented rate not only since the pre-industrial levels, but also in the last 2000 years. The two following graphics, published by the Intergovernmental Panel on Climate Change (IPCC) on 7th August 2021, support the previous statements:

Figure 2 - Change in global surface temperature (reconstructed: 1-2000 and observed: 1850-2020)



Source figure 2 - IPCC, 2021: Summary for Policymakers. In: *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.)]. Cambridge University Press. In Press. [Online] Available from: <https://www.ipcc.ch/report/ar6/wg1/>

Figure 3 - Change in global surface temperature 1850-2020.



Source figure 3 - IPCC, 2021: Summary for Policymakers. In: *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.)]. Cambridge University Press. In Press. [Online] Available from: <https://www.ipcc.ch/report/ar6/wg1/>

Correlation between CO2 and temperature's rise.

In the previous data, there was a reference to carbon dioxide (CO₂) concentrations. CO₂ is a relevant heat-trapping (greenhouse) gas, i.e. it contributes to the Earth's rise of temperature. It is released through artificial human activities such as deforestation or burning fossil fuels and natural processes such as respiration or volcanic eruptions.⁶

Since 1850, human activities have raised atmospheric concentrations of CO₂ by 48%. Scientists warn that this rise is not natural, as it is more than what had happened through natural processes from the Last Glacial Maximum to 1850 (i.e. more than 20,000 years).⁶

As stated before, in May 2020 we have reached a peak of 413 ppm of CO₂ in the planet's atmosphere. Why does this value matter? Because the pre-industrial levels of CO₂ stood at 280 ppm and just in 1958, CO₂ concentration in the atmosphere was 316 ppm.⁶

As there is a correlation between the rise of CO₂ ppm in the air and the increase of temperature in the Earth because of the greenhouse effect, current levels of CO₂ ppm are a serious threat to the Earth's ecosystems and human beings' way of living.

Scientists warn that if we keep the current rate of growth in CO₂, levels could reach 500 ppm around 2057, which may translate into more than 3°C increase. Consequences would be catastrophic: the extreme weather episodes along with the sea level rise would cause mass migrations, destroy natural resources such as the Amazon rainforest or hinder food supplies.⁶

⁶ JONES, Nicola. How the World Passed a Carbon Threshold and Why It Matters. Yale Environment 360. Yale School of the Environment. 26th January 2017. [Online] Available from: <https://e360.yale.edu/features/how-the-world-passed-a-carbon-threshold-400ppm-and-why-it-matters>

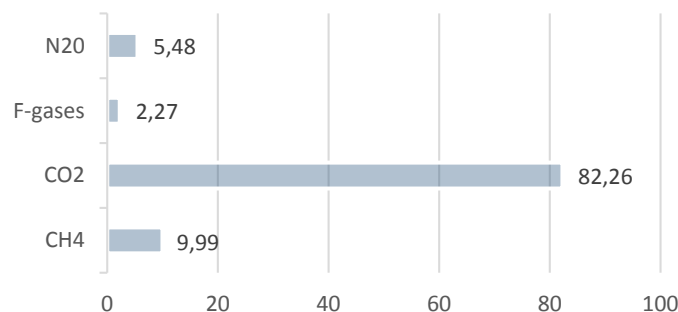
Greenhouse gases are not just CO2.

Although in the last section CO₂ has been classified as a greenhouse gas (those that trap heat in the atmosphere), the Kyoto Protocol⁷ and the United Nations Framework Convention on Climate Change (UNFCCC) refer to six greenhouse gases object to action:

- Carbon dioxide (CO₂).
- Methane (CH₄).
- Nitrous oxide (N₂O).
- Fluorinated gases (F-gases): hydrofluorocarbons and perfluorocarbons.
- Sulphur hexafluoride (SF₆).

Converting the last 5 five of them to CO₂ allows to compare them and know their individual and total contributions to global warming.⁸ The current GHG shares in the EU-27 are the following:

Figure 4- Greenhouse gases share (%) in the EU-27.



Source figure 4 - European Environmental Agency (EEA). (2021). EEA greenhouse gas – data viewer. EEA. 13th April 2021. [Online] Available from: <https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer>

⁷ The Kyoto Protocol was adopted on 11 December 1997 and entered into force on 16 February 2005. Its 192 parties are committed to limit and reduce greenhouse gases (GHG) emissions through ad-hoc targets for each of them. Basically, it transposes into practice the UN Framework Convention on Climate Change (UNFCCC), whose aim is to “prevent human interference with the climate system”. United Nations. (2021). What is the Kyoto Protocol? United Nations. Climate Change. (2021). [Online] Available from: https://unfccc.int/kyoto_protocol

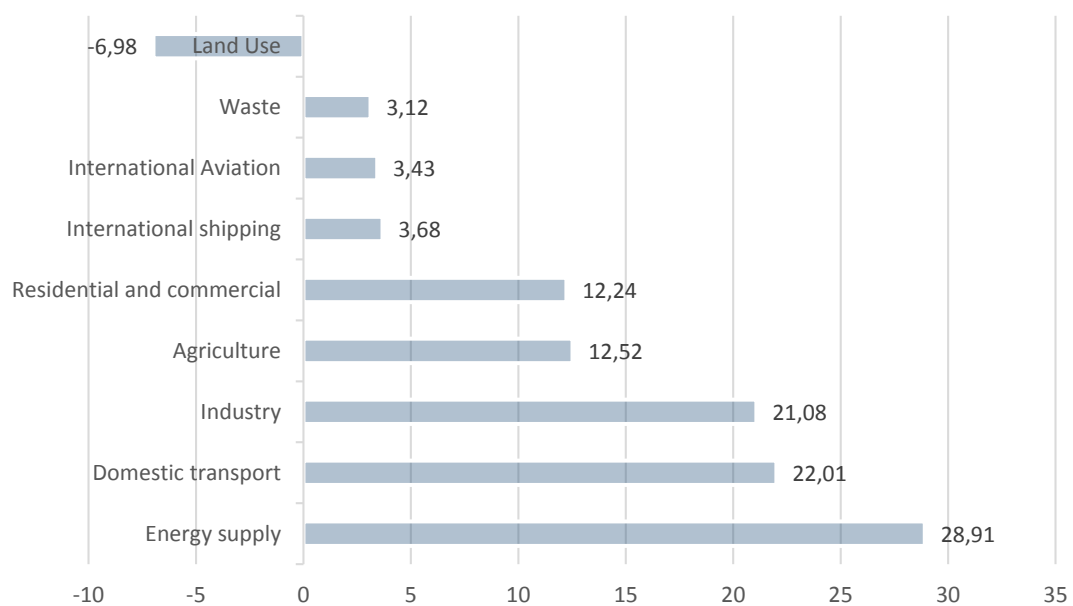
⁸ Eurostat. (2021). Shedding light on energy in the EU. A guided tour of energy statistics. Eurostat. European Commission. 2020 edition. [Online] Available from: <https://ec.europa.eu/eurostat/cache/infographs/energy/glossary.html#greenhouse-gas>

Sources of the greenhouse gas emissions.

Once that we know the greenhouse gases associated with the climate change and the increase of temperature related to them, which sectors are responsible for such damage?

The European Environmental Agency (EEA) has published the sectoral shares of GHG emissions in EU-27 in 2018:

Figure 5 - Sectoral shares of GHG emissions in EU-27 in 2018



Source figure 5 - European Environmental Agency (EEA). (2021). EEA greenhouse gas – data viewer. EEA. 13th April 2021. [Online] Available from: <https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer>.

It should be briefly explained what these sectors refer to, or at least those that need to be specified:

- Land use (and forestry). Land areas absorb CO₂ from the atmosphere, although they may also work as a source of greenhouse gas emissions. That is why the percentage is negative (-6,98%). They work as a “sink” that takes CO₂ out from the air.
- Waste. Emissions from landfills, wastewater treatment and composting among others.

- Residential and commercial. GHG emissions from fossil fuels burned for heat and the treatment of domestic waste.
- Agriculture. Emissions come from livestock such as cows, agricultural soils and rice production among others.
- Industry. Greenhouse gases that come from burning fossil fuels for energy used in industrial activities which require converting materials and chemical reactions necessary to produce goods from raw materials (e.g. cement, glass). Therefore, manufacturing and construction are included in this sector.
- Domestic transport. Emissions that come from burning fuel for vehicles. Nowadays, around 52% of cars in Europe use fuel based on petroleum (primarily gasoline and diesel).⁹
- Energy supply. It includes emissions coming from public electricity, heat production or petroleum refining among others.

Hypothetical scenarios linked to climate change and their consequences.

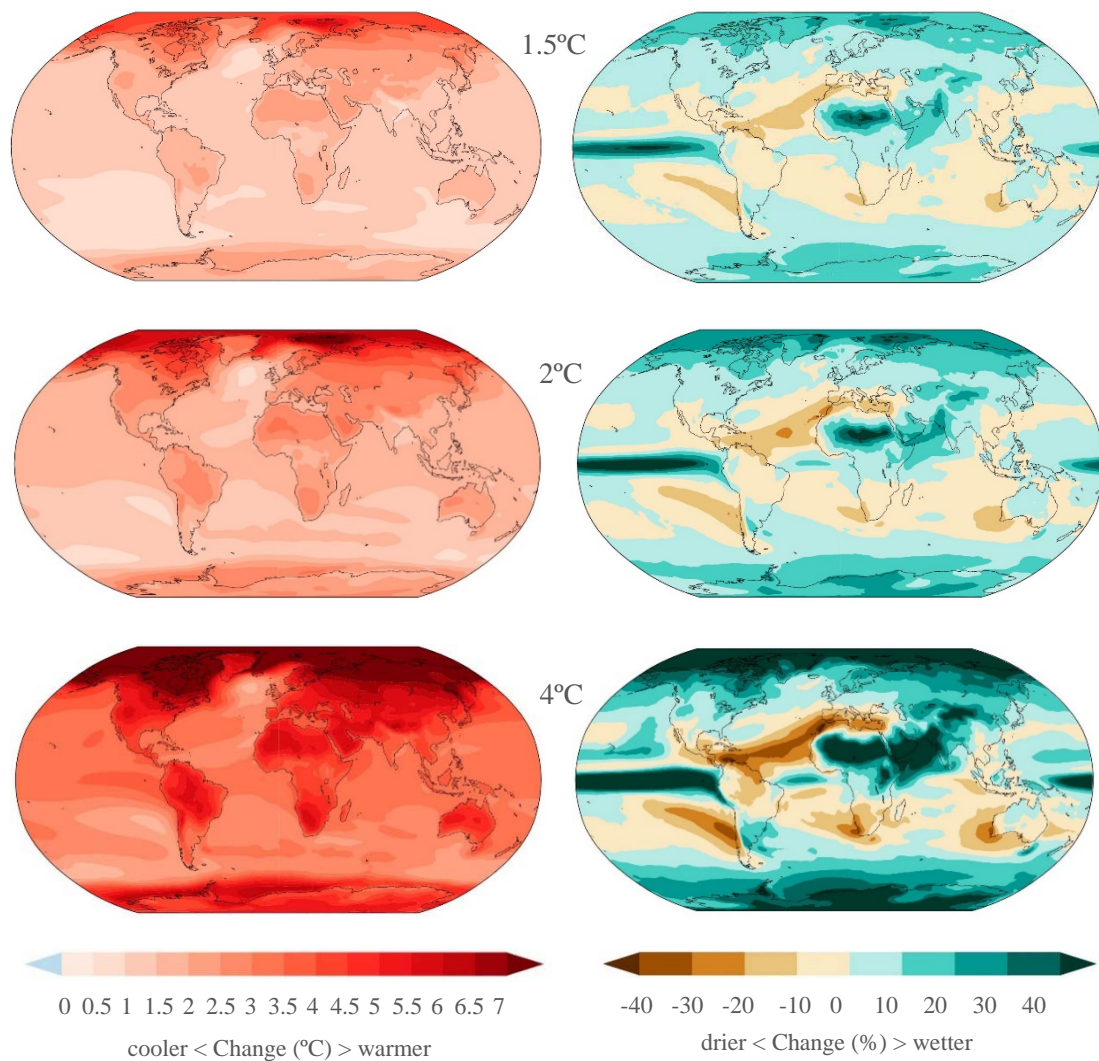
Along the previous information, global warming has been associated with figures of 1°C to 2°C, but every increase of global warming transposes into larger changes in regional mean temperature, precipitation and soil moisture. The climate changes caused in every region of the Earth are already obvious and go from heatwaves and droughts to heavy precipitation and tropical cyclones.¹⁰

⁹ European Parliament. (2021). CO2 emissions from cars: facts and figures. European Parliament. News. Society. 18-04-2019. [Online] Available from: <https://www.europarl.europa.eu/news/en/headlines/society/20190313STO31218/co2-emissions-from-cars-facts-and-figures-infographics>

¹⁰ IPCC, 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.)]. Cambridge University Press. In Press. [Online] Available from: <https://www.ipcc.ch/report/ar6/wg1/>

The following graphics^{Figure 6} represent hypothetical scenarios of climate changes (across the Earth's regions and depending on how many degrees the global warming would increase. The IPCC warns that global temperature will keep increasing until at least 2050, given any of the four imaginary scenarios below. The increase of 1.5°C and 2°C will be reached during this century unless drastic drops of GHG emissions take place in the next decades.

Figure 6 - Simulated changes at different scenarios of global warming.



Source figure 6 - IPCC, 2021: Summary for Policymakers. In: *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.)]. Cambridge University Press. In Press. [Online] Available from: <https://www.ipcc.ch/report/ar6/wg1/>

As it has been stated before, many of these hypothetical changes would be very likely irreversible for centuries and even millennia, especially those that affect the ocean, ice sheets and global sea level.

Sustainable development to fight climate change.

In order to revert these climate change trends and its consequences to the environment, the human beings and the economy, a new approach has emerged in the last decades: the sustainable development.

According to the European Commission, sustainable development “*aims to meet the needs of present generations without jeopardising the ability of future generations to meet their own needs. It involves economic, social and environmental considerations that are interrelated and mutually reinforce each other*”.¹¹

The European Environmental Board (EEB) also defines the concept as the way to “*reconcile human activity with the regeneration boundaries of the Earth. Every economic system is part of a social context and an ecosystem*”. These two latter have limits and human beings have already crossed them, concerning poverty and climate change damages worldwide.¹²

¹¹ European Commission. EU approach to sustainable development. The need for sustainable development. European Commission. 2021. [Online] Available from: https://ec.europa.eu/info/strategy/international-strategies/sustainable-development-goals/eu-approach-sustainable-development_en

¹² European Environmental Board. Sustainable development. EEB. 2021. [Online] Available from: <https://eeb.org/sustainability-and-governance/sustainable-development/>

2.2- The commitment of the international community with the fight against climate change.

Although organisations and associations that promote sustainable development are increasingly arising worldwide, they are mainly based on a local, regional or national framework. Those that seek to cross borders, they lack of the necessary official and administrative structure that they should have in order to be listened by national governments, so their recommendations and potential regulations could be included in international agreements.

However, there are at least two international organisations that have a truly authoritative voice in terms of sustainable development and fight against climate change. I refer to the United Nations and the European Union. This section deals with the UN's actions and in section 3 [*The European Green Deal and the EU's international commitment*] it will be tackled the EU's approach and policies against climate change.

According to the World Meteorological Organization (WMO), the current concern with climate issues may date from the conjunction of the following five relevant scientific, technological and geopolitical events of the 1950s, which finally served as a way to see climatology as a physical science instead of a descriptive one (i.e. the global climate system could be diagnosed and modelling predicted):¹³

- The post-World War II developments in atmospheric science which made possible to better understand the mechanisms of the large-scale circulation of the atmosphere.
- The beginning of new geophysical observations (e.g. the Mauna Loa measurements of atmospheric CO₂) throughout the 1957 International Geophysical Year.

¹³ W.ZILLMAN, John. A history of climate activities. World Meteorological Organization. 2009. [Online] Available from: <https://public.wmo.int/en/bulletin/history-climate-activities>

- The awareness of the potential meteorological observing capabilities of Earth-orbiting satellites.
- The emergence of digital computers.
- The predisposition of countries to cooperate in global issues within the framework of the United Nations System.

These developments were recalled by an UN General Assembly Resolution in 1961 and urged the WMO and the International Council for Science (ICSU) to cooperate in creating scientific and technological tools for “*monitoring, predicting and finally controlling*” weather and climate. This made possible the setting up of both the World Weather Watch (WWW) by the WMO, which focused on “*providing global infrastructure for supporting operational weather forecasting and for describing and monitoring climate*”, and the Global Atmospheric Research Programme (GARP), created jointly by the WMO and the ICSU, in order to “*improve weather forecasting and scientific basis for climate prediction*”.¹³

Also at that time, concretely in 1972, it was probably made the first international reference to sustainable development at the UN Conference on the Human Environment held in Stockholm. Although the term “sustainable development” was not directly mentioned, it was stated the idea that development and the environment could be addressed jointly (back then they were conflicting issues).¹⁴

That international scenario and the strengthening of the climate concern, made the UN General Assembly to ask the WMO to develop a study of climate change in 1974. The final report reinforced the scientific considerations about greenhouse warming and served as a basis to organise the first World Climate Conference (FWCC or WCC-1) in 1979 (it was arranged by the WMO in cooperation with the UN Educational, Scientific and Cultural Organisation

¹⁴ Sustainable Development Commission (SDC). History of Sustainable Development. 2021. [Online] Available from: http://www.sd-commission.org.uk/pages/history_sd.html

(UNESCO), the Food and Agriculture Organisation of the UN (FAO), the World Health Organisation (WHO), the UN Environment Programme (UNEP), the International Science Council (ICSU) and other scientific parties such as experts on climate. The three main conclusions of this FWCC were that countries worldwide should:¹⁴

- Use the potential of climate knowledge.
- Improve that knowledge.
- Avoid the changes that human-beings' activities may cause in climate and could damage the environment and the well-being of humanity.

Already in the 1980s, concretely in 1985, the WMO, ICSU and UNEP agreed to hold an international assessment of the increasing relevance of CO₂ and other GHG in climate change. It was known as “the Villach Conference” and its statement called on UNEP, WMO and ICSU to:¹³

- Guarantee periodic assessments of the state of play.
- Organise, if necessary, a global convention.

In 1987, the World Commission on Environment and Development went further and published the report “Our Common Future”, also known as “Brundtland Report” (after the Commission’s chairwoman, Gro Harlem Brundtland). It became a milestone as it defined the guiding principles for sustainable development as we understand it nowadays (“*that one that meets the needs of the present without compromising the ability of future generations to meet their own needs*”).¹⁵

Generally speaking, the Brundtland Report gathered the environmental concerns¹⁶ that were being raised during the previous decades and put them in

¹⁵ World Commission on Environment and Development (WCED). Development and international economic co-operation: environment. United Nations General Assembly. 4th August 1987. [Online] Available from: <https://sustainabledevelopment.un.org/milestones/wced>

¹⁶ Rachel Carson (Silent Spring, 1962), Garret Hardin (Tragedy of the Commons, 1968), Ecologist magazine (Blueprint for Survival, 1972) and the Club of Rome (Limits to Growth report, 1972).

the agenda of an authoritative and respectable international voice such as the United Nations. All those concerns agreed that humans' modern and industrial way of living was damaging the environment to such extent that pace of growth and development would result unsustainable if they kept unchanged.¹⁴

Also in 1987, the Montreal Protocol became the only UN treaty ever that has been ratified by all 198 UN countries. It dealt with substances that deplete the ozone layer and “*regulates the production and consumption of almost 100 man-made chemicals*”. These chemicals, known as ozone depleting substances (ODS), may damage the stratospheric ozone layer when they are released to the atmosphere. That layer acts as a shield that protect not only human beings, but also the environment, from dangerous levels of ultraviolet radiation from the sun. Montreal focused on reducing the production and consumption of the ODS in a way that establishes equal – but differentiated – responsibilities for developed and developing countries. However, in any case, both group of countries are committed to binding goals with specific deadlines.¹⁷

Although the Montreal Protocol was not directly intended to fight climate change, it turned to be a great success as all countries worldwide finally ratified the treaty. Therefore, they compromised to stop producing dangerous substances for the ozone layer and the results were excellent: the protocol has succeeded in eliminating almost 99% of these ODS. Moreover, in 2016, the parties have agreed, through the Kigali Amendment, to reduce their production of another GHG: the hydrofluorocarbons (HFCs).¹⁸

As the UN began to get involved in climate issues, it required the assistance of an official body which would provide it with “*regular assessments of the scientific basis of climate change, its impacts and future risks and options for adaptation and mitigation*”. Therefore, this international body, the

¹⁷ United Nations. The Montreal Protocol. United Nations Environment Programme. [Online] Available from: <https://www.unep.org/ozonaction/who-we-are/about-montreal-protocol>

¹⁸ MAIZLAND, Lindsay. Global Climate Agreements: Successes and Failures. Council on Foreign Relations. 29th April 2021. [Online] Available from: <https://www.cfr.org/backgrounder/paris-global-climate-change-agreements>

Intergovernmental Panel on Climate Change (IPCC), was created jointly by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) in 1988. It is important to remark that the IPCC does not order policymakers what actions they should take, but their task is limited to “*provide a scientific basis for governments at all levels to develop climate related policies*”, although it is true that the IPCC assessments underline negotiations at the UN Climate Conference, the UNFCCC. Currently, the IPCC has 195 members and participation in its scientific and intergovernmental structure is open to all member countries of the WMO and the UN. Hundreds of leading scientists, which are known as Coordinating Lead Authors and Lead Authors of the reports, are tasked with writing the IPCC assessments. These leading scientists are supported by other experts in specific areas, the Contributing Authors. Moreover, the authors could get the assistance of Chapter Scientists, who “cross-check between findings of the report” and do additional fact-checking. Consequently, the IPCC does not produce its own scientific research, but they work by assessing published literature.¹⁹

The IPCC released its first assessment report in 1990 and stated that “*emissions resulting from human activities are substantially increasing the atmospheric concentrations of GHG*”, so the IPCC recommended, as well as the Second World Climate Conference, a global treaty on the issue. Therefore, the UN General Assembly established the Intergovernmental Negotiating Committee (INC) in 1990 for a Framework Convention on Climate Change, which was finally adopted in 1992 at New York.

The same year, at Rio de Janeiro, more than 100 heads of State attended the UN Conference on Environment and Development (UNCED), also known as the “Earth Summit”. The Rio Earth Summit opened for signature the United Nations Framework Convention on Climate Change (UNFCCC), which main

¹⁹ IPCC Secretariat c/o World Meteorological Organization. What is the IPCC? Intergovernmental panel on climate change. Geneva, Switzerland, July 2021. [Online] Available from: <https://www.ipcc.ch/about/>

goal is to stabilize the rise of GHG emissions. Its supreme decision-making body, the Conference of the Parties (COP), represents all states that have joined the Convention (196 members plus the EU nowadays) and meet annually in order to keep the international efforts to fight climate change. Each COP is also known as Climate Summit.²⁰ Generally speaking, COPs are sessions in which Parties that have ratified the UNFCCC meet and take decisions by consensus among the 197 Parties, within the framework of an agenda that have been agreed and approved by all of them. The COP also assesses the effects of the policies developed by Parties and the progress made in achieving the goals of the Convention.

The Rio summit remarked that social, economic and environmental issues are linked so our activities (the way we produce and consume) have consequences in our environment. The main goal of this Conference was to call for international action on environmental and development issues. In order to set the path, the UNCED Conference established the Agenda 21, a guide to reach overall sustainable development in the 21st century.

A Commission on Sustainable Development (CSD) was created in order to monitor and review the implementation of the Earth Summit agreements (the Convention on Climate Change, the Convention on Biological Diversity, the Rio Declaration, the Forest Principles and the already mentioned Agenda 21).²¹

The first Conference of the Parties (COP 1) was held in Berlin in 1995. It stated that Convention's objectives would not be accomplished if developed countries did not strength and renegotiated their commitment. The Berlin Mandate, then, served to lay the ground for the Kyoto Protocol of 1997, which focused on committing developed countries to reduce GHG emissions. (The Kyoto Protocol will be further explained later, given the relevance of the agreement).

²⁰ United Nations. Conference of the Parties (COP). United Nations Climate Change. 2021. [Online] Available from: <https://unfccc.int/process/bodies/supreme-bodies/conference-of-the-parties-cop>

²¹ United Nations. Economic and social development. Earth Summit+5. 2021. [Online] Available from: <https://www.un.org/esa/earthsummit/>

Since Berlin 1995, there have been the following remarkable UN Conferences and COPs regarding sustainable development and climate change:²²

- **2002.** The World Summit on Sustainable Development (Earth Summit 2002 or Rio+10) at Johannesburg, South Africa. Apart from reviewing the implementation of Agenda 21, it also produced the Johannesburg Declaration on Sustainable Development.
- **2009.** UN Climate Change Conference at Copenhagen. Its goal was to agree a framework for climate change mitigation beyond 2012.
- **2011.** COP 17 at Durban. Parties commit to a new universal climate change agreement by 2015 and for the period beyond 2020.
- **2012.** The UN Conference on Sustainable Development (UNCSD) or Rio+20 at Rio de Janeiro, Brazil. It published the document “The future we want”, which is a declaration on sustainable development and green economy. It deals with a wide range of sustainable objectives such as agriculture, energy, transport or cities among others (poverty, food security, health, employment).²³
- **2015.** UN Sustainable Development Summit at New York. It produces a key document which has had a strong international influence, especially in the EU: “Transforming our world: the 2030 Agenda for Sustainable Development”.
- **2015.** The Paris Agreement. It was an international treaty on climate change ratified by 195 parties. It was the first time that a binding agreement gathered such representation from nations worldwide to fight climate change and fix the goal to limit global warming to below 2 (preferably to 1.5°C) by 2100 compared to pre-industrial levels.

²² Dag Hammarskjöld library. UN documentation: environment. 2021. [Online] Available from: <https://research.un.org/en/docs/environment/conferences>

²³ European Environment Agency. The Future We Want – Declaration of the UN Conference on Sustainable Development, Rio (2012). 2021. [Online] Available from: <https://www.eea.europa.eu/policy-documents/the-future-we-want-2013declaration>

Among the previous milestones, there have been three that deserve to be dealt deeply: the Kyoto Protocol (COP3) (regarding its commitment character), the Paris Agreement (COP21) (due to its binding nature) and the Agenda 2030, which sets a plan of action since 2015 to 2030 concerning people, planet and prosperity. It includes 17 Sustainable Development Goals (SDGs) that, among other objectives, seek to provide universal access to sustainable energy, transform cities and communities in sustainable places to live and produce and finally revert climate change trends. The scope of the Kyoto protocol, the Paris agreement and the Agenda 2030 will be analysed in the following paragraphs, whereas the EU's commitment to these agreements will be dealt in greater detail in section 4.

The developments of the Kyoto Protocol and the Paris Agreement are not just the work of a single COP, but there have been previous COPs annually that have made progress towards the objectives of Kyoto and Paris as well as there have been later COPs which aim to set about the regulatory framework and accomplish the main goals. In fact, given the relevance of both the Kyoto Protocol and the Paris Agreement, it has led to the creation of their respective “*Conference of the Parties Serving as the Meeting of Parties to the Kyoto Protocol*” (CMP) and the “*Conference of the Parties serving as the meeting of the Parties to the Paris Agreement*” (CMA). On the one hand, nations that are Parties to the Kyoto Protocol are represented at the COP serving as the meeting of the Parties to the Kyoto Protocol (CMP).²⁴ On the other hand, nations that are Parties to the Paris Agreement are represented at the COP serving as the meeting of the Parties to the Paris Agreement (CMA).²⁵ States which are not

²⁴ UNFCCC. 2021. Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP). [Online] Available from: <https://unfccc.int/process/bodies/supreme-bodies/conference-of-the-parties-serving-as-the-meeting-of-the-parties-to-the-kyoto-protocol-cmp>

²⁵ UNFCCC. 2021. Conference of the Parties serving as the meeting of the Parties to the Paris Agreement (CMA). [Online] Available from: <https://unfccc.int/process/bodies/supreme-bodies/conference-of-the-parties-serving-as-the-meeting-of-the-parties-to-the-paris-agreement-cma>

Parties to either the Kyoto Protocol or the Paris Agreement, participate at the COP as “observers”.

That is why, the following chart gathers all the COPs that have taken place in the UNFCCC’s history and distinguishes which ones relate to the Kyoto Protocol (CMP) or the Paris Agreement (CMA).

Table 1 - List of COPs (UNFCCC)

Year	Session	CMP or CMA	Location
1995	COP1	-	Berlin, Germany
1996	COP2	-	Geneva, Switzerland
1997	COP3	-	Kyoto, Japan
1998	COP4	-	Buenos Aires, Argentina
1999	COP5	-	Bonn, Germany
2000	COP6	-	The Hague, Netherlands
2001	COP6	-	Bonn, Germany
2001	COP7	-	Marrakech, Morocco
2002	COP8	-	New Dehli, India
2003	COP9	-	Milan, Italy
2004	COP10	-	Buenos Aires, Argentina
2005	COP11	CMP	Montreal, Canada
2006	COP12	CMP	Nairobi, Kenya
2007	COP13	CMP	Bali, Indonesia
2008	COP14	CMP	Poznan, Poland
2009	COP15	CMP	Copenhagen, Denmark
2010	COP16	CMP	Cancún, Mexico
2011	COP17	CMP	Durban, South Africa
2012	COP18	CMP	Doha, Qatar
2013	COP19	CMP	Warsaw, Poland
2014	COP20	CMP	Lima, Peru
2015	COP21	CMP	Paris, France
2016	COP22	CMP	Marrakech, Morocco
2017	COP23	CMP	Bonn, Germany
2018	COP24	CMP	Katowice, Poland
2019	COP25	CMA	Madrid, Spain
2021	COP26	CMA	Glasgow, United Kingdom

Source table 1 - <https://unfccc.int/process/bodies/supreme-bodies/conference-of-the-parties-cop?>

2.3- The Kyoto Protocol.

What is the relation between the UNFCCC and the Kyoto Protocol? Kyoto is responsible for the functionality and operability of the Convention, but within the institutional framework and objectives set out by the Convention. The Kyoto Protocol, which has 192 Parties nowadays, was adopted in the third COP in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005. It makes industrialized countries and economies in transition commit to cut GHG emissions and reduce them regarding specific and *ad-hoc* targets.⁷ Therefore, the main difference between the Kyoto Protocol and the UNFCCC is that the former commits the participating countries to stabilize GHG emissions, whereas the Convention just encouraged them to do so.

In practice, the Convention ask its Parties to develop policies on climate change and report periodically. The Kyoto Protocol, as is based on the principles and structure of the Convention, binds developed states to fulfil with the provisions of the UNFCCC. It exerts more pressure on these countries under the principle of “common but differentiated responsibility and respective capabilities”, i.e. industrialized countries were considered the main responsible for current GHG emissions and have more resources and technology at their disposal to fight climate change and adapt to the requirements. On the other hand, the Parties understood back then that poorer and developing countries will need to generate more GHG emissions in the first stage of their transition to a modern economy. In this sense, the measures addressed to these developing countries are not as demanding as the ones targeted to 37 industrialized countries and economies in transition and the European Union. These targets, which represent a reduction of 5% compared to 1990 levels over the period 2008-2012, also known as the first commitment period⁷, are the following:²⁶

²⁶ United Nations. Kyoto Protocol - Targets for the first commitment period. United Nations. Climate Change. [Online] Available from: <https://unfccc.int/process-and-meetings/the-kyoto-protocol/what-is-the-kyoto-protocol/kyoto-protocol-targets-for-the-first-commitment-period>

-8% of reduction: 26 European states.

-7% of reduction: US (although it did not ratify the Kyoto Protocol).

-6% of reduction: Canada + Hungary + Japan + Poland.

-5% of reduction: Croatia.

+/-0%: New Zealand + Russian Federation + Ukraine.

+1% of increase: Norway.

+8% of increase: Australia.

+10% of increase: Iceland.

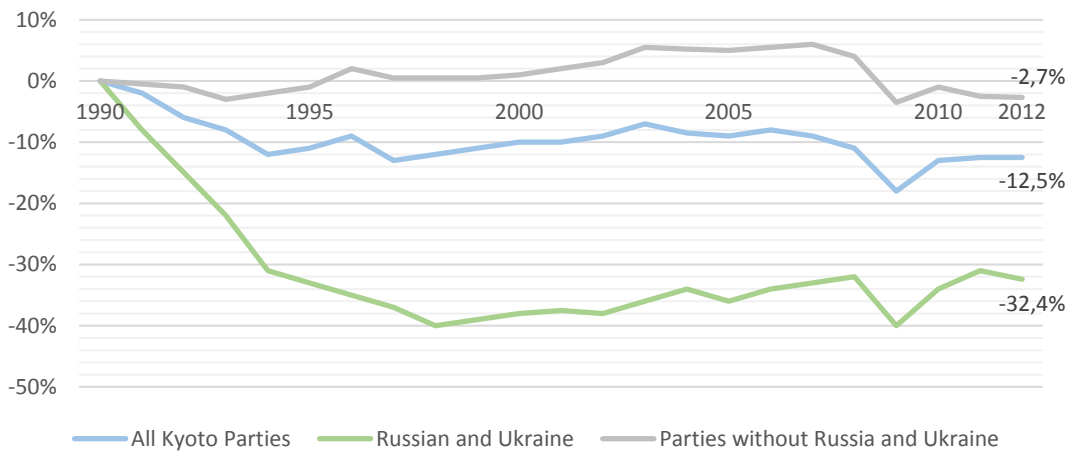
Those were the targets, but was the main goal of a 5% reduction achieved? The question may not be answered with just ‘yes’ or ‘not’. Actually, by 2012, all Kyoto Parties with targets reached a combined reduction of GHG emissions of around 12,5%, but among them, there were two countries that lowered the average significantly: Russian and Ukraine (-32,4%). The reason may probably be the collapse of the Soviet Union, which caused a remarkable decrease in heavy manufacturing industries across Russia and the recently created states. Both countries represented the two largest energy consumers in this group, so the shock significantly affected them. Therefore, without Russia and Ukraine, the rest of Kyoto parties would have just achieved a 2,7% reduction.²⁷ Figure 7

After 2012, an amendment to the Kyoto Protocol was adopted in Doha, Qatar, on 8 December 2012, which sought to establish a second commitment period between 2013 and 2020. However, the amendment could not enter into force until 31 December 2020 because of the ratifying process, which required the acceptance of at least three fourths of the Parties to the Kyoto Protocol.²⁸

²⁷ Circular ecology. The Kyoto Protocol: climate change success or global warming failure? Circular ecology. 4th February 2015. [Online] Available from: <https://circularecology.com/news/the-kyoto-protocol-climate-change-success-or-global-warming-failure>

²⁸ United Nations. The Doha Amendment. United Nations Climate Change. 2021. [Online] Available from: <https://unfccc.int/process/the-kyoto-protocol/the-doha-amendment>

Figure 7 - Kyoto Protocol GHG emissions, 1990-2012



Source figure 7 - Circular ecology. The Kyoto Protocol: climate change success or global warming failure? Circular ecology. 4th February 2015. [Online] Available from: <https://circularecology.com/news/the-kyoto-protocol-climate-change-success-or-global-warming-failure>

The values from Figure 7 and the delay in the ratifying process of the Doha amendment, directly question the success of the Kyoto Protocol, not about its content and international influence (remember that it was signed in 1997, a time when scientific data was not as significant as it is nowadays), but about its scope and objective results. I refer to its scope because the Kyoto Protocol did not target China or India, which represent two of the five greatest GHG emitters by 2017, along with the United States, the EU and Russia¹⁸, as they were considered developing countries back then. Furthermore, two of the members of the G-7, did not finally commit to the Protocol: Canada ratified it but withdrew in 2012 and the US signed it, but never ratified it.

2.4- The Paris Agreement.

Regarding the difficulties of the Kyoto Protocol to be ratified and the lack of participation of developing countries, the Paris Agreement was negotiated at the UNFCCC 21st COP in Paris in 2015. This new international treaty on climate change was adopted on 12th December 2015 by 196 countries and entered into force on 4th November 2016 (it has been ratified by 190 parties as of January 2021).²⁹

It constitutes an international legally binding treaty that aims to “*limit global warming to well below 2, preferable to 1.5 degrees Celsius, compared to pre-industrial levels*”. This long-term goal involves that parties have to reach the global peaking of GHG emissions first, so that the world could be climate neutral by 2050.²⁹

Why 1.5 degrees Celsius? When the COP gathered in Paris in 2015, it invited the IPCC to develop a special report by 2018 on “*the impacts of global warming of 1.5°C above pre-industrial levels and related global GHG emission pathways*”. In its report, the IPCC estimated that human activities are responsible of approximately 1.0°C of global warming above pre-industrial levels (a likely range of 0.8°C to 1,2°C). If it continues to grow at the current rate, global warming could reach 1,°C between 2030 and 2052.³⁰

Regarding the long-term warming trend since pre-industrial levels, it is estimated that anthropogenic global warming increasing at 0.2°C per decade (between 0,1°C and 0,3°C). As these figures refer to global averages, there are significant differences among the Earth’s regions. For example, the warming is two to three times greater in the Arctic and it is generally higher over land than over the ocean.³⁰

²⁹ United Nations Climate Change. The Paris Agreement. United Nations. 2021. [Online] Available from: <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>

³⁰ IPCC. Special report: global warming of 1.5°C. Summary for policymakers. IPCC. 2018. [Online] Available from: <https://www.ipcc.ch/sr15/chapter/spm/>

The climate-related risks for the environment and the humanity are higher for global warming of 1.5°C, but lower than if it would reach 2°C. Although these risks depend on the rate, peak and duration of warming, the IPCC states that the risks would be larger if global warming exceeds 1,5°C before returning to that level by 2100, than if global warming progressively stabilizes at 1,5°C. The impacts associated with higher global warming than 1.5°C could be long-lasting or even irreversible (e.g. the loss of ecosystems).³⁰

The Paris Agreement establishes a 5-year cycle that requires countries to increasingly update their climate action plans. The parties have already submitted their plans to accomplish the global goal of the Paris Agreement. These plans are called “nationally determined contributions” (NDCs). Along with the actions that countries will take to reduce their GHG emissions, they also set up measures to adapt to the impacts of rising temperatures. The NDCs are embedded in a wider framework: the long-term GHG emissions development strategies (LT-LEDS). Although they are not compulsory (unlike the NDCs), the LT-LEDS function as the long-term horizon to the NDCs and provides a guide for future development.²⁹

Apart from the NDCs and the LT-LEDS, the Paris Agreement also tracks progress through the enhanced transparency framework (ETF). It will start in 2024 and commits parties to report on actions taken and progress done regarding their goals to limit global warming. The ETF will be used to feed the Global stocktake which, at the same time, will serve to assess the collective progress towards the Agreements’ final goal.

Regarding financial assistance, the Kyoto Protocol considered that industrialized countries were the ones responsible for the current levels of GHG emissions and the associated damage to the environment. That involved that developing countries were not included in the binding agreement and therefore they did not have to take actions in order to reduce their GHG emissions. In this case, the Paris Agreement is targeted to all parties, but developed states have to

take the lead and provide financial assistance to less developed countries which lack of the resources to adapt and follow new climate policies that may hinder their economic and social development.²⁹

Having explained the Paris Agreement, one may wonder which are the advances comparing it with the Kyoto Protocol. The main differences between the Paris Agreement and the Kyoto Protocol are the following:³¹

- The Paris Agreement brings all countries under a unique binding agreement, instead of targeting just the industrialized nations and leaving behind developing countries.
- The goal of the Paris Agreement is to stop the global average temperature from rising more than 2 degrees Celsius above pre-industrial levels through reducing GHG emissions, whereas the Kyoto Protocol focused on cutting GHG emissions to 5% below 1990 levels.
- The Paris Agreement targets all anthropogenic GHG, while the Kyoto Protocol focused just on 6 gases: CO₂, nitrous oxide, methane, HFCs, PFCs and sulfur hexafluoride.
- The Paris Agreement has set up a committee to report annually on the progress of emissions reductions and participating countries have to update their plans for fulfilling the targets every 5 years. Most of them have fixed the period 2025-2030 to accomplish their goals. This 5-year cycle progressively increases the ambition of the GHG emissions reduction. On the other hand, the Kyoto Protocol established a first period for 2008-2012 and a second for 2013-2020. Nevertheless, the second period had difficulties to be ratified on time and the lack of compromise of key parties such as Canada or the US, along with the absence of developing and high emitter states like India or China, made the Protocol to end by the second period.

³¹ STROM, Caleb. Difference Between Kyoto Protocol and Paris Agreement. Difference Between.net. 2021. [Online] Available from: <http://www.differencebetween.net/miscellaneous/politics/difference-between-kyoto-protocol-and-paris-agreement/>

2.5- COP 25 Chile-Madrid: Why it failed.

Since the first COP in Berlin in 1995, there have been a total of 25 annual sessions. Among those 25, it has already been explained that two were remarkably special as they established global agreements with concrete emission reduction objectives: COP 3 in 1997 (Kyoto Protocol) and COP 21 in 2015 (Paris Agreement). The outcomes of the other sessions have mainly focused on “*identifying and working through existing issues and incorporating new topics*”, as well as “*adopting decisions on implementation, reviewing and monitoring the two agreements made at Kyoto and Paris*”.³²

The Conference of the Parties 25 was held in Madrid, under the Presidency of Chile, between December 2 and 15, 2019. (Chile resigned from organising the conference in its country because of the social and political instability that was suffering back then. However, Chile kept the Presidency and the executive functions, whereas Spain just developed the administrative tasks associated with holding the conference in its country).

The agreement reached at Madrid asked for “climate ambition” for 2020 and it transposed that ambition into three main issues:³²

- Parties commit to present more ambitious plans for the reduction of GHG emissions. This commitment will be presented at COP 26 in Glasgow and it involves dealing with the gap between the science’s recommendations to prevent climate change and the current emissions of the Parties.
- The agreement acknowledges that any climate policy should be constantly reviewed and updated according to science’s progress and findings. Therefore, scientific knowledge will be the basis for the countries’ climate decisions.

³² COP25. Chile. What is the COP. 2021 [Online] Available from: <https://cop25.mma.gob.cl/en/what-is-the-cop/>

- The importance of keeping the balance of the oceans and soil uses in order to guarantee the proper functioning of the climate system.

However, critics arose because of different reasons, two above all:

- Three of the greatest GHG emitters, i.e. USA, China and India, did not adhere to the commitment of reviewing their action plans to reduce GHG emissions and present their conclusions at COP26.
- It did not include the regulation of the international carbon market, as the Parties could not reach a common commitment.

Regarding this last failed issue, the international carbon markets' regulation, they represent one of the most important points of the Paris Agreement as it could play a key role in achieving its main goal: keeping global warming below 1.5°C this century.

How do international carbon markets work? Nations that do not manage to fulfil with their emissions reduction targets agreed in their national climate plans or through the Paris Agreement's nationally determined contributions (NDCs), could negotiate the purchase of emissions reductions from other countries that not only have achieved their emissions cutting goals, but have even exceeded them. Therefore, these outstanding countries would be economically rewarded for their successes and the poor performing nations would reach their reduction commitments not through objective figures nor properly targeted policies, but by purchasing the surplus cuts of the advanced countries.³³

Concerning the Paris Agreement, its Article 6 is the one which refers to international carbon markets. However, the rules by which the international carbon markets will be regulated have not yet been set up. COP 25 aimed to resolve this key issue, but it failed as other previous meetings had done before. For example, when Parties met at COP 24 in Katowice, Poland, they agreed a

³³ KIZZIER, Kelley; LEVIN, Kelly and RAMBHAROS, Mandy. What do you need to know about Article 6 of the Paris Agreement. World Resources Institute. 2 December 2019. [Online] Available from: <https://www.wri.org/insights/what-you-need-know-about-article-6-paris-agreement>

reasonable amount of rules to let the Paris Agreement become true, although they did not reach a rule-book for Article 6, mainly due to the intrinsic complexity of regulating such international market.³⁴

Concretely, Article 6 includes two operative paragraphs that refer directly to carbon markets:³³

Article 6.2 proposes a framework for international cooperation which could work as a link of the emissions-trading system of several countries. That framework for cooperation could also work as a means to transfer carbon credits between countries.

Article 6.4 refers to a UN mechanism to “*trade credits from emissions reductions generated through specific projects*”, e.g. country X could pay country Y for the construction of a solar power plant. Country Y would benefit from the clean energy and country X would receive credits for the reductions.

As it has been said, these concepts regarding carbon markets have not yet been transposed into regulated or even binding rules by the Parties. That is why the COP 25 has been seen as a remarked failure by critics, as it was expected that the Conference would reach an agreement concerning international carbon markets.

Why has been paid such attention to international carbon markets? Because if rules are properly designed, they could result cost saving and contribute to the emissions reductions’ goals. The International Emissions Trading Association (IETA) estimates the cost savings under Article 6 of \$250 billion per year and, in fact, half of countries’ first NDCs (representing 31% of global emissions) take into account international cooperation through carbon markets.³³ The IETA

³⁴ WASKOW, David; DAGNET, Yamide; NORTHROP, Eliza and THWAITES, Joe. COP24 climate change package brings Paris Agreement to life. World Resources Institute. 21 December 2018. [Online] Available from: <https://www.wri.org/insights/cop24-climate-change-package-brings-paris-agreement-life>

also considers that Article 6 could promote the disposal of 50% more emissions (approximately 5 gigatonnes of CO₂ per year) at no additional cost.³⁵

Nevertheless, the IETA warns that “*careful framing in both the design and the implementation of Article 6 is essential*”. It even states that improperly designed and implemented rules might undermine the accomplishment of the Paris Agreement’s objectives.³⁴ There would be at least three scenarios in which this poorly regulation could result counterproductive:³³

- *Double-counting*. Suppose that country X sells its emissions reductions to country Y, so the latter may count those figures to achieve its reduction targets established in the NDC. However, if country X considers that those emissions reductions (that have previously been sold to another country) are still part of its own reductions towards achieving its NDC goals, that would be double-counting.

- *Additionality*. The Parties may invest and foster sustainable projects that would have happened anyway, i.e. without the existence of the Paris Agreement and the expected regulatory framework of Article 6. For example, if regulations under Article 6 promote that country X develops a solar plant, but this country was already going to build it, in this case the carbon market would not result in a climate benefit.

- *Increase ambition and progression*. Depending on how it would be designed, Article 6 could foster or slow down progress regarding more ambition targets. For example, Article 6 could push NDCs to increasingly cover more GHGs and conflicting sectors.

³⁵ EDMONDS, Jae; FORRISTER, Dirk; CLARKE, Leon; DE CLARA, Stefano and MUNNINGS, Clayton. The economic potential of Article 6 of the Paris Agreement and implementation challenges. International Emissions Trading Association, University of Maryland and CPLC. Clarity Editorial. Washington, D.C. September 2019. License: Creative Commons Attribution CC BY 3.0 IGO. [Online] Available from: https://www.ieta.org/resources/International_WG/Article6/CLPC_A6%20report_no%20crops.pdf

After the failure of COP25, the Covid-19 pandemic postponed COP 26 to 2021, instead of the initial planning for 2020. It will be hosted by the UK with Italy's collaboration and will be held at Glasgow from 31 October to 12 November 2021.³⁶

Four main goals have been set for COP26:³⁷

- Secure global net zero by mid-century and keep 1.5 degrees within reach.

Countries will have to submit their proposals for ambitious emissions reductions by 2030 (aiming at achieving “net zero” objective by 2050 means that no more emissions are going into the atmosphere than are removed) and presumably they will include the following targets:³⁷

- Speed-up the phase-out of coal.
- Limit deforestation.
- Accelerate the switch to electric vehicles.
- Foster investment in renewable energy sources.

- Adapt to protect communities and natural habitats.

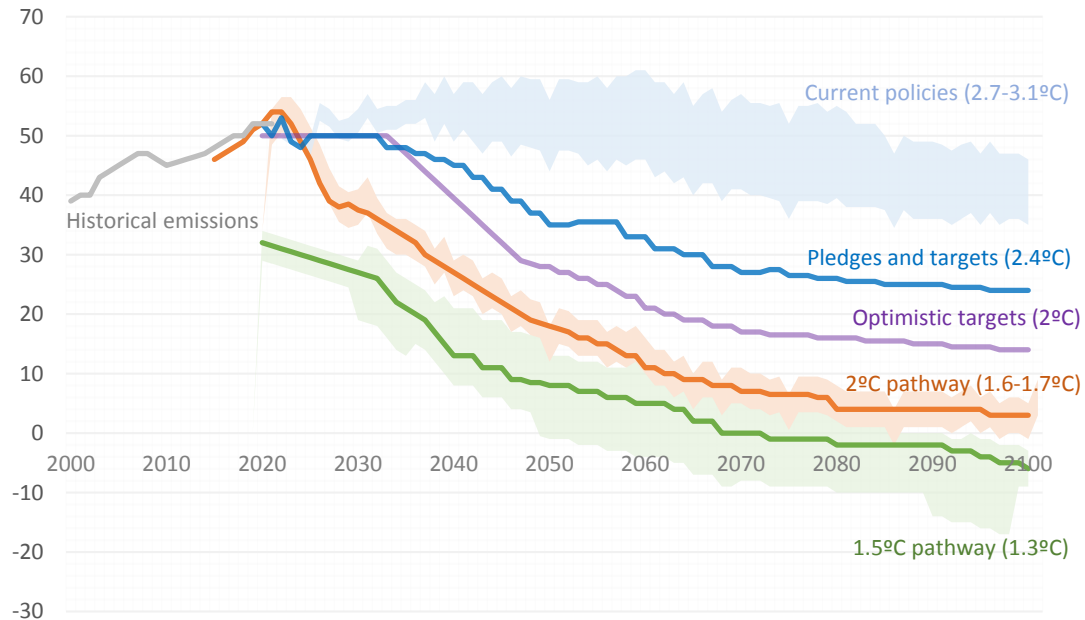
It has been assumed, thanks to the scientific community, that climate is already changing and it will keep doing it even if we cut off GHG emissions. The intensity of the associated devastating effects will depend on how much we reduce emissions and therefore, how much will increase the global temperature. Depending on how much we will reduce our emissions throughout this century, the temperature would rise even more than 3°C or keep lower than the Paris

³⁶ United Nations Framework Convention on Climate Change. Glasgow Climate Change Conference. United Nations. 2021. [Online] Available from: <https://unfccc.int/process-and-meetings/conferences/glasgow-climate-change-conference>

³⁷ UN Climate Change Conference UK 2021. COP26 goals. 2021. [Online] Available from: <https://ukcop26.org/cop26-goals/>

Agreement’s goal of 1.5°C. Figure 8 shows the different scenarios that could arise depending on the emissions reduction.³⁸

Figure 8 – CO2 emissions (in gigatonnes) and the associated temperature rise.



Source figure 8 - UN Climate Change Conference UK 2021. COP26 goals. 2021. [Online] Available from: <https://ukcop26.org/cop26-goals/>

The consequences associated with the worst scenarios (keeping current policies without further ambition) would result such catastrophic that human beings should begin to protect and restore ecosystems and even build defences, warning systems and the necessary infrastructure to prevent loss of homes, habitats and lives.³⁷

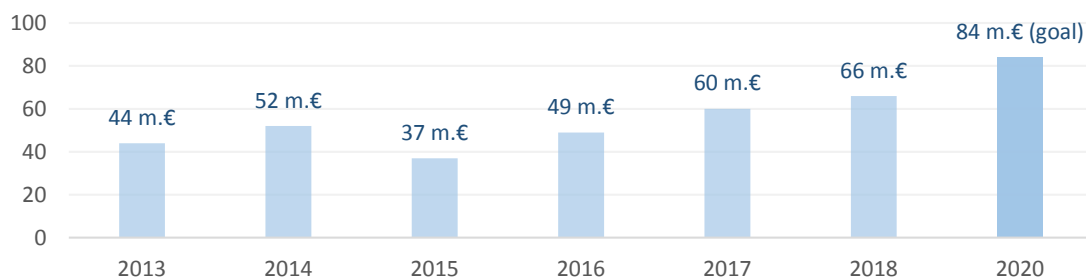
- Mobilise finance.

In order to accomplish the first two objectives, developed countries have to set at least 84.7 million euros (\$100bn) aside for climate finance per year by 2020.³⁷

³⁸ BBC News. COP26: What is the UN climate conference in Glasgow and why is it so important? BBC News. 9th August 2021.[Online] Available from: <https://www.bbc.com/news/science-environment-56901261>

This issue seems to be one of the most controversial and difficult to reach at COP26 (possibly along with the international carbon market) as by 2018, rich countries have just managed to mobilise \$79bn Figure 9 and around 75% of this money was conceded as loans to poorer countries instead of grants that they would not have to pay back. This involves that poor nations are not helped enough and many are already in debt.³⁸

Figure 9 - Climate finance mobilised by developed countries



Source figure 9 - UN Climate Change Conference UK 2021. COP26 goals. 2021. [Online] Available from: <https://ukcop26.org/cop26-goals/>

- *Work together to deliver.*

COP26 should aim at completing the Paris Agreement Rulebook, i.e. the set of rules and regulations that gives the Paris Agreement its binding character and makes it operational.

This implies that the regulation of the international carbon market (Article 6 of Paris Agreement), which was not agreed at COP25, should be address in Glasgow in order to reach an ambitious deal that makes it work.

2.6- The UN 2030 Agenda for Sustainable Development.

On 21 October 2015, The General Assembly of the UN summited the 2030 Agenda for Sustainable Development.³⁹ This document is “*a plan of action for people, planet and prosperity*”. Although it refers to problems related with peace or poverty as two of the main human challenges globally, it also establishes the priority of protecting the Earth through “sustainable consumption and production” and taking action to revert the climate change.

In this sense, the UN has set a similar meaning of “sustainable development” that the one defined by the European Commission and explained in section 2.1. The UN establishes that sustainable development is the one that “*meets the needs of the present without compromising the ability of future generations to meet their own needs. It calls for concerted efforts towards building an inclusive, sustainable and resilient future for people and planet*”.

Consequently, the 2030 Agenda defined 17 goals with 169 associated targets which should be pursued and achieved before 2030. Nine of them are directly related to the promotion of sustainable development that protects the environment and seek to stop climate change:³⁹

Goal 6. Ensure availability and sustainable management of water and sanitation.

Goal 7. Ensure access to affordable, reliable, sustainable and modern energy.

Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable.

Goal 12. Ensure sustainable consumption and production patterns.

Goal 13. Take urgent action to combat climate change and its impacts.

³⁹ General Assembly of the United Nations. Resolution adopted by the General Assembly on 25 September 2015 Seventieth session. United Nations. 21 October 2015. [Online] Available from: <https://sdgs.un.org/2030agenda>

Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development.

Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

Goal 17. Strengthen the means of implementation and revitalize the global partnership for sustainable development.

Nevertheless, the UN recognises that the primary responsible for negotiating the global response to climate change is the UNFCCC. This directly refers to goal 13 and indirectly influences the other sustainable goals that relate to the environment and the damages caused to it by the GHG emissions and the associated global warming.

The UN underlines that in order to success, it is essential to seek the balance between three key elements: economic growth, social inclusion and environmental protection, as they are interconnected and represent the basis for the well-being of individuals and societies. Although progress is being made, further action is required in this decade because goals will not be achieved by 2030 at the current speed.⁴⁰

The means of implementation depend on countries' own sustainable development policies, plans and programmes. The role of the SDGs is limited to align countries' plans with their global commitments. The UN expect that all stakeholders (i.e. national, regional and local governments, civil society and the private sector among others will promote sustainable development patterns in order to contribute to the final goals of the 2030 Agenda).⁴⁰

Regarding monitoring, the 17 SDGs will be reviewed by both global indicators, i.e. the global indicator framework for SDGs developed by the Inter-Agency and Expert Group on SDG Indicators (IAEG-SDGs) and agreed at the 48th

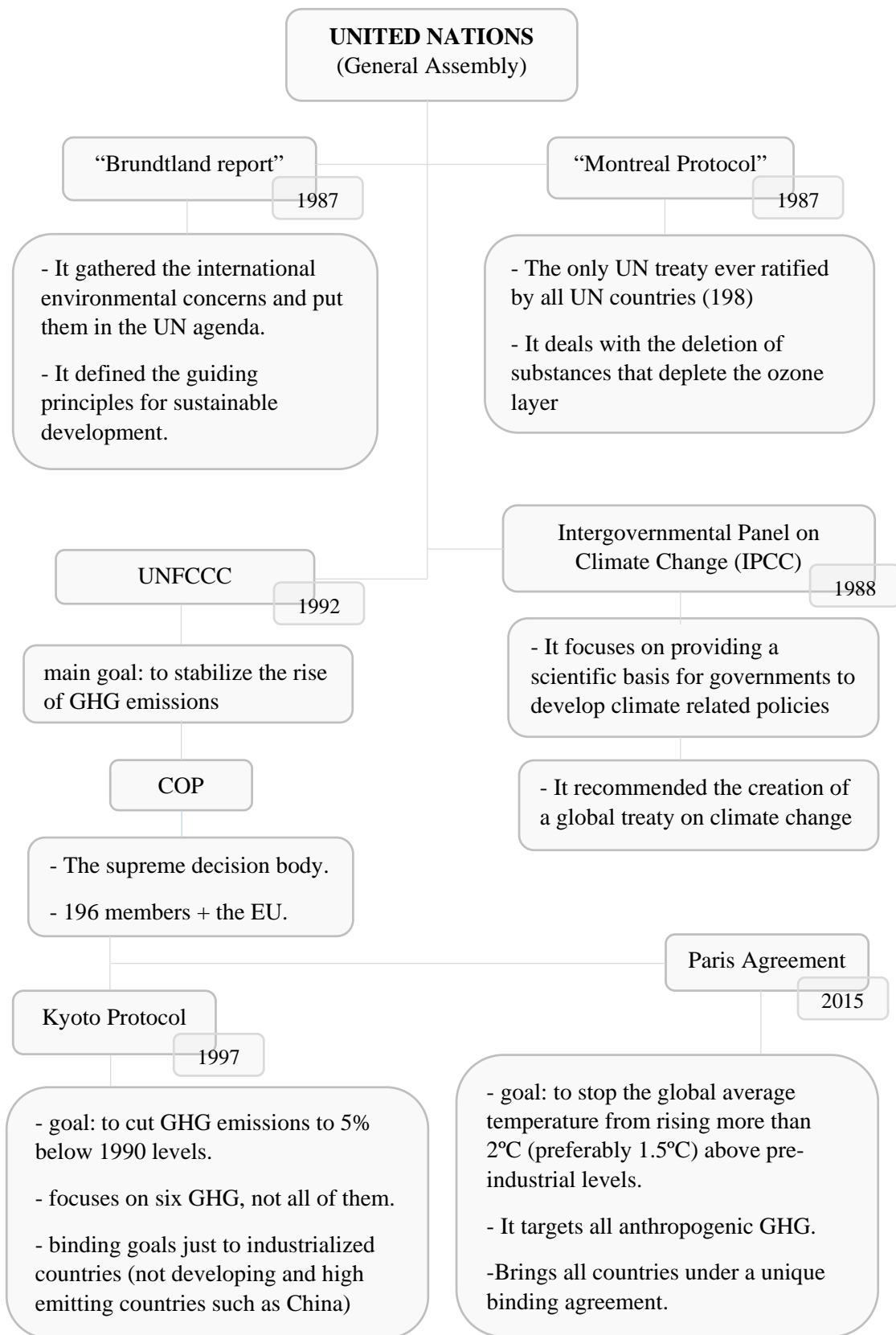
⁴⁰ United Nations. The Sustainable Development Agenda. 17 Goals for People, for Planet. United Nations. 2021. [Online] Available from: <https://www.un.org/sustainabledevelopment/development-agenda/>

session of the UN Statistical Commission in 2017, and also by national governments, which are responsible to develop their own indicators to review progress on goals and targets.⁴⁰

Another relevant issue to take account concerning the 2030 Agenda is that SDGs are not legally binding.

Therefore, this feature of relying on countries to accomplish the goals may be seen as a weakness if we compare it with the intergovernmental, binding and international character of the Paris Agreement. That is why I will focus on the Paris Agreement and its transposition to national regulations in European states and into the own European Union's *acquis communautaire*, rather than establishing the 2030 Agenda as the normative framework for sustainable development.

Summary diagram of the UN's main instruments to fight climate change.



3- THE EUROPEAN GREEN DEAL AND THE EU'S INTERNATIONAL COMMITMENT.

3.1- EU's international commitment.

As it has been stated throughout section 2, the EU has been committed to the most important and international treaty on fighting climate change, i.e. the United Nations Framework Convention on Climate Change (UNFCCC), since its birth in 1992.

This commitment implies that the EU signed the Kyoto Protocol in 1997 (back then it was the only legally binding instrument for reducing GHG emissions). The EU and its member states not only committed to the Kyoto's goal (5% cut of GHG emissions below 1990 levels by 2012), but they even exceeded it and set an 8% reduction for the community as a whole (EU-15 at that time).⁴¹

The 8% goal was actually an average to be achieved by all EU members, as Kyoto allowed groups to complete targets in conjunction. This meant that the EU established legally binding national targets, which were developed according to the wealth of each country at that moment (the Decision 2002/358/EC by which the EU approved the Kyoto Protocol included this agreement of "*burden sharing*"). The countries that entered the EU after the Protocol was adopted have also been allocated the corresponding individual targets (except for Cyprus and Malta).⁴¹ Table 2 shows the targets set for each member state.

Regarding the results for the first period of the Kyoto's protocol, the EU's total emissions were 23.5 gigatonnes of CO₂ equivalent, which translates into a reduction of around 19% (excluding the cuts coming from carbon sinks and international credits) comparing the values to the ones in 1990 (the base year –

⁴¹ European Commission. 2021. Kyoto 1st commitment period (2008-2012). [Online] Available from: https://ec.europa.eu/clima/policies/strategies/progress/kyoto_1_en

with a few exceptions for several countries – for setting up the targets). Concerning the EU-15, it achieved an overall reduction of 11.7% (without adding the reductions coming from carbon sinks), 3.7 percentage points above its own goal and 6.7 percentage points more than the Protocol’s target.⁴¹

Table 2 - EU's own targets for the Kyoto Protocol 1st period (2008-2012)⁴²

EU-15 under "burden-sharing"		Remaining EU Member States	
EU-15	-8%		
Austria	-13%	Bulgaria	-8%
Belgium	-7.5%	Croatia	-5%
Denmark	-21%	Czech Republic	-8%
Finland	0%	Estonia	-8%
France	0%	Hungary	-6%
Germany	-21%	Latvia	-8%
Greece	+25%	Lithuania	-8%
Ireland	+13%	Poland	-6%
Italy	-6.5%	Romania	-8%
Luxembourg	-28%	Slovakia	-8%
Netherlands	-6%	Slovenia	-8%
Portugal	+27%		
Spain	+15%	Cyprus	N/A
Sweden	+4%	Malta	N/A
United Kingdom	-12.5%		

Source table 2 - European Commission. 2021. *Kyoto 1st commitment period (2008-2012)*. [Online] Available from: https://ec.europa.eu/clima/policies/strategies/progress/kyoto_1_en

For the Kyoto’s second period (2013-2020), which is in between the first period and the entrance into force of the Paris Agreement (since 2020), the EU, along

⁴² The base year for carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O) was 1990, with the exception of Bulgaria (1988), Hungary (average 1985-7), Slovenia (1986), Poland (1988) and Romania (1989). The base year for fluorinated gases (HFCs, PFCs and SF₆) was 1995, with the exception of Austria, Croatia, France, Italy and Slovakia, which was set for 1990.

with Iceland, has committed to a 20% cut of GHG emissions compared to 1990 levels, whereas the Kyoto Protocol's goal is "at least 18% below 1990 levels. This objective is in line with the EU's own target of 20% by 2020.

As part of the effort to cut GHG emissions within the framework of the entrance into force of the Kyoto Protocol in 2005, the EU launched the same year its **Emissions Trading System (ETS)**, which has become the world's first and largest emissions trading scheme (carbon market) and constitutes a major pillar of EU climate policy, as it is a key tool for reducing GHG emissions cost-effectively.⁴³

The ETS sets a limit (cap) to the total GHG that companies are allowed to emit to the atmosphere annually and it compels business to monitor their emissions. The ETS establishes a fixed amount of allowances (each of them allow the holder the right to emit one tonne of CO₂ or the equivalent GHG), which represent the currency of the carbon market. Each year, companies must have enough allowances to cover their emissions or they could be penalised with significant fines. If a company is not given enough allowances, it has to cut its emissions or buying allowances from another emitter who may sell these extra allowances or keep them for the next year. Companies have to buy the allowances through auctions and its price varies by demand and supply. This implies that businesses get a financial incentive to pollute less, as "the less you pollute, the less you pay" (although there are permits that may be allocated for free in cases where there is a risk of losing companies that move their production to other nations of the world with no or laxer emission limits. This system aims to reduce GHG emissions as it becomes cheaper to cut emissions than buying extra allowances from another company. The limit of GHG emissions is progressively reduced by the ETS and less allowances are allocated. The ETS

⁴³ European Commission. 2021. EU Emissions Trading System (EU ETS). [Online] Available from: https://ec.europa.eu/clima/policies/ets_en

creates a financial incentive targeted to the emitters that reach GHG emissions reductions. This scheme is known as “cap and trade” system and it covers around 40% of EU’s GHG emissions, operates in all EU countries plus Iceland, Liechtenstein and Norway and sets limits to emissions from approximately 10,000 installations in the manufacturing industry, the power sector and airlines operating between its members.⁴³

After Kyoto and the launch of the ETS, the EU has also ratified the Paris Agreement on 4th October 2016. Although the EU policies that directly relate to the Paris Agreement goal (limiting the global warming to 2°C and preferably 1.5°C) will be further address in subsections 3.3, 3.4 and 3.5, it is worth stating that the EU’s initial nationally determined contribution (NDC) was linked to a GHG emissions reduction of 40% by 2030 compared to 1990 (under its 2030 climate and energy framework). The main EU legislation for implementing this goal was adopted by the end of 2018 and in December 2020, the Council approved the submission of the updated nationally determined contribution of the EU and its member states to the UNFCCC. This update went further from the initial target and set a reduction of at least 55% in GHG emissions by 2030 compared to 1990. These ambitious values represent the strong commitment of the EU with the UN’s international programs and actions.⁴⁴

Regarding the 2030 Agenda for sustainable development, the EU considers the SDGs as *“a useful vehicle to project globally the EU’s values and objectives, and provide a shared framework, useful for international partnerships”*. Therefore, the EU is highly interested in assuming a leading role in the

⁴⁴ European Council. Council of the European Union. 2021. Paris Agreement on climate change. [Online] Available from: <https://www.consilium.europa.eu/en/policies/climate-change/paris-agreement/>

implementation of the 2030 Agenda both domestically (among its member states) and globally.⁴⁵

Concretely, the European Commission has included the SDGs into all its proposals, policies and strategies. In fact, all 17 SDGs relate to at least one of the six Commission priorities:⁴⁶

Table 3 - relation between European Commission priorities and UN SDGs

European Commission priority	Sustainable Development Goal
A European Green Deal	2. Zero Hunger
	3. Good health and well-being
	6. Clear water and sanitation
	7. Affordable and clean energy
	8. Decent work and economic growth
	9. Industry, innovation and infrastructure
	10. Reduced inequalities
	11. Sustainable cities and communities
	12. Responsible consumption and production
	13. Climate action
	14. Life below water
15. Life on land	
An economy that works for people	1. No poverty
	3. Good health and well-being
	4. Quality education
	5. Gender quality
	8. Decent work and economic growth
	9. Industry, innovation and infrastructure
A Europe fit for the digital age	4. Quality education
	9. Industry, innovation and infrastructure

⁴⁵ European Commission. 2021. The EU and the United Nations – common goals for a sustainable future. [Online] Available from: https://ec.europa.eu/info/strategy/international-strategies/sustainable-development-goals/eu-and-united-nations-common-goals-sustainable-future_en#relatedlinks

⁴⁶ European Commission. 2021. EU holistic approach to sustainable development. [Online] Available from: https://ec.europa.eu/info/strategy/international-strategies/sustainable-development-goals/eu-holistic-approach-sustainable-development_es#relatedlinks

Promoting the European way of life	3. Good health and well-being
	4. Quality education
	10. Reduced inequalities
	16. Peace, justice and strong institutions
A stronger Europe in the world	17. Partnerships for the goals
A new push for European Democracy	5. Gender quality
	10. Reduced inequalities
	16. Peace, justice and strong institutions

Source table 3 - European Commission. 2021. EU holistic approach to sustainable development. [Online] Available from: https://ec.europa.eu/info/strategy/international-strategies/sustainable-development-goals/eu-holistic-approach-sustainable-development_es#relatedlinks

In the last meeting of the High Level Political Forum (HLPF) on sustainable development (which is the main UN platform to monitor and review the 2030 Agenda and its SDGs), held from 6 to 15 July 2021, the EU organised a side event for using the SDGs to keep pace with Europe’s recovery and “*build a better future through a new growth model*”.⁴⁵

Concerning the progress made towards the SDGs, Eurostat published a report in which it can be noted, through figures, that the EU is making progress towards all SDGs (comparing figures from 2013 to 2018 or 2014-2019), although it is truth that advances in certain goals have been done faster than in others. Concretely, significant progress has been done in SDG n°16 (*peace, justice and strong institutions*); good progress in SDGs n°1 (*no poverty*) and n°3 (*good health and well-being*); moderate progress in n°2 (*zero hunger*), n°11 (*sustainable cities and communities*), n°8 (*decent work and economic growth*), n°4 (*quality and education*), n°17 (*partnerships for the goals*), n°12 (*responsible consumption and production*), n°7 (*affordable and clean energy*), n°10 (*reduced inequalities*), n°15 (*life on land*) and n°9 (*industry, innovation and infrastructure*); and not enough progress has been done in n°13 (*climate action*) and n°5 (*gender quality*).

It seems significant the slow progress made on SDG n°13 (*climate action*) since 2013-2014 to 2018-2019, given the investment and the efforts that the EU has done through its environmental policies (which will be dealt in section 3.2) and recent ambitious programmes such as the European Green Deal and the European Climate Law. Nevertheless, the following data reveals that the EU has indeed made progress in most fields, although there are others in which results have even moved backwards:⁴⁷

- *GHG emissions in 2018*: 79.4 (index, 1990=100). It represents a cut of 2.2. index points since 2013.
- *Renewable energy in 2018*: 18.9% of gross final energy consumption. It supposes a 2.2 percentage point increase since 2013.
- *CO2 emissions from new passenger cars in 2018*: 119.6 g of CO2 per km. It means a 5.4% of reduction since 2013.
- *Near surface temperature deviation in 2009-2018*: 1.61°C compared to 1850-1899 average, while the global deviation in the same period has been 0.91°C.
- *Climate-related economic losses in 2017*: 12.1 billion euros, which is 7.6% more since 2012.
- *Ocean acidity in 2018*: 8.06 pH value, i.e. just 0.1% less since 2013.
- *Recycling of municipal waste in 2018*: 47.6% of total waste generated. It represents a 5.9 percentage points increase since 2013.
- *Collective passenger transport in 2017*: 17.1% of total inland passenger/km. It supposes 0.6 percentage point less since 2012.

⁴⁷ Eurostat. Sustainable development in the European Union. Overview of progress towards the SDGs in an EU context. Publications Office of the European Union. Luxembourg, 2020 edition. ISBN 978-92-76-17455-4. [Online] Available from: <https://ec.europa.eu/eurostat/web/products-catalogues/-/KS-01-20-192>

3.2- EU Environmental policy:

As response to the previous information set out in section 2 and in order to be a global leader in the fight against climate change, the EU has acted since the 1970s and has progressively included up-to-date regulations and measures in its *acquis communautaire*.

These measures have become a hard core of EU's action: the environmental policy, which has been awarded with 22.8 billion in the multiannual financial framework (MFF) for 2021-2027 (“environment and climate action”).⁴⁸

From the first to the eighth environment action programme.

In order to understand the current concerns for climate change and sustainable development, I consider necessary to come back to the 70s, when climate issues were already under discussion at European level and have progressively evolved and adapted to the environmental, economic and political requirements and cycles through the last five decades. Nevertheless, this update could be featured as a continuity instead of a radical change, so even when dealing with specific policy actions, there is a gradual learning process.⁴⁹

The European Community launched its environmental policies within the framework of an ambitious programme. It already included a significant amount of current ideas on “sustainable development”, as the EAP of 1973 stated the need of assessing the impacts on the environment of other policies. The Commission set up an original Community policy influenced by the first UN Conference on the Environment in Stockholm in 1972, as well as by the growing public and scientific concerns regarding the limits of growth. Consequently, the

⁴⁸ European Council. Council of the European Union. Infographic - Multiannual financial framework 2021-2027 and Next Generation EU. European Council. 2021. [Online] Available from: <https://www.consilium.europa.eu/en/infographics/mff2021-2027-ngeu-final/>

⁴⁹ HEY, Christian. III. EU Environmental Policies: a short history of the policy strategies. EU Environmental Policy Handbook. Archive of European Integration. University of Pittsburgh. 2007. [Online] Available from: <http://aei.pitt.edu/98675/>

first EAP was decided in 1973 on the basis of previous European Council commitments in 1972 to set up a Community environmental policy.⁴⁹

This first programme already recognised that the economic development, social prosperity and the protection of the environment are linked among them. A new task was assigned to the Community: the protection of the environment, which involved the prosecution of the following three main objectives:⁴⁹

- The prevention, reduction and containment of environmental damage.
- The conservation of an ecological equilibrium.
- The rational use of natural resources.

Nevertheless, these ambitious goals were seen as too optimistic regarding their viability and the attainment of policy change. In order to move forward, the EAP established a gradual approach to setting up environmental quality targets. This strategy included research activities on the inconvenience of pollutants, on the causes of pollution and on criteria for environmental goals. Once these first steps were completed, the product and environmental quality norms (mainly to protect environmental media such as water, air or soil) were defined.⁴⁹

The Second EAP (1977-1981) basically continued the terms of approach and goals of the first one, just with greater range of problems to tackle, e.g. nature protection acquired relevant attention.⁴⁹

The Third EAP (1982-1986) – and partly the Fourth (1987-1992) – represented a remarkable change in policy approach, so they were more related to the completion of the Internal Market. On the one hand, the Third EAP underlined the potential risks and benefits of environmental policies to the Internal Market and emphasised the need to link the Internal Market with the environmental policies in order to develop programmes and activities properly. The Third EAP also changed its policy approach, as it moved from a quality approach to an emission-oriented strategy. This translated into establishing limit values for stationary and mobile sources.⁴⁹

At the time when the Third EAP was effective (1982-1986) and basically throughout the 1980s, there were domestic environmental policies developed by particular member states that focused on clean-air policies, noise and risk management for industrial sites. Germany succeeded in lobbying for a harmonised European emissions control policy and other countries also achieved to export national environmental policies to a EU level, e.g. the Netherlands and other smaller states such as the Scandinavian, which have traditionally been countries with a strong tradition of strategic environmental planning.⁴⁹

The Fourth EAP (1987-1992), although it represented a continuity of the Third especially in terms of approach and practice, overlapped with a time when the Treaty (Single European Act, 1987) firstly introduced the environmental protection in its own chapter. The Fourth EAP recognised that an approach which focused on emission controls for stationary sources was not probably going to achieve ecosystem or health based quality targets. Instead, it proposed a more integrated strategy by which environmental protection was not perceived as an additive, but rather within the whole production process. Part of this integrated scheme was to cut energy and material inputs and to close cycles, so that waste rates could be reduced. Consequently, the Fourth EAP did began to introduce a “sectoral approach”, as it proposed to analyse the impact of specific economic sectors on the environment. Another innovation was introduced with the Fourth EAP: the assessment of new, incentive based instruments such as taxes, subsidies or tradable emission permits.⁴⁹

In the late 1980s and the first 1990s, the term “sustainable development” progressively became a legislative reference for environmental policy in the EU. The Fourth EAP had contributed to reach this point, as it introduced a change from “trade orientation” to a “sustainability frame”, i.e. environmental policy began to be seen as an integrated element of economic decision-making, instead of an additive policy. This new approach translated into the prosecution of

“*win-win situations*” were both environmental and economic goals could benefit. In fact, the White Paper on Growth, Competitiveness and Employment (CEC 1993) proposed a new development system in which sustainable development was considered as an instrument to improve the environment, social efficiency and competitiveness at the same time.⁴⁹

The fifth EAP (1992-1999) included several interesting and innovative elements that had been setting about during the last 1980s and the first 1990s, mainly due to the emergence of new global threats related to environmental risks and climate change; the preparations for the UNCED conference in 1992; the wider support for economic instruments and a new stream of environmentalism in Europe. Among those innovations, we could highlight the following:⁴⁹

- The main goal of sustainable development regarding its definition in the Brundtland Report.
- The reference to the sectoral approach, i.e. the integration of the environmental dimension into the most polluting sectors (transport, energy and agriculture among others) and the limits of old “end-of-pipe” approaches. The action programme proposed instead a structural update in favour of public transport, energy efficiency and waste prevention.
- The focus on new market-oriented instruments such as fiscal incentives or voluntary instruments, which promote the interest of producers and consumers in environmental decision-making.
- The consensus-oriented approach as regards to the key role of non-governmental agents and local or regional authorities to stand for the general interest of the environment.
- The establishment of mid and long-term targets for the reduction of certain pollutants and the development of instruments to achieve these goals.

However, the new approach of the Fifth EAP faced a significant obstruction from Member States. In fact, the period after the UNCED of 1992 could be

featured as a “downward cycle of environmental policies”. Several member states fostered a new agenda which focused on the competitiveness of industries and the decentralisation of environmental policies, i.e. they demand to re-nationalise environmental policies according to the subsidiarity principle. Therefore, this new agenda positioned its approaches against the ambitious ideas of the Fifth EAP.⁴⁹

In between the fifth and the sixth EAP, at the late 1990s, the environmental programmes achieved a remarkable progress. The synergies between new member states, the environmental Commissioners of that period, the strength of “rainbow” coalitions in the European Parliament and the majority of Green and Social Democrat Ministers in the Environmental Council all contributed to the changing dynamics of that period. Therefore, the Commission, the Environmental Council and the European Parliament build together a “green triangle” that succeeded in avoiding traditional veto players, as well as introducing new instruments which would have politically failed even in the environmental-pioneering states without European support. This updated EU driven approach to environmental policies influenced national ones and shaped them. Moreover, this revival of environmental legislation in the late 90s produced a regulatory boom on not only technical, but also political issues since 1996, for example:⁴⁹

- Innovative and holistic framework legislation, such as the Ambient Air Quality Directive (96/62), the Water Framework Directive (2000/60) or the IPPC-Directive (1996/61).
- New target oriented legislation, establishing maximum national emission ceilings for key pollutants, but leaving member states the freedom to choose how to reach the required cuts.
- The completion, revision or modernisation of existing legislative programmes, e.g. the directives on air quality (1999/30; 2000/69; 2000/3), on emission control for cars (98/69) and lorries (99/96) fuel

standards (in 1998) or the large combustion plants (2001), the incineration directives (2000/76) and the landfill directive (1999/31).

After this wave of pro-environmental policies, the Sixth EAP (2002-2012) did not share the ambitious targets of its predecessor. Basically, it formulated a framework of general principles and objectives, which were specified by certain strategies on issues such as pesticides, resources, recycling, soils, the urban and marine environment or the clean air. Among key priorities of the Sixth EAP were the reform of chemicals policy and the reduction of EU GHG emissions.⁴⁹

The Sixth EAP was structured around seven thematic strategies: air, pesticides, waste prevention and recycling, natural resources, soil, marine environment and urban environment. Progress made across the different areas varied, but those which had the proper preparation were suitable for the adoption of effective objectives, timetables and their subsequent implementation. Marine, soil, urban and resources strategies were seen by stakeholders as having provided most impetus, whereas air, pesticides, waste prevention and recycling focused on revising existing measures to improve coherence and address concrete legislative gaps. The final assessment of the Sixth EAP, carried out by the European Commission and the European Environment Agency (EEA) in 2011, reveals that it helped to “*provide environment policy an overarching framework for a decade during which environmental legislation was consolidated and completed to cover almost all areas of environment, with the exception of soil*”. Nevertheless, the assessment also states the shortcomings and limitations of the programme, concretely, that membership in the EAP does not guarantee that Member States are indeed committed to its targets.⁵⁰

⁵⁰ European Commission. Communication from the commission to the european parliament, the council, the european economic and social committee and the committee of the regions. The Sixth Community Environment Action Programme. Final assessment. COM(2011) 531 final. Brussels, 31 August 2011. [Online] Available from: <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A52011DC0531>

Despite being a priority in the Sixth EAP, the Council could not make progress on the goals related to soil. Although through the history of EAPs the environmental legislation has consolidated and by the end of the Sixth EAP it covered almost all areas of environment, soil policies have remain a controversial issue within the EU since presentation of the Soil Framework Directive (SFD) in 2006.⁵¹

In November 2013, in a process of co-decision of the European Parliament and the European Council, the EU adopted a General Union Environment Action Programme to 2020: “*Living well, within the limits of our planet*”, more commonly known as the Seventh EAP. It came into force in January 2014 and had a duration of seven years, so it was deliberately aligned with the Multi-Annual Financial Framework (MFF) 2014-2020. Similarly to the Sixth EAP, the Seventh has been structured around nine priority goals that cover several areas. Among them, three targets are at the core:⁵¹

- To protect, conserve and enhance the EU’s natural capital.
- To turn the EU into a resource-efficient, green and competitive low-carbon economy.
- To safeguard the EU’s citizens from environment-related pressures and risks to health and well-being.

The four priority areas for action of the Sixth EAP were rearranged into three thematic policy objectives, which at the same time are aided by four objectives that act as “enabling framework” for the effective achievement of the three core objectives:⁵¹

- Implementation of EU environmental laws.
- Scientific evidence base for environment policy.
- Investments and creating the right incentives to protect the environment.

⁵¹ Trinomics. The evolution of the EU environment and climate policy framework: from the 6th to the 7th EAP. June 2019. [Online] Available from: https://ec.europa.eu/environment/action-programme/pdf/7EAP_Issue_paper_2_evolution_6_to_7_EAP_final.pdf

- Environmental integration and policy coherence both within environment policy and with other policies.

Finally, to complete the Seventh EAP framework, two horizontal objectives are included:

- Enhancement of urban sustainability.
- Increasing the effectiveness of the EU in addressing climate challenges globally. (This was the first time that cities and global issues turned into priorities in their own right because of the environmental issues caused by rapid development and increasing population density in urban areas and due to the planetary dimension of environmental problems).⁵¹

With the end of the Seventh EAP we arrive to the current decade 2021-2030, which is covered by the Eighth EAP. This programme aims to speed up the transition to a “*climate-neutral, resource-efficient and regenerative economy*”, which will be able to give back to the Earth more than it takes. It acknowledges that human wellbeing and prosperity depend on the health of the ecosystems where they live. Building on the European Green Deal, which will be dealt in depth in section 3.3, the Eighth EAP sets up the next six priority objectives:⁵²

- Achieving the 2030 GHG emission reduction goal and climate neutrality by 2050.
- Enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change.
- Advancing towards a regenerative growth model, decoupling economic growth from resource use and environmental degradation, and accelerating the transition to a circular economy.
- Pursuing a zero-pollution ambition, including for air, water and soil and protecting the health and well-being of Europeans.

⁵² European Commission. 2021. Environment action programme to 2030. [Online] Available from: https://ec.europa.eu/environment/strategy/environment-action-programme-2030_es

- Protecting, preserving and restoring biodiversity, and enhancing natural capital (especially air, water, soil, forest, freshwater, wetland and marine ecosystems).
- Reducing environmental and climate pressures related to production and consumption (concretely in the areas of energy, industrial development, buildings and infrastructure, mobility and the food system).

The European Commission submitted the proposal for the Eighth EAP on 14 October 2020, as a response to the unprecedented environmental, climate and sustainability challenges that Europe is facing currently. The proposal, as it has been said, was built on the environment and climate action objectives of the European Green Deal and it will set out the direction for EU environmental and climate policy action until 2030. Once the Council and the European Parliament reach a common position this year, the Eight EAP will be legally binding for EU Member States.⁵²

EU's instruments to finance environmental programmes.

The Commission co-finances projects and other initiatives for the implementation of the EU's policies and legislation. The activities of the Directorate-General for Environment (DG ENV) are mainly financed through the LIFE programme, which is the EU's programme supporting environment, biodiversity and nature, although some actions for the Marine Environment are also funded under the European Maritime and Fisheries Fund. Most of the grants are managed by the European Climate, Infrastructure and Environment Executive Agency, but some of them are also managed by the DG ENV. LIFE also provides financing opportunities in form of loans or equity investments for revenue-generating or cost-saving pilot projects that foster the preservation of

natural capital, including climate change adaptation projects, through the Natural Capital Financing Facility (NCFF).⁵³

The LIFE programme has been active since its foundation in 1992 but before, the Commission has managed other funding programmes such as the ACE financial instrument (Action Communautaire pour l'Environnement or EU Actions or the Environment), which covered the fields of development new clean technologies, new techniques for measuring and monitoring the natural environment and protecting the habitats of endangered species of particular importance to the EU. Other programmes such as MEDSPA (1986-1991) and NORSPA (1989-1991) supported environmental projects in two specific regions: the Mediterranean and the Northern European maritime regions respectively. Once the ACE programme concluded in 1991, a new fund for nature was adopted: the ACNAT (Actions by the EU for Nature). It was conceived to support the implementation of the Habitats Directive in May 1992, when the EU was expanding its competence in the field of habitat conservation. LIFE I was built on ACNAT, as an environment fund that focused on five main priority fields and had a budget of ECU 400 million.⁵⁴

Currently, the European Investment Bank is responsible for the management of two financial instruments which have been introduced under the LIFE 2014-2020 Regulation: the Natural Capital Financing Facility (NCFF) and the Private Finance for Energy Efficiency (PF4EE) instrument. The current LIFE programme, which covers the period 2021-2027, has a budget of 5.4 billion euros and covers the next areas: nature and biodiversity; circular economy and quality of life; climate change mitigation and adaptation and clean energy transition.⁵⁴

⁵³ European Commission. 2021. Environment. Funding opportunities. [Online] Available from: https://ec.europa.eu/environment/funding/intro_en.htm

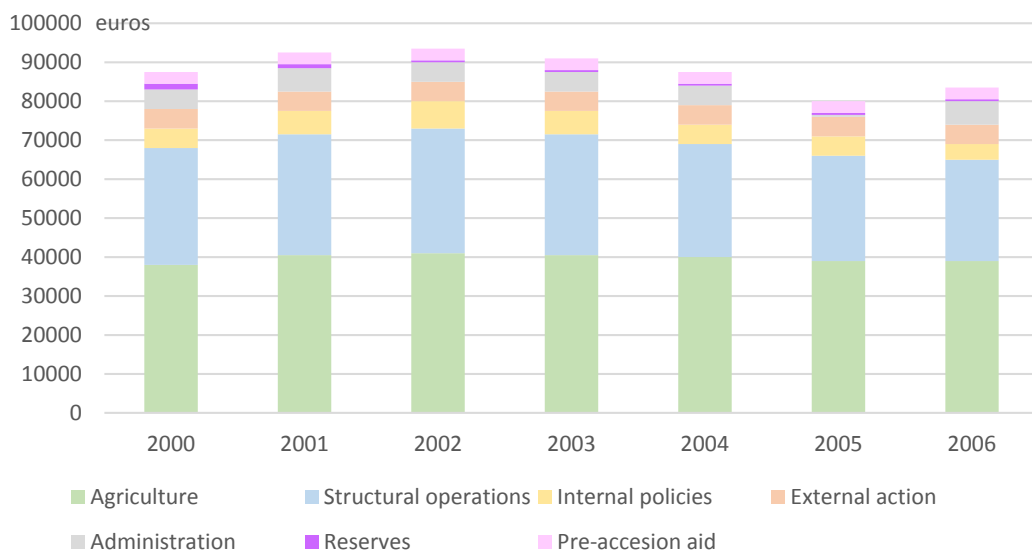
⁵⁴ European Commission. 2021. CINEA. LIFE. About Life. [Online] Available from: https://cinea.ec.europa.eu/life/about-life_es

Relevance of the environmental issue in the Multiannual Financial Framework (MFF).

Annual EU budgets are based on the Multiannual Financial Framework (MFF), which is agreed between the European Parliament, the Council and the Commission in an interinstitutional agreement. It sets the maximum amount of commitment appropriations in the EU budget each year for broad policy areas (“headings”) and establishes an overall annual ceiling on payment and commitment appropriations.⁵⁵

The environmental action programmes and their corresponding policies have had different percentage of participation in the subsequent multiannual financial frameworks. The following graphics represent how much relevance the environmental issues have had in the last MFFs (2000-2006, 2007-2013, 2014-2020 and the current 2021-2027).

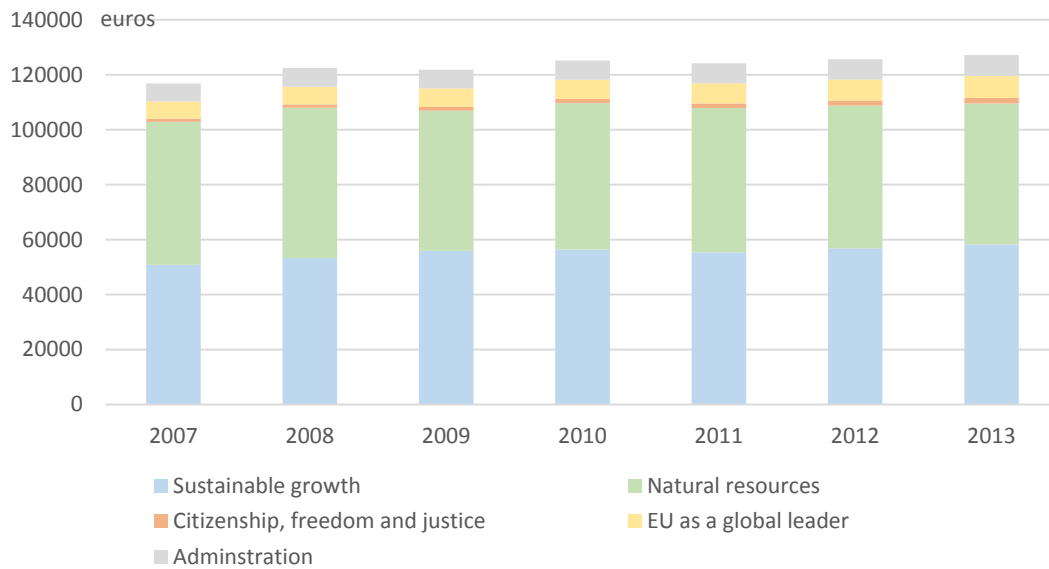
Figure 10 - Multiannual financial perspective 2000-2006



Source figure 10 – European Commission. 2021. Multiannual financial framework. Financial perspective 2000-2006. [Online] Available from: https://ec.europa.eu/budget/documents/multiannual_framework_previous_en.htm?submenuheader=2#table-1_1

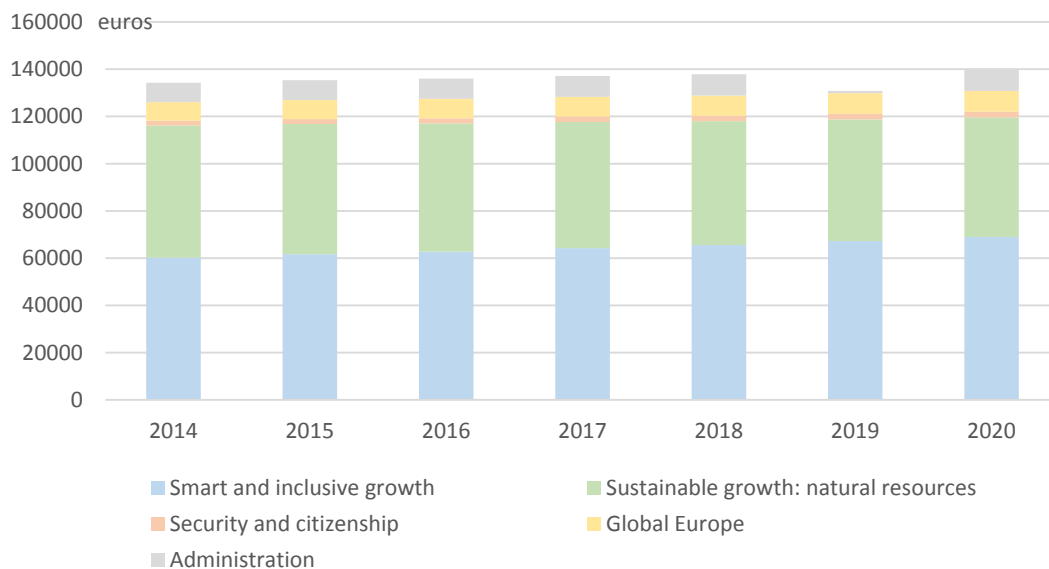
⁵⁵ European Commission. 2021. Multiannual financial framework. Financial perspective 2000-2006. [Online] Available from: https://ec.europa.eu/budget/documents/multiannual_framework_previous_en.htm?submenuheader=2#table-1_1

Figure 11 - Multiannual Financial Framework 2007-2013



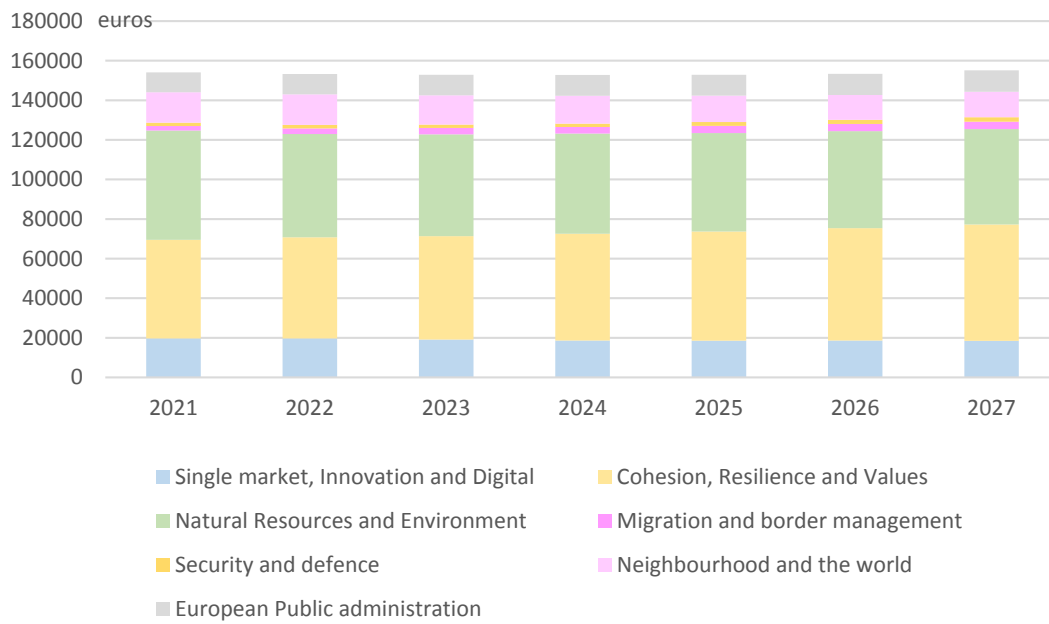
Source figure 11 – European Commission. Multiannual financial framework for the years 2007-2013. COM(2010) 72 final. Brussels, 2010. [Online] Available from: https://ec.europa.eu/budget/documents/multiannual_framework_en.htm?submenuheader=2#table-1_6

Figure 12 - Multiannual Financial Framework 2014-2020



Source figure 12 – European Commission. Multiannual Financial Framework 2014-2020. Publications Office of the European Union. Luxembourg, 2013. ISBN 978-92-79-34348-3. [Online] Available from: <https://op.europa.eu/es/publication-detail/-/publication/d2cf202e-f36a-45b2-84e7-1ac6ad996e90>

Figure 13 - Multiannual Financial Framework 2021-2027



Source figure 13 - European Parliament. Multiannual Financial Framework 2021-2027. [Online] Available from: https://ec.europa.eu/info/strategy/eu-budget/long-term-eu-budget/2021-2027/documents_en

The subsequent MFFs differ highly from one another, as the EU policies are constantly updating and adapting to the economic, social and environmental requirements. For example, the structure of the MFF 2014-2020 confirmed the decreasing importance of the traditional spending headings (Cohesion Policy and CAP), as well as the increasing relevance of two pillars: the competitiveness and the job creation expenditures together with the sustainable growth.⁵⁶

The current MFF 2021-2027 assigns 356,374 million euros to the heading “natural resources and environment”, which represents more than one third of the total 1,061,058 million euros of the MFF. This weight of the finances for the environmental policies confirms the importance that the EU is given to the climate change issue and the corresponding environmental policies to fight it.

⁵⁶ KÖLLING, MARIO and SERRANO LEAL, Cristina. An analysis of the agreement on the MFF 2014-2020. Working Paper 2/2014. Elcano Royal Institute. 12 February 2014. [Online] Available from: http://www.realinstitutoelcano.org/wps/portal/rielcano_en/contenido?WCM_GLOBAL_CONTEXT=/elcano/elcano_in/zonas_in/wp2-2014-kolling-serrano-analysis-agreement-multiannual-financial-framework-2014-2020

3.3- The European Green Deal.

When the European Parliament (EP) elected on 16th July 2019 Ursula von der Leyen as President of the European Commission, it was in part based on the ‘Political Guideline for the next European Commission 2019-2024’⁵⁷. This text could be seen as an outline of von der Leyen’s policy and legislative programme, which contained 6 priorities⁵⁸ for its 5-year term:

- A European Green Deal
- An economy that works for people
- A Europe fit for the digital age
- Promoting our European way of life
- A stronger Europe in the world
- A new push for European democracy

The first priority, the European Green Deal (EGD), was presented on 11 December 2019. It was “*a roadmap with actions for making the EU’s economy sustainable by turning climate and environmental challenges into opportunities across all policy areas and making the transition just and inclusive for all*”.

The EGD covers all sectors of the economy, specially transport, energy, agriculture, buildings and industries such as steel, cement, ICT, textiles and chemicals.

Regarding the already mentioned “circular economy”, in March 2020, the European Commission presented, under the European Green Deal, the new circular economy action plan. It includes proposals on more sustainable product design, reducing waste and empowering consumers (conceding them a right to

⁵⁷ LEYEN, Ursula von der. A Union that strives for more. My agenda for Europe: political guidelines for the next European Commission 2019-2024. Luxembourg: Publications Office of the European Union, 2019. European Union. ISBN: 978-92-76-09910-9. [Online] Available from: <https://op.europa.eu/en/publication-detail/-/publication/43a17056-ebf1-11e9-9c4e-01aa75ed71a1>

⁵⁸ European Commission. Strategy. Priorities 2019-2024. European Commission. 2021. [Online] Available from: https://ec.europa.eu/info/strategy/priorities-2019-2024_en

repair). Special attention is put on resource intensive sectors (electronics and ICT), plastics, textiles and construction.⁶³

Continuing with the EGD framework and the outbreak of the Covid-19 pandemic, on 16th April 2020 President von der Leyen highlighted the need for a European Green Deal in her speech in the European Parliament in response to the EU coordinated action to combat the coronavirus pandemic and its consequences⁵⁹:

‘[...] we will need innovative solutions and more headroom in the Multiannual Financial Framework (MFF) to unlock massive public and private investment. This will kick-start our economies and drive our recovery towards a more resilient, green and digital Europe.

[...] And it also means doubling down on our growth strategy by investing in the European Green Deal. As the global recovery picks up, global warming will not slow down. First-mover advantage will count double and finding the right projects to invest in will be key.

A more modern and circular economy will make us less dependent and boost our resilience. This is the lesson we need to learn from this crisis.

Investing in large scale renovation, renewables, clean transport, sustainable food and nature restoration will be even more important than before. This is not only good for our economies or our environment but it reduces dependency by shortening and diversifying supply chains.’

The EGD focuses not only on implementing United Nation’s 2030 Agenda and the sustainable development goals⁶⁰, but also the other priorities of the European

⁵⁹ LEYEN, Ursula von der. Speech by President von der Leyen at the European Parliament Plenary on the EU coordinated action to combat the coronavirus pandemic and its consequences. Brussels. 16 April 2020. European Commission. [Online] Available from: https://ec.europa.eu/commission/presscorner/detail/en/speech_20_675

⁶⁰ United Nations. Transforming our world: the 2030 Agenda for Sustainable Development. United Nations. 2021. [Online] Available from: <https://sdgs.un.org/2030agenda>

Commission (EC). The EGD will put sustainability at the centre of economic and general EU’s policymaking and action. The following figure can summarize the main points of this transformation:

Figure 14 - The European Green Deal



Source figure 14 - European Commission. Communication on the European Green Deal from the EC to the EP, the European Council, the Council, the EESC and the CoR. COM(2019) 640 final. European Commission Brussels, 11/12/2019. [Online] Available from: <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1588580774040&uri=CELEX:52019DC0640>

In order to comply with the EGD, Europeans will have to adapt, change and propose new policies for ‘*clean energy supply, industry, production, consumption, large-scale infrastructure, transport, food and agriculture, construction, taxation and social benefits*’.⁵⁹

3.4- The EU's circular economy action plan.

Throughout sections 2 and 3, it has been stated that sustainable development relates to three main spheres: economy, social context and environment.

As the EEB mentions, the way humans shape the economy directly affects the social context (increase of poverty rate and income inequality)⁶¹ and the environment (GHG emissions to the atmosphere through artificial activities that are needed to satisfy our current needs and ways of living).

In order to revert this social and environmental challenges, the current economic model should be rethought and redesigned, or the whole system will collapse as the following facts and figures warn:⁶²

- The *global population* is expected to reach around 8.5 billion in 2030 and 9.7 billion in 2050. If humans keep their current consumption of natural resources, we would require almost three planets in order to satisfy our needs.

- Living beings have to rely on 0.5 percent for all freshwater needs as less than 3% of the world's water is drinkable and of which 2.5 per cent is frozen in the arctic, Antarctica and glaciers.

However, *water use* has increased worldwide by around 1 per cent per year since the 1980s and at the same time, humans have been polluting rivers and lakes faster than nature can recycle and purify it.

⁶¹ Income inequality in OECD countries is at its highest level for the past half century. The average income of the richest 10% of the population is about nine times that of the poorest 10% across the OECD, up from seven times 25 years ago. Only in Turkey, Chile, and Mexico has inequality fallen, but in the latter two countries the incomes of the richest are still more than 25 times those of the poorest.

OECD. Inequality. Social and welfare issues. OECD. 2021. [Online] Available from: <https://www.oecd.org/social/inequality.htm>

⁶² United Nations. Goal 12: Ensure sustainable consumption and production patterns. Sustainable development. UN. 2021. [Online] Available from: <https://www.un.org/sustainabledevelopment/sustainable-consumption-production/>

Agriculture (irrigation, livestock and aquaculture) consumes the 69% of annual water withdrawals worldwide, industry (which includes power generation) demands 19% and households around 12%.

- It is estimated that *energy use* in OECD countries have grown 35% in 2020. After transport, commercial and residential energy use are the most increasingly growing area of global energy use.

Households consume around 29% of global energy and contribute to 21% of CO2 emissions.

A 32% increase in vehicle ownership was estimated for 2020, which represents around a 40% increase in motor vehicle kilometres.

- 1/3 of all *food* produced annually (which corresponds to 1.3 billion tons worth \$1 trillion approximately) is not consumed and turns into garbage.

The natural resource's capacity to supply food is being reduced by land deterioration, declining soil fertility, water misuse, overfishing and marine environment degradation.

The food sector is responsible for around 30% of the world's total energy consumption and 22% of total GHG emissions.

In order to improve the previous dramatic scenarios, the circular economy proposes a model in which production and consumption are based on:⁶³

- | | | |
|------------|--------------|-----------------|
| - Sharing. | - Reusing. | - Refurbishing. |
| - Leasing. | - Repairing. | - Recycling. |

The goal is that the life cycle of products is extended, so when a certain product is not useful any more, its materials are kept within the economy as long as possible. This approach involves reducing waste to a minimum.

⁶³ European Parliament. News: Economy. Circular economy: definition, importance and benefits. European Parliament. 03-03-2021. [Online] Available from: <https://www.europarl.europa.eu/news/en/headlines/economy/20151201STO05603/circular-economy-definition-importance-and-benefits>

Instead of continuing with the traditional linear economic model, which follows a ‘*take-make-consume-throw away*’ pattern, the new circular economy approach seeks to protect the environment, secure the supply of raw materials for future generations and stimulate innovation, which should boost economic growth and create jobs so there is a fair transition from the linear to the circular model.

4. THEORETICAL FOUNDATION OF THE MFD:

The EU is certain about one thing: we will not meet the climate and sustainable goals if we not bring the building and construction sector into the circular economy.⁶⁴

As it has been already mentioned, one of the objectives of the European Green Deal is to “turn the EU into a modern, resource-efficient and competitive economy that will produce no net Greenhouse Gases emissions by 2050.”

According to the European Commission, the construction sector and the buildings’ lifecycle accounted for around 40% of all GHG emissions.⁶⁵ If the EU hopes to become neutral carbon by 2050, the construction sector and the buildings’ lifecycle will play a key role.

The construction has more to say within the framework of the European Green Deal and the circular economy. Improving waste and water management is essential for the circular model, so the construction and buildings, which represents 33% of all waste produced and water used, will have to transform its current processes so that they can be integrated in the circular economy of the EU.

Furthermore, as 40% of all energy consumption is associated with buildings, from the construction to the final renovation or demolition of them⁶⁵, this constitutes another essential area of improvement to reach the European Green Deal’s objectives.

⁶⁴ DODD Nicholas; CORDELLA Mauro; TRAVERSO Marzia; DONATELLO Shane. Join Research Centre. Level(s) – A common EU framework of core sustainability indicators for office and residential buildings. August 2017. Publications Office of the European Union. ISBN 978-92-79-76907-8. [Online] Available from: <https://publications.jrc.ec.europa.eu/repository/handle/JRC109286>

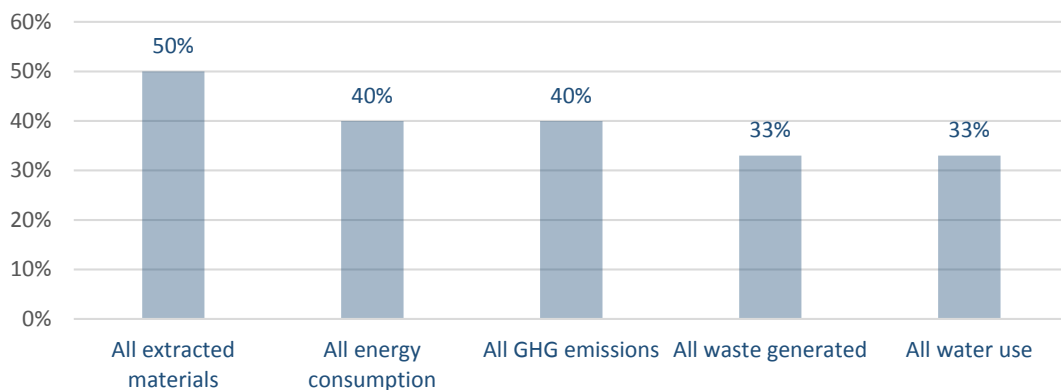
⁶⁵ European Commission. Circular economy. Level(s). European framework for sustainable buildings. DG Environment of the European Commission. 2021. [Online] Available from: https://ec.europa.eu/environment/topics/circular-economy/levels_en

5. CASE STUDY: THE CONTRIBUTION OF THE CONSTRUCTION SECTOR TO ENVIRONMENTAL POLICIES.

5.1- The construction sector and the buildings lifecycle. State of play.

In the previous sections, especially those regarding the EGD and the circular economy, it has been mentioned several times the words “buildings” and “construction”. The reason is that the construction sector is a major challenge within the EGD and the sustainable development themselves, as it represents, as long with the buildings’ lifecycle:

Figure 15 - The challenge of the building’ lifecycle and construction sector.



Source figure 15 - European Commission. Circular economy. Level(s). European framework for sustainable buildings. DG Environment of the European Commission. 2021. [Online] Available from: https://ec.europa.eu/environment/topics/circular-economy/levels_en

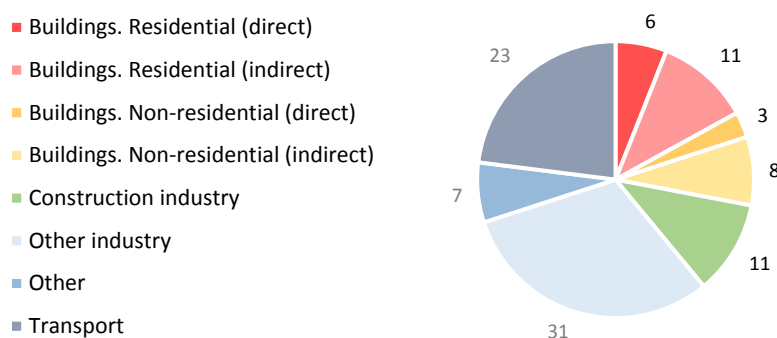
The United Nations (UN), along with the International Energy Agency (IEA)⁶⁶, published in 2019 “the Global Status Report for Buildings and Construction

⁶⁶ The IEA was created in 1974 in order to secure oil supplies. Nevertheless, the organisation has evolved and nowadays it focuses on a wide variety of issues such as electricity security, climate change, air pollution, energy access and efficiency among others. It has 30 member and 8 association countries. International Energy Agency (IEA). (2021). About. Mission, areas of work, structure, leadership, membership and history. IEA. 2021. [Online] Available from: <https://www.iea.org/about>

Sector⁶⁷, within the framework of UN’s Environment Programme (UNEP)⁶⁸ and the Global Alliance for Buildings and Construction (GlobalABC)⁶⁹.

This report stated that the buildings and construction sector accounted for 36% of final energy use and 39% of energy and process-related GHG emissions in 2018. 11 percentage points of that 39% resulted from direct manufacturing building materials and products such as steel, cement or glass⁶⁷.

Figure 16 - Global share (%) of buildings and construction emissions in 2018



Source figure 16 - United Nations Environment Programme and the International Energy Agency. *The Global Status Report for Buildings and Construction Sector*. United Nations Environment Programme. 2019. ISBN 978-92-807-3768-4. [Online] Available from: <https://www.iea.org/reports/global-status-report-for-buildings-and-construction-2019>

This data reveals that reducing GHG emissions in the buildings and construction sector is a key step in order to achieve the Paris Agreement commitment²⁹ and the UN Sustainable Development Goals (SDGs)⁷⁰, specially SDG 7 (*affordable*

⁶⁷ United Nations Environment Programme and the International Energy Agency. *The Global Status Report for Buildings and Construction Sector*. United Nations Environment Programme. 2019. ISBN 978-92-807-3768-4. [Online] Available from: <https://www.iea.org/reports/global-status-report-for-buildings-and-construction-2019>

⁶⁸ The UNEP is a leading global environmental authority which aims to set the global environmental agenda, foster the sustainable development and serve as an authoritative advocate for the global environment. United Nations Environment Programme. (2021). Who we are. About us. United Nations. 2021. [Online] Available from: <https://www.unep.org/about-un-environment>

⁶⁹ The GlobalABC is a voluntary partnership of associations, business, national and local governments, inter-governmental organisations that seek a common goal: a zero-emission, efficient and resilient buildings and construction sector. It is currently made-up of 130 members, among which are 29 countries. Global Alliance for Buildings and Construction (GlobalABC). (2021). About. Mission and vision. GlobalABC. 2021. [Online] Available from: <https://globalabc.org/about/about-globalabc>

⁷⁰ The Sustainable Development Goals refer to 17 goals fixed by the UN in order to foster prosperity while protecting the planet that should be pursued by all countries. United Nations. (2021). 17 Goals to transform our world. United Nations. 2021. [Online] Available from: <https://www.un.org/sustainabledevelopment/>

and clean energy), SDG 11 (sustainable cities and communities) SDG 12 (responsible consumption & production) and SDG 13 (climate action).

The previous data refers to GHG emissions globally. In Europe, the construction industry also represents a key sector to intervene regarding climate action. It is responsible for over 35% of the EU's total waste generation (remind that in the EU-27 in 2018, waste accounted for 3.12% of GHG emissions). Furthermore, GHG emissions from material extraction, manufacturing of construction products, along with construction and renovation of buildings are estimated at 5-12% of total national GHG emissions. It is estimated that increasing material efficiency could save 4/5 of those emissions.⁷¹ Actually, the EEA has estimated that actions addressed to reduce the use of concrete, cement and steel in the construction industry could cut materials-related GHG emissions by 61% over all the building's life cycle stages until 2050.⁷²

⁷¹ European Commission. (2021). Buildings and construction. European Commission > Internal Market, Industry, Entrepreneurship and SMEs > Sustainability. 2021. [Online] Available from: https://ec.europa.eu/growth/industry/sustainability/built-environment_en

⁷² European Environment Agency. Cutting greenhouse gas emissions through circular economy actions in the buildings sector. European Environment Agency. 9th July 2020. ISBN 978-92-9480-247-7 [Online] Available from: <https://www.eea.europa.eu/themes/climate/cutting-greenhouse-gas-emissions-through/cutting-greenhouse-gas-emissions-through>

5.2- Sustainable construction. What it is and what it could be.

One may wonder, if the buildings' lifecycle and the construction sector cause such damages to the environment, why has it not switch to a more sustainable approach yet?

Actually, it has done it, but progress is not as fast as in other sectors due to the limitation of basic materials used in structures (cement and steel) and claddings (glass, china and composite products) among other features inherent to the construction such as excavations, waterproofing made of petroleum products, lack of recycling or the transport of materials t to the construction site.

Since the 1990s, there have two main international rating systems in sustainable construction and green buildings:

- *BREEAM*: Building Research Establishment Environmental Assessment Methodology.
- *LEED*: Leadership In Energy And Environmental Design.

Both rating systems are certifications. They assess what has been built and rate it according to health, efficiency, cost-saving and environmentally-friendly scales.

However, these methods are not regulations or building laws. A developer or organisation may get involve in these rating systems voluntarily to make their projects worth more environmentally speaking. They do not bind constructions to comply with certain rules in sustainability, so there is a lack of worthy international laws that set up the standards to develop sustainable buildings.

Responsibility in this matter relies on national and specially regional and local governments. For example, since 2010 and as part of its strategy to become a carbon neutral city by 2025, Copenhagen became the first European city to pass a law that require to install green roofs in all new buildings with roof slopes of less than 30 degrees. This is a way of fostering sustainability standards in

construction as vegetated roofs may absorb as much as 80% of rainfall (reducing stress on storm-water systems), reduce urban temperatures (avoiding the “heat island effect” in cities) and protect roof membranes from the sun’s UV rays, so their life is extended in comparison with an unprotected membrane.⁷³

These policies are welcome in a sector that has too much to cover yet, although if it is not pursued in an international framework, sustainability will never reach construction. GHG emissions are produced in a certain region or country, but they are released to the atmosphere, that is common for the entire world.

Therefore, what is or what should be the sustainable construction?

Sustainable construction is that which seek to:

- Use, as much as possible, local or regional materials instead of demanding products from far places that involve international transport.
- Use long-lasting building materials.
- Replace the use of high-pollutant materials such as steel or cement for structures with more friendly ones such as wood.
- Reduce, reuse and recycle materials in order to decrease the amount of waste generated.
- Foster innovation so that new composite materials complement the traditional ones.
- Find new materials that replace oil-based products such as waterproofing or PVC windows.
- Become more industrial so buildings’ components may be assemble in a certain place and then move to the construction site in order to promote competition and modernization of the sector. More emphasis would be placed on the design of the construction process and on the “how to make

⁷³ KROGSGAARD, Peter. Case: Green roofs in Copenhagen. State of Green. 2021. [Online] Available from: <https://stateofgreen.com/en/partners/city-of-copenhagen/solutions/green-roofs-in-copenhagen/>

it” instead of entrust all the assembling to the construction site workers. At the same time, this will bring the modernisation of the construction workforce, as more graduated employees with specific and technical knowledge will be required in that industrial and design process.

- Develop zero-energy buildings (through geothermal power, solar and photovoltaic panels, windmills and tidal power) that even produce an excess of energy which could be transfer to the public net.

- Be neutral carbon since the design phase until the end of the construction. The construction process should not emit more GHG than the atmosphere is able to absorb.

- Reduce the use of water.

- Guarantee a fair transition so that these changes do not leave any employee behind. Investment in training and education should be assure.

5.3- The value of the sustainable construction in the European Green Deal and the circular economy.

Reaching this point, it must be recall the objective of the Master's Thesis, i.e. to demonstrate that the EU needs to strongly include the construction sector and the building's lifecycle in its environmental policies and climate laws, or the goal of being climate neutral by 2050 will not be achieved on time.

Throughout the Master's Final Dissertation, it has constantly been stated that the prime target of the European Green Deal and the circular economy has been to reduce the GHG emissions, so that it prevents the excessive concentration of them between the atmosphere and the Earth's surface, so the heat of the sunbeams that are reflected back from the Earth do not get trapped and promote the increase of global warming.

Therefore, the question should lie in how much reduction are the construction sector and the buildings lifecycle able to contribute. On the one hand, it seems highly improbable that the cement (which is widely used in the buildings sector for the concrete of structures and for mortars that assemble different elements throughout the whole construction process) would be replaced for other material with similar performance in the short-term. Here the challenge is written with capital letters, as cement is responsible for around 5% of global GHG emissions⁷⁴ (depending on the source and the formulas to calculate it) and the European industry represents around 10% of global cement production. Nevertheless, already by 2011, technological advances in European cement production were seen as a potential advantage as they could cut the energy consumption by up to 10% and CO2 emissions by 4%.⁷⁴

On the other hand, there are construction processes and techniques which hold a great margin of manoeuvre, especially in the building's lifecycle when dealing

⁷⁴ DG Environment News Alert Service. Science for environment policy. Innovative ways to reduce CO2 emissions from the cement industry. Issue 258. European Commission. 20 October 2011. [Online] Available from: https://ec.europa.eu/environment/integration/research/newsalert/pdf/258na1_en.pdf

with issues such as the energy consumption, energy efficiency and water management.

In this sense, the potential value of the construction sector and the building's lifecycle will be analysed differentiating between the following five areas and three distinct times: the design process, the construction process and the lifespan of the building.

- The *selection of essential materials* needed in construction processes (cement, steel, glass, aluminium, plasterboard, stoneware or oil-based products such as asphaltic sheets for waterproofing) during the design process and their manufacturing (production process).
- *Energy efficiency* during the design process and the building's life.
- *Energy sources* during the design process.
- *Water management* during the design process, the building's lifespan and the construction process.
- *Waste management* during the construction process.

It is not coincidence that the previous four areas are the ones analysed in Figure 15, as the construction sector and the buildings lifecycle account for 50% of all extracted materials, 40% of all energy consumed and 33% of all water consumed and waste generated.⁷⁵

These key areas of action, along with other areas with lower impact on the environment, are responsible for 40% of all GHG emissions⁷⁵, depending on the source and on the amount of activities that are included under the umbrella of the construction sector and the buildings' lifecycle. If sustainable policies are addressed to these fields, then near 40% of all GHG emissions could be eliminated. *How we design not only the buildings, but also the construction processes, may turn nearly half of the problem into nearly half of the solution.*

⁷⁵ European Commission. Circular economy. Level(s). European framework for sustainable buildings. DG Environment of the European Commission. 2021. [Online] Available from: https://ec.europa.eu/environment/topics/circular-economy/levels_en

Table 4 summarizes how much margin of improvement may provide each of these five areas of action to the reduction of GHG emissions.

Table 4 - Areas of action to reduce GHG emissions in the construction sector and the building's lifecycle

<i>Area of action</i>	<i>Responsibility of the building's lifecycle and the construction sector</i>	<i>When to decide and determine it</i>	<i>Potential contribution to reduce current GHG emissions</i>
Materials	50% of all extracted materials	During the design and the manufacturing process	High
Energy efficiency	40% of all energy consumed	During the design process and the building's life	Really high.
Energy sources	40% of all energy consumed	During the design process	Extremely high. Nearly net zero emissions.
Water management	33% of all water consumed	During the design and construction process, the building's life	Really high
Waste management	33% of all waste generated	During the construction process	Extremely high. Nearly net zero emissions.

6. CONCLUSIONS:

One may wonder, after reading the Master's Thesis, why the focus on the European Green Deal and its environmental policies. Why do not directly analyse the potential of the construction sector and the building's lifecycle in the objectives of the Paris Agreement? One could argue that if the Paris Agreement is the worldwide reference in the fight against climate change and the consequent reduction of GHG emissions, why to choose European policies which are presumably at a lower international level.

I find one answer with two interconnected reasons for choosing the impact of the sustainable construction in the European Green Deal and the EU's environmental policies. The first one deals with the *scale* and context of the construction sector. Unlike the aviation business, the maritime transport or the energy production, which all three are developed in an international context, the buildings and their construction process are at a local context, usually regulated by national laws, but mainly by local and regional standards. Therefore, the first reason is about the "playing field". Building regulations at such international scale of the 191 Parties of the Paris Agreement (the ones that have ratified it) would be presumably too ambitious and improperly targeted. Instead, at the European scope, the EU has already instruments to not only to propose policies and shape them, but also to transposing them into the Member States' national regulation framework and make them binding. That would be the second reason of the answer, i.e. the relative facility of the EU to introduce regulations and laws in the Member States, which represent nearly 500 million people and the whole community is among the five greatest GHG emitters of the world.

On the other hand, one could also wonder why giving such importance to the construction sector and the buildings' lifecycle.

First of all, the difference between the term "*construction sector*" and "*buildings' lifecycle*" should be clear in the context of this work. "*Construction*

sector” has been used to refer to the process of the building’s construction, since the first activities that are done in the construction site until the building is delivered to their developers or owners. Regarding the term “*buildings’ lifecycle*”, it has been used to refer to the building’s life, since the end of its construction until the last days of its operational lifetime. I consider important to remark that the active life of a building is usually more than a century, as structures are designed to be safe for more than 100 years at least in developed countries. This fact is relevant for the case study because it involves that how we design buildings will determine how much GHG they will emit (through demand for heating, cooling, the degree of insulation of the external cladding and facades...).

Concerning the matter at hand, i.e. the importance of the construction sector – and buildings’ lifecycle – in the reduction of global GHG emissions, it seems interesting to recall how much these sectors contribute to the global emissions. According to the Fifth Assessment Report (AR5) of the IPCC⁷⁶, the buildings are responsible for the 6.4% of the global GHG emissions (they arise from onsite energy generation and burning fuels for heat in buildings or cooking in homes, but the emissions from electricity use in buildings are not included in this 6.4%). Moreover, 25% of the global emissions come from electricity and heat production, of which 12% are again building’s indirect emissions. This involves that around 18.4% of GHG emissions come from the use of buildings. For example, how much heat or cold the buildings lose or gain, determine how much GHG we add or deduct from those previous percentages. In addition to that, there are other significant emissions associated to the construction process such as the manufacturing or production of construction materials.

⁷⁶ IPCC, 2014: Summary for Policymakers. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. [Online] Available from: <https://www.ipcc.ch/report/ar5/wg3/>

In order to summarize and use a single reference value, the Global Status Report for Buildings and Construction 2019, published by the International Energy Agency (IEA), states that the buildings and the construction sector are responsible for 36% of final energy use and 39% of energy and process-related CO₂ emissions (in 2018).⁷⁷ These figures coincide with the ones analysed in the case study, so both sectors the construction process and the buildings' life-service, represent a potential reduction of global GHG emissions of around 40%. In order to attain this ambitious goal of reducing the 40% of GHG emissions that the buildings are responsible for, there are five areas of improvement in which regulations and climate laws should focus: the selection of materials, energy-efficiency, energy use (where do the buildings take the energy from), water management and waste management.

Consequently, the conclusion that I draw from this Master's Final Dissertation is that the European Union has the instruments and the institutional framework to develop binding environmental policies that promote sustainable construction, so the current global 40% greenhouse gas emissions associated to the construction sector and the buildings' lifecycle are reduced and this will consequently facilitate the attainment of the goals set by the European Green Deal and the circular economy.

⁷⁷ Global Alliance for Buildings and Construction, International Energy Agency and the United Nations Environment Programme (2019): 2019 global status report for buildings and construction: Towards a zero-emission, efficient and resilient buildings and construction sector. [Online] Available from: <https://www.iea.org/reports/global-status-report-for-buildings-and-construction-2019>

7. LIST OF ABBREVIATIONS AND ACRONYMS.

ACE	EU ACTIONS OR THE ENVIRONMENT
ACNAT	ACTIONS BY THE EU FOR NATURE
AR5	ASSESSMENT REPORT FIVE
BREEAM	BUILDING RESEARCH ESTABLISHMENT ENVIRONMENTAL ASSESSMENT METHODOLOGY
C3S	THE COPERNICUS CLIMATE CHANGE SERVICE
CMA	COP SERVING AS THE MEETING TO THE PARIS AGREEMENT
CMP	COP SERVING AS THE MEETING TO THE KYOTO PROTOCOL
CO2	CARBON DIOXIDE
COP	CONFERENCE OF THE PARTIES
CPLC	CARBON PRICING LEADERSHIP COALITION
CSD	COMMISSION ON SUSTAINABLE DEVELOPMENT
DG ENV	DIRECTORATE GENERAL FOR ENVIRONMENT
EAP	ENVIRONMENT ACTION PROGRAMME
ECTS	EUROPEAN CREDIT TRANSFER & ACCUMULATION SYSTEM
ECMWF	EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS
EEA	EUROPEAN ENVIRONMENT AGENCY
EEB	EUROPEAN ENVIRONMENTAL BOARD
EGD	EUROPEAN GREEN DEAL
ETF	ENHANCED TRANSPARENCY FRAMEWORK
ETS	EMISSIONS TRADING SYSTEM

EU	EUROPEAN UNION
FAO	FOOD AND AGRICULTURE ORGANISATION OF THE UN
FWCC	FIRST WORLD CLIMATE CONFERENCE (WCC-1)
IAEG	INTER-AGENCY AND EXPERT GROUP
IEA	INTERNATIONAL ENERGY AGENCY
ICSU	INTERNATIONAL COUNCIL FOR SCIENCE
IUCN	INTERNATIONAL UNION FOR CONSERVATION OF NATURE
GARP	GLOBAL ATMOSPHERIC RESEARCH PROGRAMME
GCOS	GLOBAL CLIMATE OBSERVING SYSTEM
GHG	GREENHOUSE GASES
GlobalABC	GLOBAL ALLIANCE FOR BUILDINGS AND CONSTRUCTION
HLPF	HIGH LEVEL POLITICAL FORUM
IETA	INTERNATIONAL EMISSIONS TRADING ASSOCIATION
LEED	LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN
LT-LEDS	LONG-TERM GHG EMISSIONS DEVELOPMENT STRATEGIES
MFD	MASTER'S FINAL DISSERTATION
MFF	MULTIANNUAL FINANCIAL FRAMEWORK
NASA	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
NCFF	NATURAL CAPITAL FINANCING FACILITY
NDCs	NATIONALLY DETERMINED CONTRIBUTIONS
NGO	NON-GOVERNMENTAL ORGANISATION
NZEB	NEAR ZERO ENERGY BUILDING
ODS	OZONE DEPLETING SUBSTANCES

OECD	ORGANISATION OF ECONOMIC COOPERATION & DEVELOPMENT
PF4EE	PRIVATE FINANCE FOR ENERGY EFFICIENCY
PPM	PARTS PER MILLION
SDC	SUSTAINABLE DEVELOPMENT COMMISSION
SDGs	SUSTAINABLE DEVELOPMENT GOALS
SFD	SOIL FRAMEWORK DIRECTIVE
UN	UNITED NATIONS
UNCED	UN CONFERENCE ON ENVIRONMENT AND DEVELOPMENT
UNED	UNIVERSIDAD NACIONAL DE EDUCACIÓN A DISTANCIA
UNEP	UNITED NATIONS ENVIRONMENT PROGRAMME
UNESCO	UN EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANISATION
UNFCCC	UN FRAMEWORK CONVENTION ON CLIMATE CHANGE
WCED	WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT
WCRP	WORLD CLIMATE RESEARCH PROGRAMME
WHO	WORLD HEALTH ORGANISATION
WMO	WORLD METEOROLOGICAL ORGANIZATION
WWW	WORLD WEATHER WATCH

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