



Strategic Dossiers 193 B

Climate change and its impact on defence

Spanish
Institute for
Strategic
Studies



MINISTRY OF DEFENSE



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Preface

María Dolores de Cospedal y García
Minister of Defence

In 2010, the Spanish Ministry of Defence published its Strategy Dossier 150 entitled «Security, Energy Model, and Climate Change» which it analysed the emerging interdependence between these three factors and their impact on the strategic scenario of the 21st century, which demonstrates the interest and attention with which the Armed Forces, as one of society's main servants, faces the phenomenon.

Climate change is a complex issue. The signing of the Paris Agreement and the approval of the 2030 Agenda for Sustainable Development indicate that the international community is aware of the need to invest in the planet's sustainability and the decarbonisation of the economies as the only path to ensure peace and the future of coming generations with a multi-disciplinary and unifying approach.

Cooperation between private and public organisations and the public's participation are basic tools with which to fight global warming. Consumption behaviour and energy models need to change and a commitment must be made to the environment.

This Strategy Dossier is the result of this principle of collaboration. In it the Ministry of Defence and Iberdrola aim to go one step further in research into the impact climate change may have on defence and on Spain's Armed Forces as the monitoring of its evolution and development continue from a

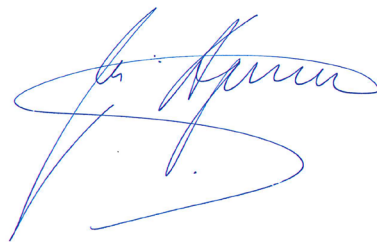
scientific perspective and European and Spanish policies are updated under the framework of international efforts in mitigation and adaptation.

The 2017 National Security Strategy lists climate change as one of the major challenges facing human kind over the coming decades. The risks associated with climate change are not only humanitarian in nature, there are also political and security risks. Climate change is a multiplier of all of these risks since it worsens existing unstable situations, especially in fragile regions where the lack of resources and weak governments can trigger conflict situations, the increased presence of radicals, and mass migration. The Sahel is a clear, highly concerning example of the negative impact of climate change for security for Spain and, by extension, for the European Union.

The consequences of climate change will undoubtedly affect the armed forces' operational requirements and their strategy.

The armed forces, as many others, generate CO₂ emissions but through their culture of permanent transformation they use their technological capabilities driving innovation to reduce their carbon footprint as they adapt their bases and facilities to environmental standards, and develop their properties as sinks to absorb as much greenhouse gas emission as possible. They also continue to bolster the possibilities of cooperation in any environment disasters or humanitarian catastrophes where they are needed.

In the concept of comprehensive security, the Ministry of Defence is aware of the challenges to security to be found in environmental deterioration, extreme weather events, depleted natural resources, and pollution. Concern for the environment in the Spanish Armed Forces is one of the challenges that the Ministry has been energetically facing for the past several years within its commitment to guarantee the defence of our interests within and beyond our borders.

A handwritten signature in blue ink, appearing to be 'M. Dolores de Cospedal', written in a cursive style.

Presentation

Ignacio S. Galán
Chairman of Iberdrola

The need to address climate change is one of the most important issues on the agenda for governments, institutions and companies around the world. The conclusions of the relevant climate summits and international forums agree that we are confronting the most complex challenge we have ever faced and the greatest global threat to human beings in the 21st century.

The time to act has come, it is time to move from words to deeds, by promoting measures that will lead us towards a truly sustainable development model. Mitigating the effects of global warming is essential if we are to avoid endangering the future of the planet and the people who live on it.

The urgency of this task is clearly reflected in the most recent reports published by the scientific community, which indicate that the highest ever emissions of carbon dioxide, the main cause of climate change, were reached in 2017.

This fact endangers life as we know it today. It results in new weather patterns that, in turn, cause migratory movements, habitat alterations and food shortages in certain areas. The consequences of this go beyond the field of the environment and affect many others, such as culture, ethics and security.

A reality that is so indisputable demands an effective response from all sectors and actors in society, both public and private.

Iberdrola and the Ministry of Defence are aware of the gravity of the problem and its severe repercussions for society. They have, therefore, decided to work hand in hand to make this publication possible. *Strategic Dossier 193. Climate change and its impact on defence* stems from a shared vision based on the spirit of service to people and the protection of the natural environment.

The six chapters of this dossier provide an educational and insightful analysis of climate change from all angles: its causes and impact, the policies put in place to mitigate it, and its repercussions for security and defence. Prestigious environmental experts explain in detail the scientific evidence for global warming, analysing the national and international implications of this challenge. In addition, members of the Armed Forces who are experts in fields such as geopolitics and strategy discuss how these areas can also play a key role in preventing and addressing their effects.

Iberdrola as a company is fully committed to providing a reliable, safe, and high quality energy supply as an essential part of sustainable social development. We first detected the need to address the problems posed by global warming nearly two decades ago. Despite significant scepticism at that time, we embarked on a hitherto unexplored path that many now recognise as the right and ideal path that has consolidated clean energy as a viable and efficient alternative to replacing fossil fuels.— This firm commitment has made us a leader in renewables and the world's leading wind power producer, which has led us to reducing our emissions by 75% since 2000, achieving levels that are 32% below the European average. But we want to do more, and that is why we have set ourselves the target of reducing them by 50% more by 2030.

That is why we are delighted to participate in this dossier, which I am certain will be of great value to its readers. I would like to thank and congratulate all the people who have collaborated in its production, with whom Iberdrola shares a concern for a better future and the aspiration to provide effective solutions to achieve it. It is a path that we must all travel together, striving to ensure that the only footprint we leave behind is our contribution to a more sustainable world.



Preamble

Patricia Espinosa

*Executive Secretary of the United Nations Framework
Convention on Climate Change (UNFCCC)*

We are witnessing the effects that climate change is having all over the world at all levels, right from that on our daily life in communities to that on companies. These effects are going to define peace, security, prosperity and even the fate of entire countries during the 21st century.

Extreme weather events are wreaking havoc on infrastructure and the livelihoods of millions of people, leaving behind multimillion dollar bills for reconstruction in both rich and poor countries, where in some cases, these disasters reverse development achievements that took years to achieve.

However, when we see the solutions that are taking shape in all corners of the world, there are reasons to be hopeful that we will be able to tackle climate change. Governments, cities, businesses and citizens are striving to align their development plans with the objectives of the Paris Agreement on climate change, the first universal agreement to set out measures against this existential threat. The Paris Agreement together with the Sustainable Development Goals (SDGs) lay the groundwork for a better future for all.

Among the efforts being made at national and global levels, there are also those of defence ministries, which not only have a key role to play in actively reducing greenhouse gas emissions from their operations and supply chains, but also in setting their sights higher with regard to climate change in other areas of government management.

We have listened to military leaders from Europe, the United States, Australia and India acknowledge that if we do not act against climate change, this problem will become a dangerous multiplier of existing threats.

We are all concerned today, and rightly so, with the growing risk of terrorist attacks on fragile states, whose capacity to forge ahead is already stretched to the limit. There are also concerns that the security of countries that are now enjoying stability will be put at risk by the consequences of climate change, such as those in southern Europe, which due to their geographical or meteorological characteristics are prone to the effects of climate change, such as droughts and more frequent and persistent heat waves.

Such concerns arise within a complex context, in which, on the one hand, we see a reduction in defence budgets in many developed countries and, on the other, an increase in the need for peace keeping operations, protecting displaced persons and launching rescue missions in countries affected by natural disasters and extreme weather events.

Climate Change and its Impact on Defence, published by the Spanish Institute for Strategic Studies, Spanish Ministry of Defence, with the support of the energy company Iberdrola, reflects the urgent need to take action to address climate change.

This work should serve to increase everyone's resolve to get back on course and achieve the Paris Agreement's objectives within reasonable periods, from a scientific and economic point of view.

Let's start with the good news. In 2015, countries demonstrated unprecedented levels of confidence and cooperation with regards to the adoption of the Paris Agreement. The agreement sets out a series of clear objectives for economies to be sustainable and resilient vis-à-vis the inevitable effects of climate change, which, after more than two centuries of industrial development based on the burning of fossil fuels, are already a reality.

The agreement also calls on countries to adopt policies and put measures in place to reduce emissions quickly enough to limit the rise in global average temperature to below 2 degrees Celsius and as close as possible to 1.5 degrees with respect to the levels of the pre-industrial era.

The agreement charges countries, in collaboration with all economic sectors and non-state actors such as cities, states, regions, companies, investors and civil society, with the task of achieving climate neutrality or a so-called zero emissions level at the beginning of the second half of the century.

To achieve this, it is necessary to start by drastically reducing emissions from 2020 to a level where they can be safely absorbed by the Earth's natural systems such as forests, soils and coastal ecosystems such as mangroves and sea grasses.

If we do nothing, the average global temperature could rise to levels that would lead, for example, to the drying up of the Amazon rainforest, one of the largest water sources in the world; to large-scale disappearances of coral reefs on which fishing and tourism depend; to the reduction of agricultural production throughout the world; or to the disappearance of islands and coastal cities all over the world.

If we act now, and over time increase the level of ambition inherent in our actions, through improving public transport and reducing poverty, we are likely to save money, stimulate economic activity with the growth of new sectors of green technologies, generate more quality employment and secure all kinds of advantages, from cleaner and healthier air to greater availability of water and food.

There are clear signs that this profound economic transformation is already underway and that in all parts of the world, people are keen for unparalleled change. After all, the Paris Agreement came into force in record time, in under one year after its adoption, and today, it has already been ratified by 175 Parties.

In addition, we are seeing how different economic and social sectors are aligning their action plans with the Paris Agreement and the contributions determined at the national level.

The announcements made during the last United Nations conference on climate change (COP23) - held in Bonn, Germany, under the presidency of the small island developing state of Fiji—confirmed this trend. These are just a few of such announcements:

- According to the scientific report prepared for COP23 by Future Earth and The Earth League, the world's capacity of installed renewable energy has been doubling approximately every 5.5 years, which anticipates the total decarbonisation of the energy sector by mid-century.
- The Norwegian Government together with the multinational Unilever and other partners announced the creation of a US \$400 million fund to promote efficient agriculture, sustainable forest management and support for small farmers.
- During COP23, the Platform for Local Communities and Indigenous Peoples was launched, a political milestone whose objective is to guarantee the full and equal participation of all peoples in climate action. The latter, on the accepted basis that when taking decisions governments are responsible for taking into consideration and respecting the rights of indigenous people when decision-making.
- During the conference, the «Ocean Pathway» strategy was presented, whose objective is to promote, before 2020, the implementation, including financing, of climate action measures that favour healthy oceans.

- A new allocation of US \$125 million was announced by the German Government for the InsuResilience initiative, which, by 2020, aims to make sure that 400 million poor and vulnerable people worldwide are kept safe from climate change effects.
- During the COP, the so-called Fiji Clearing House for the transfer of climate risks was presented. It is a new digital platform to help vulnerable countries find insurance and affordable solutions to protect themselves against climate risks.
- The governments of Germany and the United Kingdom, among other partners, announced the provision of US \$153 million for the expansion of programmes to combat climate change and deforestation in the Amazon.
- The European Investment Bank announced that it will allocate US \$75 million to a new investment programme with a total of US \$405 million for water management in Fiji. The aim is to improve the resilience of the distribution of water resources and the purification of waste water for the almost 300 000 people who live in and around Suva, the capital of Fiji.
- The conference was widely represented by the so-called America's Pledge, which brings together prominent public and private representatives committed to ensuring that the United States remains a world leader in reducing emissions and meets the climate objectives presented at the time under the Paris Agreement.
- The Green Climate Fund and the European Bank for Reconstruction and Development announced that they will allocate US \$37 million to the Saïss Project for water conservation in Morocco. In total, this project will allocate US \$243 million to adapt agriculture to the effects of climate change.
- The Powering Past Coal Alliance was another of the initiatives presented at the meeting. It is an alliance of 25 countries, states and regions to accelerate the progressive reduction in the use of coal and help communities and workers affected by this transition.
- The United Nations Development Programme (UNDP), Germany, Spain and the European Union launched a €42 million support programme to help countries implement the contributions determined at the national level and, therefore, comply with the Paris Agreement.

Besides the United Nations climate conferences, events to encourage the world's necessary transformation to successfully tackle climate change are becoming more numerous.

Thus, a few weeks after the Bonn conference, the President of France, Emmanuel Macron along with Jim Yong Kim, President of the World Bank, and António Guterres, Secretary General of the United Nations, celebrated the anniversary of the adoption of the Agreement with the «One Planet Summit».

At the summit, numerous positive announcements on climate finance were heard, which will also reinforce efforts to achieve the Sustainable Development Goals (SDGs).

Among the most important announcements related to facts coming from some of the United Nations agencies.

- The UN Environment Programme and BNP Paribas signed a historic agreement that provides a US \$10 billion fund to support small farmers in developing countries, in the area of renewable energy, forestry and access to water, among other sustainable activities that are environmentally compatible.
- The governments of Canada, Colombia, Costa Rica, Chile and Mexico, together with governors and prime ministers of the United States and Canada, committed to apply an internal price to carbon dioxide emissions when making decisions on public investment. They also encouraged private companies to follow suit by establishing internal carbon pricing systems.
- Iberdrola and eight other large European industrial companies, which issue green bonds, announced that they will double the amount of bonds issued. Iberdrola, a leader in green financing, is also one of the 14 companies which have committed to implement the recommendations of the «Task Force on Climate-related Financial Disclosures» (TCFD) over the next three years, and to join the Powering Past Coal Alliance.
- The insurance company AXA committed to multiply its green investments by four, up to €12 billion, before 2020, and promised to withdraw €3 billion in investments in high carbon footprint energy companies.
- Storebrand, the largest private pension fund in Norway, launched a US \$1.3 billion investment fund programme free of fossil fuel related securities.
- The World Bank announced that it will no longer finance gas and oil exploration and production projects after 2019, in all but the exceptional circumstances of certain very poor countries.

The good news does not stop there. There are already 205 sub-national governments that have signed or supported the *Under2 MOU* initiative, which commits them to reducing their emissions per capita to two tonnes or between 80 and 90% by 2050 with respect to 1990 levels. Included among the signatories, coming from 43 countries and 6 continents are, for example, Andalusia, the Basque Country, Catalonia and Navarre.

Together, these 205 territories have a population of more than 1.3 billion people, the equivalent of 17% of the world's population; and a Gross Domestic Product (GDP) of US \$30 trillion, which represents almost 40% of the world economy.

These announcements are only a few of the many and solid initiatives, which are looking to speed up climate action. However, they are not sufficient in themselves. Much more needs to be done to achieve the goals of the Paris Agreement.

The most recent UN Environment report estimates that, even if all the national climate action plans presented by the countries under the Paris Agreement are implemented, we will continue to fall short, since we will only move forward one third of the way necessary to reach the objective of limiting global warming to far below 2 degrees Celsius.

The global average temperature has already increased around 1 degree centigrade above pre-industrial levels and the World Meteorological Organisation has confirmed that 2017, together with 2016 and 2015 were the three warmest years for which data are available.

Governments must, as soon as possible, raise their level of ambition with regard to national climate action plans, so that global emissions reach their ceiling in 2020 and begin to rapidly decline.

The key to such a raise in the level of ambition is the Paris Agreement's implementation and, immediately there after, defining its rules and those relating to its operation. The agreement needs an operational manual that explains how countries should report on their emissions, their climate actions and that should define what other information is necessary, from climate finance to support for the development of capabilities in developing countries.

This transparent framework, which should be fully in place by 2018, will assure all countries that what they have committed to is being achieved.

Climate financing is increasing, but it must do so more quickly. By 2020, funding of US \$100 billion must be reached to support developing countries.

Rapid changes are also necessary to focus global financial architecture towards new paradigms of wealth generation, which truly reward low-carbon emitting investments.

We live in a very rich world. It is estimated that banks, pension funds, sovereign wealth funds and accounts belonging to large companies manage assets worth US \$300 billion.

However, to date, only 1% of this money is dedicated to low carbon investments despite the existence of great opportunities to invest in sustainable development.

The Organisation for Economic Cooperation and Development (OECD) recently published a report *Investing in Climate, Investing in Growth*, which argues that uniting the growth and climate agendas could increase the wealth of G20 countries by an average of 1% before 2021, and up to 2.8% by 2050.

If we take into account the economic benefits of reducing the effects of climate change such as coastal flooding or damage caused by storms, the net increase in world GDP in 2050 would be close to 5%. The report highlights the particular importance of investing in sustainable infrastructure.

To limit the rise in average global temperature to far below 2 degrees Celsius, and as close to 1.5 degrees as possible, consistent with the Paris Agreement's temperature goal, it will be necessary to invest close to US \$7 trillion per year from now until 2030.

That sounds like a lot of money, however, the study points out that this amount is only 10% higher than that currently invested in infrastructure with a large carbon footprint. The report also emphasises that investing in favour of the climate, besides saving the planet, would save money, since increasing energy efficiency would each year save about US \$1.7 trillion in fuel worldwide.

The report makes a series of recommendations regarding the integration of the Paris Agreement's objectives and ambitions into national economic policies. This includes, for example, strengthening policies for mitigating climate change, through, for example, charging for carbon emissions, reforming fossil fuel subsidies, smart regulation and using public procurement as a tool to promote a low-carbon economy.

The report also underlines the role of private sector investments and the importance of supporting local administrations, businesses and workers in order to achieve a just transition.

Not only is it necessary to invest in a climate compatible way in material infrastructures such as energy, construction or transport, but it is also necessary to more intelligently manage the world's intangible infrastructure, including forests and the agricultural sector.

There is also good news regarding this aspect. According to the CDP, more and more companies are supporting the Paris Agreement's objectives, committing themselves to reduce deforestation arising from their raw material supply chains.

Among these companies is Arcos Dorados, the Latin American McDonald's franchise; the Swiss fragrances and flavours firm Firmenich; the Brazilian meat company JBS; the American health care products manufacturer Johnson & Johnson; Brazilian paper producer Klabin; and the Canadian restaurant group Restaurant Brands International.

Forests play a fundamental role in the face of climate change, since deforestation is responsible for between 10 and 15% of global greenhouse gas emissions, as well as causing the loss of natural habitats and an increase in social conflicts.

All this shows that global financial architecture must be reformed so that markets take into account long-term wealth, and not profit that is risky and short-term.

In this sense, there are also positive signs. According to a report by UN Environment, there are now 217 measures taken by finance ministries, central banks and regulatory bodies to promote sustainable finance in almost 60 countries.

One measure in this line is, for example, China's announcement to evaluate the climatic risks of its investments, increase financing for clean energies and move towards a more sustainable financial system. China also plans to launch the world's largest emissions trading market, with the aim of reducing its emissions and moving towards sustainable development.

It is clear that the global financial system must continue to evolve taking into account the environmental risks of investments and overcome short-termism. To urgently achieve this, it is necessary for different actors to implement mutually reinforcing policies and regulations that support the Paris Agreement.

If we do the right thing, private capital will respond and set the billions needed for global transformation in motion.

We have before us a panorama of great risks, but also one of enormous opportunities, and they all have the same common denominator: urgency. The world will only respond to the challenge of climate change, if it acts quickly and in a concerted manner. Governments must cooperate with each other, but also within their own administrations, ministries must share objectives and action plans.

The armed forces are responsible for maintaining security vis-à-vis any type of risk, among which climate change is increasingly visible. Defence ministries have the capacity and responsibility to act in favour of the climate both from defence command centres and from government cabinets.

Building a prosperous and secure world, which opens a new developmental path will require thought and collective action at all levels of society.

As António Guterres, Secretary General of the United Nations said: «We need more ambition; climate change is moving faster than us, and we cannot afford to lose this war.»

If we all act together, we can win the battle for the good of present and future generations.

Video resume



Introduction

Climate change and its impact on defence

José Francisco Pérez-Ojeda y Pérez

Laudato si', mi' Signore – «Praise you, my Lord», sang St Francis of Assisi. In that beautiful song he reminded us that our common home is also like a sister with whom we share our existence, and like a beautiful mother who welcomes us in her arms: «Praised be you, my Lord, for our sister Mother Earth, who sustains us, and governs and produces diverse fruits with colourful flowers and grass» (Encyclical Letter «Laudato Sí» by the Holy Father Francisco).

«I sent my ships to fight against men, not against storms.» (Attributed to Felipe II).

The consideration of climate change as enhancing risk forces the Ministry of Defence in its strategic analyses to keep in mind the evolution of this phenomenon and its consequences. This is why the Spanish Institute of Strategic Studies (IEEE) has devoted a book to the Armed Forces and Climate Change.

This book is structured on the basis of a scientific analysis that highlights the unquestionable reality of climate change, the current situation and the foreseeable and undesirable effects that will inevitably occur if the appropriate measures are not taken.

These measures must necessarily be based on international agreements adopted on the basis of studies prepared by the Intergovernmental Panel on Climate Change (IPCC) and international agreements between a large majority of countries in the world and among which the EU and its members

have transferred the agreed measures regarding greenhouse gas (GHG) emissions, penetration of renewables and energy efficiency to regulatory commitments.

These are being transposed to the corresponding national legislation under the direction of the Ministry of Agriculture, Fisheries, Food and Environment (MAPAMA) and in such a way that the successive updates of the regulatory framework place Spain at the forefront of the fight against climate change.

If the measures to mitigate the consequences of climate change are not adopted, they may be dramatic for society: migrations, scarcity of resources, floods, spread of diseases, etc. In this scenario, it is clear that climate change is a risk enhancer.

In Spain, its Armed Forces as a national organisation, both for its staff and resources and for its social leadership, must be a reference in the fight against climate change and in the preparation and adaptation to face its effects. This will require a transformation effort that must result in a strategy and an application of the necessary measures and the corresponding plans.

The implications of the possible consequences of climate change for the armed forces make it necessary to address this issue from two different approaches: preparation on the one hand and mitigation and adaptation on the other. Preparation to have the capacity to act and help in the face of disasters or threats caused by climate change and, therefore, adequate training and resources, and on the other hand, to ensure that the impact of their own operation on the environment as regards emissions, carbon footprint, etc. be the smallest possible and always compatible with the mission.

In this sense, the armed forces must prepare to face the consequences of climate change. As guarantors of security, they may have to face conflicts of a multiple nature: mass immigrations, natural catastrophes, social disorders, humanitarian catastrophes. On the other hand, the conditions in which these events could occur necessarily require a preparation and training that allows for action under extreme weather conditions, which will involve adapting armament and materials capable of withstanding and maintaining its effectiveness in these conditions.

In writing the different chapters of this book, the IEEE assembled a group of experts who give a coherent view of those aspects that can serve the Ministry of Defence as a guide: to continue and strengthen its efforts to reduce the carbon footprint by reducing its emissions of CO₂ and other greenhouse gases; to increase, as far as possible, its absorption capacities through natural sinks that constitute the plant masses of its manoeuvre fields, and; to adapt and prepare (resilience) for events, which are widely discussed here and which presumably will occur as a consequence of climate change.

Military history is full of situations where extreme climatic conditions changed the power relations of combat between two opponents. As happened, for

instance, with the destruction of the Spanish Armada by a storm at the end of the 16th century, or as happened several times with the successive land incursions in Russia. More recently, in both Persian Gulf Wars (1991 and 2003), large sandstorms immobilised both air and land combat material for several days.

With regard to the English Navy and the decisive influence that the weather had on the disastrous fate of the great Armada, how was it that a storm of such proportions occurred in that place in the middle of August, totally out of season for such weather events? Today we know that a major new event was taking place in Europe, a climate change that scientists have dubbed the «little ice age». The storm that hit the North Sea in August 1588 and destroyed the Spanish navy had its origin in the Caribbean, where a tropical hurricane produced a major cyclonic depression in the Azores area. Three days after leaving the coasts of Florida, the same western gale blew furiously around the Irish coasts, hitting the Spanish ships and causing most to be wrecked. Something absolutely unexpected and completely unpredictable, which shows the decisive influence that weather has had on some important historical events.¹

Scientific approach

The important thing is no longer the occurrence of adverse weather phenomena, since as the examples show, they have always been there, but the fact that the frequency and intensity will probably, in the near future, be much greater, turning them from something isolated into habitual phenomena.

The exacerbation of extreme weather conditions, prolonged droughts, flooding of large areas, rising sea levels, the retreat of glaciers and increase in endemic diseases are possible consequences in the coming decades².

According to the 5th report (AR5) of the IPCC, global warming is unequivocal and establishes the clear human influence on the climate system. As explained in the first chapter of this book by the Professors of the Comillas University, Mr. Pedro Linares and Mr. Iñigo Losada, climate change is a phenomenon of known causes and predictable consequences.

At least for the «principle of prudence» and given the seriousness of the effects of climate change for humanity and the planet, society in all of its areas and levels must take the necessary measures to minimise them as far as possible.

¹ QUESADA RETTSCHLAG, Fernando R «The Great Armada and Climate Change».

² PISSOLITO, Coronel Carlos. Blue Helmets Association. «The Consequences of Climate Change for Defence».

EU policy

The global scientific consensus gathered by the IPCC has determined that to avoid the most negative effects of climate change, the average temperature of the Earth should not increase by more than 2°C (many scientists believe that this limit should even be below 1.5°C), which is coupled with certain ranges of reduction of greenhouse gas emissions to achieve it.³

This political commitment of the European Council gave rise to legislative measures proposed by the Commission and which should come into force before 2020. These are those that will largely replace the legislative framework currently in force.

The impact and future risks of climate change must be rigorously analysed in order to predict how it will affect humanity in different areas of the globe, particularly Europe and specifically Spain, so that with this knowledge base agreements of the United Nations can be adopted as well as European laws, and be transposed to Spain and therefore to its armed forces.

The European Union's commitment to the fight against climate change on a global scale is embodied in the internal policies and standards that are among the most ambitious in the world, despite the fact that in terms of emissions the Union is quantitatively reducing greenhouse gas emissions and its contribution to global emissions.

In the second chapter, the adviser-coordinator of the Environment of the Permanent Representation of Spain in the EU, Mr. Miguel Castroviejo Bolibar, brings us closer to the EU policy on climate change, the objectives and the main legislative instruments aimed mainly at reducing greenhouse gas emissions and achieving energy efficiency.

Response of Spain

Last July, the National Security Council approved the Energy Security Strategy, which devotes special attention to issues related to supply and economic and environmental sustainability. If the navigability of the Arctic increases, the situation of relations between energy emitting and receiving countries will almost certainly be altered. For Spain, in particular, the supply of oil and natural gas has a risk component due to the possible instability of the producer regions.

At the same time, Spain is firmly committed within the EU to promote economic competitiveness and energy security, greater awareness of this problem and a greater commitment internationally towards renewable energy and sustainable growth.

³ <http://www.ipcc.ch/pdf/assessmet-report/art4/syr/ar4syrrsp.pdf>.

Environmental deterioration must be stopped and decisively reversed. To do this, we are adapting to the new demands to fight against climate change. The Spanish Office of Climate Change of the Ministry of Agriculture, Food and Environment has launched new initiatives to generate low-carbon economic activity and create sustainable employment (Plans to Promote the Environment, Climate Projects, the Carbon Footprint Registry, etc.). A new Law on Climate Change and Energy Transition is being prepared in which these initiatives will be established.

Ms. Valvanera Ulargui, General Manager of the Spanish Office of Climate Change of the MAPAMA, in the third chapter of this book introduces the official position of Spain in terms of regulations and actions to promote attitudes that align the policies on Spain's struggle against climate change and its effects.

Climate change and security

For many years, climate change has ceased to be a strictly environmental problem and has become one in economic, social and security terms. Some authors even raise it to a higher level to treat it as an ethical problem⁴ and contextualised in a crisis of the human condition that is experienced today. For this reason, they suggest that it is necessary to broaden the study and extend the impact of climate change to other disciplines such as social sciences and humanities to address its social, cultural, historical and ethical dimensions.

In 2011, Solomon Hsiang, then a professor at Princeton University (USA) and now of the Goldman School of Public Policy at the University of California in Berkeley (USA), was the co-author of a work that showed that the number of cases of civil war doubled in the tropics during the moments when «El Niño» produced unusually high temperatures in these latitudes. This work was the first to show that a global climate effect could be directly related to conflicts. Increasing temperatures and changes in rainfall patterns increase the risk of conflicts⁵.

The US Defence Department distinguishes between adaptation efforts, those aimed at anticipating expected changes, and mitigation efforts, that is, those aimed at reducing greenhouse gas emissions. At the heart of this is the consideration, expressed in the «Quadrennial Defence Review 2014», that climate change can increase the frequency, scale and complexity of future missions, including those related to supporting civil authorities, while at the same time it can diminish the efficiency of the military units' training tasks. An increase in the demand

⁴ HOLM, P.; TRAVIS, C. «The New Human Condition and Climate Change: Humanities and Social Science Perceptions of Threat». *Global and Planetary Change*, 156/2017, pp. 112-114.

⁵ «Wars: the hidden effect of climate change». *MIT Technology Review*.

for support operations for civil authorities is expected, as well as humanitarian support and assistance in cases of natural disasters.

Furthermore, the need to increase land, sea and air capabilities in the Arctic region will be accentuated by the appearance of limitations in the traditional environments of military operations. In general, there will be an increase in instability in certain countries and geographical areas, with its potential consequences in terms of the planning, availability and projection of forces.

Another effect also widely documented is the increase in adverse weather events on coastal areas. These can cause mass displacements of the population, especially where it is most concentrated on coastal areas (like in the Maghreb, for instance) and increase humanitarian crises due to adverse weather events.

The emergence of armed conflicts is not directly related to natural disasters caused by climate change. However, its consequences, such as droughts, rising sea levels, rising temperatures or the more frequent appearance of adverse weather events have the potential to heighten social tension by fostering the emergence of conflicts in regions that are prone to destabilisation⁶.

Climate change is a great risk to national security. US President Barack Obama was emphatic that it «represents a threat to the preparation of the forces» and that «it will shape the way in which infrastructures are planned, operated, equipped and protected, today and in the long term».

The consequences of climate change will undoubtedly affect both the operational requirements of the armed forces and their strategic orientation. In the former, in addition to the obvious consequences related to the adaptation of planning processes and acquisition of weapons and material, it is worth noting the need to reduce dependence on fossil fuels. It is not only about reducing the emission of polluting gases, undoubtedly an important achievement in itself, but also about avoiding the vulnerability that this dependence means in an operational environment where supply might not be guaranteed.

On the other hand, and continuing with the operational requirements, a growing political and social pressure is to be expected that the armed forces strictly comply with the environmental demands in any situation, whether at the national level or in the area of operations. This will give rise to the need to adopt ever stricter regulations and could result in changes in the classical conduct of military operations.

Finally, the need to face possible crises stemming from the phenomenon of climate change may require the establishment of mechanisms for coordination and even integration of capacities, bilaterally and multilaterally, with countries in the regional surroundings that share similar environmental

⁶ Ministry of Defence Intervention in Morocco. September 2016.

risks. It is therefore necessary to maintain continuous dialogue at the bilateral and multilateral level that avoids frictions between the States in competition for maritime spaces or for their resources. The 5 + 5 Defence initiative (informal forum of dialogue of the countries of the western Mediterranean basin) is ideally situated for this purpose.

In the fourth chapter Ms. María del Mar Hidalgo of the IEEE analyses the binomial Climate Change - Security in detail.

Climate change and Armed Forces. Their transformation

In a similar line, NATO distinguishes between efforts aimed at reducing the environmental effects of military activities (*Environmental Protection*) and the need to respond to security challenges from that environment (*Environmental Security*). In the former, the underlying argument is that environmental degradation can be a source of economic and social instability and cause new tensions, while its preservation can provide lasting stability and security. Therefore, to achieve success in the mission it is considered necessary to reduce environmental damage during military operations as far as possible. On the other hand, regarding *Environmental Security* it is considered necessary to highlight:

- The need for international cooperation and information sharing.
- The probable increase in missions related to the protection of critical infrastructures.
- The need to achieve energy efficiency in operations (*Smart Energy*).
- And above all, the growing tendency to regard the armed forces as guarantors of an immediate response (*first responder*) to natural disasters.

At the international level, the recent International Conference of Ministers and Senior Officials of Defence «The Implications of Climate Change for Defence», held in Paris in 2015, prior to COP 21, also produced similar conclusions⁷. In particular, the French Defence Minister in his closing speech pointed out the importance of the defence institutions preserving the environment (*Green Defence*), although he also stressed the imperative need to carry out an analysis of the risks resulting from climate change and their possible impact on anticipation, protection, prevention and intervention functions. Other speakers had previously emphasized aspects such as the need to increase the resilience of the units, as well as to adapt weapons and equipment to foreseeable extreme conditions, the convenience of reducing dependence on fossil fuels and, in general, the tendency towards a greater future demand in terms of natural disaster assistance missions, taking advantage of the

⁷ The Conference received the participation of the Secretary General of Spanish Defence Policy as a speaker.

rapid response capacity of the armed forces in this field, in which they have a critical comparative advantage over other institutions⁸.

For the armed forces to maintain their capacity to respond to the new (and very diverse) threats presented to them, it is necessary to establish a process of constant transformation, which not only provides solutions to the present situation, but also grants the organisation the necessary flexibility to also adapt to new changes that the future will surely bring.

The geopolitical impact of climate change establishes new challenges to the continuous process of transformation of the Armed Forces in all its areas⁹. The changes that are currently noticed will continue and will intensify over time to a degree that will depend on the success of the mitigation policies in progress.

Other aspects related to the high temperatures of both the air and the sea will in the future have a greater influence on the operation of personnel, platforms and weapons systems and, of course, their future designs. «The change in weather conditions and the increase in extreme weather events, including high and low temperatures, drought and floods... have a significant impact on operations. These circumstances include an increased risk to life and safety, injuries and a degrading effect on mission performance... Numerous military studies cite weather conditions as one of the main factors in the battle, with examples from the Revolutionary War to the Operation Desert Storm»¹⁰.

The increasing frequency and severity of disasters caused by these phenomena is driving society to demand the intervention of the State, which has, in its Armed Forces, a very valuable instrument for their availability, autonomous capabilities, and ease of projection, but will have to be transformed as events evolve.

In terms of strategic orientation, the risks resulting from climate change will probably alter the potential missions of the armed forces towards those related to humanitarian support and assistance in natural disasters. This will imply the need to introduce the use of capacities that up to now have been considered civilian ever more in defence planning. This is something that has been done for some years now, either through coordination mechanisms at a strategic level or through the creation of specialised military units such as the Spanish Military Emergency Unit (UME).

⁸ Ministry of Defence Intervention in Morocco. September 2016.

⁹ NATO uses the acronym DOTMLPFI: *doctrine, organisation, training material, leadership, personnel, facilities and interoperability*; while Spain uses MIRADO: *material, infraestructura, recursos humanos, adiestramiento, doctrina and organización*.

¹⁰ WEATHERLY, J. V.; HILL, D. R. *The impact of climate and extreme weather events on military operations*, U.S. Army Engineering Research and Development Centre, New Hampshire, December 2004, p. 1.

In the specific case of the armed forces, the lines of action to be followed should be: to ensure their preparedness to intervene in the increasingly frequent cases of humanitarian emergencies on the coast and to incorporate the necessary requirements into their design and action to limit their environmental and climate footprint as far as possible.

The training of forces in extreme heat and cold, as well as the assistance of specialised military units for psychological support to victims, is another area that must receive greater attention within the specific military training of their units.

In short, a comprehensive and permanent transformation of the military institution in all its areas, from doctrine to interoperability, becomes more necessary than ever, as well as a new energy and environmental culture.

The Ship Captain. Mr. Ignacio García Sanchez, Deputy Director of the Spanish Institute for Strategic Studies, in the fifth chapter analyses the need to transform the armed forces and their necessary adaptation capacity to face the challenges that the phenomenon of climate change may pose.

Climate change and Spanish Armed Forces

The Spanish Armed Forces should, as far as possible, do their daily preparation and training while respecting the environment, limiting GHG needs as far as possible, thus reducing the consumption of fossil fuels to a minimum and stressing the use of renewable energies.

In this sense, the Ministry of Defence has taken important steps, first with the publication of the Ministerial Directive, which bases the Ministry's environmental policy on the principle of sustainable development compatible with the function of the armed forces, developed by the Directive of the Secretary of State of Defence in which the principles and objectives are established, as well as the actions to be taken, establishing the implementation of Environmental Management Systems in all the units as a fundamental tool.

In terms of the natural environment, the most relevant actions are directed in the first place to the prevention and extinguishing of forest fires in the training fields, for which standards of use have been established to make the protection of fauna and flora compatible and to avoid fire risks.

Technical plans for the prevention of forest fires are prepared for the fire protection of the training fields, which are approved by the Ministry of Agriculture and Fisheries, Food and Environment, and to improve the conservation status of the different forest masses, collaboration agreements have been established with MAPAMA (Green Agreement). The management of the forest masses on the military training fields has made it possible to partially offset the CO₂ emissions from the activities of the armed forces,

having calculated in a study that 26,635 ha of the wooded mass in the training fields absorb 132,000 tons of CO₂ a year, and work has begun on calculating the carbon footprint produced by the activities of the armed forces.

In terms of environmental quality and to tackle atmospheric pollution, measures are being taken to mitigate the increase in emissions that affect the ozone layer (Montreal Convention) and the greenhouse effect (Kyoto Protocol), fostering the use of clean fuels. Against soil contamination, in addition to promoting the proper management of waste, and the sealing and restoration of uncontrolled landfills, fuel and flammable liquid installations are being adapted to the regulations.

To do all this, it is essential to have qualified staff, for whom a training and awareness-raising programme was prepared, which has been in operation since 2004.

The fundamental tool of the Ministry of Defence to achieve these objectives is the establishment of Environmental Management Systems in accordance with the ISO-14.001 standard, which allow the environmental behaviour of bases, barracks and military establishments to be evaluated. The Spanish Ministry of Defence has the most installations with environmental certification of the European Union.

It is essential to know and cooperate for the fight against climate change. In this sense and at the international level, as already mentioned, representatives of the Department participate in the DEFNET Group (informal forum formed by experts from the Ministries of Defence of the EU countries to coordinate positions between military interests and the environment).

In 2015, Spain participated in the meetings of the Ministries of Defence preparing for the twenty-first meeting of the Climate Change Convention (COP 21). And in 2016, in the COP 22 preparatory meeting, also held in Marrakesh (Morocco) and which was attended by the Minister of Defence.

The Ministry of Defence participates in the meetings of the Consultative Forum for Sustainable Energy in the Defence and Security sector, organised by the European Defence Agency (EDA). This Forum examines the practical elements of EU energy legislation and their possible application by the armed forces of Europe.

At the national level, the Ministry of Defence is present on the National Climate Council, an organisation that oversees Spanish compliance with all the commitments acquired in relation to climate change.

The Ministry of Defence, in terms of the fight against climate change, has initiated a programme conceived with an open and participatory character. Open to provide it a dynamic character and continuous updating with the evolution of the phenomenon of climate change itself. Participatory, because collaboration and participation are sought of all those entities that due to

their experience and technical or scientific specialisation can contribute values of improvement to this Ministry of Defence programme to:

- Identify the main sources and activities that generate greenhouse gas emissions.
- Obtain and communicate accurate and credible information on the amount of greenhouse gas emissions.
- Allow the planning of a programme of reduction, mitigation, adaptation and offsetting of emissions.
- Provide the necessary tools and training for the Ministry personnel to participate in the periodic measurement and reduction.
- Identify the most appropriate measures for the preparation and adaptation of the armed forces to act in the face of possible disasters related to climate change.

The armed forces should also contribute to documenting scientific studies that seek to quantify the impact of climate change on the oceans. The campaigns of the ships *Hespérides* and *Las Palmas*, and the activities of the Antarctic Bases Juan Carlos I and Gabriel de Castilla are included in this sense.

The peoples of the Mediterranean, the bridge between civilisations and cultures, today have a common challenge: to preserve the environment to guarantee the well-being of the generations that will follow us. It is a challenge to which Defence can contribute decisively if we are able to work in concordance. The 5 + 5 Defence initiative is ideally placed to implement this path of dialogue¹¹.

The Ship Captain Juan Rico Palma, biologist and former head of the Environment Department of the Ministry of Defence and Mr. Francisco Rodríguez Martín, responsible for the climate change negotiation of the Environment Department of the Ministry of Defence, describe in chapter 6 of this book the current situation of the armed forces in the fight against climate change and outline the Ministry of Defence Plan to address the future strategy to combat the effects of climate change.

Finally, citing the words of the Minister of Defence, I conclude that the armed forces work and will work convinced that their preparation and service spirit will result in the security, stability and progress of our society.¹²

¹¹ Minister of Defence intervention in Morocco. September 2016.

¹² Minister of Defence 2016. Day of the Immaculate Conception Marine Infantry Academy.

Video resume



Chapter one

Scientific approach to climate change

Pedro Linares and Íñigo Losada

Abstract

This chapter provides an overview of the state of the art of the scientific knowledge about climate change. Based on the work done by the Intergovernmental Panel on Climate Change (IPCC), it analyses the concept of climate change, its causes, attributions and evidences, as well as its consequences. This analysis is placed within a general risk framework, which is considered the best to analyse the risks that climate change poses to security, defence, and the Armed Forces.

Keywords

Climate change, IPCC, greenhouse gases.

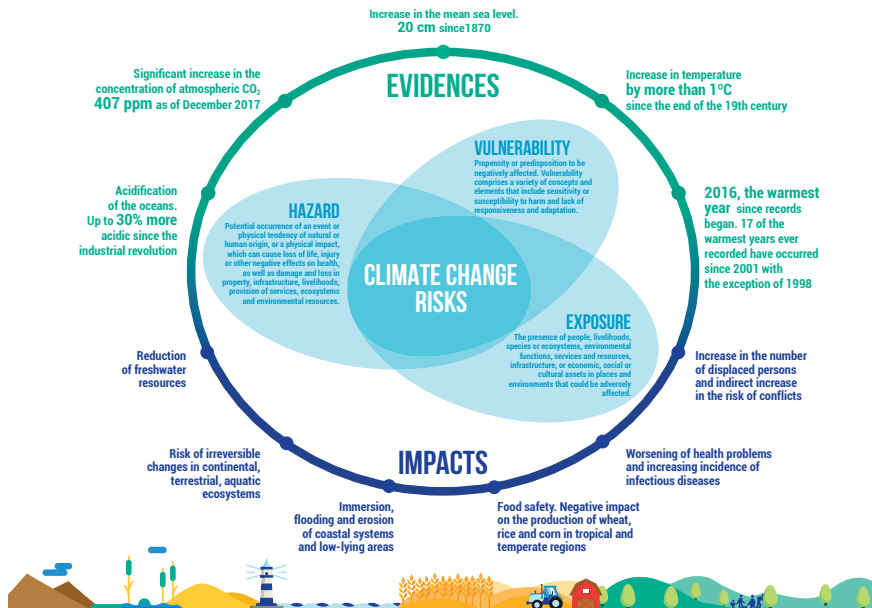
SCIENTIFIC APPROACH TO CLIMATE CHANGE



CLIMATE CHANGE DEFINITION:

Climate changes directly or indirectly attributable to human activity that alter the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.

ARTICLE 1 OF THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC) 1992



STRATEGIES FOR MITIGATION AND ADAPTATION TO CLIMATE CHANGE



IMPROVEMENT IN THE EVALUATION OF CLIMATE PHENOMENA



SUBSTANTIAL REDUCTION OF EMISSIONS IN THE COMING DECADES



IMPROVEMENT IN SAVINGS AND ENERGY EFFICIENCY



NEED FOR INTEGRATED RESPONSES THAT LINK ADAPTATION AND MITIGATION WITH OTHER SOCIAL OBJECTIVES



INTEGRATED PLANNING



DEVELOPMENT OF STANDARDS AND SPECIFIC ADAPTATION PLANS



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Introduction

This chapter summarises the scientific approach to climate change. In other words, it presents a synthesis of the knowledge that science has about climate change and its impact on natural and socio-economic systems, as a starting point to understand the relationship between climate change, security, defence and the armed forces.

Much of the information comes from the synthesis of the reports of the three working groups (WG) of the Intergovernmental Panel on Climate Change (IPCC) and correspond to the fifth cycle (AR5) prepared by said Group or Panel since its creation in the early 90s. This source is undoubtedly the most rigorous in scientific terms and has also been submitted to the scrutiny of evaluators and governments from more than 190 countries. This initial information has been accompanied by some of the recently published advances and specific information for Spain.

The IPCC is the main international body for the assessment of climate change. It was created by the United Nations Environment Programme (UNEP) and the World Meteorological Organisation (WMO) in 1988 to provide a scientific overview of the current state of knowledge about climate change and its potential environmental and socio-economic impacts.

The IPCC is a scientific body and, as such, provides comprehensive assessments of the state of scientific, technical and socio-economic knowledge on climate change, its causes, possible impacts and response strategies. But it is also an intergovernmental body, and all member countries of the United Nations and WMO can be part of it. Currently, 195 countries are members of the IPCC.

The IPCC is organised into three working groups and a special group (see figure 1). WG I addresses the physical basis of climate change; WG II, the

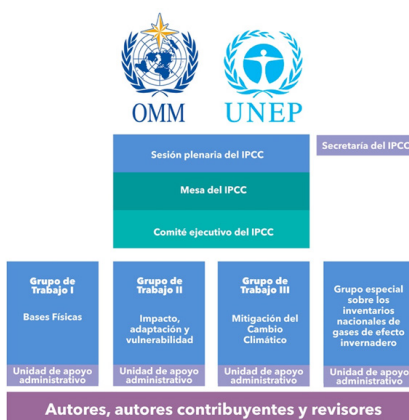


Figure 1. Structure of the IPCC.

impact of climate change and adaptation; and finally the WG addresses the mitigation of climate change. In addition, there is a special additional group dedicated to national inventories of greenhouse gases. Its objective is to formulate and refine a methodology for calculating and reporting national emissions and absorptions of greenhouse gases.

Thousands of scientists from around the world contribute to the work of the IPCC on a voluntary basis as authors, contributing authors and reviewers.

Since its inception, the IPCC has prepared five activity reports. Each new report gives the advances of science with respect to the previous report and also establishes in what areas new research is necessary. Recently, the 5th report (AR5) has been presented, which places special emphasis on the evaluation of the socio-economic aspects of climate change and its consequences for sustainable development, regional aspects, risk management and the preparation of a response through adaptation and mitigation, also showing more than 100 signs of the impacts produced by climate change. The sixth cycle (AR6) has just begun and is expected to see the light in 2020.

Brief description of the phenomenon of climate change

Climate change and its causes

Climate change refers to changes in the state of the climate that can be identified through changes in time, average values and/or variability of its properties. These changes persist typically for decades or longer periods.

Climate change can be caused by internal natural processes or by external forcing such as modulation in solar cycles or volcanic eruptions or by persistent man-induced changes in the composition of the atmosphere or in land uses. In this regard, it should be noted that the United Nations Framework Convention on Climate Change (UNFCCC) defines climate change in its article 1 as «climate changes directly or indirectly attributable to human activity that alter the composition of the global atmosphere and that are superimposed on the natural variability observable in equivalent periods of time». Therefore, UNFCCC clearly distinguishes between, on the one hand, climate change attributable to man, which includes, among others, what is commonly known as global warming and, on the other hand, climatic variability attributable to natural causes.

In this sense, according to AR5 the warming in the climate system is unequivocal, and since the 1950s many of the observed changes have been unprecedented in recent decades to millennia. The atmosphere and the ocean have warmed up, the volumes of snow and ice have decreased and the sea level has risen.

In terms of the physical explanation of the problem, there is general agreement in the scientific community that the fundamental cause of global

warming is the result of the expansion of the greenhouse effect, which is a process in which the thermal radiation emitted by the Earth is trapped in the atmosphere due to the presence of a set of gases known as greenhouse gases (GHGs). Solar radiation passes through the atmosphere and heats the Earth's surface. Part of this heat is radiated back. Much of this heat is absorbed by the GHG molecules and radiated in all directions, causing a warming of the Earth's surface and the lower part of the atmosphere. One of the characteristics of these gases is that they remain active in the atmosphere for a long time, which is why they are usually called long-stay gases. Among these gases are: water vapour, methane, nitrous oxide, carbon dioxide and chlorofluorocarbons (CFC).

Water vapour is the most abundant, highlighting its feedback with the weather. As the Earth warms, the water vapour increases and consequently the probability of cloudiness and rainfall. Carbon dioxide is a minor component of the atmosphere, but it is very important since its release into the atmosphere is the product of natural processes such as breathing or volcanic eruptions, but also the product of human activities such as deforestation, change in land uses and the combustion of fossil fuels.

Man has contributed to increasing the concentration of CO₂ in the atmosphere by more than a third since the Industrial Revolution began. This is, without a doubt, the long-stay GHG that is most contributing to climate change. Methane is a hydrocarbon that is also the result of natural processes and human activities, including the decomposition of waste in landfills, agriculture, and especially rice cultivation, as well as the digestion of ruminants and the management of manure in livestock. Nitrous oxide is also closely linked to agricultural activities, especially to the use of commercial and organic fertilisers and the combustion of fossil fuels or biomass. Finally, CFCs are synthetic compounds of industrial origin with different applications. Although they are also considered GHG, their emission is currently firmly controlled thanks to international agreements to avoid their contribution to the destruction of the ozone layer.

The latest IPCC report says that human influence on the climate system is clear, and also shows that recent anthropogenic emissions of greenhouse gases are the highest in history.

Among other conclusions, the report states that anthropogenic emissions of greenhouse gases have increased since the pre-industrial era, largely as a result of economic and demographic growth, and are now greater than ever. This has resulted in atmospheric concentrations of carbon dioxide, methane and nitrous oxide never previously recorded, at least, in the last 800,000 years. The effects of emissions, as well as other anthropogenic factors, have been detected throughout the climate system and it is highly probable that they have been the dominant cause of the warming observed since the second half of the 20th century.

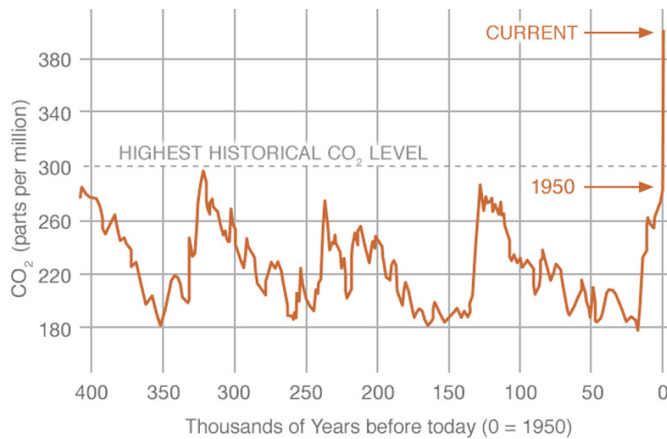
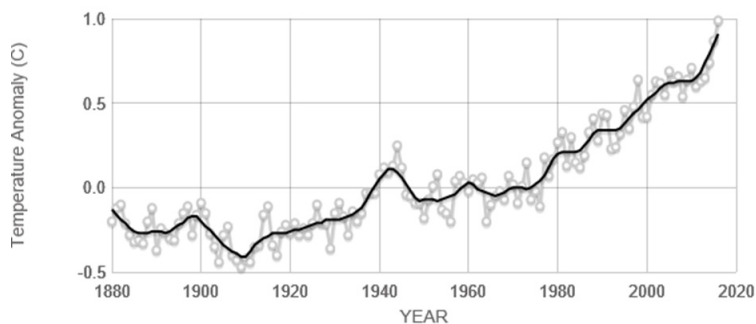


Figure 2: Source: NASA. Evolution of the concentration of CO₂ in the atmosphere in parts per million in the last 400,000 years.

Observed signs and impacts

In recent decades, climate changes have caused impacts on natural and human systems on all continents and in all oceans. The impacts are due to observed climate change, regardless of its cause, which indicates the sensitivity of natural and human systems to climate change.

One of the most important impacts observed is the increase in the global mean surface temperature. Figure 3 shows the changes in temperature with respect to the average of the base period 1951-1958. As can be seen, up to 2016, there was an increase of 0.99°C, and more than one degree since the end of the NINETEENTH century. Seventeen of the hottest years recorded in the 136 years records have been held have occurred since 2001, with the exception of 1998. 2016 was the hottest year registered so far. (Source: NASA/GISS).



Source: climate.nasa.gov

Figure 3. Source: NASA. Evolution of the temperature anomaly (difference with respect to the reference period 1951-1958) observed between 1880 and 2017.

Another indicator of climate change is the increase in the mean sea level, caused mainly by two factors linked to global warming: the increase of water in the ocean basins due to the loss of ice masses in glaciers and at the polar ice caps and the volumetric expansion of sea water due to the increase in its temperature.

Since 1993, when satellite measurements started to be taken, the mean sea level has increased by 84.8 mm (to 7/2017) at a rate of 3.4 mm/year (Source: NASA).

Figure 4 shows the reconstruction of the increase of the mean sea level from tide gauges on the coast, which allows a longer series to be obtained. As can be seen, the rise in the mean sea level since 1870 shows a certain variability, but with a clear long-term trend that has led to a rise of 20 cm from 1870 to today.

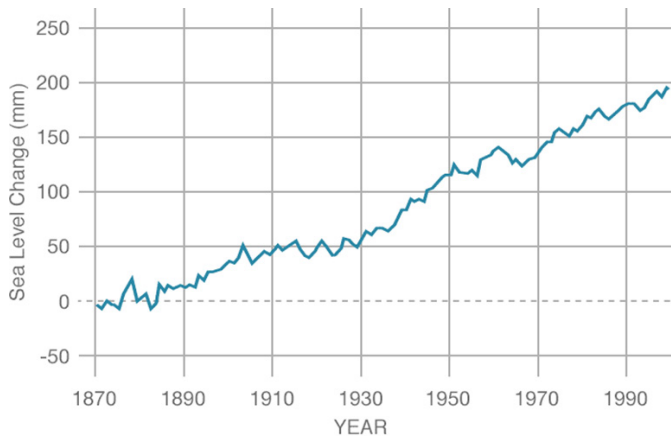


Figure 4: Source NASA/CSIRO: Evolution in mm of the average global sea level between 1870 and the present, obtained from tide gauges on the coast.

Both in the temperature and the sea level, the represented indicator is the result of a global spatial average. It is therefore necessary to consider that in different geographical areas of the world the value of the increases/decreases in temperature and sea level have reached very different values.

But climate change does not only affect average values. Since about 1950 changes have been observed in many extreme weather and climate phenomena. Some of these changes have been linked to anthropogenic influence, such as the fall in the number of extreme cold temperatures, the increase in extreme warm temperatures, the rise in maximum sea levels and the larger number of intense rainfalls in various regions.

This effect is easy to understand if, for example, we think that the displacement of the mean values of the temperature to the right or left of its statistical

distribution leads to an increase in the number of extreme events or their intensity. This therefore modifies the number and intensity of cold or heat waves in a given region.

Likewise, the total sea level on the coast, which is the sum of the mean sea level and other short-term components, is increased by the effect of the increase in the average level, resulting in an increase in the frequency of extreme flooding events.

But besides the physical variables, climate change has brought important impacts on the natural and socio-economic systems that have been observed and documented during the last decade. For example, it has been seen that in many regions changes in precipitation or loss of snow pack and ice are altering the hydrological systems, which affects water resources in terms of quantity. Likewise, there is evidence that many terrestrial, freshwater and marine species have modified their geographical distribution areas, seasonal activities, migratory patterns, abundances and interactions with other species in response to the ongoing climate change.

In addition, in this last decade impacts on the socio-economic system have been identified that have also been attributed to climate change.

Figure 5, published in the SPM of the last report of the IPCC, AR5, illustrates a substantially large number of impacts identified in recent decades that are attributable to climate change through scientific evidence supported by publications. The symbols indicate categories of impacts attributed to climate change, the relative contribution of climate change (large or small) to the observed impact and the level of confidence in attribution.

Among the impacts derived from extreme phenomena associated with the climate (for example: heat waves, droughts, floods and forest fires), there is the alteration of ecosystems, the disorganisation of food production and water supply, damage to infrastructure and settlements, morbidity and mortality, and the consequences for mental health and human well-being. The greatest warming occurs at higher latitudes than in the tropics, where the pattern of precipitation changes is very complex. Among the observed impacts, a large number are due to the combination of changes in temperature and rainfall. This is the case, for example, in Africa, where glaciers located in the east of the continent are melting, river discharge is falling in the west, and fires are increasing at Kilimanjaro, among others.

The increase in mean sea level is of particular concern in the State Islands (SIDS), where deterioration of coastal vegetation and degradation of groundwater as a cause of saline intrusion are occurring, and flooding and coastal erosion are increasing.

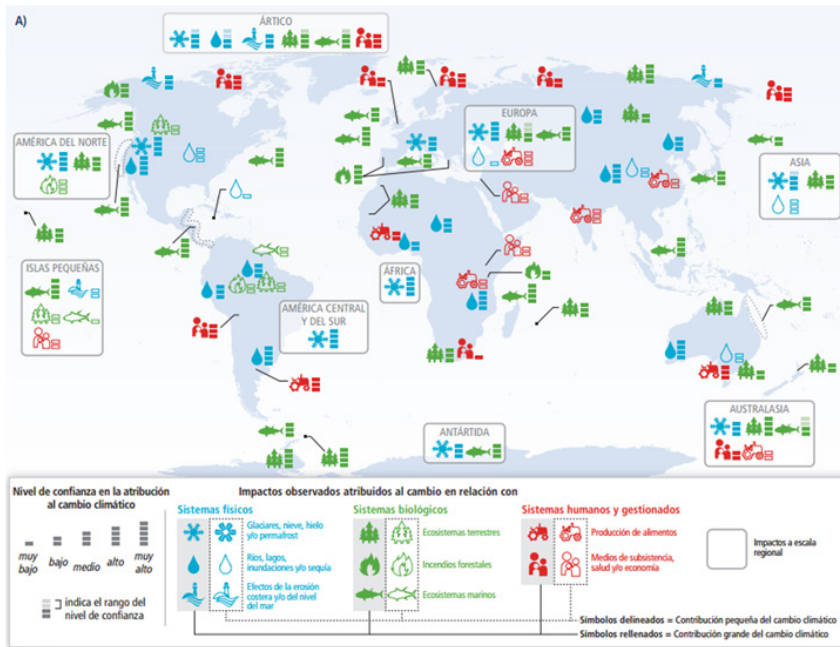


Figure 5. Global patterns of observed climate change impacts (IPCC, 2014).

Some of the impacts detected in Europe are the changes in extreme rainfalls, the alterations in the distribution of species, and the effects that warming is producing on the health and lifestyle of the population of the northern part of the continent.

Figure 5 shows a pattern of heterogeneous climate change across the entire planet as a whole. Some natural and human systems (and the regions in which they are found) are also more vulnerable to climate change than others.

Although the observed records are very heterogeneous in nature since in the countries with lower incomes report fewer impacts than the richer countries, this does not mean that they actually suffer fewer impacts. There are also fewer observations in remote areas, such as deep ocean or mountainous areas with scattered populations and deserts.

The risks of climate change

In order to understand the risks derived from climate change and its possible future evolution, a conceptual framework must be established that allows us to analyse the risk and its consequences from its components. The IPCC therefore introduced, in the AR5 and previously in the Special Report on Extreme Events (SREX), the framework described in figure 6 that

integrates the approach followed in the analysis of disaster risks with that corresponding to climate change.

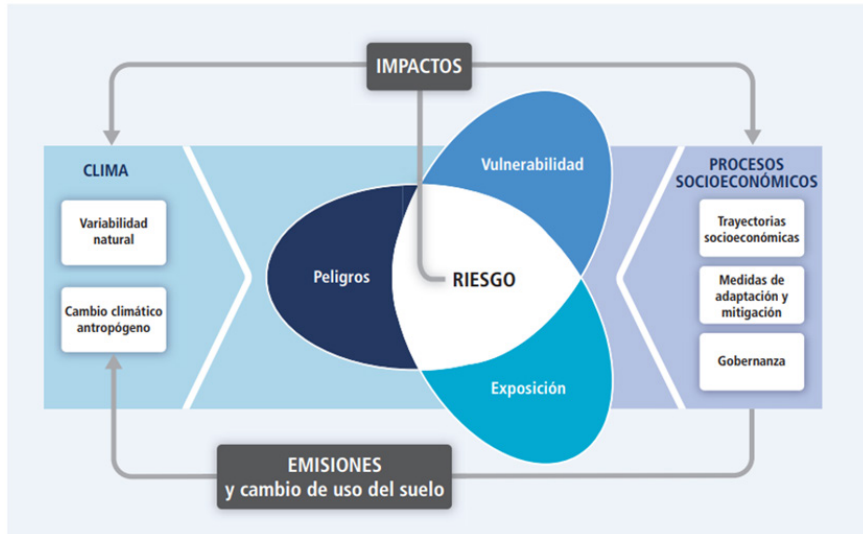


Figure 6. General framework for the analysis of risks derived from climate change (IPCC, 2014).

This scheme allows the analysis of the risks derived from climate change for multiple or individual impacts and their application in different strategic sectors such as water, energy, security, defence, infrastructures or in natural areas such as ecosystems, river basins or on the coast. Likewise, it allows the synergistic effects that climatic forcings have on the risk to be visualised together with those that occur in exposure or vulnerability. Finally, it offers the chance to identify solutions acting on each of the components of the risk individually or through joint mitigation and/or adaptation actions that reduce the risk.

Thus, for example, with flood impacts, the increase in the mean sea level represents an increase in the danger and consequently in the risk to our naval bases, since it contributes to increasing the probability of events that exceed the design limits of existing naval infrastructures. However, this risk will be even greater if the infrastructures, equipment, facilities or assets are deployed and developed in low or little protected areas or the number of assets increases (exposure increase). Also, if existing or future assets are not adequately maintained or measures are not taken to increase their resilience to flooding, there is an increase in vulnerability. Each of these effects individually produces an increased risk in the face of climate change, but their joint action increases the risk even more. In this case, while sea level rise can only be addressed through mitigation, reduction of exposure or vulnerability can be addressed through adaptation.

Also, if the operations of the armed forces are going to take place in geographical regions where an increase in average temperatures and in the frequency and intensity of the extreme events (heat waves) is projected, the reduction of the risks on our units deployed in the region can only be addressed through measures that reduce their exposure and vulnerability to extreme temperatures, since the increase in temperature can only be combated through mitigation.

Therefore, to understand the potential effects of climate change on security and defence, it is necessary to analyse in detail how each of the components of risk can evolve over time and how they can affect both assets and operations linked to these sectors.

The adequacy of placing the consequences of climate change on defence and security in the framework of risk, leads us at this point to consider it necessary to include a set of definitions that will serve to conceptualise the approach to the risks derived from climate change (adapted from IPCC, 2014).

Hazard: potential occurrence of an event or physical tendency of natural or human origin, or a physical impact, which can cause loss of life, injury or other negative effects on health, as well as damage and loss in property, infrastructure, livelihoods, provision of services, ecosystems and environmental resources.

Exposure: the presence of people, livelihoods, species or ecosystems, environmental functions, services and resources, infrastructure, or economic, social or cultural assets in places and environments that could be adversely affected.

Vulnerability: propensity or predisposition to be negatively affected. Vulnerability comprises a variety of concepts and elements that include sensitivity or susceptibility to harm and lack of responsiveness and adaptation.

Impacts: effects on natural and human systems of extreme weather and climate events, and climate change. The impacts generally refer to effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services and infrastructures due to the interaction of climatic changes or dangerous weather phenomena that occur in a specific period of time, and to the vulnerability of the companies or the systems exposed to them. The impacts are also called consequences and results. The impacts of climate change on geophysical systems, including floods, droughts and sea level rise, are a subset of the impacts called physical impacts.

Risk: potential consequences in which something of value is in danger with an uncertain outcome, recognising the diversity of values. Often the risk is represented as the probability of occurrence of dangerous events or trends multiplied by the impacts in case such events or trends occur. Risks result from the interaction of vulnerability, exposure and danger (see Figure 6).

Due to their transcendence in the expression of possible solutions to reduce risks, two important concepts such as adaptation and resilience are also introduced here.

Adaptation: process of adjustment to real or projected climate and its effects. In human systems, adaptation seeks to moderate or avoid damage or take advantage of beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to the projected climate and its effects.

Resilience: the ability of social, economic and environmental systems to cope with a dangerous event, trend or disturbance by responding or reorganising to maintain their essential function, identity and structure, while preserving the capacity for adaptation, learning and transformation.

Analysing the derived risks that climate change can bring in the future over any sector or geographical area, it is necessary to determine the evolution of each of the components of the risk, which is what we call projections. In the next section we analyse the scientific knowledge of the projections, fundamentally, of the contributions of the hazard to the risk.

Climate change projections

The climate models

This section mainly analyses the hazard projections. As shown in figure 6, the danger is entirely conditioned by climate, specifically by its natural variability and especially by climate change which in turn is conditioned by the socio-economic trajectories of the future and their impact, for example, on the uses of land, energy policy or GHG reduction agreements that are reached and implemented in the coming decades.

The continuous emission of greenhouse gases will cause greater warming and lasting changes in all components of the climate system, which will increase the likelihood of serious, widespread and irreversible impacts for people and ecosystems and consequently in the sectors of interest for defence and security.

Therefore, accumulated CO₂ emissions will largely determine global warming at the end of the 21st CENTURY and beyond. This has led since the 90s to the generation of largely varying projections of greenhouse gas emissions that depend on socio-economic development and climate policy that are usually represented by different scenarios. These GHG projections are the essential forcing of the general circulation models (GCM) that allow us to obtain projections of the fundamental climate variables for different time horizons. The continuous improvement in our knowledge of the fundamental processes and in our modelling capabilities has allowed us to reach a new generation of GCM significantly improving the quality of the projections that are currently available, and reducing the existing uncertainties. However, the climate projections are the product of numerical modelling and are therefore not exempt from uncertainty.

The GCMs are the basis on which regional circulation models (RCMs) are developed that improve the spatial resolution of the initial models and integrate new processes characteristic of the regions in which they are implemented, considerably improving the quality of the projections. The results of these models are generally those that serve as a basis to project the impacts and risks of climate change. However, there are not RCMs for all regions of the planet, nor are they of the same quality, or cover all the variables necessary to cover the needs of the impact community. This is therefore an important source of uncertainty when assessing the risks arising from climate change.

Description of the RCP. Projections of climate change indicators

In order to understand how the future projections of climate change have been generated, it is necessary to introduce the concept of the Representative Concentration Paths (RCP). Unlike the emission scenarios considered in the previous IPCC reports, the RCPs represent four paths or trajectories of the possible concentrations of greenhouse gases that are used by the community that investigates climate change. They describe four possible climate futures that depend on the emission policy in the years to come. The four RCPs, called RCP2.6, RCP4.5, RCP6 and RCP8.5, receive their acronym based on the value of the radiative forcing expected in 2100 with respect to the pre-industrial era, that is (+2.6; +4.5, +6, +8.5 W/m², respectively).

RCPs represent a broad spectrum of options with respect to anthropogenic emissions of greenhouse gases (Figure 7). For example, RCP2.6 assumes that the maximum annual global GHG emissions will occur between 2010 and 2020, with a significant subsequent reduction. This scenario would be compatible with an immediate implementation of the terms of the Paris Agreement, possible but unlikely. The peak of the emissions corresponding to RCP4.5 occurs in 2040 with a subsequent decrease and the RCP8 has its maximum in 2080. However, RCP8.5 considers that emissions will continue to increase throughout the 21st CENTURY, corresponding to the most unfavourable scenario.

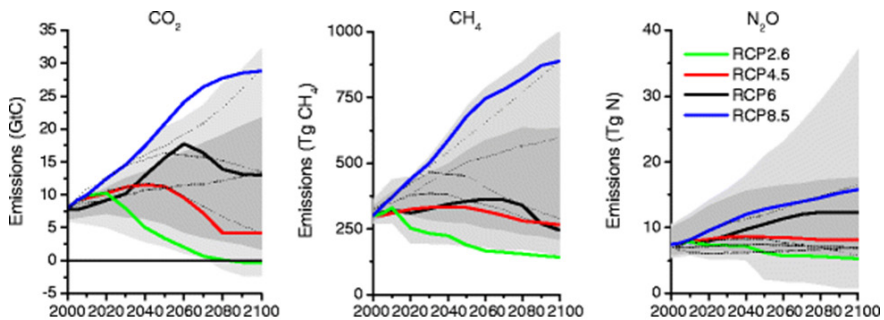


Figure 7. Emissions of the main greenhouse gases through the RCP.

The grey area corresponds to the 98% and 90% percentiles (light and dark grey, respectively) obtained based on the literature. The dashed lines correspond to four of the emission scenarios considered in previous IPCC reports (van Vuuren *et al.*, 2011).

As can be seen in Figure 7, with respect to CO₂ emissions, RCP8.5 shows a trend that corresponds to the upper limit contained in the literature (rapid increase in concentrations). RCP6 and RCP4.5 show a stabilisation of the CO₂ concentration (close to the literature average). Finally, RCP2.6 has a peak CO₂ concentration around 2050 followed by a slight decrease at the end of the century. Regarding the concentrations of CH₄ and N₂O, the order in which the RCPs are located is the direct result of the level of climate policy adopted. The trends in CH₄ concentrations are more pronounced given the short life of the compound. RCP2.6 and RCP4.5 show an emission peak within half a century. With regard to the concentration of N₂O, the scenarios remain in the same order, although in this case the emissions for RCP4.5 remain stable and those corresponding to RCP6 increase with time.

In all emission scenarios evaluated, the projections indicate that the surface temperature will continue to increase throughout the 21st CENTURY. It is very likely that heat waves occur more frequently and last longer, and that episodes of extreme rainfall are more intense and frequent in many regions. The ocean will continue to warm and acidify, and the overall mean sea level will continue to rise.

These conclusions are taken from the modelling with GCM and RCM models within the framework of the Coupled Model Intercomparison Project (CMIP) that began in 1995 and in which more than 30 GCM from different institutions of the world are grouped to perform climate modelling, allowing the comparison of data from the pre-industrial era with different future projections. During the 2010-2014 period, the CMIP5 phase was completed, which served as the basis for all the projections included in the AR5 as well as for most of the research on different aspects of climate change carried out in recent years. The sixth phase, CMIP6, is currently underway, and the results are expected to be released in 2020.

Among the most important results on projections prepared for AR5, it is worth mentioning those in the following table:

Emission scenario	Representative Concentration Pathway (RCP)	2100 CO ₂ concentration (ppm)	Temperature Increase (°C) 2081-2100	Mean sea level rise (m)					
				2046-2065	2100	Scenario	2200	2300	2500
Low	2.6	421	1.0 (0.3-1.7)	0.24 (0.17-0.32)	0.44 (0.28-0.61)	Low	0.35-0.72	0.41-0.85	0.50-1.02
Medium low	4.5	538	1.8 (1.1-2.6)	0.26 (0.19-0.33)	0.53 (0.36-0.71)	Medium	0.26-1.09	0.27-1.51	0.18-2.32

Emission scenario	Representative Concentration Pathway (RCP)	2100 CO ₂ concentration (ppm)	Temperature Increase (°C)	Mean sea level rise (m)					
				2081-2100	2046-2065	2100	Scenario	2200	2300
Medium high	6.0	670	2.2 (1.4-3.1)	0.25 (0.18-0.32)	0.55 (0.38-0.73)	High	0.58-2.03	0.92-3.59	1.51-6.63
High	8.5	936	3.7 (2.6-4.8)	0.29 (0.22-0.38)	0.74 (0.52-0.98)				

Table 1. Projections of temperature and mean sea level for different RCP and time periods (IPCC, 2013).

Table 1 is highly illustrative given that it shows different aspects that must be taken into account when analysing the risks derived from climate change in the future. Firstly, it shows how the different associated emission and RCP scenarios are linked to different concentrations of CO₂ in the atmosphere in 2100. Note that NASA's latest measurement of CO₂ in the atmosphere indicates that we have reached 406.94 ppm (09/2017). As a reference, it should be mentioned that in September 2013 the observed value was 396.76 ppm. We can therefore conclude that we are very close to reaching the values of RCP2.6. This RCP leads to a temperature increase of between 0.3°C and 1.7°C (1° of average value). Note that, in this table, the projections are shown as the difference between the period reported (for example, 2081-2100) and the control period, which in this case corresponds to 1986-2005. The values that these projections show are the result of an ensemble (aggregation of several models) between various model runs and climate models. This information is expressed as a function of the mean value and the percentiles of 5% and 95% of the distribution (entered in brackets) of the simulated cases.

Likewise, the table reproduces the projections of increase in the mean sea level. This increase is a response to the volumetric expansion of the ocean due to the warming of its waters, to which the contributions of the water volumes from the ice losses in glaciers and ice masses in the continent must be added (e.g. Greenland). Note that there are few differences between the different RCPs until the middle of the century, with mean values between 0.24 and 0.29 m and a variation of the corresponding percentiles of between 0.17 and 0.38 m. In 2100, the most unfavourable RCP suggests an average sea level rise of 0.74 m (the percentiles of 5% and 95% correspond to 0.52 m and 0.98 m, respectively). It is at the end of the century when the differences between mitigation policies are clearly evident.

In this table, very long-term projections (2300-2500) are also included for the first time. Although with great associated uncertainty, it is important to highlight a relevant aspect. Due to the thermal inertia of the ocean, the mean sea level would continue to rise, and could exceed 6 m in the most pessimistic case. That is to say, although the decision to reach a situation of zero emissions will be taken today, the average level of the sea would continue to rise for hundreds of years.

Although a large part of the scientific community works with these projections of an increase in the mean sea level, they are not very conservative in analysing the risks. The IPCC seeks to reduce uncertainties as much as possible, rather than trying to consider all possible scenarios, however unlikely they may be, which is something inherent to risk management. For this reason, AR5 exclusively includes the projections of the mean sea level obtained from simulations of GCM models and although they are cited, the values predicted by other so-called semi-empirical models that have been published in the last decade are not included (Rahmstorf, 2007). All these models coincide in predicting increases in sea level of between 1.5 m and 2.5 m, therefore much higher than those established by the IPCC. This aspect is highly disputed by the community that analyses impacts and risks, since the selection of the temperature or sea level projections can give rise to risk values and therefore to very different adaptation objectives.

The other relevant aspect to consider is that in this section the projections of climate change indicators (temperature and sea level) that are calculated as a global average have been discussed. It is evident that, for the purposes of the analysis of impacts or risks, the search for solutions requires local or at least regional projections since the spatial variability of the behaviour of the climatic variables is very important.

Regional projections. The IPCC Atlas

The climate system can be global in extension, but its manifestations (for example, through atmospheric processes, oceanic circulation, bioclimatic zones, daily time and long-term climatic trends) are regional, or even local, in their occurrence, nature and implications. In this regard, the IPCC has developed an Atlas of global and regional projections as part of the AR5 (IPCC, 2013). This atlas presents a series of figures that show the global and regional climate change patterns that have been generated as part of the CMIP5. Maps of changes in air temperature and relative changes in rainfall (expressed as a percentage of mean rainfall) are presented for different seasons, for the entire globe and for a series of sub-continental regions. The results refer to average changes for periods of 20 years in the short term (2016-2035), medium term (2046-2065) and long term (2081-2100) relative to the reference period 1986-2005. As an example, the results are shown in the Southern European/Mediterranean region.

Temperature is one of the most studied geophysical variables and a clear indicator of global warming. As figures 9 and 10 show (in both, upper left panel) the air temperature increased during the 20th century and will continue to increase throughout the 21st. In the southern European winter, the projections show temperature increases of between 2°C and 4°C by the end of the century for RCP4.5 and RCP8.5 respectively. As regards the summer season, the projections to 2100 are greater, with increases of 3°C

(RCP4.5) to 7°C (RCP8.5). The spatial maps (see the lower panels of figures 9 and 10) allow us to observe the variability of these changes throughout the region. In Spain, increases of between 2°C and 4°C are projected in summer for 2081-2100 (RCP4.5). In winter, the projected increases are lower, but in all cases considered, from 2050 on, they are above 1°C.

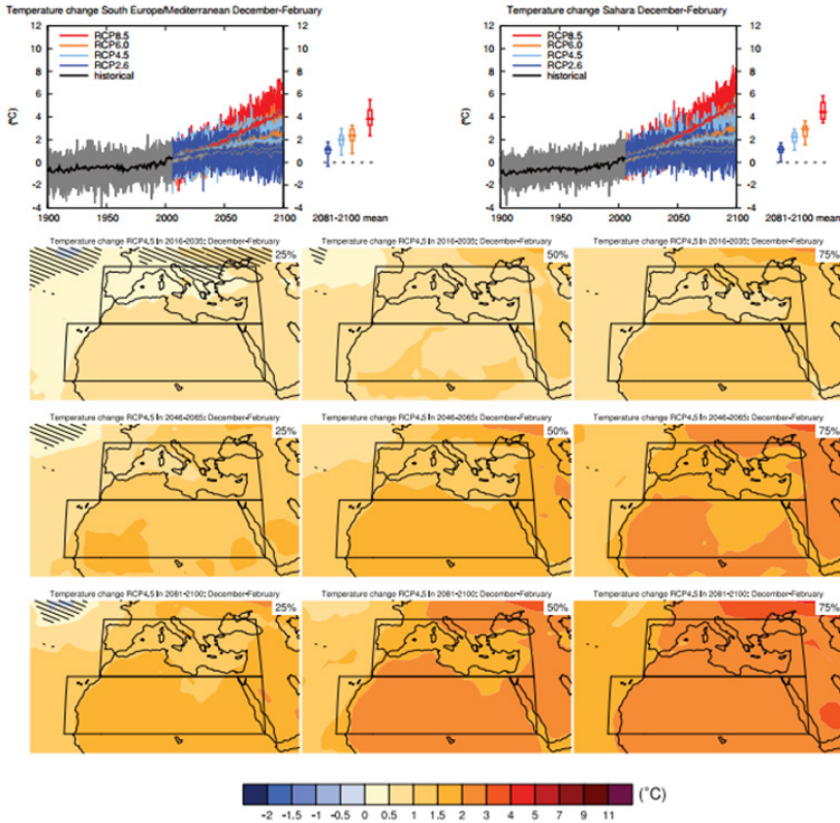


Figure 9. (Top left) Time series of temperature changes relative to 1986-2005 averaged over grid points located on land in the southern European/Mediterranean region (30°N to 45°N, 10°W to 40°E) from December to February. (Top right) The same for grid points located on land in the Sahara (15°N to 30°N, 20°W to 40°E). The fine lines denote one member of the ensemble per model, the thick lines the average of the CMIP5 models. The percentiles of 5%, 25%, 50% (median), 75% and 95% of the distribution of the mean changes for 2081-2100 and for the four RCPs are shown. (Below) Temperature change maps in 2016-2035, 2046-2065 and 2081-2100 with respect to 1986-2005 for scenario RCP4.5. For each point, the percentiles of 25%, 50% and 75% of the CMIP5 ensemble distribution are shown; this includes the natural variability and dispersion of the models. The shading indicates the areas in which the differences of the 20-year average of those of the percentiles are less than the standard deviation of the current natural variability estimated by the models of the 20-year average differences (IPCC, 2013).

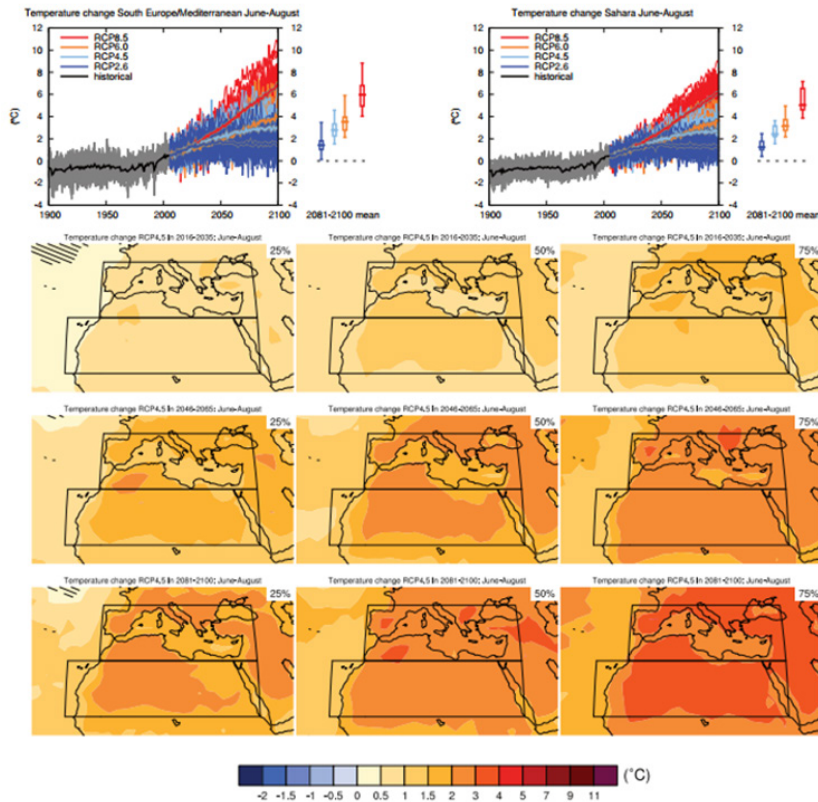


Figure 10. (Top left) Time series of changes in temperature relative to 1986-2005 averaged over grid points located on land in the southern European/Mediterranean region (30°N to 45°N, 10°W to 40°E) from June to August. (Top right) The same for grid points located on land in the Sahara (15°N to 30°N, 20°W to 40°E). The fine lines denote one member of the ensemble per model, the thick lines the average of the CMIP5 models. The percentiles of 5%, 25%, 50% (median), 75% and 95% of the distribution of the mean changes for 2081-2100 and for the four RCPs are shown. (Below) Temperature change maps in 2016-2035, 2046-2065 and 2081-2100 with respect to 1986-2005 for scenario RCP4.5. For each point, the percentiles of 25%, 50% and 75% of the CMIP5 ensemble distribution are shown; this includes the natural variability and dispersion of the models. The shading indicates the areas in which the differences of the 20-year average of those of the percentiles are less than the standard deviation of the current natural variability estimated by the models of the 20-year average differences (IPCC, 2013).

Figures 11 and 12 (upper left panel) represent the time series of changes in relative rainfall (percent change over the mean) in the grid land points representing the southern European/Mediterranean region (30°N-45°N, 10°W-40°E), for October-March (rainy season) and April-September (summer season). You can see how the changes show a slight reduction in rainfall in both cases. Up to mid-century, the projections of the 4 RCPs are very similar, differing more at the end of the century, where, in October-March and for RCP8.5, the projection is 12% less rainfall. In April-September, by contrast,

these changes reach 20%. With regard to spatial maps (see bottom panel in figures 11 and 12), we can see how, for the percentiles of 25% and 50%, in Spain a general reduction in rainfall is expected. This reduction is somewhat more pronounced in the summer period (April-September) and in all the percentiles studied, with reductions of between 20% and 30% in some areas for the period 2081-2100. In the rainy season (October-March), a reduction in rainfall of around 10% for the percentiles of 25% and 50% of the distribution is expected at the end of the century, and a slight increase (between 0% and 10%) for the 75th percentile.

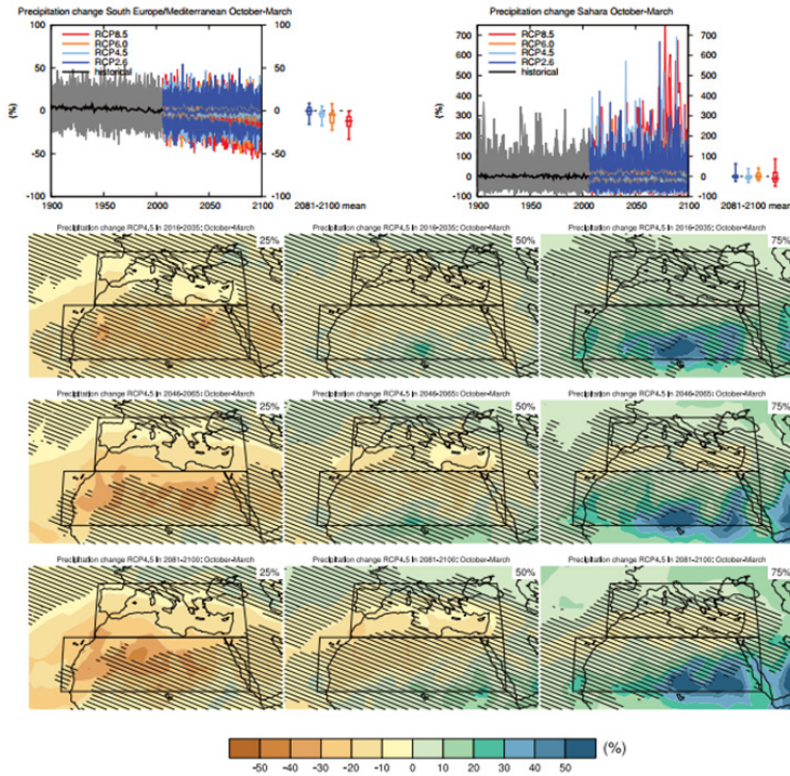


Figure 11. (Top left) Time series of changes in rainfall relative to 1986-2005 averaged over grid points located on land in the southern European/Mediterranean region (30°N to 45°N, 10°W to 40°E) from October to March. (Top right) The same for grid points located on land in the Sahara (15°N to 30°N, 20°W to 40°E). The fine lines denote one member of the ensemble per model, the thick lines the average of the CMIP5 models. The percentiles of 5%, 25%, 50% (median), 75% and 95% of the distribution of the mean changes for 2081-2100 and for the four RCPs are shown. (Below) Maps of change in rainfall in 2016-2035, 2046-2065 and 2081-2100 with respect to 1986-2005 for scenario RCP4.5. For each point, the percentiles of 25%, 50% and 75% of the CMIP5 ensemble distribution are shown; this includes the natural variability and dispersion of the models. The shading indicates the areas in which the differences of the 20-year average of those of the percentiles are less than the standard deviation of the current natural variability estimated by the models of the 20-year average differences (IPCC, 2013).

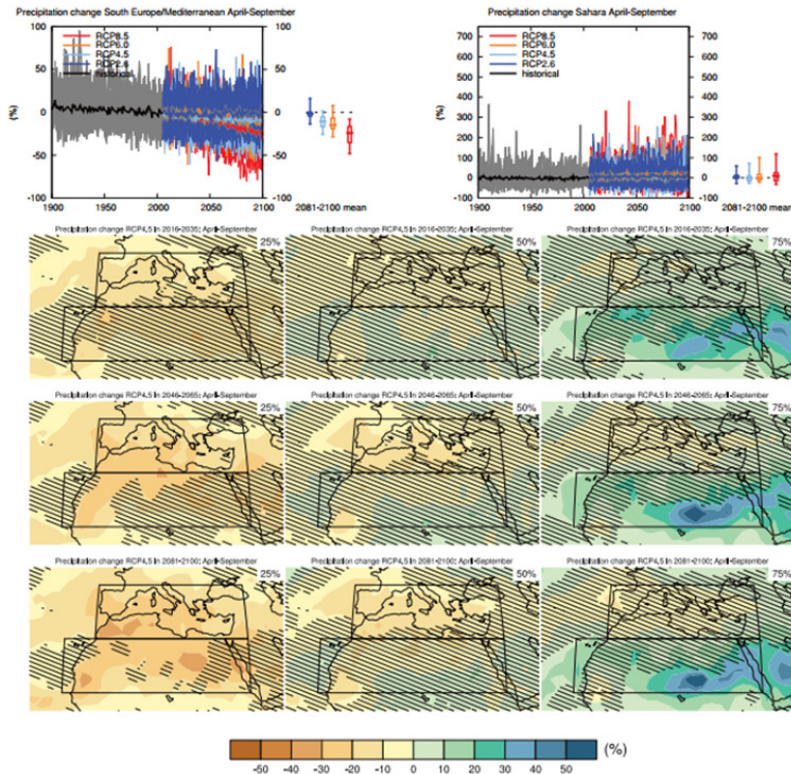


Figure 12. (Top left) Time series of changes in rainfall relative to 1986–2005 averaged over grid points located on land in the southern European/Mediterranean region (30°N to 45°N, 10°W to 40°E) from April to September. (Top right) The same for grid points located on land in the Sahara (15°N to 30°N, 20°W to 40°E). The fine lines denote one member of the ensemble per model, the thick lines the average of the CMIP5 models. The percentiles of 5%, 25%, 50% (median), 75% and 95% of the distribution of the mean changes for 2081–2100 and for the four RCPs are shown. (Below) Maps of change in rainfall in 2016–2035, 2046–2065 and 2081–2100 with respect to 1986–2005 for scenario RCP4.5. For each point, the percentiles of 25%, 50% and 75% of the CMIP5 ensemble distribution are shown; this includes the natural variability and dispersion of the models. The shading indicates the areas in which the differences of the 20-year average of those of the percentiles are less than the standard deviation of the current natural variability estimated by the models of the 20-year average differences (IPCC, 2013).

Note that the atlas only offers information about changes in atmospheric temperature and rainfall. The GCM and RCM offer a lot of other information on atmospheric climatic variables, however, it should be noted that, as of today, they do not provide information on marine variables, so additional modelling is required.

Figure 13 shows projections of wave changes (significant wave height) by seasons by the end of the century with respect to the base period (1979–2005) obtained as an ensemble of 30 GCM models, for RCP8.5.

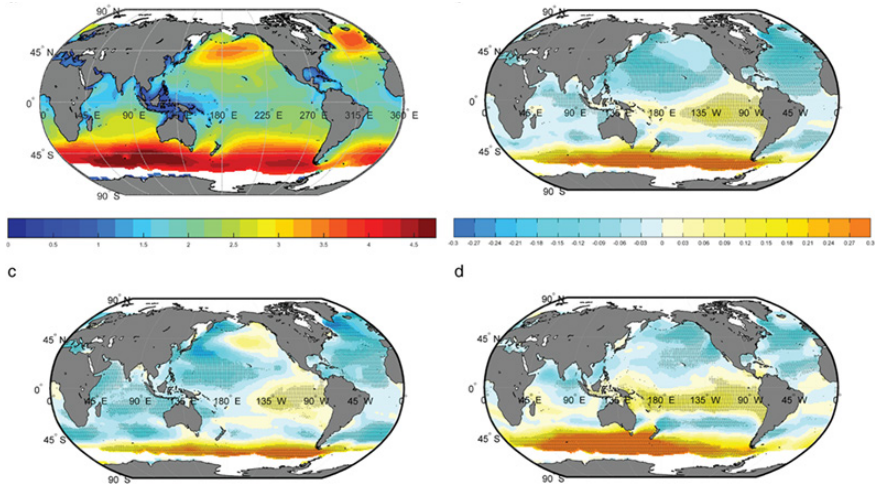


Figure 13 Source: Camus et al. (2017) (a) Significant mean annual wave height (m) for the period 1979-2005. (b-d). Projected changes in annual values, in the EFM, JAS seasons for the period 2070-2100 with respect to (1979-2005) for the RCP8.5.

The results show that the increase in wave height is mainly projected in the southern hemisphere.

Figure 14 shows the relative sea level projections (RSLR) for 2070-2100 for RCP4.5. It must be emphasised that the projection includes the effect of subsidence or isostatic rebound on the coast since what matters in terms of the determination of impacts is the value of the sea level with respect to the coast. Note the great variability along the world's oceans with increases of more than 80 cm and depressions of up to 20 cm in the areas near the Arctic and Antarctic.

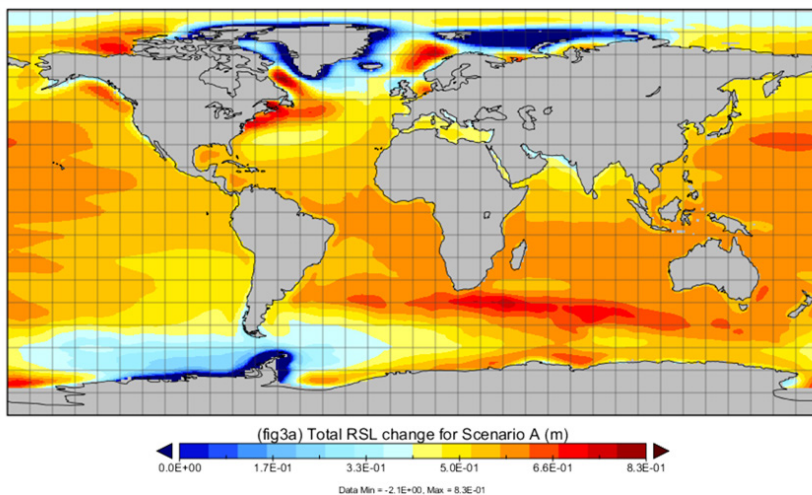


Figure 14. Relative sea level projections (RSLR) at the end of the century for RCP4.5. Source (Slangen, 2014).

Climate projections for Spain

The State Meteorological Agency (AEMET) provides both numerical and graphic information on the projections of climate change for the twenty-first century, regionalised for all of Spain and corresponding to different emission scenarios. These projections are essential for the evaluation of impacts and risks derived from climate change.

The results refer to different emission scenarios (RCP), different global climate models and different regional models, and constitute the most recent source of regionalised projections of climate change available in the European context. The use of sets of evolutions (ensemble/multi-model) allows us to estimate the associated uncertainties, both with the evolution provided by the global models, and by the regionalisation calculated with the regional nested models.

The projection maps of maximum temperature, minimum temperature and rainfall for two periods of the 21st CENTURY are shown below as an example: 2046-2061, 2081-2100, regionalised with different techniques.

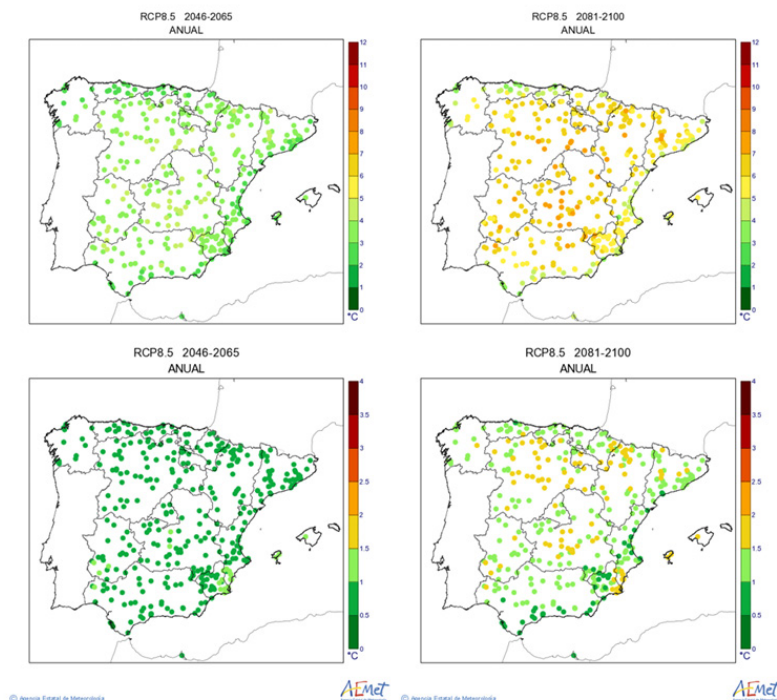


Figure 15. Changes in the maximum annual average temperature (upper panels) and uncertainty (lower panels) for RCP8.5, with respect to the control period 1961-2000 (AEMET).

Figure 15 shows the projections of the change in the maximum annual mean temperature and its uncertainty (obtained as twice the standard deviation) throughout the 21st century for RCP8.5. The results show an increase in temperature of between 1°C and 5°C mid-century, and up to 8°C by the end of the century. These increases are greater in the central zone of the country and much less pronounced on the coast, especially in the regions of Asturias and Cantabria. As can be seen, the uncertainty is greater where the change is greater and as we move away in time, reaching the 2nd by the end of the century.

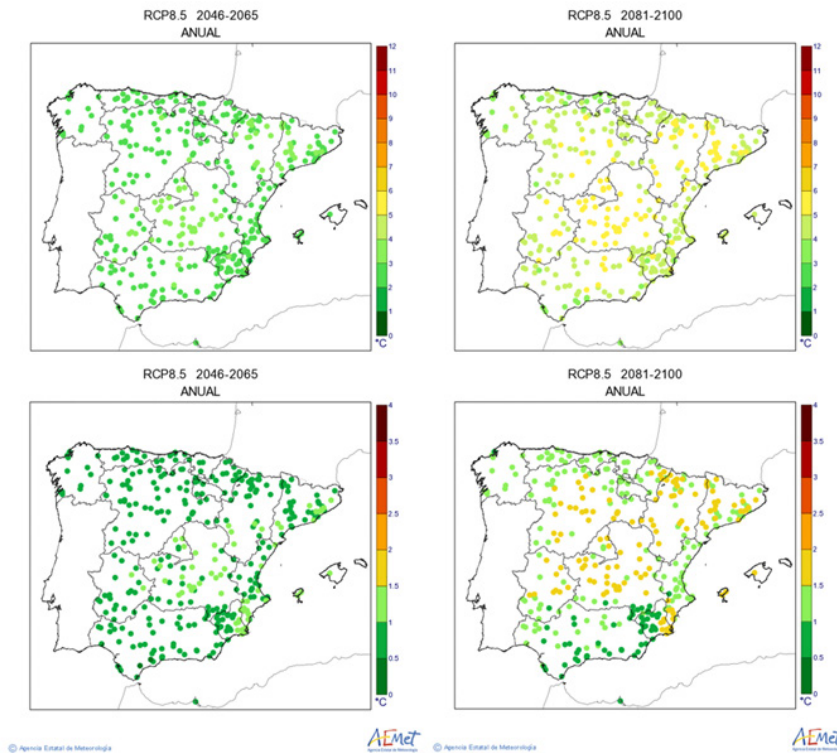


Figure 16. Changes in the minimum annual average temperature (upper panels) and uncertainty (lower panels) for RCP8.5, with respect to the control period 1961-2000 (AEMET).

Figure 16 shows the projections of the change in the minimum annual mean temperature and its uncertainty (obtained as twice the standard deviation) throughout the 21st century for RCP8.5. Although the pattern of change is similar to that observed in the maximum temperature, the spatial variability is smaller. The increase in the minimum temperature by the middle of the century is between 2°C and 5°C throughout the country. By the end of the century, the increases are

up to 6 degrees, with Castilla La Mancha being the region in which the largest increases will occur.

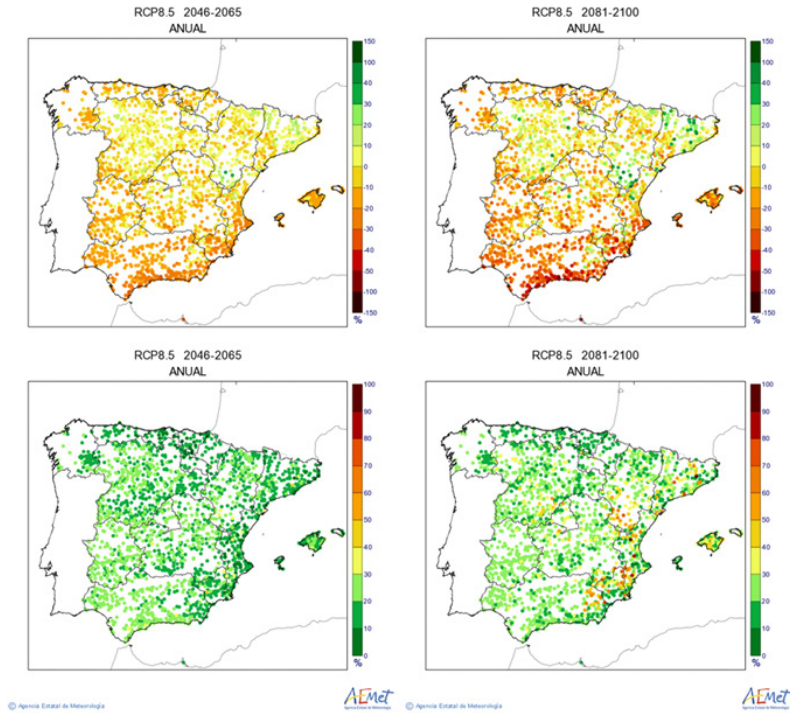


Figure 17. Changes in average accumulated annual rainfall (upper panels) and uncertainty (lower panels) for RCP8.5, compared to the control period 1961-2000 (AEMET).

Figure 17 shows the projections of change in accumulated average annual rainfall and its uncertainty (obtained as twice the standard deviation) throughout the 21st century for RCP8.5. By mid-century, rainfall will be reduced by up to 40 mm in the coastal areas of Andalusia and Murcia, and 30 mm in the Cantabrian region. On the other hand, it will increase by up to 10 mm in the central-northern area of the country, and up to 40 mm in specific locations in Catalonia and Aragon. By the end of the century, the decreases in rainfall will be more pronounced, more than 50 mm in the south of the country. The increases in the central-northern area will be somewhat higher, reaching 40 mm in some areas, especially in Catalonia and Aragon.

Most of these projections were prepared within the framework of the National Adaptation Plan (PNACC). One of the fundamental instruments for disseminating this plan is AdapteCCA.es (<http://www.adaptecca.es>), a platform for exchanging and consulting information on adaptation to climate

change in Spain. In it you can find all the available information on regionalised climate change projections prepared by the AEMET and some autonomous communities.

For the Spanish coast, MAGRAMA and MINECO jointly financed the project «Climate Change on the Spanish Coast» (C3E) developed by IH Cantabria of the University of Cantabria. One of the results of this project was the C3E viewer (<http://www.c3e.ihcantabria.com>) in which climatic projections are collected for the variables of marine dynamics on the Spanish coast.

The other components of risk: exposure and vulnerability

As already described above, in addition to the danger, there are other non-climatic factors that influence the level of risk, such as exposure and vulnerability. Both are dynamic, vary in time and space, and depend on economic, social, geographic, demographic, cultural, institutional and environmental factors.

The exposure represents the population, assets and activities at potential risk or that may suffer damage due to an impact. It has dimensions that are physical (buildings and infrastructure), social (people and communities) and economic (activity flows). Therefore, it is highly determined by territorial planning, economic development and overpopulation in cities.

Vulnerability refers to the susceptibility or sensitivity of systems to damage, and is related to concepts such as resilience, fragility and adaptability. It depends to a large extent on the nature of the impact in question, but also on the characteristics of the population (for example, in terms of age and cultural level), of the buildings (for example, as regards the type of foundations and materials), of the ecosystems (for example, as regards their adaptive capacity) and of the rest of the recipients of the impact.

In the analysis of risks associated with climate change, some of these factors are considered: the projection of the population, the migratory processes, the changes in territorial planning and projections in the food or energy demand. However, like the previous, these are not lacking in uncertainty, so it is necessary to analyse the risk in different scenarios.

Impacts and risks of future scenarios of climate change

There is general agreement among the scientific community that climate change will increase existing risks and create new risks for natural and human systems. However, the characteristics intrinsic to risk mean that they are distributed in a disparate way and are generally greater for disadvantaged people and communities (high vulnerability) of the countries, regardless of their level of development.

Another aspect on which there is agreement is that many of the impacts associated with climate change that are now beginning to be observed and that will occur in the near future, will continue for centuries, even if the anthropogenic emissions of greenhouse gases are stopped. In this sense, it must be stressed that the risks of abrupt or irreversible changes increase as the magnitude of the warming increases.

AR5 in its «Summary for policy makers» includes a set of sectoral risks, among which the following stand out. These conclusions are formulated in terms of the language used by the IPCC to describe the uncertainties. These formulations are not included in the following summary, but can be consulted in the previous reference.

Freshwater resources. Projections during the twenty-FIRST CENTURY indicate that renewable resources of surface water and groundwater will be substantially reduced in most subtropical dry regions, thereby intensifying competition for water between sectors.

Terrestrial ecosystems and fresh water. In this century, the magnitudes and rates of climate change associated with medium to high emission scenarios will pose a high risk of abrupt and irreversible change at the regional level in the composition, structure and function of continental terrestrial and aquatic ecosystems, including wetlands.

Coastal systems and low areas. Given the projected rise in sea level throughout the 21st CENTURY and beyond, coastal systems and low-lying areas will increasingly experience adverse impacts such as immersion, coastal flooding and coastal erosion.

Food safety. In relation to the main crops (wheat, rice and corn) in the tropical and temperate regions, projections indicate that climate change without adaptation will have a negative impact on production with increases in local temperature of 2°C or more above the levels of the late 20th CENTURY, although there may be individual locations that benefit from this increase.

Urban and rural areas. Many global risks of climate change are concentrated in urban areas. Measures that increase resilience and enable sustainable development can accelerate successful adaptation to global climate change. The most important rural impacts in the future are expected to occur in the short term and subsequently in relation to water availability and supply, food security and agricultural incomes, especially regarding changes in food and non-food crop production areas all over the world.

Sectors and key economic services. For most economic sectors, projections indicate that dynamic impacts such as changes in population, age structure, income, technology, relative prices, lifestyle, regulation and governance will be greater than the impacts of climate change.

Health. Until the middle of the century, the impact of projected climate change will affect human health mainly due to the worsening of existing health problems (very high level of confidence). Throughout the 21ST CENTURY, climate change is expected to cause an increase in poor health in many regions and especially in low-income developing countries, compared to the reference level without climate change.

Human security. Projections indicate that climate change throughout the 21st CENTURY will increase the number of displaced people.

Climate change can indirectly increase the risks of violent conflicts in the form of civil war and violence between groups by increasing the intensity of the forces which, according to extensive documentation, drive such conflicts, like poverty and economic crises. The impacts of climate change on the essential infrastructure and territorial integrity of many States are expected to influence national security policies.

In addition, the report includes a summary of what it identifies as key regional risks. Figure 18 shows an example for Central and South America.

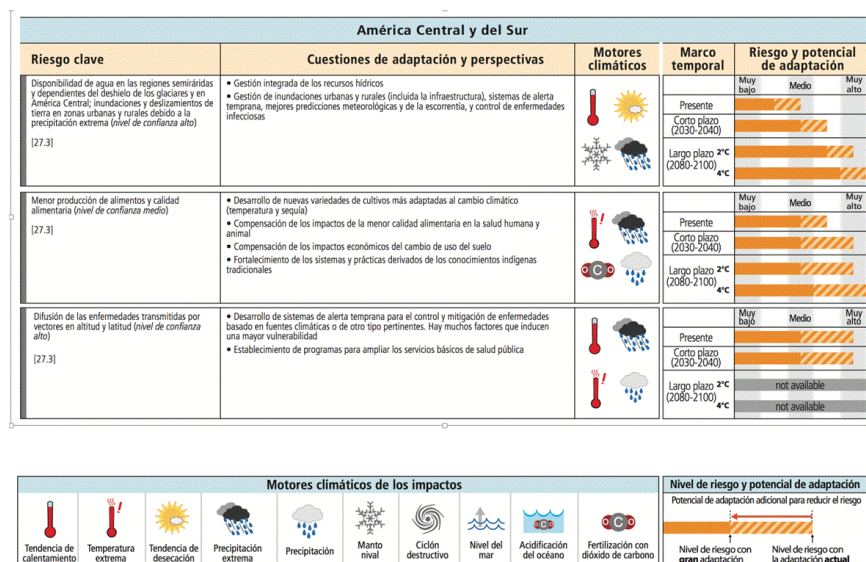


Figure 18. Key risks of climate change and potential for risk reduction through adaptation and mitigation for Central and South America. Each key risk is represented by a value between very low and very high for three time frames: the present, the short term (2030-2040), and the long term (2080-2100). The climate dynamics of the impacts are indicated by icons. Source (IPCC, 2014).

The water-energy-food nexus

As has been observed in the previous sections, climate change presents risks for all sectors of economic activity. But it should be pointed out that

these risks are also intertwined through the connections that relate these sectors, and may give rise to generally positive feedback mechanisms that increase the effects of climate change in these sectors.

One of the areas in which this phenomenon occurs in a particularly intense way is known as the water-energy-food nexus. This link can be illustrated by the following figure.

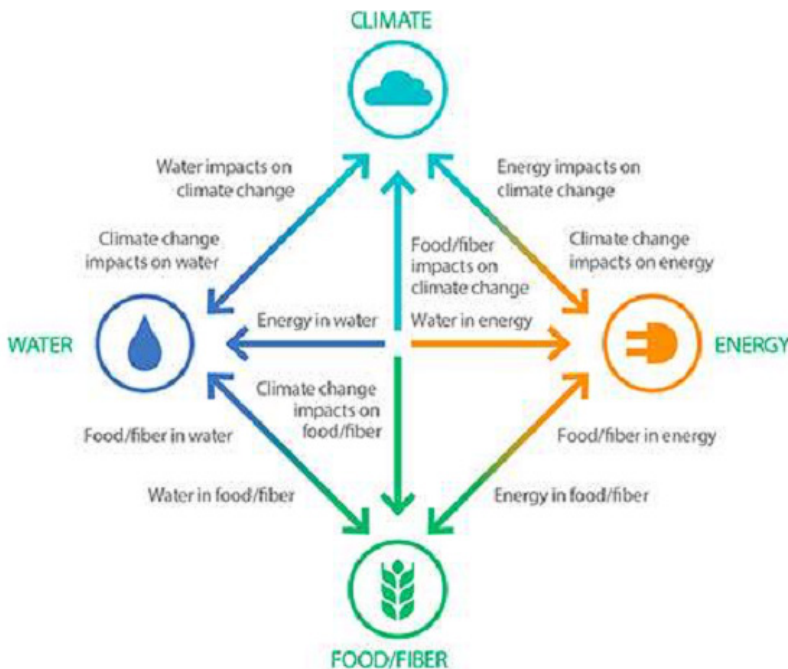


Figure 19. The water-energy-climate-food nexus. Source (WBCSD, 2013).

As you can see, water is necessary for the production of both energy and food. In turn, energy is necessary for the supply of drinking water, and also for food production. Finally, agricultural land may be necessary for energy production (biomass), and forests also affect water availability. And all these elements are influenced by climate change, restricting the volume of water available, altering the demand for energy and also its production, and conditioning agricultural productivity. The relevance of this link is supported by numerous publications, both academic and institutional, on this subject, which can be found summarised in Khan *et al* (2017a).

In Spain, there are few studies that analyse this link. We quote and summarise the three that we know:

Mayor (2016), in his doctoral thesis, studies the water-energy-food nexus for the Duero basin. To do this, she quantifies the water, energy and agricultural

production flows that connect these sectors, and analyses the coordination of sectoral policies and institutions. The author concludes that a greater degree of coordination is necessary for the planning of these sectors.

For their part, Willaarts *et al* (2016) extend the analysis of the water-energy-territory nexus for Spain and evaluate the implications of future energy scenarios regarding the use of water and soil or climate change (although without taking into account the feedback between these sectors). The study also retrospectively evaluates to what extent the intensification of agriculture in the last decade has modified the use of natural resources (land, water and energy) and reduced environmental impacts, concluding that the evolution has been positive, except in energy terms, which have increased.

Finally, Zarrar Khan, in his doctoral thesis at the Universidad Pontificia Comillas (Khan *et al*, 2016 and 2017b), developed an integrated water-energy model that allows the evaluation of the impact of different hydrological or energy policies in both sectors jointly. In his works, Khan demonstrates the value of the joint planning of both sectors, which allows water and energy consumption to be reduced as well as the economic costs; and also the interest of taking ex-ante into account the effects of climate change for hydrological and energy planning.

Overall, all the studies analysed underline the need to take into account the interaction between these sectors, which are strategic for our country, when evaluating the impact of climate change. Thus, any strategy to adapt to them should be carried out jointly, something that on the other hand requires collaboration between different institutions at sectoral and territorial level.

Strategies for mitigation and adaptation to climate change

As mentioned in the description of climate change risk analysis, adaptation and mitigation are complementary strategies to reduce and manage the risks of climate change. While adaptation acts on exposure and vulnerability, mitigation is closely linked to the danger, but also to changes in land uses, technology and socio-economic trajectories that are in turn linked to exposure and vulnerability.

There is general agreement in the scientific community that if emissions are substantially reduced in the coming decades, reductions in climate risks can be achieved throughout the 21st CENTURY and beyond. Likewise, it is considered that a reduction in emissions will contribute to making the trajectories of sustainable development resilient to the climate.

What is also clear is that, if no new mitigation efforts are introduced apart from those currently existing, as called for in the Paris Agreement, by the end of the 21ST CENTURY, warming will cause a high to very high risk of serious, generalised and irreversible impacts worldwide. This even assuming that important adaptation strategies are followed in different regions and sectors of the world.

To achieve the goal of reducing warming below 2°C in relation to pre-industrial levels, or even less, significant reductions in emissions would be required over the next few decades, and near zero emissions of CO₂ and other greenhouse gases by the end of the century.

The lack of mitigation strategies that significantly limit emissions requires the implementation of efficient and sustainable adaptation strategies. However, even if the most demanding mitigation strategy was implemented immediately, we would not be exempt from the introduction of adaptation measures.

Experts acknowledge that there are adaptation options in all sectors (water, security, coasts, infrastructures, etc.) but their context of application and potential to reduce climate-related risks is different between different sectors and regions. Therefore, adaptation measures should be considered at the local/regional level and with specific projects for each sector involved, but in an integrated manner. In most cases, adaptation entails important co-benefits, synergies and counterparts for the reduction of other risks, for a significant improvement in the sustainability and quality of life of citizens. The greater the magnitude of climate change, the greater the challenges for many of the adaptation options will be, with situations for which adaptation measures are not viable due to their inefficiency, cost or non-sustainability.

Many adaptation and mitigation options can contribute to tackling climate change, but none suffice alone. For the implementation of the options to be effective, policies and cooperation are needed at all scales; and to strengthen it, integrated responses are required that link adaptation and mitigation to other social objectives (IPCC, 2013).

Mitigation of climate change in Spain

The climate change mitigation strategy for Spain, currently being prepared within the framework of the Law on Climate Change and Energy Transition, is basically determined by the higher level objectives established by the European Commission (and in turn by the Paris Agreement). Thus, very ambitious decarbonisation objectives have been established for 2050 of the economy: between 80% and 95% reduction with respect to the 1990 emissions, equivalent to a total of between 14 and 58 MtCO₂eq, which can be compared with the emissions of 2015, which were 340 MtCO₂eq.

This basically implies the complete decarbonisation of the electricity sector, which must therefore be completely based on sources without CO₂ emissions (renewable, hydro or nuclear)¹. Transport or heating and cooling of buildings

¹ In this regard, it is interesting to note that carbon capture and sequestration (CCS) technologies, which could be used to allow the use of fossil fuels, present numerous uncertainties over their technical viability, not only with respect to capture, but also and above all, to the permanent storage of captured CO₂. In addition, these technologies do not

must also remove CO₂ emission sources almost completely, which can be achieved, inter alia, by the electrification of these end uses, and by managing demand. More complex is the reduction of emissions in industry, because its thermal consumption may not be easy to electrify, and it also has emissions directly associated with its non-energy chemical processes (mainly the production of cement and fertilisers). In these cases, CCS might be a necessary option. Finally, GHG emissions from agriculture and waste, which are also difficult to eliminate completely, especially the first, should be reduced.

The scope of the changes required in the energy and industrial sector will be determined mainly by the requirement of the imposed level of emissions, as well as by the growth of energy and industrial demand. Thus, the 80% reduction scenario allows fossil fuels to continue to have a certain share in the Spanish energy mix, provided that demand is reduced through energy efficiency. On the other hand, if demand grows as pre-2008, or if the reduction target is restricted to 95%, fossil fuels can only make a token contribution, so the rest of the energy supply should be provided by CO₂-free energies.

In this regard, a critical element is the availability or non-availability of nuclear technologies (both for technical reasons and social acceptance), as well as the potential of renewable energy that is available. In scenarios of high demand and low renewable potential, nuclear energy, or another technology without CO₂ emissions, could be necessary to reduce emissions to the required limits. Another critical aspect is the manageability of the energy system with a high penetration of variable renewable energies, which may require a significant volume of backup energy (either by storage, or by dispatchable fossil and renewable technologies). Finally, the economic cost of each of the decarbonisation paths will be determined by the technological evolution of the different energy sources, as well as by the capacity to reduce the energy intensity of the economy, something also essential to improve security of supply.

Lastly, these decarbonisation paths must be guided by appropriate policies. Although the expected technological advance of renewable energies can achieve the decarbonisation of the electricity sector to a large extent without public support, this is not the case of other sectors, which will need appropriate signals (basically a price for CO₂, as well as standards or information policies).

Adaptation to climate change in Spain

As mentioned above, adaptation can reduce the risks of climate change impacts, but its effectiveness is limited, especially when climate change is significant or occurs at an important rate.

guarantee the capture of 100% of the CO₂ emitted, so they would not be compatible with complete decarbonisation of the electricity sector.

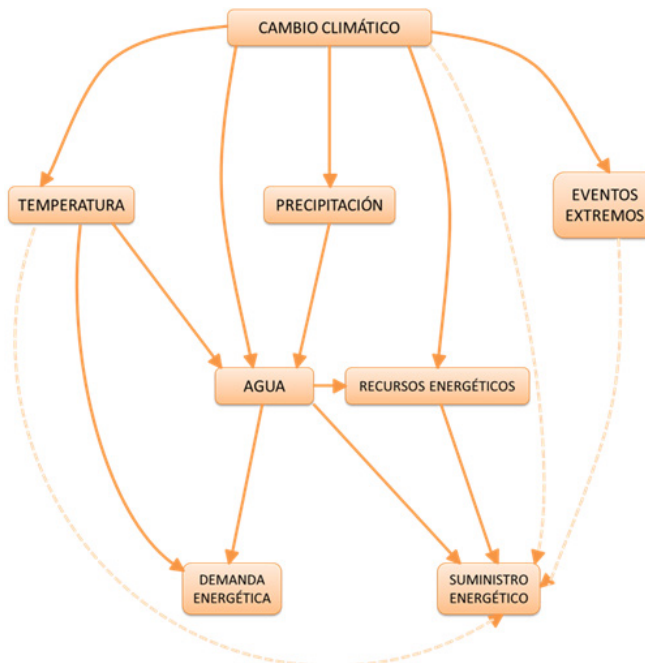
Since 2004, adaptation to climate change has been a priority objective for Spain. In 2006, the National Plan for Adaptation to Climate Change (PNACC) was approved, following a broad process involving the main coordinating bodies on climate change in Spain: the Commission for the Coordination of Climate Change Policies (CCPCC) and the National Climate Council (CNC); the Cabinet took notice of it on 6 October 2006.

The PNACC is a reference framework for coordination among the Spanish Public Administrations on impact assessment, vulnerability and climate change adaptation activities. The PNACC is implemented through work programmes, which specifically define the activities to be carried out. The first work programme of the PNACC, adopted when the Plan was approved, already identified the evaluation of the impact of climate change on the coastal areas among its 4 priority lines. The second work programme was adopted in July 2009, in which all the work that began with the first work programme was assumed and incorporated.

The third work programme 2014-2020, among the areas of work and lines of activity prioritised for different geographical territories, contains the coastal areas and includes the development of the Strategy of Adaptation to Climate Change of the Spanish Coast approved in the *Official State Gazette* in July 2017.

But there are other sectors that have also been or are being analysed. Forests, biodiversity and agriculture are some of them. One of the strategic sectors is also the energy sector.

Climate change will affect the energy sector in different ways, as shown in figure 20.



For Spain, regarding the energy supply, a reduction in the capacity of hydro (approximately 10%) and wind (between 15 and 40%) energy production is expected by 2050. Photovoltaics could increase production by 5%. In terms of demand, an increase is also expected in the demand for cooling (15%), and a fall in the demand for heating.

To deal with these changes, the measures proposed by the experts (see Girardi *et al*, 2015) include improvement in the evaluation of phenomena, joint planning, improvement in energy saving and efficiency, and the preparation of standards and specific adaptation plans.

Summary and conclusions

this chapter offers an overview of the state of the art of scientific knowledge of climate change. Based on the work carried out by the Intergovernmental Panel on Climate Change (IPCC), it analyses the concept of climate change, its causes, attributions and evidence, as well as the analysis of its consequences. This analysis is presented in a general framework of risk that is considered the ideal framework to also analyse the risks that climate change has on security, defence and the armed forces.

The information shows that in a framework of uncertainty we have the necessary databases, methodology and tools to make an assessment of the risks that climate change can generate for defence and makes it possible to identify which regional and sectoral aspects will have a greater impact on it.

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Video resume



Chapter two

European Union policy on climate change

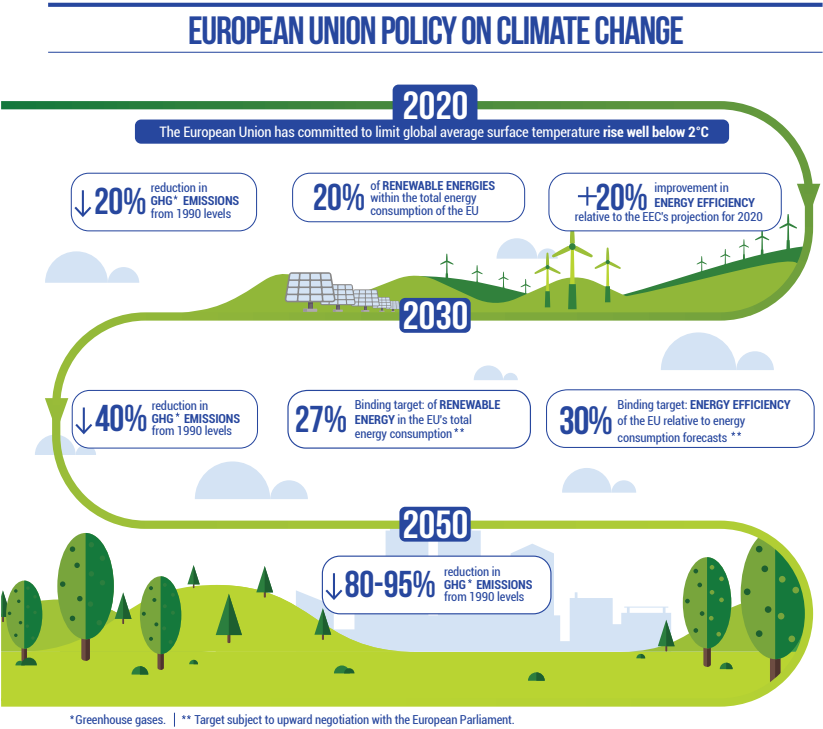
Miguel Castroviejo Bolívar

Abstract

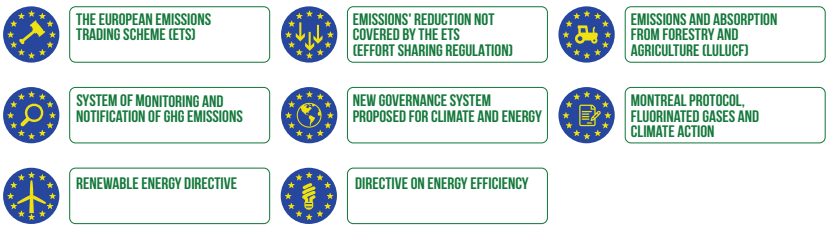
Since the beginning of 1990s the European Union promoted and participated actively in international negotiations on climate change. The commitment of the EU to the fight against global climate change materializes in the policies and internal rules which, as we shall see below, are among the most ambitious in the world.

Keywords

Climate change, EU, Kyoto Protocol, Paris Agreement.



MAIN LEGISLATIVE INSTRUMENTS ON CLIMATE CHANGE



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The European Union and the fight against climate change on the world stage

Since the beginning of 1990s the European Union promoted and participated actively in international negotiations on climate change. The first major step was the adoption of the United Nations Framework Convention on Climate Change (UNFCCC) at the 1992 Rio Summit, which encompasses 195 countries. This was followed by the adoption in 1997 of the Kyoto Protocol, which, despite the blow received by the refusal to ratify it by the then largest emitter, the USA, in 2001, it was ratified by the European Union in 2002. This was followed, along with a small handful of countries, by the negotiation and signing of the second commitment period of this Protocol, which extends it until 2020. The ratification of the Paris Agreement in October 2016 completes the participation and active drive of the European Union in all the major global milestones dedicated to the fight against climate change that have occurred to date.

The European Union's commitment to the fight against climate change on a global scale is embodied in the internal policies and rules that, as we will see below are among the most ambitious in the world, and also in its continuous promotion in its relations with third countries. Thus, the fight against climate change has been present for years at all international, regional or bilateral summits that the European Union holds with its partners, as well as in trade negotiations and relevant association agreements. In addition, within the scope of foreign policy, the European Union has a specific Climate Diplomacy Action Plan aimed at including and promoting the fight against climate change in its relations with all relevant countries and institutions. Without willing to be exhaustive, we must also remember that in its international dimension it also pays the necessary attention to the security dimension through the appropriate debates and conclusions of the Council.

And all this, despite the fact that in terms of emissions, the Union is having an ever smaller contribution in quantitative terms to global greenhouse gas emissions. The explanation is twofold, since on the one hand its own emissions are decreasing in absolute terms, and on the other, those of other countries, particularly the large emerging economies, continue to grow and gain greater relative weight.

Figure 1 shows the relative weight of the European Union's emissions in the world as a whole, as well as the global reduction trajectory included in the Paris Agreement of December 2015.

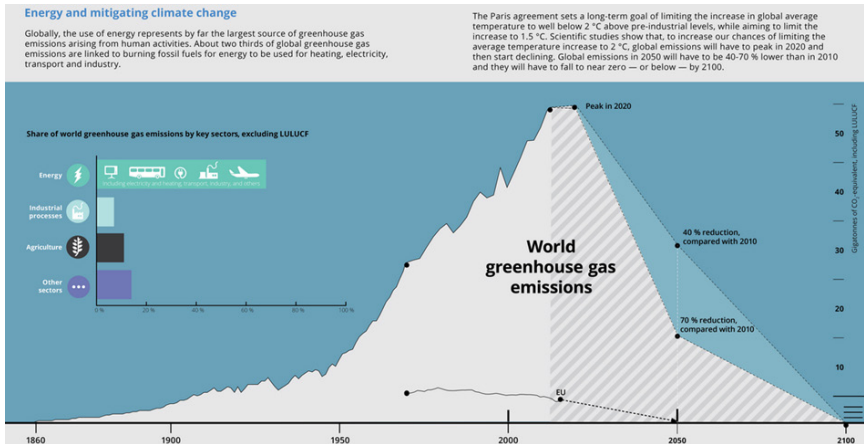


Figure 1. Global and European Union emissions and the emissions mitigation trajectory included in the Paris Agreement. Source: EEA ¹.

This relative significance and evolution of European emissions is well reflected in Figure 2, which shows the evolution of emissions since 1990 in the five largest emitters.

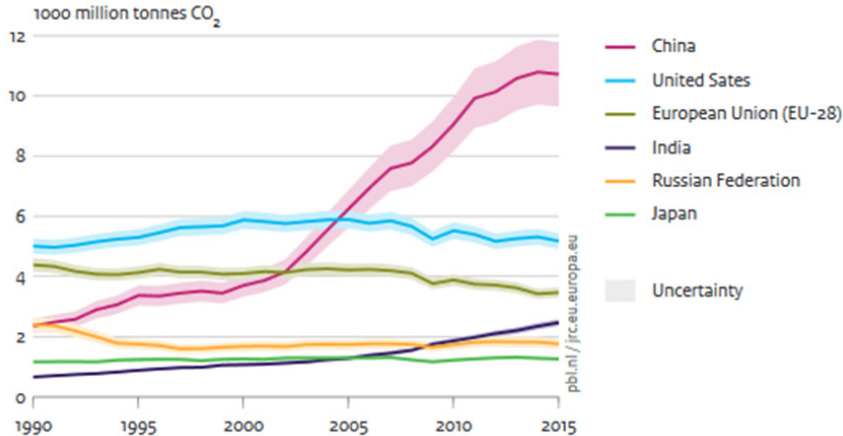


Figure 2. Emissions of CO₂ from fossil fuels and cement from the five largest emitters and from the European Union. Source: PBL, JRC².

We see that the European Union went from being the second global emitter of this type of gases, and very close to the USA in 1990, when China and

¹ https://www.eea.europa.eu/signals/signals-2017/infographics/energy-and-mitigating-climate-change/image/image_view_fullscreen.

² PBL, JRC. 2016. «Trends in Global CO₂ emissions: 2016 report». http://edgar.jrc.ec.europa.eu/news_docs/jrc-2016-trends-in-global-co2-emissions-2016-report-103425.pdf.

Russia emitted less than half, to third place in a line that continues to fall and with emissions increasingly distant from those of China and the USA, while approaching those of India.

The Union's effort to reduce emissions, especially since the end of the last century and strongly driven by the two international instruments in force at the time, the UNFCCC and the Kyoto Protocol, bore fruit in the fact that their greenhouse gas emissions in 2015 were already 22% lower than in 1990. According to the EDGAR database, the total emissions of greenhouse gases of the European Union in 2012 were 8.8% of global emissions. Figure 3 shows the same proportion approximately in 2014 for CO₂ emissions and certain industrial processes.

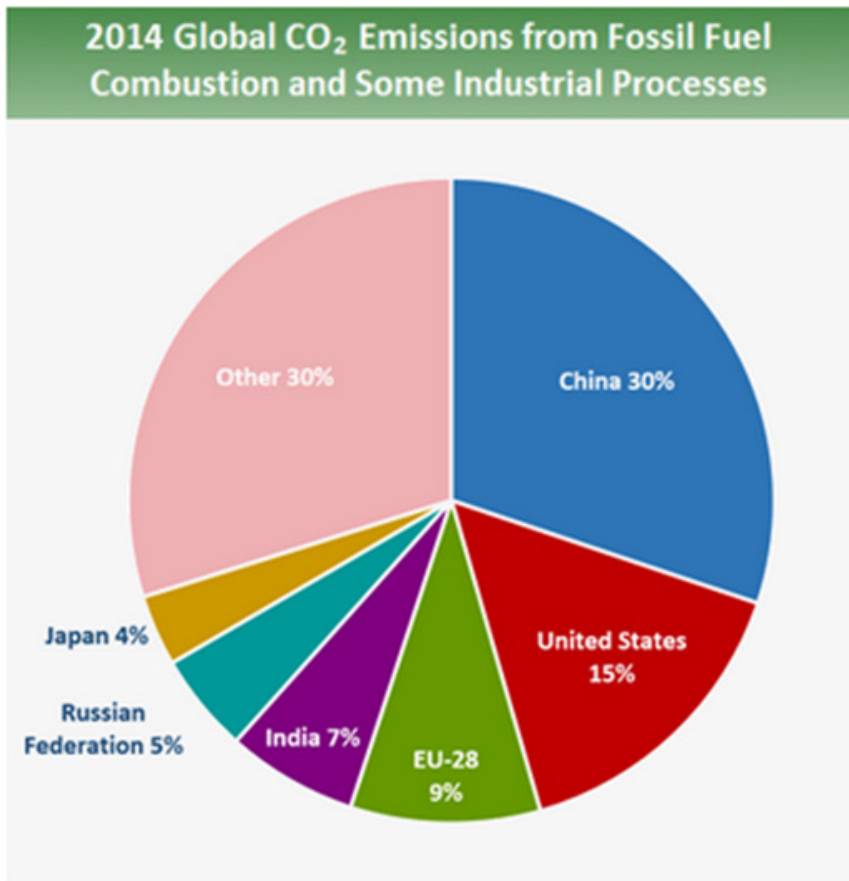


Figure 3. Source: EPA, USA³.

³ <https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data#Country>.

One aspect that particularly stands out in this journey is that, contrary to what certain voices predict, this reduction of emissions could be made, and continues to be made, while maintaining economic growth. The European Union was successful in delinking economic growth and environmental degradation in terms of climate change. Figure 4 shows this evolution throughout the considered period.

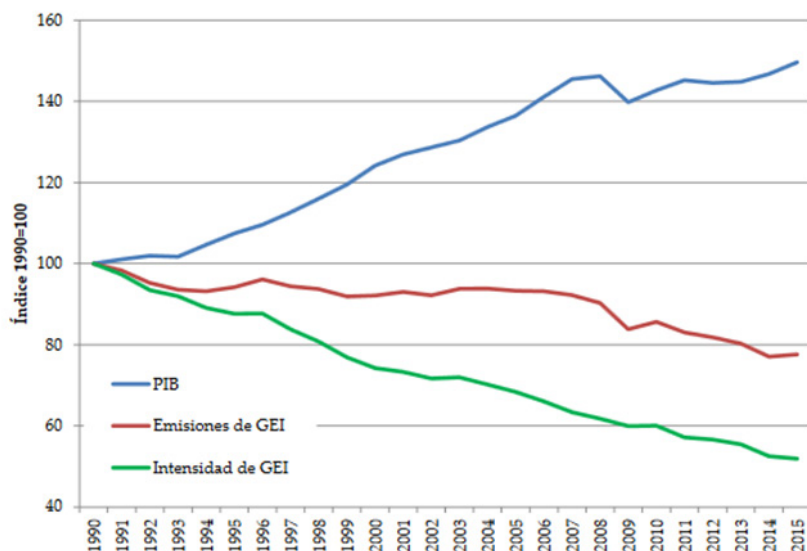


Figure 4. Evolution of GDP, greenhouse gas emissions and the intensity of emissions in the economy. Source: European Commission⁴.

It is also to be noted how at the same time, the intensity of emissions of the economy, measured as the ratio between emissions and GDP, was also considerably reduced.

Regarding the emission sources and achievements made, the graphical representation of the situation of the European Union in 1990 and in 2015 according to Eurostat data (figure 5), speaks for itself on the sectors in which the action of the Union placed an emphasis and in those where it must be placed in the future to achieve the objectives set by the European Council and agreed internationally.

⁴ European Commission. 2016. Report of the Commission to the European Parliament and the Council. «Application of the Paris Agreement: Advances of the European Union towards the objective of a minimum reduction of 40%». COM, 2016, pp. 707-end. <https://ec.europa.eu/transparency/regdoc/rep/1/2016/ES/COM-2016-707-F1-ES-MAIN.PDF>.

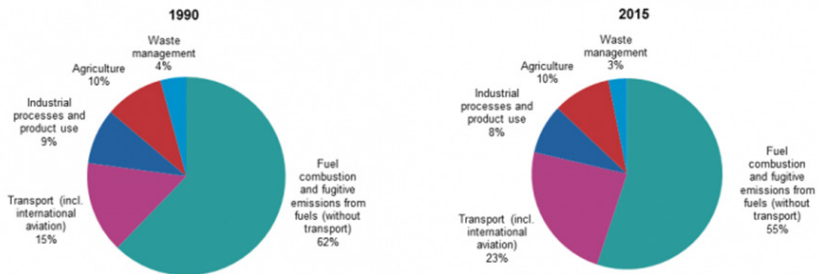


Figure 5. Emissions of greenhouse gases in the European Union - 28 by source, in 1990 and 2015. Source: Eurostat⁵.

The following pages will focus on the analysis of climate change policy in the European Union with regard to mitigation.

The formulation of European Union climate change policy: the institutional game

The speed and consistency with which the climate policy of the Union was developed during its barely 20 years of active existence is explained because only a policy with support at the highest level can go so far and in such a short time. And this is because this policy was directly taken in hand by the European Council a decade ago. As a result of the seriousness of the environmental problem generated by climate change, the international attention paid to it and its economic dimension, the European Council intervenes periodically and actively in the formulation and promotion of this policy. This means that practically all the institutions of the Union participate in one way or another in the matter, which makes it very special compared to other sector policies. Thus, the robust framework of political and legal acts that define it at the European Union level is established. Both types of acts play a complementary and mutually reinforcing role, as we shall see below.

Acts of a political nature These are acts adopted individually by an institution of the European Union. They mark the view of the institution that adopts them on the matter in question and their application is not enforceable before the courts of justice.

Particularly noteworthy among them are those adopted by the European Council, which is the official body that brings together the Heads of State and Government of the 28 Member States of the European Union. It is therefore the institution with the highest political level and its decisions have a particular relevance for all the others. It usually acts as a guide for the action

⁵ [http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Greenhouse_gas_emissions_analysis_by_source_sector_EU-28_1990_and_2015_\(percentage_of_total\)_new.png](http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Greenhouse_gas_emissions_analysis_by_source_sector_EU-28_1990_and_2015_(percentage_of_total)_new.png).

of the other institutions. 2007 can be cited as the year in which the high-level management of the climate and energy policy of the European Union began to take on a more concrete form. Firstly with the conclusions of March of the same year, in which the objectives for 2020 were set. Then with several others adopted either in outstanding international meetings or following the progress towards the previously decided objectives. The conclusions of October 2014 are also highlighted, which establish the objectives in terms of climate and energy for the decade following 2020, that is to say, from 2030.

The conclusions of the Council are also of particular importance. Although it may be better known for its essential legislative role, the Council also plays a political role which, in the particular case of climate change, is generally manifested through the adoption of «Council conclusions». They are also of great importance and are often adopted in preparation for the debates of the European Council, to establish the position of the European Union in international negotiations on climate change or, on other occasions, as a reaction to other political acts, such as the «communications» from the European Commission. They are typically adopted by the Environment Council. The conclusions of the Ecofin Council on climate finance are also frequent and recently the Council of Foreign Affairs on climate diplomacy has also been included in this line of action.

For its part, the European Commission also makes key contributions to this group of political acts. Apart from its capacity for exclusive legislative initiative within the European Union, it often makes important contributions within the framework of political reflection at key moments with the publication of «communications from the Commission». In practice, they largely nurture the political debates of the European Council and the Council.

Finally, the European Parliament, in addition to its role as co-legislator with the Council, also frequently adopts resolutions related to climate change intended to publicise the position of the institution and influence the political debates of the European Council and the Council. These resolutions are sometimes adopted in reaction to the communications of the Commission.

Legal acts. These are directives, regulations and decisions adopted jointly by the Council and the European Parliament on the basis of a legislative proposal from the Commission. They are binding instruments, whose compliance can be demanded before the courts of justice, and put into practice the internal climate policy of the European Union. As we will see later, they cover a whole series of domains, ranging from the standards most directly directed to the climate sector to another series of standards in the field of energy, transport, building and finance, for example.

In short, the political acts of each institution start from their own initiative and the legal acts are proposed by the Commission and adopted by the Council and the European Parliament. However, all remain within a framework of obvious mutual influence and under the political direction and drive of the European Council.

The European Union objectives for 2020, 2030 and 2050. The drive of Copenhagen and Paris

The objectives for 2020

In view of the end of the first period of compliance with the Kyoto Protocol in the years 2008-2012, a new agreement to replace it after 2010 began to be intensely prepared. This new instrument should be approved at the Conference of the Parties (COP) of the UNFCCC to be held in Copenhagen in December 2009. One of the great objectives of the time was to bring the United States and China to the future agreement and although in the end the attempt failed and the agreement was not reached, expectations were high in the years before. The European Union, a great promoter of the fight against climate change on a global scale, wanted to attend the meeting with its homework done and therefore decided in advance to set ambitious and unilateral ambitions for climate and energy by 2020. It was its contribution to encourage other countries to make similar efforts in a «lead by example» exercise. With this fund, the European Council, under the Presidency of the German Chancellor Angela Merkel, adopted⁶ the «2020 climate-energy framework» in the conclusions of March 2007. This framework at the time was the most ambitious contribution made by the developed countries towards the COP in Copenhagen. It highlights the following goals and objectives on climate and energy to be achieved by the European Union by 2020:

- to limit the increase in the global average temperature to no more than 2°C, with which the European Council endorses the figure given by science through the IPCC;
- this gives a clear mandate to energy policy to incorporate the climate goals by establishing that the fight against climate change is one of the three objectives of energy policy together with security of supply and guaranteeing the competitiveness of European economies;
- to reduce the European Union's greenhouse gas emissions by 20% with respect to 1990 and to reduce them by up to 30% if other developed countries commit to comparable efforts;
- to achieve a 20% improvement in energy efficiency compared to the values projected by the Commission for 2020;
- to achieve 20% of renewable energies in the total energy consumption of the European Union;
- a minimum of 10% for all Member States as a proportion of biofuels in all fuel (gas oil and petrol) in transport.

⁶ Conclusions of the European Council of 8 and 9 March 2007. Conclusions of the Presidency. Doc. 7224/07. <http://data.consilium.europa.eu/doc/document/ST-7224-2007-INIT/es/pdf>.

In order to understand the ambition of the European Council at the time, it must be borne in mind that the adopted goals were not only a negotiating position but that they also contained a commitment from the Union itself, even if no international agreement was reached, as was the case. This domestic objective was the famous 20-20-20 in 2020 (20% reduction of greenhouse gases, 20% renewable energy and 20% energy efficiency).

These conclusions largely gave rise to the complex legislative framework on climate and energy that is currently in force, and which is driving the transformation that we face towards 2020.

The objectives for 2030

After the Copenhagen disappointment, it became clear that a Kyoto-type agreement in which binding commitments were addressed only at developed countries could not succeed and a comprehensive agreement was sought that would include commitments for all the Parties to the Convention. Later, the appointment for this agreement was scheduled in Paris for December 2015. Here too the European Union wanted to lead by example and a year earlier, in October 2014, the European Council adopted some conclusions⁷ with the climate and energy goals and objectives for 2030 in the so-called «climate-energy framework 2030». The following stand out:

- To reduce greenhouse gas emissions by 40% compared to 1990, with the detail of distributing the contribution between the sectors subject to the emissions trading regime and those that are not; the former must reduce their emissions by 43% by 2030 compared to 2005, and the latter by 30%;
- It sets a binding minimum target of 27% as the contribution of renewable energies within the total energy consumption of the European Union;
- It establishes an minimum indicative target of a 27% improvement in the energy efficiency of the European Union with respect to the energy consumption forecasts and determines that it must be reviewed before 2020 with a view to raising it to 30%.

This political commitment of the European Council resulted in turn in a complete package of legislative measures proposed by the Commission and which are now being debated in the Council and in the European Parliament and should come into force before 2020. These will largely replace the current legislative framework of 2020.

Below, figure 6 shows a graphic representation of the meaning of the objectives indicated in relation to the trajectory and reduction efforts carried out to date.

⁷ European Council of 23 and 24 October 2014. Conclusions. Doc. EUCO169/14 <http://data.consilium.europa.eu/doc/document/ST-169-2014-INIT/es/pdf>.

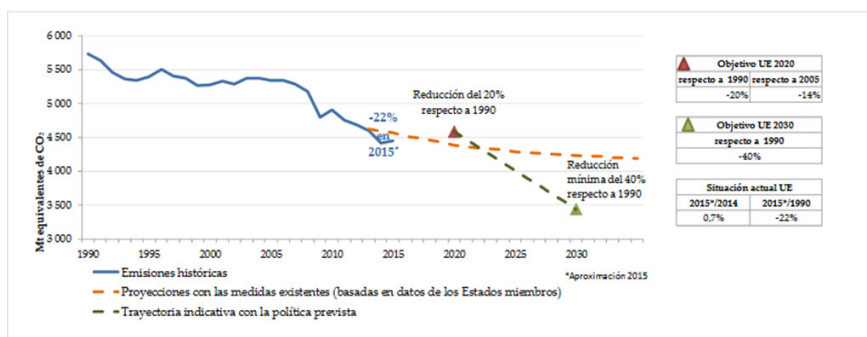


Figure 6. Mitigation objectives before 2030 and progress made up to 2015. Source European Commission ⁸.

The objectives for 2050

The global scientific consensus gathered by the IPCC⁹ has determined that to avoid the most negative effects of climate change, the average temperature of the Earth should not increase by more than 2°C, which is coupled with certain ranges of reduction of greenhouse gas emissions¹⁰ to achieve it.

In preparing COP15 on climate change in December 2009 in Copenhagen¹¹ and in order to lead by example, in October 2009 the European Council returned to the position of the European Union for this COP and adopted¹² quite detailed conclusions in which it established a European Union long-term climate goal for 2050.

The emission reduction established for the European Union was 80-95% in relation to 1990, in the context of the joint reductions of the developed countries. This figure in the form of a fork is that given as necessary by the IPCC so that the average temperature of the Earth does not rise above 2°C, as previously agreed. The language used by the European Council on this occasion is different from the usual and is rather more ambiguous, but for the first time it establishes a long-term objective that in practice is still frequently used as a point of reference by the different institutions of the European Union in political discussions on climate matters.

⁸ European Commission. 2016. Report of the Commission to the European Parliament and Council, «Implementation of the Paris Agreement: Advances of the European Union towards the objective of a minimum reduction of 40%». COM, 2016, pp. 707-end. <https://ec.europa.eu/transparency/regdoc/rep/1/2016/ES/COM-2016-707-F1-ES-MAIN.PDF>.

⁹ Intergovernmental Panel on Climate Change.

¹⁰ http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_sp.pdf.

¹¹ 15 Conference of the Parties to the United Nations Framework Convention for the fight against climate change.

¹² Brussels European Council of 29 and 30 October 2009. Conclusions of the Presidency. Doc. 15265/09. <http://data.consilium.europa.eu/doc/document/ST-15265-2009-INI/ES/pdf>.

The road map of the Commission: Towards a low carbon economy in 2050

At the COP16 held in Cancun in December 2010, it was agreed to support this objective of not exceeding the 2°C increase and in this context the Commission announced the presentation of a roadmap¹³ of the European Union to reach a low carbon economy by 2050. Its objective is to analyse what would be the most appropriate path to achieve the emission reduction objectives established by the European Council and already included in the international agenda for the year 2050.

This Roadmap is based on a modelling made from three scenarios in terms of the evolution of various factors between now and the year 2050. These scenarios take into account factors such as action in the fight against climate change on a global scale, technological progress and the prices of fossil fuels. As a whole, the models are applied for a domestic reduction (excluding the use of credits from outside the European Union) of greenhouse gas emissions of 80% by 2050 with respect to 1990. It is noteworthy that this 80% reduction is in the lower limit of the range agreed by the European Council and recommended by the IPCC (80-95%). A key element of the exercise is to determine what would be the most profitable route for the EU as a whole to reach this point.

The roadmap gives guidance on where reduction efforts should be applied beyond 2020 to achieve the major reductions proposed and sheds light on two key aspects on the way to 2050, namely: 1) the reduction milestones in different years and 2) the reduction efforts that correspond to the different sectors of economic activity.

It must be borne in mind that this communication from the Commission is not binding on any institution. However, even today its consideration and analysis helps to justify the climate objectives that the Union is gradually adopting.

Milestones on the roadmap to 2050

The roadmap shows that to achieve 80% domestic reduction by 2050, the profitable road leads to a reduction of greenhouse gas (GHG) emissions of 40% by 2030 and 60% by 2040, preceded by 25% in the year 2020, always in relation to 1990 emissions, as shown in figure 7. All this indicates that the closer we get to the year 2050, the greater the effort, while recognising that the sooner actions are taken, the lower the cost of the whole effort. The profitability of recent years is based on the fact that more technologies

¹³ Communication from the Commission – Roadmap towards a competitive low-carbon economy by 2050. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0112:FIN:ES:PDF>.

are expected to be available. Conversely, failure to follow these reduction milestones could limit the investments needed in the early phases and consequently lead to higher prices at the end. In short, the Commission considers that any other path than that marked on this roadmap will end up being more expensive for the EU.

The goal of a 40% reduction by 2030 was already formally agreed by the European Council in October 2014, as we saw above.

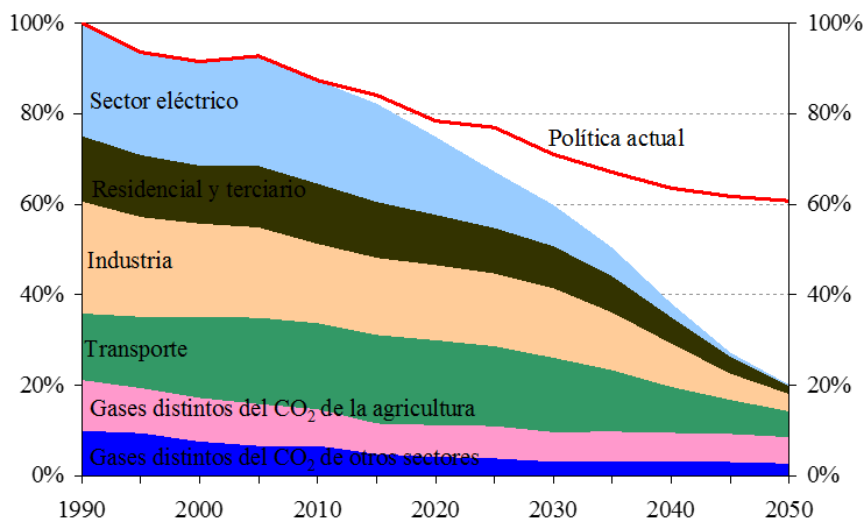


Figure 7. EU greenhouse gas emissions: towards an internal reduction of 80% (100% = 1990). Source: European Commission ¹⁴.

The effort by economic sectors

The challenge posed by the reduction objectives is equivalent to a full-fledged economic revolution, and particularly for some sectors such as the energy sector and also for residential and services, which must reduce their emissions by more than 90% compared to 1990. On the other hand, those that contribute least to the reduction are the agricultural sectors (gases other than CO₂) and transport, which does not mean that they are not asked for a great effort. Table 1 shows the efforts by sector for the range of scenarios analysed.

¹⁴ Communication from the Commission - Roadmap towards a competitive low-carbon economy by 2050. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0112:FIN:ES:PDF>.

GHG reductions compared to 1990	2005	2030	2050
Electricity (CO ₂)	- 7%	- 54 to - 68%	- 93 to - 99%
Industry (CO ₂)	- 20%	- 34 to - 40%	- 83 to - 87%
Transport (including aviation, excluding sea transport) (CO ₂)	+ 30%	+ 20 to - 9%	- 54 to - 67 %
Residential and services (CO ₂)	- 12%	- 37 to - 53%	- 88 to - 91%
Agriculture (other than CO ₂)	- 20%	- 36 to - 37%	- 42 to - 49%
Emissions other than CO ₂	- 30%	- 72 to - 73%	- 70 to - 78%
Total	- 7%	- 40 to - 44%	- 79 to - 82%

Chart 1. Contribution of the economic sectors to the reduction effort. Source: European Commission¹⁵.

A - Maximum decarbonisation in the energy sector

The model shows a reduction of emissions from 93% to 99% by 2050 for the energy sector in all scenarios, which, in practice, means its almost total decarbonisation. It does not take much imagination to realise the enormous challenge that it will mean for electricity production by 2050 not to emit CO₂, especially taking into account that at the same time part of the transport and consumption of heating is also expected to use electric power. The technological change that will have to be achieved is practically total and means the abandonment of some of today's and historically most used technologies.

The technologies on which the models foresee that electricity production will essentially lie will be those associated with renewable sources, fossil fuels with carbon capture and storage (CAS) and nuclear energy. These three technologies are expected to cover 60% of electricity production by 2020 and up to 80% by 2030.

B - Buildings and associated services

The reduction potential of this sector is also very high and achieves a decrease in GHG emissions from 88% to 91% of emissions by 2050 compared to 1990. Most of the consumption, about two thirds of the total, takes place in heating and cooling and cooking and water heating, which means about a fifth of the total. The reduction potential is essentially based on measures of efficiency and energy saving in both public and private buildings, and to this the Union devotes and expects to devote a large part of its efforts in this field in the future.

It is worth particularly highlighting the ambitious objective of the Directive on energy efficiency of buildings¹⁶, May 2010, which establishes that by 1

¹⁵ Communication from the Commission - Roadmap towards a competitive low-carbon economy by 2050. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0112:FIN:ES:PDF>.

¹⁶ Buildings Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast) <http://www.idae.es/>

December 2020 all new buildings will be of almost zero energy consumption, a date that is brought forward to 1 January 2019 for new publicly owned buildings.

C - Industrial sectors

This is the third sector in terms of reduction potential for the year 2050, with forecast greenhouse gas reductions ranging from 83% to 87% depending on the scenario. The models show that the effort is essentially achieved with more efficient industrial processes and based on the application of innovative technologies, both for CO₂ emissions and for the others, with special mention to carbon capture and storage, which is understood to be a technology that will already be profitable in certain industrial sectors, such as steel and cement, from the year 2035. It is also worth noting the €10 billion annual investment that the Commission estimates will be necessary to implement it.

D - Reductions in transport

Transport, which according to the European Environment Agency (EEA) is responsible for more than 20% of greenhouse gas emissions in the European Union, has shown particular resistance to efforts to reduce emissions. It considers that the first sign of reduction could appear towards the year 2030, when the emissions would return to 1990 levels.

The scenarios modelled in the roadmap aim at a range of reductions for transport by 2050 (excluding sea transport) of 54% to 67%, whose achievement should be considered a success given the behaviour of the sector to date. To reach this point, the main measures would be in the field of efficiency in the use of fuel, use of non-fossil fuels, increased use of biofuels and in transport management, such as infrastructure fees and congestion charges, the improvement of public transport, the establishment of smart taxes and others. Its effectiveness will be shown from 2025 by providing the implementation of new transport technologies such as electric vehicles, hydrogen-powered vehicles and hybrids, which provide a determining potential, as shown in Figure 8. Here you can see how, in accordance with the modelling of the Commission and in this ambitious scenario, without electric vehicles, reductions in the transport sector could not be achieved.

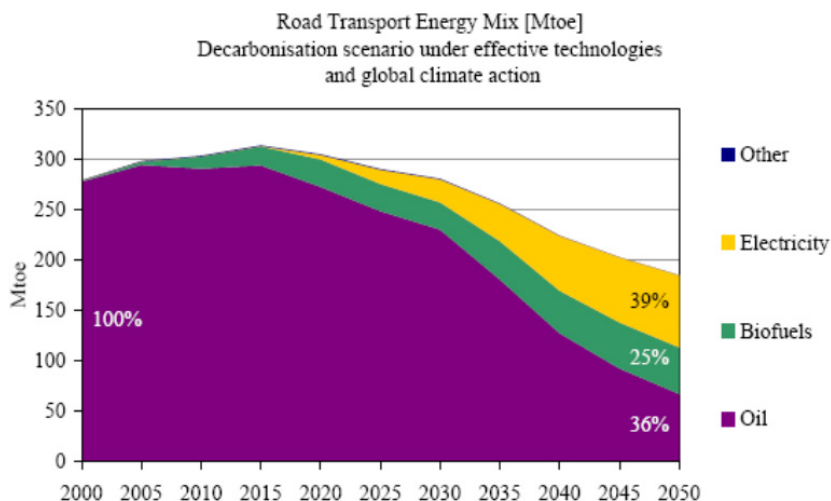


Figure 8. Contribution of fuel types to reductions in the transport sector. Source: European Commission¹⁷.

E - Agriculture

Agriculture is another example in which the reduction of emissions is of limited potential. In fact, the roadmap model shows a maximum reduction capacity of 42% to 49% by 2050 in the different scenarios, and always for emissions other than CO₂, with the peak to be achieved in 2030.

Regarding the measures to be applied, the key appears in two lines of action: on the one hand, the best available practices in waste and slurry management, use of fertilisers, biogasification and livestock production, for example, and on the other, the potential for carbon sequestration (forests, woody vegetation, grasslands, soil conservation, wetlands, peat bogs, etc.) offered by agriculture.

In this sector there is a very special paradox, because on the one hand it must reduce its emissions, but on the other it is practically advocated to increase them. With a population that, according to current estimates, may exceed 9 billion people by 2050 and a development that happily tends to feed it better, it will be necessary to produce more and more food, intensify crops and more intensely transform lands that today can be considered natural. This logically leads to an increase in greenhouse gas emissions and to the reduction of carbon stores. The dilemma of agriculture is while it is difficult to contain its emissions, it may also be very costly not to do so, because

¹⁷ Communication from the Commission - Roadmap towards a competitive low-carbon economy by 2050. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0112:FIN:ES:PDF>.

the effects of climate change on natural resources (climate, water, soil etc...) may cause a loss of output in many areas of agricultural production.

Main legislative instruments on climate change

The European Emission Trading Scheme

The reduction of emissions by 20% by 2020 compared to 1990 is equivalent to a reduction of 14% compared to 2005. To achieve this figure, the European Union divides the total emissions into two large blocks: those covered by the European emission trading scheme and those covered by the system of distribution of efforts. The former must be reduced by 21% and the latter by 10%, both with respect to 2005.

The European emission trading scheme (ETS)¹⁸ was an essential pillar in the European Union's response to the emission reduction obligations of the Kyoto Protocol and was created experimentally in 2005. It became mandatory in 2008. It is a market instrument that is currently applied to more than 11,000 fixed installations or air operators distributed among 31 countries, 28 of the European Union and 3 of the EEA¹⁹, which together exceed the figure of 500 million inhabitants. It covers about half of European carbon dioxide emissions.

Today it represents around 75% of the international carbon market and is the largest in the world. Other countries and regions seek experiences and sources of inspiration for the development of their own markets here²⁰. The European Union also actively seeks to link it to other markets in third countries in order to increase its size and effectiveness, and is in advanced negotiations with some of them.

In essence, it consists of establishing an annual European cap of greenhouse gas emissions that can not be exceeded and that is also being reduced to achieve the previously established reduction targets of the European Union (for example, that by 2030 its total emissions do not exceed 43% of 1990). In line with this cap, a series of emission rights are issued -one per ton of equivalent CO₂- that end up in the operators included in the system. The way to access these rights can be free (limited access) or by purchase, in organised auctions or by direct purchase on the secondary market. The emission right thus becomes the currency of this market, a currency that can be used only once. Operators have the obligation to make an annual inventory of their emissions and to deliver the national authorities a number of rights equal to the emissions they have had in that year. If they have more rights, they can

¹⁸ Commonly cited in English ETS, for *Emission Trading Scheme*.

¹⁹ EEA, European Economic Area.

²⁰ Today there are already national or regional carbon markets in China, South Korea, Canada, Japan, New Zealand, Switzerland and the United States.

keep or sell them. If they lack rights, additional rights should be procured, which they can buy on the market, until they equal the emissions.

The main advantage attributed to the scheme is that it allows facilities to choose the cheapest option to reduce the emissions they are forced to make, since they can choose between continuing to issue and purchase the rights they lack at the end of the year or otherwise reduce emissions (by changing production processes, for example) and, where appropriate, sell or save their surplus rights for later. These are therefore economic and strategic decisions for facilities and not environmental, because the environmental objective is ensured by the total ceiling of emissions established at European level, and can not be exceeded as a whole.

Since 2005, the system has undergone successive reforms, in which the number of participating countries has been increased, the number of greenhouse gases covered and the number of sectors affected. It is currently in phase 3, period 2013 - 2020. The reform of what will be phase 4 for the period 2021-2030 is also under discussion in the Council and in the European Parliament, and which will adjust the ETS to the decision of the European Council of October 2014 on the climate-energy 2030 framework. Below is a brief description of how the system works in 2016.

Sectors and greenhouse gases covered by the ETS system

The directive applies to emissions generated by high energy consumption facilities such as the combustion with thermal power of more than 20 MW (except for waste incineration) and, above certain thresholds, to oil refineries, coke producers, production of steel and other metals, production of aluminium, manufacturing of cement, lime, ceramic products, paper pulp, production of various chemical products (such as nitric acid, adipic acid, ammonia, hydrogen) and aviation emissions on internal flights of the EEA.

In terms of gases, they vary by sector, but cover the emissions of carbon dioxide (CO₂), nitrous oxide (N₂O) and per fluorocarbons (PFC).

How many emission rights are issued annually?

First of all, remember that an emission right is the right to emit an equivalent ton of carbon dioxide.

The cap of issued rights is calculated annually by the Commission. Part of the average figure issued by the Member States in the second phase (2008-2012) and the amount set in 2010 is thereafter reduced by 1.74% per year. This achieves the reduction target set for 2020 to emit 21% less than in 2005, which is the part that corresponds to ETS in the effort to reduce greenhouse gas emissions by 20% with respect to 1990. In absolute figures,

the maximum ceiling of ETS emissions in 2013 for fixed installations was 2,084,301,856 tons, and the annual reduction is 38,264,246 up to 2020. For aviation, the ceiling was established at 95% of the historical emissions of the sector corresponding to the years 2004-2006.

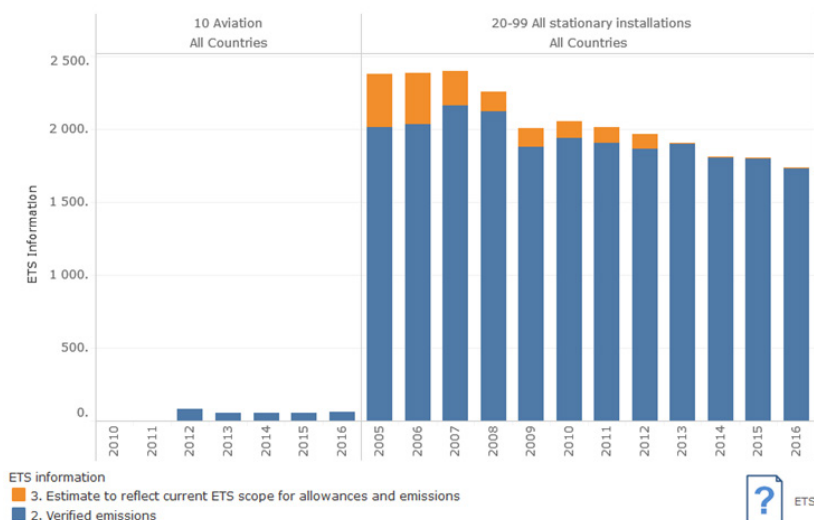


Figure 9. Historical emissions of the sectors covered by ETS. Source: European Environment Agency, 2017²¹.

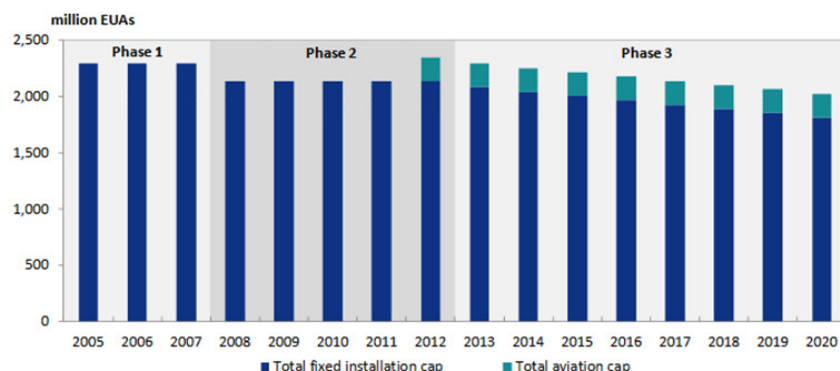


Figure 10. Evolution of the ceiling of emission rights (millions) of ETS. European Commission²².

²¹ <https://www.eea.europa.eu/data-and-maps/dashboards/emissions-trading-viewer-1>.

²² European Commission (2015). EU ETS Handbook. https://ec.europa.eu/clima/sites/clima/files/docs/ets_handbook_en.pdf.

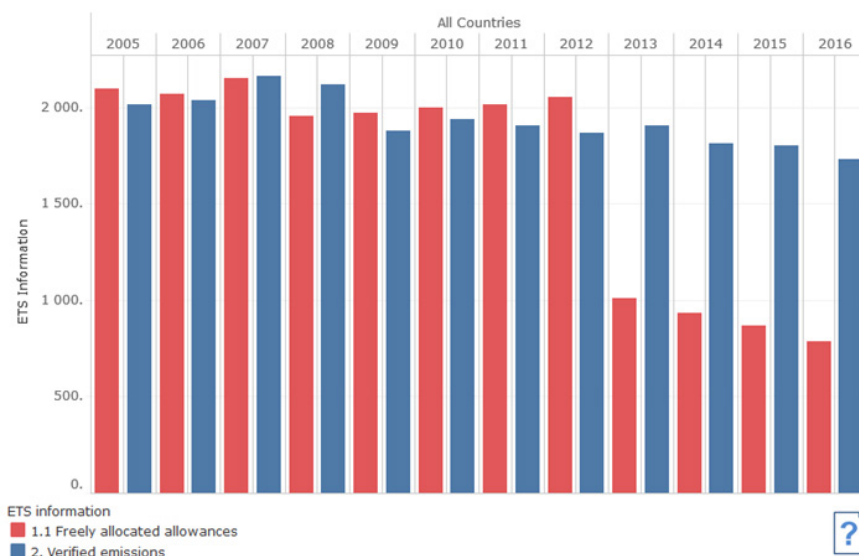


Figure 11. Evolution of verified emissions and rights assigned freely. Source EEA²³.

Figure 11 shows how since the beginning of phase 3 of the ETS in 2013 when the auction was imposed, the difference between the rights assigned free and the verified emissions has grown.

Distribution of rights between operators

As stated above, the rights are distributed among operators through two totally different methods: auction and free allocation. Obviously, operators can also gain and get rid of rights through their direct purchase on the market.

From stage 3, the default distribution method and that used is the auction. It is a question of the facilities reflecting the cost of carbon in the price of products. Free allocation is understood as something residual that is necessary to maintain due to various market circumstances, for example if competition against products from third countries does not allow the cost of carbon to be transferred to the prices of products.

The auction method is mandatory for all electricity generation, although there is an exception for eight Member States (Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Lithuania, Poland and Romania) which can also distribute free a part of the rights for their electricity generators in order to modernise the sector.

²³ <https://www.eea.europa.eu/data-and-maps/dashboards/emissions-trading-viewer-1>.

As for the industrial sectors, there is a progressive increase in the auctioned proportion that goes from 20% in 2013 to 70% by 2020.

The Commission estimates that in the whole of this phase 3, 57% of the total rights will have been auctioned and the remaining 43% will have been distributed free.

The free allocation also applies 100% to all facilities that are at risk of carbon leakage due to competition with facilities outside the European Union, as will be seen below.

For aviation, 15% of its rights are auctioned and the rest is distributed free. This distribution is made from a reference parameter in tons of CO₂ per ton - kilometre for the different operators.

The free allocation among the facilities that are entitled to it is done in a totally harmonised way for the whole of Europe. An industrial facility in Budapest or Madrid will thus receive its rights with exactly the same rules in both sites. The distribution is preferably through reference parameters that establish the number of rights to be delivered per unit of product (for example, ton CO₂/ton product). The reference is taken from 10% of the most efficient installations within the system for each sector. Figure 12 shows an example in the case of aluminium. This favours the incorporation of the most efficient technologies in emission savings in the different industrial processes.

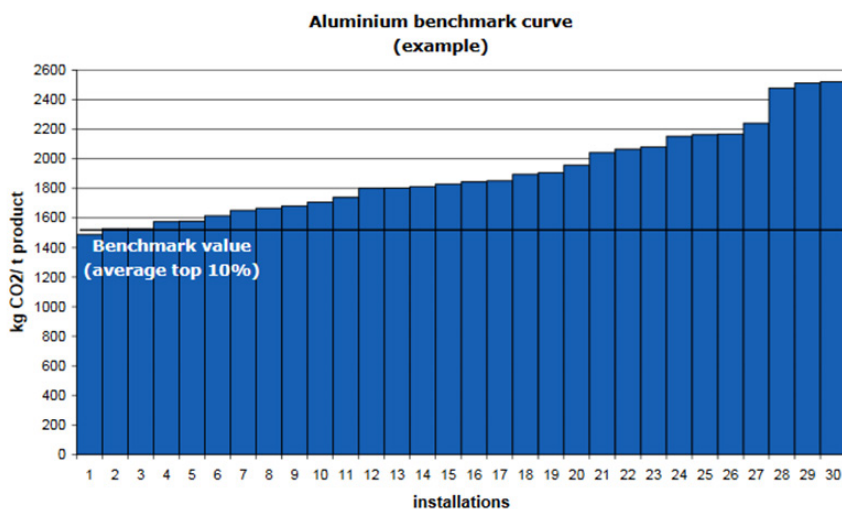


Figure 12. Aluminium reference parameter curve. Source: European Commission²⁴.

²⁴ European Commission (2015). EU ETS Handbook. https://ec.europa.eu/clima/sites/clima/files/docs/ets_handbook_en.pdf.

This graph shows that when setting the reference value from the 10% best emissions (the first 3 in this case), the end installations, for the same volume of production as the former, will receive far fewer rights than the emissions they generate, which will force them to buy those they lack. This provides a permanent incentive to reduce emissions through technological improvement.

On the other hand, there is a safeguard clause that also establishes a maximum ceiling for the free allocation to the corresponding facilities, and this can not exceed the proportion that these facilities had as a whole in the ETS in the years 2005-2007. Since what is fixed is the proportion, as the maximum ceiling of ETS is lowered each year and the same proportion is always applied to it, what finally decreases is the final volume assigned free. The rights that may be missing from the different facilities are reduced proportionally to all of them when making the annual allocation and they will have to look for them on the market.

Protection against the risk of carbon leakage

The emissions trading regime inevitably leads to a reflection on issues related to the risk of carbon leakage, which could lead to the relocation of industrial activity from the EU to third countries where there are not these carbon pricing mechanisms which, in the end, add production costs. This would be harmful both environmentally and economically. Environmentally because, with relocation, emissions would be transferred to other places with fewer restrictions, which could even increase them instead of the sought-after reduction. And economically because activity and employment would be lost in the European Union to the benefit of third countries.

It is obvious that in the case of the existence of an international binding regime on climate change applied globally that includes a price for carbon throughout the world, this risk would tend to disappear since similar conditions would apply everywhere, and it would not make sense for operators to make the pilgrimage in search of emission paradises.

European industry, and particularly that based on more intensive use of energy, has called for measures to avoid this risk of carbon leakage, and this has been established in the current climate-energy package. In practice, however, there are many factors that influence the location of a production centre (labour costs and qualifications, markets, access to raw materials, regulatory and investment stability, for example), and carbon costs are but one factor among others, and certainly not that of greater weight. This is an intense debate in which there is no shortage of analyses that considerably reduce the risk of these carbon leakages materialising in practice (see Tscherning, a study²⁵ carried out precisely in the industrial heart of the

²⁵ TSCHERNING, R. (2011). The EU ETS Rules on Carbon Leakage and Energy Intensive Industry in the Federal Republic of Germany, *European Energy and Environmental Law Review* Wolters Kluwer.

European Union, in Germany). There are many studies in this regard and, with the carbon prices known to date, it has not yet been proven that there have been relocations due to the price of carbon.

The ETS determines the risk of carbon leakage for a certain sector through a combination of the extra costs generated by access to emission rights and their exposure to international trade. In this way, a sector with very little extra cost or that is hardly exposed to international trade would hardly be at risk of carbon leakage, while another in the opposite situation would have a high risk. A list of sectors at risk of carbon leakage is prepared and reviewed periodically.

The sectors included in the list of carbon leakage are exempted from auction and they are guaranteed free access to 100% of their emission rights, within the limits established by the ETS, in order to avoid their having additional costs.

Monitoring, reporting and verification of the system. Penalties

Operators are required to monitor and report their emissions every year, with reports that have to be approved by accredited verifiers. On 30 April of each year, they must deliver a number of rights equivalent to the previous year's emissions. The rights are then cancelled and can not be reused. The integrity of the system is guaranteed through a single Union registry including all issued rights.

A market system like this would be unfair and could not work well without a monitoring and control mechanism for all actors and without sufficient sanctions to deter potential non-compliers. This is necessary to create the necessary trust between all the actors and to prevent those who do not comply from gaining an advantage over others.

It is the Member States participating in ETS that establish the sanctions for non-compliance, which must in any case be proportionate and dissuasive. The fines imposed to date move in a range varying between the minimum of €75,000 of Slovenia to the maximum of €16,000,000 of Estonia. The system also imposes a uniform cost at European level of €100 for each surplus ton issued at the end of each year, for which the corresponding right was not delivered.

According to the ETS report of 2016²⁶ in 2015 there were six countries that imposed sanctions for excess emissions and eight that imposed fines on fixed installations. The country that issued most fines was the United Kingdom, with 22. The most frequent cause was for not delivering the emission

²⁶ European Environment Agency (2017). Application of the European Union Emissions Trading Directive. Analysis of national responses under Article 21 of the EU ETS Directive in 2016. EEA Report No. 4/2017.

inventories. The highest of €12,300,000 was imposed by Italy on a facility for operating without authorisation. Six others imposed fines on air operators.

Negotiated volumes and market value of ETS. Price stability

It is difficult to make an accurate estimate of volumes negotiated each year and even more of the market value. Firstly, because although the volumes auctioned each year are known, as can be seen in figure 13, what can not be predicted is the volume of transactions between the operators, which will depend on many factors including the strategic decisions of every business.

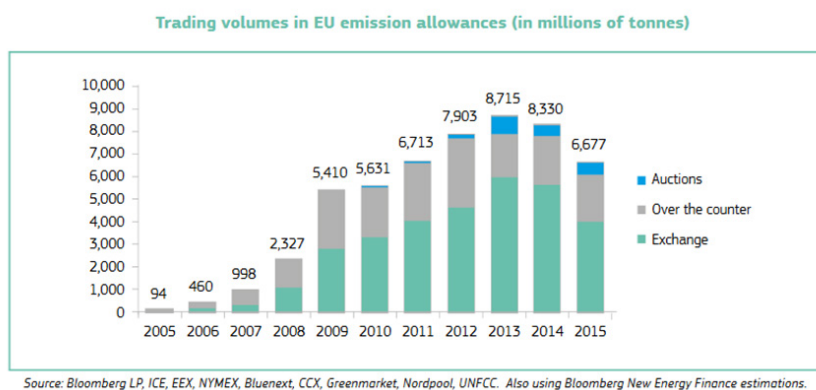


Figure 13. Volume of rights negotiated each year in ETS. Source: European Commission²⁷.

Regarding the value of the ETS market, the prediction is even more difficult, because to the previous unknown we must add the evolution of the price of the right. What the data show is the rapid development of this market, which, non-existent before 2005, showed a continuous increase in volumes negotiated until 2013 and which, in combination with the prices of the emission right, also showed a continued increase in value, reaching 81 billion euros in 2011. The results of the financial crisis were felt strongly from that year, when the combination of the lower volume traded and the lower price of the right made its value fall to less than half in 2013.

The price variability is an element that caused particular concern to the European legislator due to the market instability and the weakening of the price sign, just the opposite of what were the objectives of the ETS to encourage investments in low carbon technologies.

Since one of the causes of the low prices of the emission right is the excess of rights on the market (the causes of this surplus are many and are partly in

²⁷ European Commission 2017. The EU Emissions Trading System (EU ETS). Fact sheet. https://ec.europa.eu/clima/sites/clima/files/factsheet_ets_en.pdf.

the original design of ETS), it was decided to reduce it and stabilise the market to make prices more predictable and higher. A «market stability reserve»²⁸ was created for it in 2015, which in essence consists of removing the rights that are above a certain volume from the market and reintroducing them on the market when their volume falls below a certain threshold. This reserve should be operational as of 2019 and it is likely that in phase 4 its design will be further strengthened to make it more efficient.

The reduction of emissions not covered by the European emissions trading system

As we saw in the previous section, for the non-ETS group, the European Union has the operational objective of reducing emissions by 10% by 2020 compared to 2005. In 2013, the total volume represented 55% of the greenhouse gas emissions of the European Union. This group includes the facilities of small industry (those not covered by the first section) and most of the diffuse sources of emissions such as transport (except for aviation and international navigation), buildings, waste or agriculture (with the exclusion of emissions from land use and forests, which is expected to be included, however, after 2021).

The nature of the emissions from this non-ETS group, many distributed diffusely within each Member State, makes it impossible to focus on the distribution of the cap between individual issuers, so the chosen solution consists of dividing the effort of reducing by 10% at Union level in differentiated efforts for each of the 28 Member States. Unlike ETS, emission targets for the sectors covered are not established here, but the choice of how and in which sectors to carry out the reductions is left to each Member State. To this end, it must adopt the national measures it deems appropriate, in addition to the reduction measures that can be established at Union level, among which we can mention those relating to CO₂ emissions from vehicles and vans, fluorinated gases and equipment, mobile air conditioning, those relating to energy (energy efficiency or output of buildings, for example) or landfills, among others.

The instrument providing for distribution between Member States and the applicable conditions is a decision of the Council and of the European Parliament adopted in 2009, the Effort Sharing Decision²⁹ (ESD³⁰). The instrument tries to make the distribution of costs and efforts as fair and equitable as possible and

²⁸ <http://eur-lex.europa.eu/legal-content/ES/TXT/HTML/?uri=CELEX:32015D1814&from=EN>.

²⁹ Decision no. 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the efforts of the Member States to reduce their greenhouse gas emissions in order to meet the commitments made by the Community up to 2020. <http://eur-lex.europa.eu/legal-content/ES/TXT/HTML/?uri=CELEX:32009D0406&from=ES>.

³⁰ Better known as Effort Sharing Decision.

uses the economic capacity of each Member State based on its relative wealth (per capita income in 2005), combined to a certain degree with the profitability of the measures to be adopted. This means that there is a greater contribution from the richest countries, but also taking into account the places where it is cheaper to reduce in the whole of the Union. With this, the richer Member States have to reduce their emissions while the poorer, to grow faster, reduce less and can even increase them. The scheme incorporates an upper and a lower limit, so that no Member State will be obliged to reduce more than 20% of its emissions nor be able, on the other hand, to increase them more than 20%. Finally, all the Member States gave their approval to the system used, as shown in figure 14.

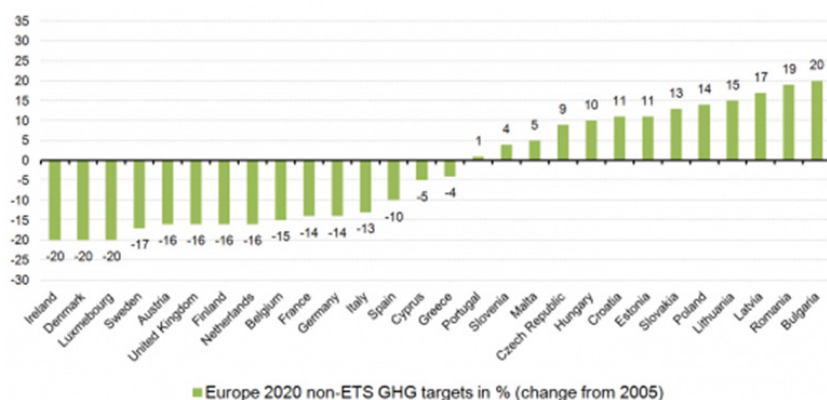


Figure 14. Greenhouse gas reduction goals in non-ETS sectors by Member State under the Effort Sharing Decision. Source: European Commission³¹.

The ESD also establishes annual maximum emission limits per Member State, which are given by an annual downward trajectory from 2013 to 2020. The Commission calculates the annual allocation of emissions (AAE) that corresponds to each one of them for each year. They are binding and the Member States have to answer for them. To facilitate compliance with these annual objectives and set them apart from circumstances of force majeure such as weather phenomena (extreme winters or summers) or economic crises, which could temporarily hinder the expected reductions, the ESD also foresees a series of flexibilities within the Member States and between them, throughout the compliance period (2013–2020). Thus, if one year a Member State makes reductions greater than those required by the annual objective, it can drag that excess compliance to successive years and count them later³². Conversely, if in a given year their

³¹ https://ec.europa.eu/clima/policies/effort_en.

³² It is the so-called «banking» or «drag».

emissions are above the established target, the Member State may borrow up to 5% of the AAEs the following year, when they will have to be discounted³³.

Member States may also transfer (generally through sale) their AAEs to each other when they have over-compliance. Finally, and within certain qualitative and quantitative limits, they can also buy international credits from the Clean Development Mechanism and the Joint Implementation Mechanism³⁴.

To date, according to the official data of inventory of the last year published, the Member States are meeting the established objectives with a certain ease. Thus, for example, between 2005 and 2013 all sectors reduced their emissions, some up to 25%, such as the waste sector (see figure 15). The total emissions of 2014 were already 12.9% below those of 2005, so the 2020 target had already been reached six years in advance.

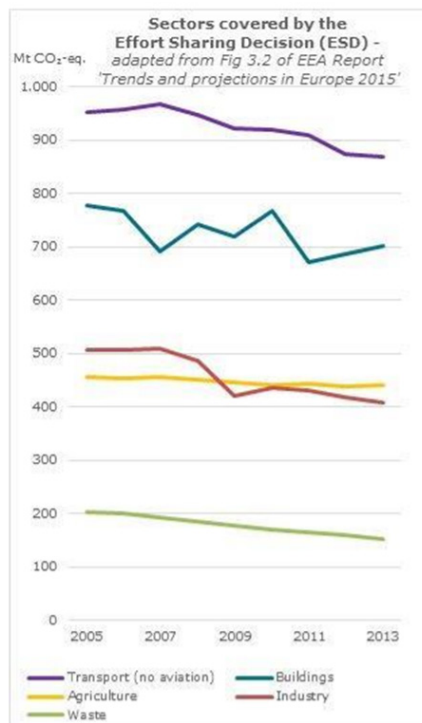


Figure 15. Reductions of emissions of non-ETS sectors achieved in the European Union in 2013-2015. Source: European Commission³⁵.

³³ It is the so-called «borrowing» or «loan».

³⁴ They are the two flexibility mechanisms developed in the implementation of the Kyoto Protocol.

³⁵ European Commission. 2016. Report from the Commission to the European Parliament and the Council on evaluating the implementation of decision no. 406/2009/EC pursuant to its article 14. COM, 2016, pp. 483-end. <https://ec.europa.eu/transparency/regdoc/rep/1/2016/EN/1-2016-483-EN-F1-1.PDF>.

In addition, in order to verify compliance with the annual objectives marked by their linear trajectory, the Member States are obliged to measure and control their emissions through a monitoring system. They must also inform the Commission each year of the progress made and future projections, both of the emissions and of the policies and measures that they plan to apply. In case of non-compliance with the annual objectives, once the available flexibilities are exhausted, they are subject to certain sanctions and the obligation to implement corrective actions.

Projections for 2020 also show comfortable compliance with the European Union's 2020 target (see figure 16). Projections by Member State show that by 2020 all will have internally reached their target for that year except four, Luxembourg, Ireland, Belgium and Austria. The latter will have to adopt additional measures or use the margins given by the flexibility mechanisms to achieve their objectives.

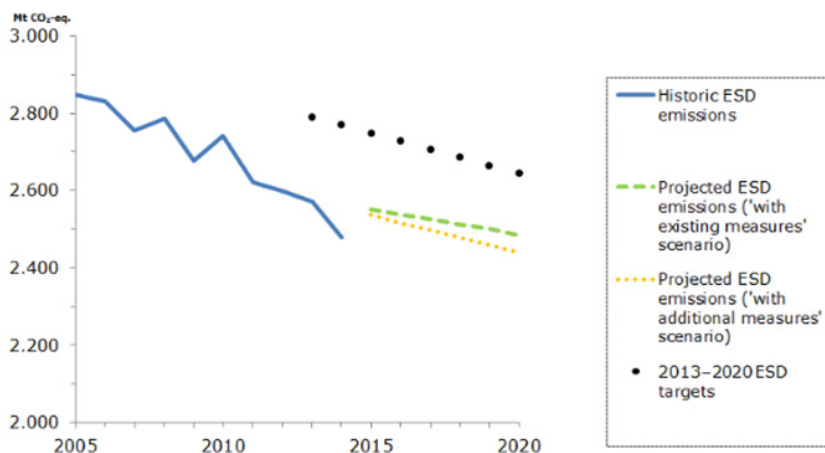


Figure 16. Emissions covered by the real and projected ESD 2005 - 2020. Source: European Commission³⁶.

As for the future, as with ETS, the Council and the European Parliament are now discussing the new provision on the share-out of efforts that should regulate this sector between 2021 and 2030. The new objective established by the European Council and already agreed by the European Union within the framework of the Paris Agreement of 2015 is to reduce this group of emissions by 30% in 2030 compared to 2005. One of the important features of the new proposal is that it already incorporates emissions and removals of greenhouse gases from the use of the land and its changes, as well as forestry. In any case, until the agreement between the Council and the European Parliament is reached, it will not be possible to know what the new scheme will finally be.

³⁶ European Commission. 2016. Report from the Commission to the European Parliament and the Council on evaluating the implementation of decision no. 406/2009/EC pursuant to its article 14. COM, 2016, pp. 483-end. <https://ec.europa.eu/transparency/regdoc/rep/1/2016/EN/1-2016-483-EN-F1-1.PDF>.

Emissions and absorptions from forestry and agriculture (LULUCF)

The use of land is also of particular relevance in terms of climate change. On the one hand, soils and vegetation cover store carbon and can remove it from the atmosphere through plant growth and good soil management, where considerable quantities are stored. Conversely, they can also emit CO₂, for example, when deforested, wet areas are drained or when permanent grasslands are transformed into cultivation areas. In the field of climate change policy, all of these modifications are called «land use, land use change and forestry» and are commonly referred to by their acronym LULUCF. As a whole, these surfaces cover more than 75% of the European Union and are its largest CO₂ storage.

Until now, the European Union has been a carbon sink since its LULUCF absorptions are larger than its emissions. According to EEA data³⁷, in 2014 the net total absorbed in the whole of the European Union was 308 Mton-CO₂-eq³⁸, and only four countries counted net emissions (Denmark, Ireland, Latvia and the Netherlands). The main cause of this balance lies in reforestation and in the rate of annual forest harvesting, which was considerably less than the growth of forests (a variable directly linked to the absorption of CO₂). The figure is in line with the average of 320 Mton-CO₂-eq a year absorbed since 2000, and with a decreasing trend in the last 7 years. These figures reached up to about 10% of the total greenhouse gas emissions of the European Union in certain years.

On the other hand, climate and energy policy can also be very directly related to LULUCF emissions. Thus, for example, if the reduction of greenhouse gases in the production of electricity is achieved by changing the energy source from a fossil fuel to biomass, the increase in biomass consumption could result in the reduction of CO₂ stored in a forest. Hence, in view of a policy that facilitates the use of biomass as a source of renewable energy, it makes perfect sense to also analyse its effect on the global carbon balance, since it can reduce the sink effect in forests.

Currently and until 2020, LULUCF emissions and removals are not included in either the ETS or the non-ETS group and therefore do not count towards the reduction target for 2020. However, they are subject to certain obligations both internal to the European Union and internationally in the framework of the second commitment period of the Kyoto Protocol. At an internal level, since 2013, Member States have been obliged to account for emissions and absorptions derived from forest plantations, reforestation and deforestation, and under certain conditions those derived from crops and the management of grasslands³⁹.

³⁷ EEA. 2016. *Trends and projections in Europe 2016 – Tracking progress towards Europe's climate and energy targets*.

³⁸ Millions of tons of equivalent CO₂.

³⁹ Decision 529/2013 / EU of the European Parliament and of the Council of 21 May 2013 on accounting standards applicable to emissions and absorptions of greenhouse gases

Regarding the Kyoto Protocol, the obligation is that there should be no net emissions in the LULUCF sector. In other words, if a Member State increases its emissions through deforestation or its agricultural activity, it will have to offset them with new reforestations or by improving the management of forests, crops or pastures. And if this is not enough to offset the emissions, the corresponding rights will have to be found by other methods, such as buying them from other Member States or discounting them from their emissions in other sectors. This is what is called the «no debit» rule in LULUCF, which in practice prohibits this sector from counting as a net issuer.

For all of the above, accounting for LULUCF emissions and absorptions in the overall greenhouse gas emissions of the European Union only increases the coherence of the system by providing a more global vision of the whole. This was decided by the European Council in October 2014 by including the LULUCF sector within the goal of reducing emissions by 2030. As we pointed out above, the Commission already included it in the new ESD proposal, in which the main developments with regard to Decision 529/2013/EU are the following:

- The LULUCF emissions and removals of the next period 2021-2030 are counted within the objective of reducing the emissions of greenhouse gases in the sectors not covered by the ETS system by 30% by 2030 with respect to 2005;
- The non-debit rule for LULUCF emissions in the territory of each Member State is established as a domestic norm of the European Union, accounted for up to 2030 in two five-year periods (2021-2025 and 2026-2030);
- Various accounting flexibilities are incorporated to reflect the conditions in the different Member States; among them the net absorptions can be accumulated in the whole period of ten years and can be transferred between Member States;
- To compensate for the limited capacity of agriculture to reduce emissions explicitly recognised by the European Council, and to encourage actions aimed at absorbing CO₂, up to 280 Mton of CO₂ at European Union level can be offset with LULUCF absorptions instead of forcing net reductions of emissions in other sectors;
- This limit of 280 Mton is distributed among the Member States according to the weight of the emissions of their agricultural sector. Spain can therefore offset up to 29.1 MT of CO₂ from its non-ETS sectors with LULUCF net absorptions from 2021 to 2030, equivalent to 1.3% of its total emissions not covered by ETS.

resulting from activities related to land use, land use change and forestry and on information related to the actions related to said activities. <http://eur-lex.europa.eu/legal-content/ES/TXT/PDF/?uri=CELEX:32013D0529&from=EN>.

The system of monitoring and reporting of greenhouse gas emissions. Emissions from sea transport and heavy vehicles

Knowing the reality of greenhouse gas emissions in each country is an essential issue from many points of view, although it may seem that it is something of a technical nature. In fact, its negotiation at the international level within the UNFCCC is and has always been polemical and politically controversial.

On the one hand, at the domestic level, it is essential to analyse the mitigation needs, to define and reliably plan the necessary actions and to assess their effectiveness, as well as the progress towards the reduction objectives. On the other hand, the functioning of certain mechanisms such as the trading of emission rights or international credits without a reliable emission measurement system is inconceivable. And, at the international level, it is a key pillar of transparency, an element that is essential to generate trust among the different parties involved in agreements to combat climate change. For example, the continued provision of financial assistance from one country to another is difficult if it is not reliably known that the resources contributed are used and what effects they have. Figure 17 can serve as an example of the importance of having reliable data to produce all the relevant climate information.

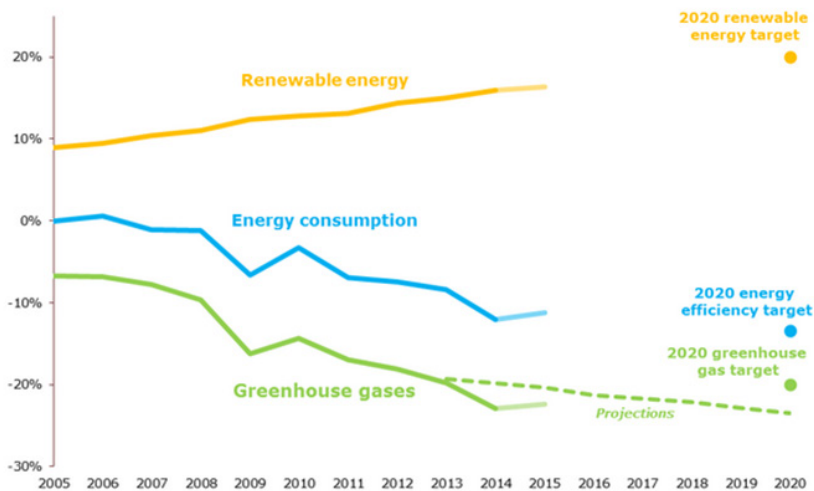


Figure 17. Progress towards climate and energy objectives in Europe. Source: EEA ⁴⁰

At the international level there are already various obligations derived from the UNFCCC and the Kyoto Protocol. The new rules deriving from the Paris Agreement are currently being negotiated. At European Union level, the provisions in force in this area, supplemented by additional regulations, are

⁴⁰ European Environment Agency, 2016. Trends and projections in Europe 2016 – Tracking progress towards Europe's climate and energy targets. Copenhagen.

set out in a specific regulation on monitoring and notification⁴¹. It establishes a framework for careful monitoring and notification of anthropogenic emissions of greenhouse gases by sources and their absorption by sinks and for their periodic evaluation. It is a complex system that has the necessary provisions to ensure the completeness, transparency, accuracy and comparability of national inventories with each other and with respect to the inventory of the European Union.

The monitoring regulation of the European Union includes the obligation for the Member States to prepare an annual inventory of emissions of seven greenhouse gases from all sectors such as industry, energy, waste, agriculture, LULUCF and others. Also annually, they must report on the technical and financial support provided to developing countries and the destination of the proceeds from the auctioning of emission rights under the ETS (on which there is a certain commitment to allocate at least 50% to the domestic and international fight against climate change). With this information, the European Commission each year prepares the inventory of greenhouse gases of the European Union that refers to the UNFCCC and covers the period from the base year of 1990 to two years before the present.

Furthermore, both the Member States and the Commission have a system for the biennial notification of policies and measures and of the projections of anthropogenic emissions by sources and of absorption by sinks of greenhouse gases, as well as of the national low-carbon strategies and their modifications. Every four years there is also a similar notification on adaptation to change by the Member States to the Commission.

On a global scale, the shipping greenhouse gas emissions are becoming increasingly important in overall emissions. This importance is accentuated as the other sectors reduce their own. According to data from the International Maritime Organisation (IMO)⁴², marine transport emissions are around 1 billion tons of CO₂ per year, which represents about 3% of total emissions, and they are expected to grow between 50% and 250% up to 2050. According to the same Organisation in its Second Study of Greenhouse Gases, with existing technologies and applying operational measures, these emissions could be reduced by 75%.

Emissions from international shipping are not included in the commitments to reduce greenhouse gases in the European Union despite the fact that

⁴¹ Regulation (EU) no. 525/2013 of the European Parliament and of the Council of 21 May 2013 concerning a mechanism for the monitoring and reporting of greenhouse gas emissions and for notification, at national or Union level, of other information relevant to climate change.

⁴² IMO 2014. 3rd IMO GHG study. <http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Greenhouse-Gas-Studies-2014.aspx>.

according to the Commission's data⁴³ in 2013, they accounted for 4% of total emissions and they had grown 48% between 1990 and 2008, and were expected to do so by 86% by 2050 with respect to the same year, 1990.

For this reason they have been subject to individualised treatment and the European Commission devoted a specific communication to them⁴⁴. One of the singularities of the sea transport sector is that it has an institution dedicated to it, the IMO, which deals with its regulation on a global scale and with which it is necessary to cooperate to implement the appropriate measures. The Commission therefore proposes a gradual approach focusing on three successive stages:

- a) Implement a monitoring, notification and verification system at European Union level;
- b) Establish reduction goals for the sector, and
- c) Apply a market mechanism to achieve the reduction of emissions.

Along with the communication, the Commission presented a proposal for a regulation for phase a) based on fuel consumption and so that afterwards a global monitoring and notification scheme could also be established through the IMO. The regulation was subsequently approved by the Council and the European Parliament⁴⁵ in 2015 and is the current framework with which the monitoring of these emissions in the European Union is regulated.

As a result, starting in 2018, large ships (more than 5,000 tons) that use European ports will have to control their verified emissions as well as other environmental information. The scheme essentially consists of the companies responsible for such ships having to draw up a plan to monitor the emissions for each of the ships with respect to any trip to or from a port under the jurisdiction of a Member State. This monitoring plan, which must be followed by a fixed and common form approved for the entire European Union, will be monitored by an accredited verifier and, starting in 2019, will result in the annual notification of the verified emissions.

As for the heavy road transport sector and unlike for light vehicles and trucks, there is currently no measurement and emission limitation policy.

⁴³ European Commission. 2013. Commission Staff Working Document accompanying document to the Proposal from the Commission to the European Parliament and Council for the inclusion of greenhouse gas emissions from maritime transport in the EU's reduction commitments. Impact assessment.

⁴⁴ European Commission. 2013. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Integration of emissions from maritime transport in the European Union's greenhouse gas reduction policies.

⁴⁵ Regulation (EU) 2015/757 of the European Parliament and of the Council of 29 April 2015 on the monitoring, notification and verification of carbon dioxide emissions generated by maritime transport and amending Directive 2009/16/EC.

An *ad hoc* policy is now being developed. Buses and trucks are responsible for about 25% of transport emissions, which represents approximately 5% of the total greenhouse gas emissions of the European Union, according to data of the Commission⁴⁶, which also calculates that in the absence of an adequate policy, these emissions may still grow by 10% by 2030 compared to 2010. For this reason, the Commission has established a calculation tool for these emissions (*Vehicle Energy Consumption Calculation Tool*, VECTO) and has adopted a proposal for a regulation for monitoring and reporting them for new vehicles⁴⁷. The regulation is now under discussion in the Council and the European Parliament and, once adopted, will from 2019 require producers of vehicles of over 7.5 tons to calculate CO₂ emissions and fuel consumption of the new vehicles they produce, so the respective emissions will be able to be known as of the year 2020. In the near future, the obligation is expected to be extended to trucks of smaller tonnage and that from 2018 the Commission will take a step forward and also submit a legislative proposal to limit emissions from heavy transport.

With this real and reliable information generated through these new instruments, the establishment of realistic and achievable reduction commitments in both sectors, sea maritime and heavy road transport, will be facilitated, and action on climate will be completed in all sectors of the economy.

The new governance system proposed for climate and energy

In the new «climate-energy framework⁴⁸ 2030» adopted in October 2014, the European Council called for the development of a reliable and transparent governance system to help ensure that the European Union achieves its energy policy objectives. It also said that it should build on existing pillars, such as national programmes to combat climate change, national plans on renewable energies and energy efficiency, and rationalise the elements related to planning and reporting, which are currently separated.

The Commission therefore presented a proposal for a regulation on «governance of the Energy Union»⁴⁹, which is now under negotiation in the Council and the European Parliament. This new regulation foresees important changes and new obligations with respect to the current situation. It forms part of the «Clean energy for all Europeans» package approved in November

⁴⁶ https://ec.europa.eu/clima/policies/transport/vehicles/heavy_en.

⁴⁷ European Commission. 2017. Proposal for a Regulation of the European Parliament and of the Council on the monitoring and reporting of CO₂ emissions and fuel consumption of new heavy goods vehicles.

⁴⁸ <http://www.consilium.europa.eu/es/meetings/european-council/2014/10/23-24/>.

⁴⁹ European Commission. 2016. Proposal for a Regulation of the European Parliament and of the Council on the governance of the energy union. <http://ec.europa.eu/transparency/regdoc/rep/1/2016/ES/COM-2016-759-F1-ES-MAIN-PART-1.PDF>.

2016 and simplifies, integrates and reinforces the planning, monitoring and reporting obligations of the Member States and the Commission in the field of climate and energy. When in force it is expected to facilitate the monitoring of progress towards the objectives of the Energy Union, in particular those related to climate change, renewable energies and energy efficiency of the European Council package and the Paris Agreement. It also provides for the Commission to be empowered to take certain measures if there is a risk of failing to achieve the common objectives of the European Union in the area of renewable energy and energy efficiency so as to force the Member States to act more.

The regulation, once approved, should also overcome the current situation in which the obligations of monitoring and notification in these fields come from dispersed standards, approved at different points in time and that respond to different objectives. They also mean that similar obligations sometimes fall on the same public bodies at different times, with overlaps in the information to be drawn up. It also ensures that the obligations are extended in a useful way beyond 2020, the deadline for the application of some of the current obligations. Together, it integrates 31 planning, monitoring and notification obligations and repeals 23.

Regardless of how the final text is approved, the Commission's proposal establishes a robust planning, information and notification regime where the main novelties appear in the field of energy, since in the field climate change what it does in essence is to assume the current obligations in terms of monitoring and notification, for which it repeals the existing standard (see above) and integrates it in the new. In essence, the proposal incorporates the following obligations:

- National energy and climate plan. From a first draft on which the Commission can make recommendations, the Member States should draw up a first 10-year plan on energy and climate in January 2019 for the years 2021-2030. Following the same procedure, the plans will be renewed every ten years. The plan has a content already defined in the text itself, common to the 28 Member States and will address the essential issues of energy and climate planning in order to achieve the objectives of the Union. In this way, it is expected to facilitate the Commission's task in terms of monitoring and controlling the obligations of the Member States and achieving the common objectives. Member States also have an obligation to consult the public on energy planning and to report their results to the Commission.
- Implementation follow-up. Member States have to make a progress report every two years on the implementation of the plans and on progress towards the planned objectives. Also in this case they must follow some detailed forms previously established and common for all. These reports cover all dimensions of the energy and climate regulations, and require explaining how they are moving towards the objectives of

the Paris Agreement. The report becomes annual in terms of emissions of greenhouse gases, the destination of revenue from emission rights auctions and financial assistance to developing countries for mitigating climate change.

- Long-term low emission strategies. They must contain a 50-year perspective, they must incorporate the aspects that derive from international obligations and their implementation, and they must be reported every ten years.
- Breach of the objectives to 2030. In case of risk of non-compliance, the Commission is empowered to require Member States to adopt measures in addition to those foreseen in the plans and they may be asked to contribute to the establishment of a European platform for financing renewable energy projects. It is also planned to enable the Commission to adopt additional common measures on the energy efficiency of products and buildings.
- It also foresees that, in the area of climate change, the monitoring, notification and planning obligations will be aligned dynamically with those that are derived from the Paris Agreement at international level.
- It also establishes the obligation for the Commission to prepare each autumn a report on the State of the Energy Union, in which it will give an account of the situation, work and progress of the Member States and the European Union on this matter.

It is, as we see, an ambitious set of measures that are expected to have a facilitating, driving and important control effect in achieving the objectives of the European Union.

A singular instrument: the Montreal Protocol, fluorinated gases and climate action

The Montreal Protocol on the protection of the ozone layer is an example of a particularly effective instrument of environmental policy. Since its establishment in 1987, it has managed to reduce the consumption of substances that deplete the ozone layer by more than 98%, which is now beginning to show signs of recovery. As these substances used to be also generally potent greenhouse gases, their reduction also provides important benefits in the fight against climate change. The dark side of this brilliant action is that the fluorinated gases that were developed in substitution of the prohibited substances, though not harmful to the ozone layer, have been shown also to be powerful greenhouse gases that can have a warming potential of up to 23,000 higher than CO₂. For this reason it is also necessary to reduce or suppress the use of these fluorinated gases as far as possible .

Of the large family of fluorinated gases, the most relevant from the point of view of climate change are by far the hydro fluorocarbons (HFCs). The European Union is a pioneer in the proposal and application of policies to control these

substances both internationally and internally. At international level, it has very actively supported the modification⁵⁰ of the Montreal Protocol to also include HFCs among controlled substances, which was achieved at the COP in Kigali in October 2016 after many years of negotiations with the adoption of the Kigali Amendment⁵¹. With this new agreement over the progressive elimination of HFCs, it is expected to avoid the emission of 80 Gton of equivalent CO₂ by 2050.

Internally and after the 2006 regulation⁵² on certain fluorinated greenhouse gases, the European Union adopted a new regulation in 2014⁵³ on fluorinated greenhouse gases that introduces more stringent measures to reduce and control HFCs that is expected to prevent, only in Europe, the accumulated emission into the atmosphere of 1.5 Gton of equivalent CO₂ by 2030 and 5 Gton by 2050.

The contribution to climate action from other sectors

In addition to the climate policy itself, the European Union is developing various measures in the fight against climate change in other specific economic sectors that are high emitters of greenhouse gases, such as energy, construction and transport. The following are the most relevant legislative measures from the point of view of climate change in these sectors.

Renewable Energies

The European Union is a pioneer and world leader in the development and deployment of renewable energy. Since the 1997 *White Paper* on renewable energy sources⁵⁴ the Union has maintained an active policy in this field that has been sustained over time at the highest level, as can also be seen in the mission letter of the President of the Commission to the Commissioner for Energy and Climate⁵⁵ at the beginning of the mandate in 2014, in which he expressly instructs him to make the European Union a world leader in renewable energy.

The directive on energy from renewable sources⁵⁶ (RED, for renewable energy directive) is currently the framework that regulates the action in this field until

⁵⁰ https://ec.europa.eu/clima/sites/clima/files/f-gas/docs/eu_hcf_amendment_en.pdf.
https://ec.europa.eu/clima/sites/clima/files/f-gas/docs/eu_hcf_amendment_en.pdf.

⁵¹ http://ozone.unep.org/sites/ozone/files/pdfs/FAQs_Kigali_Amendment_v3.pdf.

⁵² <http://eur-lex.europa.eu/legal-content/ES/TXT/PDF/?uri=CELEX:32006R0842&from=EN>.

⁵³ <http://eur-lex.europa.eu/legal-content/ES/TXT/PDF/?uri=CELEX:32014R0517&from=EN>.

⁵⁴ European Commission. 1997. Commission memo Energy for the future: renewable energy sources. *White paper for a Community Strategy and Action Plan*. http://europa.eu/documents/comm/white_papers/pdf/com97_599_es.pdf.

⁵⁵ https://ec.europa.eu/commission/sites/cwt/files/commissioner_mission_letters/arias-canete_en.pdf.pdf.

⁵⁶ Directive 2009/28 / EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and repealing

2020. It is part of the aforementioned 2020 climate - energy package approved by the European Council in March 2007. The directive establishes a general framework to guarantee that the objective is achieved that at least 20% of the final gross energy consumption of the European Union in 2020 comes from renewable sources, which must be achieved through a mandatory objective for each Member State established in the directive itself, as shown in table 2. The objectives per Member State range from 11% for Luxembourg to 49% for Sweden. Spain has an objective of 20%, a value that matches the average of the European Union.

	Cuota de energía procedente de fuentes renovables en el consumo de energía final bruta, 2005 (S_{2005})	Objetivo para la cuota de energía procedente de fuentes renovables en el consumo de energía final bruta, 2020 (S_{2020})
Bélgica	2,2 %	13 %
Bulgaria	9,4 %	16 %
República Checa	6,1 %	13 %
Dinamarca	17,0 %	30 %
Alemania	5,8 %	18 %
Estonia	18,0 %	25 %
Irlanda	3,1 %	16 %
Grecia	6,9 %	18 %
España	8,7 %	20 %
Francia	10,3 %	23 %
Italia	5,2 %	17 %
Chipre	2,9 %	13 %
Letonia	32,6 %	40 %
Lituania	15,0 %	23 %
Luxemburgo	0,9 %	11 %
Hungría	4,3 %	13 %
Malta	0,0 %	10 %
Países Bajos	2,4 %	14 %
Austria	23,3 %	34 %
Polonia	7,2 %	15 %
Portugal	20,5 %	31 %
Rumanía	17,8 %	24 %
Eslovenia	16,0 %	25 %
Eslovaquia	6,7 %	14 %
Finlandia	28,5 %	38 %
Suecia	39,8 %	49 %
Reino Unido	1,3 %	15 %

Table 2. Overall national objectives of the Member States in relation to the share of energy from renewable sources in the final energy consumption in 2020 set by the renewable energy directive of 2009. Source: DER.

Directives 2001/77/EC and 2003/30/EC. <http://eur-lex.europa.eu/legal-content/ES/TXT/PDF/?uri=CELEX:32009L0028&from=en>.

The RED obliges each Member State to make and implement a National Plan of Action on Renewable Energy and to publish a progress report every two years on the application of the plan and the progress towards the established objectives. The directive leaves Member States free to choose the type of renewable energy they prefer (wind, solar, biomass or others), to design measures of support and promotion for renewables and to set specific objectives for the electricity, heating and refrigeration, transportation sectors, as well as the guarantee that biofuels will meet the sustainability criteria of the directive itself.

According to the latest data update from the European Environment Agency (EEA)⁵⁷ in 2016, the European Union is on track to meet the 2020 target, as can be seen in Figure 18.

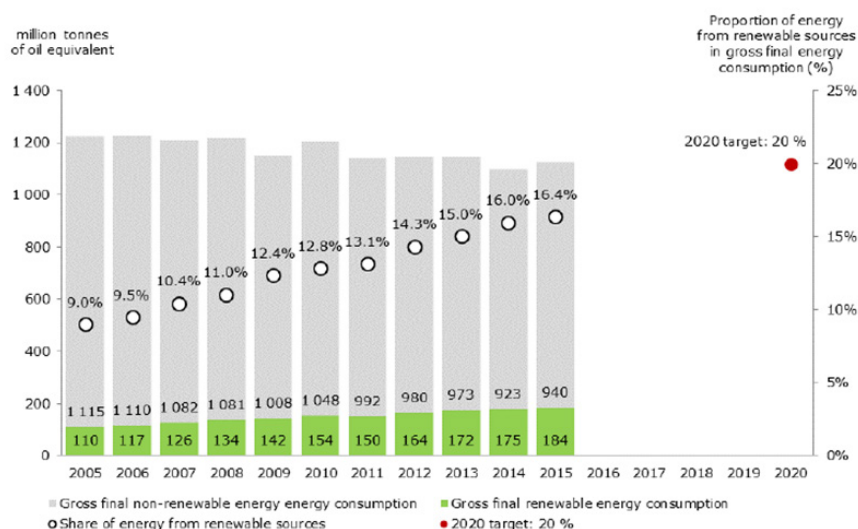


Figure 18. Gross final consumption of energy from renewable and non-renewable sources in the European Union between 2005 and 2015. Source: EEA, 2016.

The proportion of energy from renewable sources reached 16% in 2014, with a value already above the target from the RED, and for 2015 the estimate is a proportion of 16.4%. However, progress varies considerably depending on the sector in question, as does the degree of penetration of renewables in each sector. The Progress Report on Renewables⁵⁸ of the Commission in 2017 shows that the heaviest sector in the consumption of renewables is heating and cooling, with 48% of consumption, compared to 42% for electricity and 8% for transport.

⁵⁷ EEA. 2016. *Trends and projections in Europe 2016 – Tracking progress towards Europe's climate and energy targets*.

⁵⁸ European Commission. 2017. Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. «Renewable energy progress report». COM (2017) 57 final. <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52017DC0057&qid=1488449105433&from=EN>.

Final Energy Consumption in the EU28 in 2015
based on Öko-Institute proxies, statistical transfers and mult. counting excluded in Mtoe

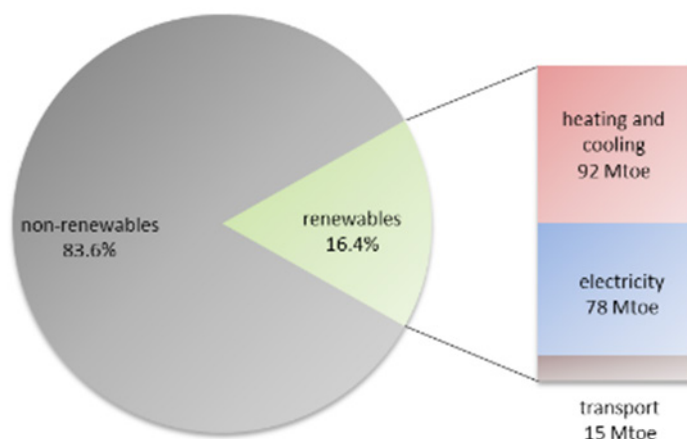


Figure 19. Source: European Commission, 2017.

The sector in which the penetration of renewables has advanced the most is electricity, with close to 30% in 2015 for the whole of the European Union, compared to just over 18% for heating and cooling, which, as we have seen, has a much greater weight in the consumption of energy, as seen in figure 20. However, both are ahead of the aggregate trajectories of the national plans of the Member States for that year at Union level.

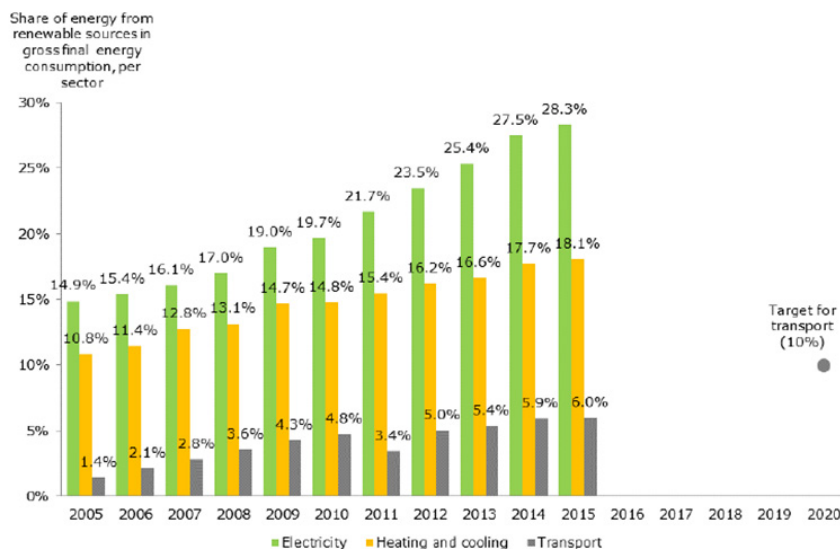


Figure 20. Proportion of energy consumption from renewable sources by sector in the European Union between 2005 and 2015. Source: EEA, 2017.

When considering the relative weight of different renewable energy sources, the figures also vary by sector. Thus figure 21 shows that in the heating and cooling sector, biomass is dominant with 82% of renewable production, while in electricity it is still hydroelectric, with 38%, followed by wind with about 30%. What is worth noting, however, is the change in trend, because while the hydroelectric proportion fell from 74% to 38% between 2004 and 2015, wind power quadrupled in the same period. In this regard it should be remembered that renewable energy accounts for 85% of the investment in electricity generation at this time⁵⁹ and that according to Irena,⁶⁰ generation costs were reduced by 80% for solar and 30% to 40% for wind between 2009 and 2015.

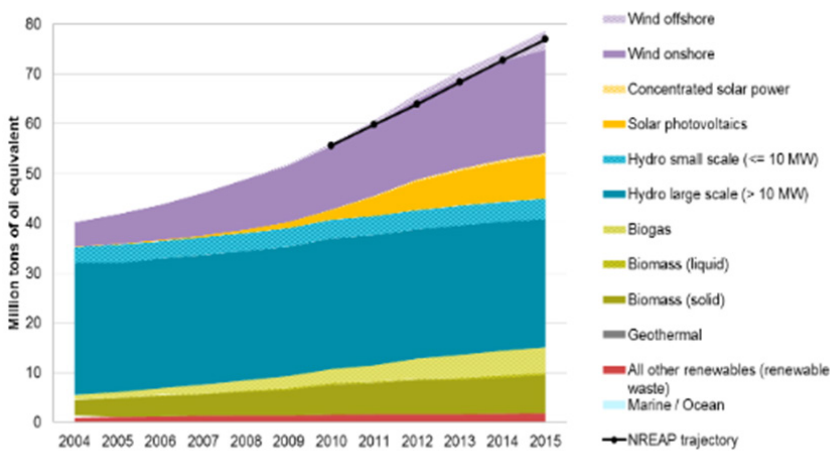


Figure 21. Production of renewable electricity in the European Union-28 by energy source. Source: European Commission, Renewables Report, 2017.

However, the sector in which the penetration is slowest is transport, with a proportion of only 6% of renewables in 2015. Within this, the absolutely dominant source is biofuels, which account for 88% of the contribution, and in particular biodiesel, which covers 79% of the total.

With regard to transport, it is important to also take into account that in the DER, together with the Directive on the quality of fuels⁶¹ (DCC), two objectives are established in relation to the use of renewables in the sector. The RED reflects

⁵⁹ https://ec.europa.eu/energy/sites/ener/files/documents/technical_memo_renewables.pdf.

⁶⁰ IRENA (2016). The Power to Change: Solar and Wind Cost Reduction Potential to 2025.

⁶¹ Directive 2009/30/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 98/70/EC in relation to the specifications of petrol, diesel and gas oil, introduces a mechanism to control and reduce greenhouse gas emissions; the 1999/32/EC Directive of the Council is modified in relation to the specifications of the fuel used by inland waterway vessels and Directive 93/12/ECC is repealed. <http://eur-lex.europa.eu/legal-content/ES/TXT/PDF/?uri=CELEX:32009L0030&from=EN>.

the objective of the European Council of 2007 that by 2020 10% of the fuels for transport should come from renewable sources and the DCC forces fuel operators to reduce the intensity of greenhouse gases of the fuels supplied by 6%.

The establishment of both objectives is still relatively controversial due to the difficulty of their implementation and the possible negative environmental effects derived from it. Perhaps the most prominent is that related to indirect land use change (ILUC). The problem is that a large part of biofuels can be produced on agricultural land, which causes the production of food to move to other lands that have to be transformed into agricultural land. It is this second transformation of land that can cause additional emissions of greenhouse gases, as well as loss of biodiversity and other environmental damage. Occasionally, these induced greenhouse gas emissions far exceed the savings produced by the use of biofuels. Perhaps the most frequently used example to present this negative effect is the transformation of natural lands to produce palm oil in developing countries. To correct this effect, the European Union adopted a new directive that limits the maximum proportion of biofuels that can be produced on agricultural land to 7% to remain within the objective of 10% and establishes an indicative target of 0.5% of second generation fuels (from waste, biomass and others), whose contribution counts double for the 10% objective, and which can obviously not be produced on agricultural land.

In November 2016, with the aforementioned «Clean energy for all Europeans» package, the Commission presented a new proposal for a renewables directive⁶² with which to regulate the post-2020 regime and achieve the 2030 objectives. In essence, with the new proposal:

- It establishes the binding objective for the European Union of 27% of renewables mentioned above, without this time having objectives per Member State (although the 2020 objectives are maintained as a minimum baseline);
- It is demanded to increase the proportion of renewables in heating and cooling by 1% per year;
- Common principles of support for the deployment of renewables are established and retroactive changes in the Union are prohibited;
- The administrative procedure for authorising renewable projects with a single window is sped up and maximum periods are established for authorisations ranging from 6 months to three years;
- The objectives of renewable consumption in transport are modified; the proportion of second generation biofuels is increased to 3.6% in 2030 and

⁶² Proposed directive of the European Parliament and Council on the promotion of the use of energy from renewable sources (recast). COM, 2016, pp. 767-end. http://eur-lex.europa.eu/resource.html?uri=cellar:3eb9ae57-faa6-11e6-8a35-01aa75ed71a1.0006.02/DOC_1&format=PDF.

the proportion of first generation biofuels that can be counted towards the mandatory target is reduced to a maximum of 3.8% by 2030;

- New criteria of sustainability and reduction of emissions of greenhouse gases are established that will be applied to biofuels, bioliquids and biomass.

The proposal is now being debated in the Council and the European Parliament with the aim of approving it as soon as possible.

Energy efficiency

Energy efficiency is widely recognised as a very effective way to reduce greenhouse gas emissions. It also saves money and improves energy security. It is not surprising, therefore, that it plays an important role in the climate and energy policy of the European Union. Therefore, when talking about the fight against climate change, it is often said that the best energy is the energy that is not consumed: this is often the phrase used to justify energy efficiency action in a few words.

The objective set by the European Council for 2020 in terms of energy efficiency is to reduce primary and final consumption (which includes all the energy distributed to end users except that used by the industry) by 20% of energy with respect to the projections for said year, which means that in 2020 the primary energy consumption of the European Union can not exceed 1,483 Mtoe⁶³ or 1,086 Mtoe in final energy. To achieve this, the European Union adopted a series of specific measures, most notably the energy efficiency directive⁶⁴ (2012), the ecological design directive for energy-related products⁶⁵ (2009), the product energy labelling directive⁶⁶ (2010) and the buildings energy efficiency directive⁶⁷ (2010).

These are particularly important measures in the energy efficiency directive:

- The obligation of certain energy distributors to reduce the volume of sales to end consumers by 1.5% per year, although there may be exceptions and Member States are also allowed to achieve the same results with alternative measures (taxes, tax incentives and others);
- The imposition of certain smart metering and billing systems for electricity, natural gas, heating and cooling of district and domestic hot water, in order to provide better information on consumption (hourly consumption, individualised consumption and others) and to facilitate savings;
- The requirement to governments in public contracting to only buy products, services and buildings of high energy efficiency and to promote the same measure with regional and local public authorities;

⁶³ Mtoe, millions of tons of oil equivalent.

⁶⁴ <http://eur-lex.europa.eu/legal-content/ES/TXT/PDF/?uri=CELEX:32012L0027&from=ES>.

⁶⁵ <http://eur-lex.europa.eu/legal-content/ES/TXT/PDF/?uri=CELEX:32009L0125&from=EN>.

⁶⁶ <http://eur-lex.europa.eu/legal-content/ES/TXT/PDF/?uri=CELEX:32010L0030&from=EN>.

⁶⁷ <http://eur-lex.europa.eu/legal-content/ES/TXT/PDF/?uri=CELEX:32010L0031&from=en>.

- The establishment of an annual target from 2014 onwards for renovation of 3% of the total surface of public buildings of central governments;
- The requirement for the Member States to implement long-term energy renovation strategies for public and private buildings.

According to the data up to 2015, the European Union is on track to meeting

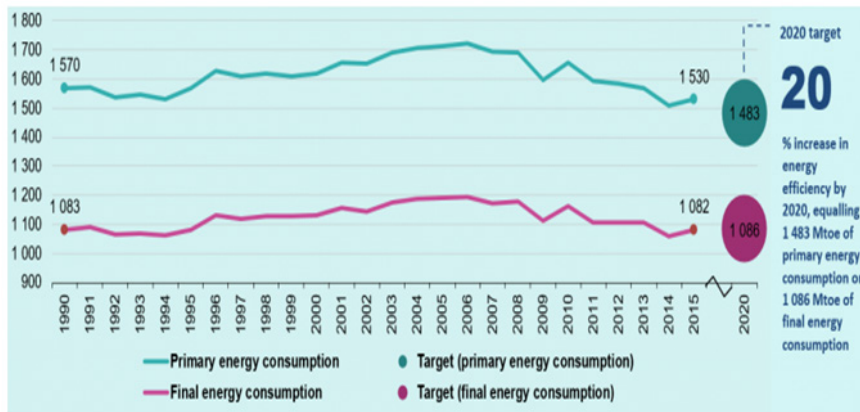


Figure 22. Consumption of primary energy and final energy in the European Union-28, from 1990 to 2015. Source: Eurostat ⁶⁸

the 20% target in 2020 (see figure 22), which, we must not forget, is measured in reductions with respect to the initial projections for 2020. In 2014, its primary energy consumption was 12% lower than in 2005, only 1.6% above the 2020 target according to the Commission⁶⁹. In fact it fell from 1,712 Mtoe in 2005 to 1,507 Mtoe in 2014. If the trend continued, it would ultimately lead to consumption 13.4% below that of 2005.

In terms of final energy, in 2014 the European Union had already achieved the 2020 target with a reduction of 11% compared to 2005, going from 1,191 Mtoe in that year to 1,062 Mtoe in 2014, already below the target of 1,086 Mtoe.

Despite these good results, the estimates⁷⁰ foresee a possible increase in consumption due to economic recovery and population growth, which is why they warn of the need to make additional efforts.

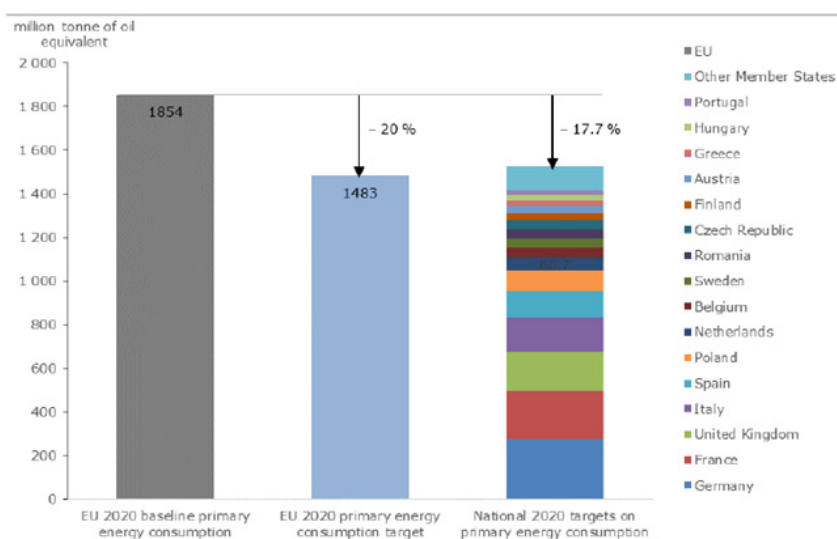
⁶⁸ http://ec.europa.eu/eurostat/statistics-explained/index.php/Europe_2020_indicators_-_climate_change_and_energy#The_EU_needs_to_further_pursue_energy_efficiency_improvements.

⁶⁹ Report from the Commission to the European Parliament and the Council: 2016 assessment of the progress made by Member States in 2014 towards the national energy efficiency targets for 2020 and towards the implementation of the energy efficiency directive 2012/27/EU as required by article 24 (3) of the energy efficiency directive 2012/27/EU. COM, 2017, pp. 56-end. <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52017DC0056&from=EN>.

⁷⁰ EEA. 2016. *Trends and projections in Europe 2016 – Tracking progress towards Europe's climate and energy targets*.

The new proposal for a directive on energy efficiency presented by the Commission in November 2016 with the Clean energy package for all Europeans, now being discussed in the European Council and Parliament, foresees some important changes, among which:

- The establishment of a new and binding objective, higher than that of the European Council of 2014 of 30% by 2030, to be distributed among the Member States through indicative objectives that they should include in their integrated climate and energy plans. Figure 23 shows the objectives of each Member State for 2020;
- Periodic and continuous revision of the objective, the first time in 2027 and then every 10 years, with a view to achieving the 2050 objectives;
- The revision of the systems of measurement and billing of energy consumption, with a view to making them smarter and facilitating the remote management of consumption;
- Diverse changes in the implementation of the directive, including the panoply of measures to be adopted by the Member States.



Note: The Member States grouped as 'Other Member States' are those that have a 2020 target for primary energy consumption lower than 20 Mtoe and a 2020 target for final energy consumption lower than 15 Mtoe. In order of decreasing magnitude of 2020 targets, these countries are Denmark, Bulgaria, Slovakia, Ireland, Croatia, Slovenia, Estonia, Lithuania, Latvia, Luxembourg, Cyprus and Malta.

Figure 23. Objectives of reduction in primary energy consumption by Member States for 2020. Source: EEA, 2017.

Buildings are a particularly powerful deposit of energy efficiency and therefore have a specific directive that adds obligations to that envisaged

in the energy efficiency directive to renew the annual 3% of the public building already seen. Among its most important obligations is that all new buildings should be «almost zero energy consumption» from 2021 (2019 for public buildings). It also incorporates many operational measures such as the development of energy certificates that must accompany all sales or rentals of buildings or the establishment of minimum energy performance requirements for new buildings and major renovations, among others. With the well-known Clean Energy package for all Europeans of November 2016, a proposal to revise and update this directive is also incorporated.

The reductions in transport. The Commission's roadmap

The transport sector is responsible for about a quarter of the greenhouse gas emissions of the European Union and, unlike the other sectors, its emissions are still higher than in 1990 due to the increase in the activity of the sector and the vehicle fleet. Despite all the mitigation measures applied. Between 1990 and 2013 its emissions still grew⁷¹ by 22% (figure 24).

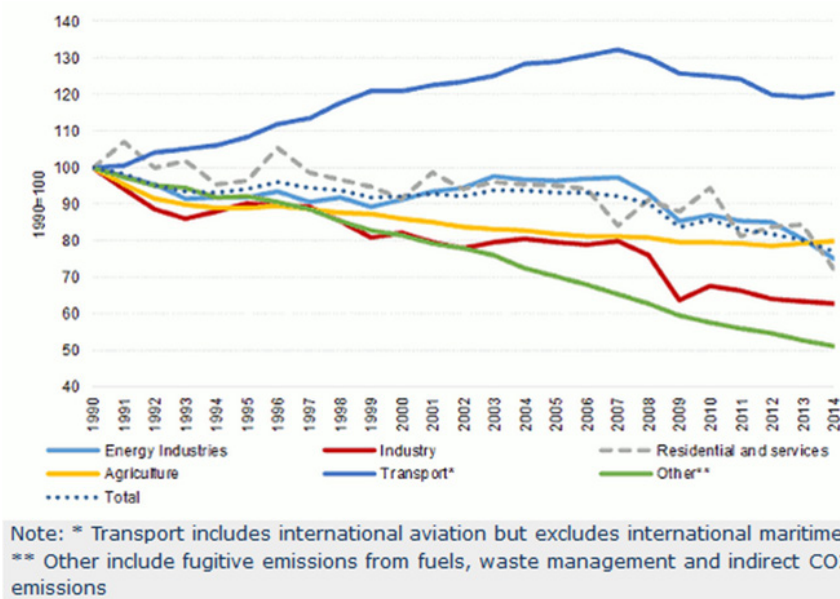


Figure 24. Evolution of greenhouse gas emissions by sector in the European Union 1990 - 2014. Source: European Commission⁷².

⁷¹ European Parliament 2015. Research for TRAN Committee: Greenhouse gas and air pollutant emissions from EU transport – In depth analysis. Directorate General for internal Policies - Policy department B: Structural and Cohesion Policies. [http://www.europarl.europa.eu/RegData/etudes/IDAN/2015/563409/IPOL_IDA\(2015\)563409_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/IDAN/2015/563409/IPOL_IDA(2015)563409_EN.pdf).

⁷² https://ec.europa.eu/clima/policies/transport_en.

Within transport, road transport is the cause of the vast majority of emissions, as can be seen in Figure 25, with more than 70%.

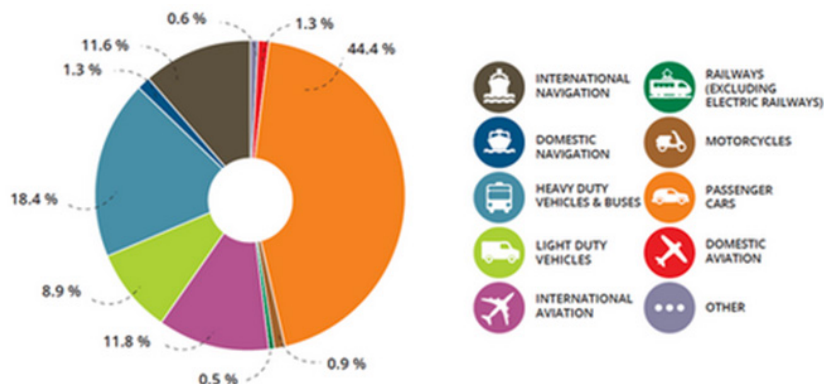


Figure 25. Emissions of greenhouse gases by transport in the European Union-28 in 2014. Source: EEA⁷³.

The action of mitigation of climate change in transport covers measures of different kinds, most notably trade in emissions (for aviation), fuel quality and promotion of biofuels, emission limits in vehicles and development of infrastructure for clean transport (charging points for low consumption vehicles) d out. In view of the data, it is not surprising that the greatest emphasis is placed on reducing emissions from road transport.

The Commission published a *White Paper on transport* in 2011⁷⁴ in which it set the long-term goal of reducing transport emissions by at least 60% by 2050. With this, it proposes a coherent effort with the objective of global emission reduction. The measures adopted later have shorter-term objectives that are also consistent with this long-term objective. An important complement is the European Strategy in favour of low-emission mobility⁷⁵ adopted by the Commission in July 2017 and with which it intends to direct a package of future measures in improving the efficiency of transport systems, in the deployment of low-emission means of transport and in the progress towards vehicles with zero emissions. It should be remembered in this regard that this type of transport measures also have numerous other advantages for improving our quality of life, such as reducing air pollution or congestion, among others.

⁷³ <https://www.eea.europa.eu/signals/signals-2016/articles/transport-in-europe-key-facts-trends>.

⁷⁴ https://ec.europa.eu/transport/sites/transport/files/themes/strategies/doc/2011_white_paper/white-paper-illustrated-brochure_es.pdf.

⁷⁵ http://eur-lex.europa.eu/resource.html?uri=cellar:e44d3c21-531e-11e6-89bd-01aa75ed71a1.0004.02/DOC_1&format=PDF.

With regard to the emissions reduction targets for 2030, as today only EU aviation emissions are within ETS, the vast majority of transport reductions fall within the effort that Member States should make in non-ETS sectors, for which the reduction is 30% compared to 2005. Together with national measures that may be taken (traffic regulation, means of transport in cities, among others), the measures taken at Union level are capital. As can be seen, on the other hand, in Figure 26, the weight of transport varies considerably from one Member State to another.

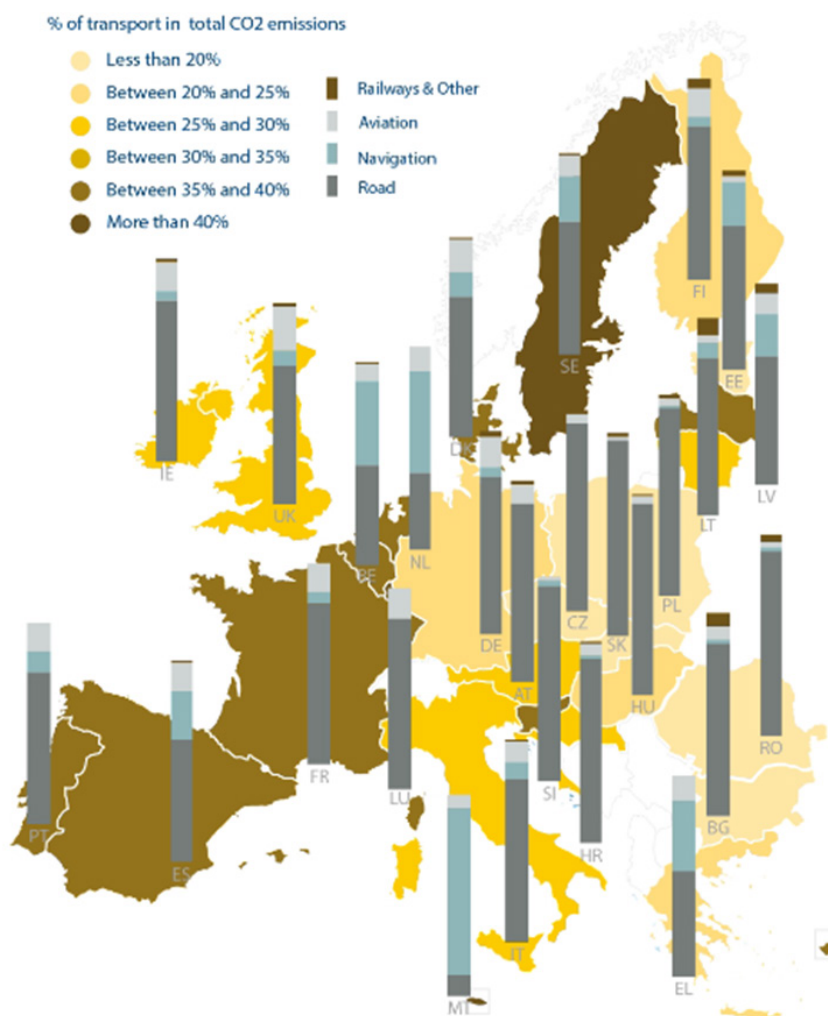


Figure 26. CO2 emissions from transport by form of transport in the European Union in 2012.
Source: European Parliament .

⁷⁶ [http://www.europarl.europa.eu/RegData/etudes/BRIE/2015/569031/EPRS_BRI\(2015\)569031_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/BRIE/2015/569031/EPRS_BRI(2015)569031_EN.pdf).

Along with the measures already discussed on fuels and others, among the most important measures are those related to vehicle emission limits. The target for passenger vehicles of 130 grams of CO₂/km for 2015 was already reached in 2013 and that of the trucks of 175 grams of CO₂/km for 2017 was also reached in 2014. The new targets are 95 grams of CO₂/km for passenger vehicles by 2021 and 147 grams of CO₂/km for trucks by 2020.

In addition, the Commission must submit new legislative proposals in 2018 with new limits for these vehicles after 2021 and also to boost the penetration of low emission vehicles (hybrids, electric or hydrogen cells), as part of the reduction effort. It also plans to soon submit a proposal for emission limits for heavy vehicles, as indicated above.

Financing the fight against climate change in the European Union

The priority given by the European Union to the fight against climate change is also reflected in the financial effort devoted to it. In the financial framework for the period 2014-2020, it has been established that at least 20% of the European Union budget, that is, close to 200 billion euros, will be devoted to actions related to the fight against climate change. This obligation covers all major areas of Union policy⁷⁷: the structural and investment funds (€115 billion for climate, 25% of the total for this), the common agricultural policy (13.6 billion on climate in 2015), Horizon 2020, which is the key instrument of research policy (€27 billion on climate), and the development policy⁷⁸, which in 2015 along with the Member States and the EIB contributed a further €17.6 billion for the fight against climate change in developing countries. On the other hand there are other programmes of variable financial significance that also contribute a part of their resources to the fight against climate change, such as the Life programme, which finances demonstration projects.

In terms of low-emission technologies, particular mention should be made of a programme that is financed with the proceeds of auctions of emission rights under ETS. This is the NER 300 programme, which enables the European Investment Bank to auction up to 300 million rights to finance demonstration projects in mature, low-emission energy technologies that are not yet viable on a commercial scale, and that also include the capture and storage of carbon.

In addition, also in relation to ETS, member states paid the amount of €4.9 billion in 2015, 77% devoted to climate-related actions, according to the distribution shown in figure 27.

⁷⁷ European Commission. 2016. Report of the Commission to the European Parliament and the Council. Adoption of the Paris Agreement: Advances of the European Union towards the goal of a minimum reduction of 40%. COM, 2016, pp. 707-end. <https://ec.europa.eu/transparency/regdoc/rep/1/2016/ES/COM-2016-707-F1-ES-MAIN.PDF>.

⁷⁸ https://ec.europa.eu/clima/sites/clima/files/budget/docs/pr_2013_11_19_en.pdf.

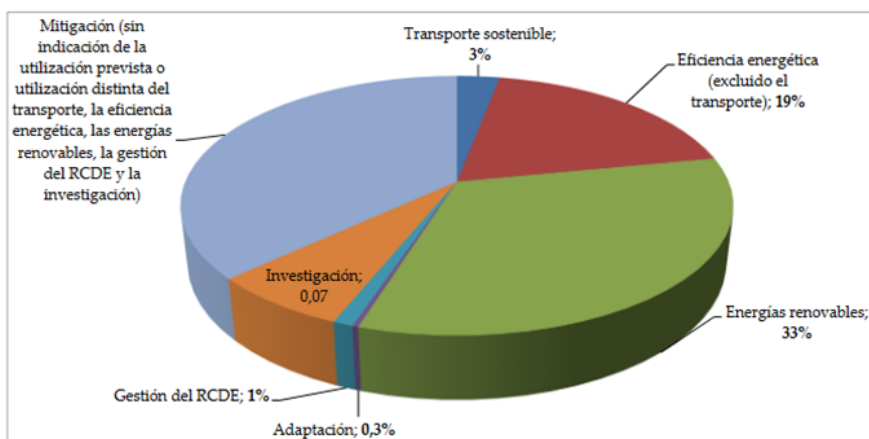


Figure 27. Use of revenue from the auctioning of emission allowances spent on climate and energy in the Member States, by sector (weighted EU average) in 2015. Source: European Commission⁷⁹.

Among the financial measures of the European Union we should also mention the activity of the public European Investment Bank, which has become one of the major multilateral providers of financing regarding climate change, and which has also provided funds for emerging and developing countries outside the European Union. And we must also mention the European Fund for Strategic Investments, which plans to mobilise large sums (more than half a billion € in the latest extension of 2016) in large projects that pay particular attention to the low-carbon economy.

⁷⁹ European Commission. 2016. Report of the Commission to the European Parliament and the Council. Adoption of the Paris Agreement: Advances of the European Union towards the goal of a minimum reduction of 40%. COM, 2016, pp. 707-end. <https://ec.europa.eu/transparency/regdoc/rep/1/2016/ES/COM-2016-707-F1-ES-MAIN.PDF>

Video resume



Chapter three

Spain's response to the challenge of climate change in the new international scenario

Valvanera Ulargui Aparicio

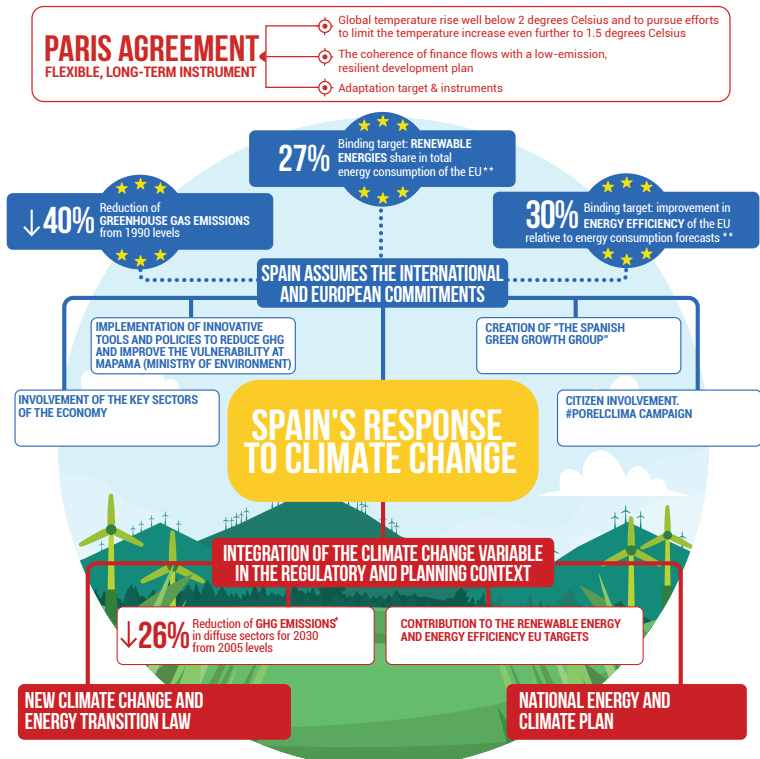
Abstract

The impacts of climate change already being felt globally and in Spain in particular, given our country's high vulnerability to the adverse effects of this phenomenon, by its geographical location and its socio-economic characteristics. The efficient and sustainable use of natural resources, renewable energy and energy efficiency are key to successfully address the shift towards a model of development needed for the fight against climate change.

Keywords

Climate change, Spain, Energy model, Paris Agreement.

SPAIN'S RESPONSE TO THE CHALLENGE OF CLIMATE CHANGE IN THE NEW INTERNATIONAL CONTEXT



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Brief history of the United Nations Framework Convention on Climate Change

Climate change is a global phenomenon because of its causes and its effects, and requires a multilateral response based on the collaboration of all countries. The impacts of climate change already being felt globally and in Spain in particular, given our country's high vulnerability to the adverse effects of this phenomenon, by its geographical location and its socio-economic characteristics. There is a consensus on the causes of climate change in the scientific community and we also know that the response to the challenge inevitably brings about a profound change in our way of producing and consuming.

It has taken decades to reach this unanimity. The international response to this challenge, until the conclusion of the Paris summit in 2015, was based on two legal instruments: the United Nations Framework Convention on Climate Change, adopted in 1992 and the Kyoto Protocol of 1997. In both instruments, only a few countries had an obligation to reduce their greenhouse gas emissions. It was not enough.

We go back to the year 1979, where the first World Climate Conference identified climate change as a global and urgent problem, and governments were called on to confront it. Since then, a large number of international conferences have been held in order to provide a united response from all countries to this problem.

In 1990, the Intergovernmental Panel on Climate Change (IPCC) published its first Assessment Report on the state of global climate, which became the main reference for the negotiations of a convention on climate change in the United Nations General Assembly. After the Earth Summit in 1992, the United Nations Framework Convention on Climate Change (UNFCCC) was adopted, together with the Convention on Biodiversity and the Convention on Desertification.

With almost universal participation (196 countries ratified it), the UNFCCC is the main United Nations forum where all matters related to the mitigation of greenhouse gas emissions are negotiated, as well as measures of adaptation to the impacts of the climate change and the necessary tools to meet the objectives of the Convention: capacity building, financing and development, and technology transfer.

Its main objective is the «stabilisation of concentrations of greenhouse gases in the atmosphere on a level that prevents anthropogenic (man-made) interference in the climate system». This results in an urgent need to change our production and consumption models towards low emission standards, that is, to avoid the burning of fossil fuels, which is the main cause of global warming.

The important economic and social implications derived from the fight against climate change make international negotiations on this matter very complex. Despite this, in a few years, in 2015, the universal Paris Agreement was adopted, which sends a clear signal about the need to move globally towards a new model of low-carbon development, resilient to the climate.

The United Nations Framework Convention meets annually through the Conference of the Parties (COP). These meetings take place at the end of the year in different countries, on a rotation basis between the different geographical regions of the United Nations.

At the first Conference of the Parties, held in Berlin in 1995, it was recognised that the commitments included in the UNFCCC for industrialised countries were insufficient, as they were of a qualitative nature, and the «Berlin Mandate» was launched, through which the Kyoto Protocol was negotiated.

After two years of negotiations, in 1997, the Kyoto Protocol was adopted, which was qualified as the most ambitious environmental agreement achieved to date. This Protocol includes binding commitments to reduce greenhouse gas emissions for the industrialised countries of the time, which agreed to reduce their emissions by 5% during the five-year period 2008-2012, compared to 1990 levels. Developing countries do not have commitments to reduce emissions in this framework. It also includes a strict compliance regime with economic penalties. The Kyoto Protocol came into force in February 2005 with the participation of 38 parties¹, after the ratification of Russia on 18 November 2004. The European Union and its Member States ratified it in May 2002, under the Spanish presidency of the European Council. The Protocol came into being incomplete, without the United States, which never ratified it due to the opposition of the North American Congress. Another notable absence was that of Canada, which withdrew from compliance with its obligations in 2012.

But the international community led by the European Union, aware that the given framework was neither complete nor sufficient, did not cease in its commitment and, since 2007 has negotiated a universal agreement by which all countries (and not just developed countries) would contribute to reducing global emissions of greenhouse gases. It would be an enormous quantitative and qualitative step to solving the problem of global warming.

In 2009, the Climate Summit in Copenhagen tried to reach that agreement for the first time, although it was not possible. Neither the political nor the economic situation of that time favoured establishing an agreement with a still important divergence between the positions of developed and developing countries in relation to the responsibilities and contributions that each group had to make at the national level to curb the problem.

¹ European Union (including eastern countries), Iceland, Japan, Liechtenstein, Monaco, New Zealand, Norway, Russia, Switzerland, Ukraine and Australia.

From 2011, negotiations were held in the Durban Platform Work Group, created specifically to design a framework for action in which to count on the commitments of all countries to fight against the causes and effects of climate change. The work of the Group concluded with the adoption, on 12 December 2015, of the Paris Agreement.

Since the Paris summit, the negotiation of the technical elements left pending in the Agreement has been carried out in a comprehensive way, taking into account the obligations and elements already existing in the scope of the Convention on Climate Change and in the Protocol. It thus seeks to ensure that the climate regime expressed by the Paris Agreement does not start from scratch but is built on existing architecture.

The climate summit in Paris: a turning point in the fight against climate change and on the international agenda

2015, a key year in the international process

2015 was a key year on the international agenda, with results that will affect all sectors and levels of society, including governments, citizens and the business sector. A road map towards a new and more sustainable world was established with the participation of all.

The Paris Climate Summit (COP21), held in December 2015, concluded with the approval of the Paris Agreement², a historic agreement in the fight against climate change and a universal and legally binding agreement that constitutes the cornerstone to achieve a low-emission, climate-resilient and globally sustainable development. This Agreement sends a clear message to the international community: global development requires a change in growth patterns, so that it is possible to grow while reducing greenhouse gas emissions and strengthening resilience against the effects of climate change.

That same year, at the United Nations Summit for Sustainable Development held in New York from 25 to 27 September, the 2030 Agenda was approved, which includes the so-called Sustainable Development Goals (SDGs). One of them, goal 13, specific on climate action, highlights the transverse effect of climate change on the planet's sustainable development. The Agenda, which came into force on January 1, 2016, supported by 193 countries, represents the political commitment to sustainable development at the highest level. In addition, in July of that same year, the Addis Ababa Action Agenda was approved on financing for development, and which is the basis for implementing the 2030 Agenda for sustainable development.

² http://unfccc.int/files/essential_background/convention/application/pdf/spanish_paris_agreement.pdf.

The Paris Agreement on climate change thus becomes a key element in achieving the sustainable development goals. Climate policies have to be part of the development policy of the countries, they are the same agenda, since they would not be understood in isolation.

The 17 Sustainable Development Goals (SDGs) and their 169 targets have been defined to provide a joint, indivisible and transversal response. Sustainable development requires considering the three dimensions: economic, social and environmental.

Therefore, the proposed transformation is integrating and global in multiple aspects, and is aimed at:

- All public actions: actions, decisions, strategies, policies.
- All levels of action: local, regional, national, regional and global.
- The different agendas: cooperation, economic, environmental...

Of these 17 goals, 13³ are directly related to the environment and one, as mentioned above, goal 13, focuses on climate action.

The transversal nature of the SDGs, which includes economic, social and environmental considerations, makes it necessary for those responsible in all countries to combine these three aspects to ensure their proper implementation.

We must not forget that, in 2015, the impacts of the global economic and financial crisis persisted, and yet the entire international community opted to adopt these three agreements, which are essential for global development in the mid-term. This, without a doubt, gives a positive signal on the new possibilities of economic growth in the development of a new sustainable and low carbon model.

The negotiation of the Paris Climate Agreement

The importance of the Paris Agreement is clear, since it is the first time that all countries have contributed to the fight against climate change, according

³ [1] Goal 1. To bring an end to poverty in all its forms throughout the world.
Goal 2. To bring an end to hunger, to achieve food security and better nutrition, to promote sustainable agriculture.
Goal 3. To guarantee a healthy life and promote well-being in all societies.
Goal 4. To guarantee quality, inclusive and equitable education and to promote permanent learning opportunities for all.
Goal 6. To guarantee the availability and sustainable management of water and sanitation for all.
Goal 7. To guarantee access to affordable, reliable, sustainable and modern energy for all.
Goal 8. To promote sustained, inclusive and sustainable economic growth, full and productive employment and decent jobs for all.

to their respective national capacities and circumstances. The importance of working together and under the same governance that makes it possible to reduce emissions of greenhouse gases on a large scale, with a quantified objective, is recognised, that is the objective of maintaining the increase in global average temperature below 2°C with respect to pre-industrial levels and even, if possible, below 1.5°C. This is the climatic risk that the international community can accept.

But the Agreement goes further and, for the first time, reflects the importance of adaptation as well as mitigation, thus recognising a reality: that the effects of climate change are already being felt throughout the world and that all countries have to urgently adapt to its negative effects. One of the most innovative and visionary elements of the Agreement is that it also includes a financial objective that goes beyond the debate on climate finance that had taken place to date. This objective points out the need to ensure that all public, but also private, financial flows have to be consistent with a development path that is low in emissions and resilient to the climate, thus becoming a critical tool to face climate change.

Scientific studies clearly identify the negative effects of climate change for scenarios in which the increase in global average temperature of the earth exceeds 2°C with respect to pre-industrial levels. Many of these effects have impacts on natural systems (water resources, ecosystems or coastal areas), but also important effects on human systems, both in food production and in increases in temperature or in negative effects for health.

In this sense, climate change has a multiplying effect that will increase existing inequalities, the tension factors and international insecurity at global, regional and national levels. One of the most well-known impacts of climate change refers to territory losses and border disputes, which could even lead to the disappearance of entire countries, such as the Small Island States.

The negotiation of the Paris Agreement was a long and complex process, which took place at a time marked by the strong economic and financial crisis, in which the different players in the negotiation had concerns and interests which in many cases were not shared. France, leading the Summit, was able to promote an agreement in which all countries were reflected, and also, for the first time, to mobilise a large number of non-governmental players through the so-called Lima-Action Agenda Paris, now known as the Global Action Agenda on Climate Change. The binomial United States (then under the Obama Administration) - China, which worked together throughout 2015, was key to leading the negotiation, presenting its contributions in a coordinated way to the Paris Agreement and giving a clear signal to the world that the two largest world powers were committed to a successful outcome of the COP21.

Together with both powers, the European Union and Spain with the rest of the Member States were key players in the success of the summit. Europe

reached the negotiations in Paris as the undisputed leader and with the experience of more than a decade working on policies to combat climate change with positive results: in 2013, emissions had been reduced by 19% compared to 1990 and, in that period, the EU's gross domestic product had increased by 45% in real terms. The EU has demonstrated its leadership with the fulfilment of the Kyoto Protocol, the establishment of the emissions trading system and the approval, in 2008, of the European Energy and Climate Change Package 2013-2020, by means of which concrete objectives were established to be achieved by the year 2020 in terms of renewable energy, energy efficiency and reduction of greenhouse gas emissions. Maintaining this line of firm involvement in the fight against climate change, the Heads of State and Government of the European Union, one year before the Paris Summit, on 24 October 2014, approved the new Framework for Climate Change and Energy to 2030, where the objective that was presented in Paris of reducing the emissions of greenhouse gases by at least 40%, by the year 2030, with respect to the reference year, 1990, was established.

In addition, in the substantive scope of the negotiations, the European Union sought an Agreement that was legally binding, global, ambitious and in solidarity. In this way, fundamental proposals were presented, such as the five-year review mechanism; for the articulation of the agreement, bridges were built between the different positions of the countries and the Coalition of Ambition was led together with other countries. This Coalition, which involved more than one hundred developed and developing countries from all continents, played a key role in achieving an ambitious outcome at COP21, by pressing for the Paris Agreement not to fall short in its objectives.

EMISIONES DE CO ₂ eq (2014) Millones de toneladas	SIN LULUCF	CON LULUCF	% del total
GLOBALES	45.740,70	48.892,37	
China	11.911,71	11.600,63	26,04
Estados Unidos	6.371,10	6.319,02	13,93
Unión Europea (28)	4.053,66	3.624,82	8,86
India	3.079,81	3.202,31	6,73
Federación Rusa	2.137,83	2.030,14	4,67
Japón	1.314,59	1.322,05	2,87
Brasil	1.051,00	1.357,18	2,30
Indonesia	789,48	2.471,64	1,73
Canadá	745,11	867,00	1,63
Irán	733,61	800,68	1,60
México	721,65	729,10	1,58
República de Corea del Sur	671,19	631,60	1,47
Australia	589,73	523,21	1,29
Arabia Saudita	583,37	583,37	1,28
Sudáfrica	524,89	527,22	1,15
Turquía	431,48	366,61	0,94
Tailandia	358,42	374,38	0,78
Argentina	348,65	443,26	0,76
Ucrania	347,55	344,13	0,76
Paquistán	333,38	361,98	0,73

Fuente: WRI (CAIT), 2017

Along with a clear political will, parallel to the negotiation itself, in Paris there was a mobilisation of non-governmental actors within the framework of the Global Action Agenda, from civil society, cities and regions, private and business sector, investors, banks, etc., which not only demanded greater government commitment, but tabled their firm commitment to the fight against climate change by launching a large number of initiatives with which to complement and strengthen the efforts of governments. These initiatives can be consulted on the website of the secretariat of the United Nations Framework Convention on Climate Change <http://climateaction.unfccc.int/>.

This mobilisation, key to the success of the Summit, showed that in 2015 many of the solutions, clean technologies, were already accessible and competitive and that in the sharing of powers in global geopolitics came other players who were ready to abandon the most polluting technologies and to put low-carbon innovations at the centre of national development policies entailing a series of benefits, not just environmental, but economic and social too.

Finally, another important factor in the development of the Agreement was the consideration by the countries that a scenario in which no action was taken against climate change was not an option, since the costs of inaction will, in any case, be greater than the costs involved in the implementation of policies and measures. Paris was seen by many as a critical opportunity which could not be missed, to express a global response to climate change appropriate to the scale of the challenge we face.

The Stern Report, of October 2006, already concluded that, if we do not act, the global costs and the risks of the climate change will be equivalent to the loss of at least 5% of the annual global GDP, now and always. Taking into account a greater diversity of risks and impacts, estimates of damages could reach 20% or more of GDP. In contrast, the costs of relevant actions - reducing greenhouse gas emissions to avoid the worst impacts of climate change - can be limited to around 1% of global annual GDP.

The features of the Paris Agreement.

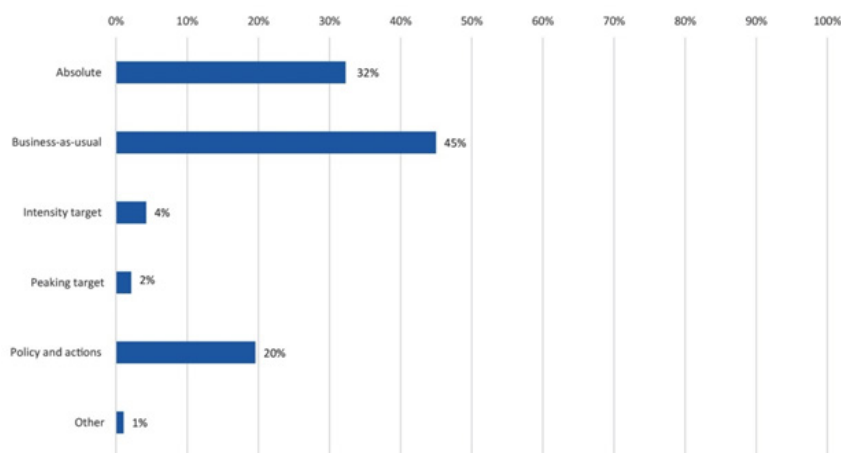
The Paris Agreement was designed as a flexible and long-term instrument. It has three global objectives that guide its general functioning: i) the objective of 2°C, ii) an objective in terms of adaptation and iii) the coherence of financial flows with a scheme of low emission and resilient development. But it is also a framework that responds to current reality and guarantees its long-term sustainability by being designed in a way that, every five years, allows stock to be taken of its operation and progress in achieving the above objectives.

Its elements reflect the current world in which countries have internalised that the fight against climate change, both the reduction of emissions and the implementation of adaptation measures, are essential aspects to ensure the sustainable development of their economies. This idea is reflected in the

concept of «nationally determined contributions». This term, coined in 2013 at the Warsaw Climate Summit, allows each country, based on its national priorities and needs, to determine its contribution to the fight against climate change. In these contributions, each country voluntarily presents its commitments on climate change. The contributions are equivalent to the action plans for combating climate change backed at the highest level, include objectives or actions to reduce GHG emissions in the various socio-economic sectors and, in many cases, objectives and needs in terms of adaptation to impacts of climate change, as well as financial, technological and training needs.

The Report of the Secretariat of the UNFCCC, published in May 2016, *Aggregate effect of the intended nationally Determined Contributions: an update Synthesis report by the secretariat* analyses the global content and aggregate effect of these contributions. The information collected on these contributions is very relevant for different players who will manage «financial and support instruments in developing countries and projects and sectors related to the fight against climate change». New opportunities are thus generated for institutional, technical and business cooperation and collaboration, on which it is important to join efforts to explore and exploit synergies. While also taking into account the other many social and economic co-benefits that are derived from climate change policies.

In this context, it is worth mentioning the recently launched Alliance of Nationally Determined Contributions (*NDCs Partnership*) that brings together developed and developing countries, as well as international organisations, and that aims to increase cooperation and support to countries in the implementation of their NDCs, while also promoting synergies with the Sustainable Development Goals (SDGs) of the 2030 Agenda. The support unit of this partnership is managed by the World Resources Institute.



Graph: Types of mitigation goals communicated in the countries' NDCs. Source: Report "Aggregate effect of the intended nationally determined contributions: an update Synthesis report by the secretariat", UNFCCC Secretariat, 4 May 2016.

The fact that some 190 countries have voluntarily submitted their contributions, covering around 90% of global emissions, clearly shows a change in the perspective of countries in the fight against climate change. The vast majority of the international community has made it clear that it is willing to fight against climate change for the general good, but also as a fundamental development strategy, which implies a change in the definition and prioritisation of public policies and the investments that accompany them. Public policies that go beyond the competences assigned to the environmental departments, to integrate and guide the remaining competencies towards sustainability, from economic to fiscal, health, education, security, or sectoral such as energy, transportation, housing, etc. The Agreement recognises that the sum of these national contributions may not be sufficient at first, so it is ensured that, every five years, it is necessary to evaluate the extent to which progress has been made towards the general objectives, and to make decisions over the necessary ambition to cope with climate change. The first of these analyses of progress towards the commitments is foreseen for 2023 and its results will be fundamental to ensure that the following contributions submitted by countries are more ambitious than the current, promoting a spiral of ambition on a regular basis that brings us closer to what science tells us more and more clearly, that it is necessary to confront climate change.

The outcome of the Paris Summit was expressed through two key documents: the Agreement itself, a legally binding international treaty that includes the most lasting aspects in which the main characteristics are expressed, and a decision that adopts it where some of the most operational issues are resolved, such as the mandates for its development or substantive details thereof. Some of the most concrete characteristics of the Paris Agreement are:

- For the first time, it includes, in a binding treaty, the «quantified objective of preventing the increase in global average temperature from exceeding 2°C compared to pre-industrial levels» and furthermore seeks to promote additional efforts that make it possible for global warming not to exceed 1.5°C, the main demand of the most vulnerable countries, such as the islands. It is a quantified ambition set out in a legally binding agreement and marks a path which establishes that by the middle of the 21st century we have to reach a development model that is climate-neutral. To comply, all countries agree to present their objectives of reducing greenhouse gas emissions and the sum of all national commitments has to result in the achievement of the 2°C objective.
- It is a «dynamic» Agreement that includes a regular review mechanism whereby emissions reduction efforts will be updated every five years, a period in which the the situation regarding the fulfilment of the objectives of the Agreement and the next round of commitments should be reviewed, which will always be more ambitious than the current. The first of these reviews is planned for 2023.

- Until now, adaptation was reflected in response to the lack of ambition to reduce emissions. The Paris Agreement recognises the urgent importance for all countries to have enough resilience to confront the impacts of climate change that are already being felt. Thus it establishes a qualitative global objective, at the same level as the 2°C goal, to increase the capacity for adaptation at the global level, that is, for all countries, and recognises the specific needs of the most vulnerable countries in adapting to the negative impacts of climate change.
- The Agreement lays the foundations for a transformation towards low emission development models, not only through the mitigation objectives, but also because it has a «financial objective» beyond the traditional approach of official aid between developed and developing countries. The Paris Agreement recognises the need to ensure that global financial flows are consistent with low-emission and climate-resilient development patterns, thus involving private sector investors in the fight against climate change, and giving a clear signal that it is necessary for the financial flows to be intelligently redirected to promote climate-respectful development.
- In this sense, the «mobilisation of all types of financial sources» beyond the public, as well as global efforts to promote actions that strengthen the provision of support to developing countries, is one of the characteristics of the Agreement. The importance of adaptation, as well as mitigation, is also reflected in the text when contemplating a balance between funding dedicated to adaptation and that devoted to mitigation, answering one of the main demands of developing countries, and especially those whose contribution to global emissions of greenhouse gases is minimal, but which do have real needs when implementing measures to adapt to climate change.

Climate funding is an essential element in the global effort to combat climate change. This issue is key in the context of international climate change negotiations, and has been included as an obligation since 1992 in the articles of the United Nations Framework Convention on Climate Change. Therefore, the Paris Agreement has an important financial package that will help its implementation and that will be built on the basis of the existing objective for developed countries of moving 100 billion dollars per year, starting in 2020, through different sources, an objective that will be revised upwards before 2025.

As a result of the Paris mandate, the developed countries in 2016 presented a concrete roadmap to show their commitment and path to achieve the goal of 100 billion, based on a report prepared by the OECD detailing the forecasts and commitments of financial flows from developed countries. This roadmap stresses that public financing flows (bilateral and multilateral) from developed to developing countries alone will likely reach 67 billion dollars

by 2020. To this mobilisation of public financing, we should add leveraged private financing flows, so it is estimated that the objective will be met.

Within this context, as a developed country, Spain has been contributing to this effort. Since 2012, 1,985,134,959 million euros have been earmarked for climate financing.

Table: Evolution of climate financing Spain to developing countries

Climate financing Spain					
YEAR	2012	2013	2014	2015	2016
Total	205,677,244	254,575,047	463,129,072	466,719,757	595,033,839

Includes official development aid contributions (bilateral and multilateral) other official flows.

- The Agreement reinforces the «current system of transparency and accountability» of the United Nations Framework Convention on Climate Change, making transparency and information one of its basic pillars. The establishment of a framework of common information for all countries is therefore promoted, which will make it possible to know the real efforts in the fight against climate change, both in terms of emissions and absorptions of greenhouse gases and financial and technological support and for the capacity building provided and received. In this way, it seeks to ensure a clear understanding of climate change actions in the context of the Convention, thus promoting trust among countries since they can know the level of effort of the main actors in their environment.
- The information will be a key element in the operation of the Agreement since it will be one of the fundamental elements to be considered in the five-year review and will help to highlight the needs and potential improvements that may be incorporated as experience is acquired in its implementation.
- The Agreement recognises the «importance of technology and, in particular, of innovation», as a critical tool to improve resilience to climate change and reduce greenhouse gas emissions and is committed to working on the basis of existing infrastructure to achieve the development, dissemination and large-scale transfer of the necessary technologies to enable a global change.

The strong commitment of the international community to the agreement made it possible to bring it into force in record time. On 4 November 2016, less than a year after its adoption, the Paris Agreement came into force thanks to the European Union's ratification that made it possible for the criteria established in the Agreement itself to be met⁴. Spain, for its part, completed the ratification process on 2 February 2017.

⁴ 55 parties representing a total of at least 55% of the total greenhouse gas emissions would have deposited their instruments of ratification.

The early enforcement of the Agreement, however, posed a technical challenge. The Agreement was a general framework that still had many specific aspects fundamental for its operation and application pending development. Initially, when negotiations began, it was expected that it would not be operational until 2020, so there was time to finalise outstanding issues.

On the enforcement in 2016, many of its elements were not yet closed. Therefore, at the Marrakesh Climate Summit in 2016, a clear calendar was adopted that tried to ensure that the negotiations were not delayed: in December 2018, during the Climate Summit in Katowice (Poland), all of the outstanding elements of the so-called Paris Agreement Work Programme had to be finished. This Work Programme includes issues such as the details of the common transparency framework and information obligations of all countries, the design of the review mechanism or global review, whereby every five years it is necessary to evaluate the progress towards the achievement of the objectives of the Agreement, or the mechanism to facilitate the implementation and compliance with it, among others.

Spain's response from public policy on climate change

Spain's policy on climate change

We are in a new international scenario where the economic and social transition towards sustainable and low carbon models is unstoppable. The current development model has become obsolete and this forces us to rethink how new models of production and consumption should be, in order to preserve the planet and allow sustainable development and the answer is clear: the efficient and sustainable use of natural resources, renewable energy and energy efficiency are key to successfully face this transition

If we confront the challenge of facing the new change of development model where the fight against climate change will play a key role as a trigger and inspirer of a new reality, which is already happening and is innovative, competitive and respectful of the environment, we will be able to take advantage of this competitive advantage over new powers, such as China or India, which are positioning themselves in the new geopolitical order, and where no-one wants to lose positions in this new green race.

It is clear that this transformation will only take place if a clear signal of the assumed commitment and a certain framework is given to all public and private players, and the first unavoidable step is therefore the establishment of ambitious individual greenhouse gas reduction commitments.

Spain has assumed the international and European commitments to fight climate change, is aware of its responsibility and it should be noted that the strategy implemented in the country in recent years has improved

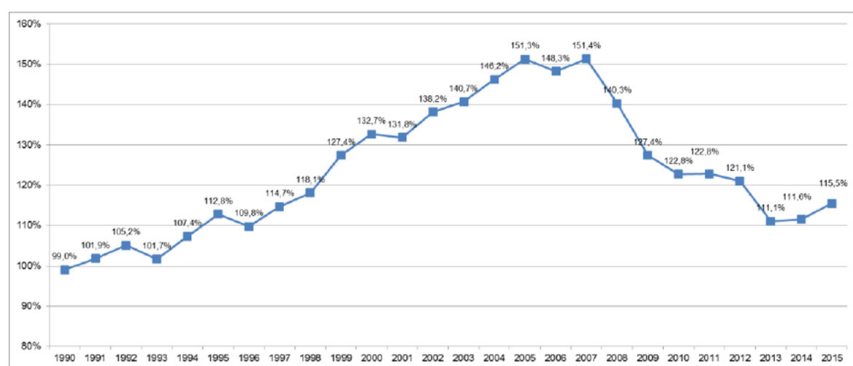
exponentially and has allowed a contribution to the principle that should inspire all policies: to make the environment an ally of economic and social development. Evidence of this commitment are some of the initiatives launched in recent years:

- It has been possible to involve all key economic sectors in the fight against climate change. And thanks to this, emissions from Spain have been reduced through the measures contemplated in the Roadmap 2020, which estimates reductions of more than 50M TCO₂eq and includes actions in areas such as agriculture, the residential sector and transport, among others.
- From the Ministry of Agriculture and Fisheries, Food and Environment, innovative instruments have been established that have allowed a new model of low emission development to be promoted. Initiatives such as the Climate Projects, the Environmental Promotion Plans or the Carbon Footprint Registry are examples of the generation of economic activity in our country, which have shown to favour the creation of employment.
- Progress has also been made in environmental taxation. The actions undertaken in the sector of fluorinated gases have proven to be very effective in reducing emissions (6 million tons in 2015, representing a decrease of 41% in emission reductions, compared to 2014).
- Within the framework of the policy of collaboration and dialogue with all the agents involved, the creation of a stable working group between the Administration and Spanish companies involved in the fight against climate change has been promoted: the Spanish Group of Green Growth that has the objective of sharing information and collaborating in the common goal of achieving a sustainable and low carbon economy.
- And it is involving citizens more and more. Spanish society is beginning to feel involved in the fight against climate change. And its commitment to everyday actions that contribute to reducing emissions is a good example of this. Thanks to the «One million commitments for climate» campaign, many Spaniards have been reached.

Furthermore, the variable of climate change has been integrated into the regulatory and planning context. Some examples are the Environmental Assessment Law, which includes the obligation to consider climate change in the environmental evaluation of plans, programmes and projects; the reform of the Law of Natural Heritage and Biodiversity, which incorporates the need to design adaptation and mitigation measures to minimise the risks and impacts of climate change on biodiversity; and the new Coast Law, which establishes the obligation that the projects to be developed on the coast contain an assessment of the effects of climate change. In addition, it promotes the realisation of coastal regeneration projects. And under its framework, a Strategy for the adaptation of the coastline has been prepared.

Likewise, second cycle hydrological planning considers climate change a determining factor, since it integrates future scenarios in which a reduction in natural water resources is expected as a consequence of climate change, and incorporates the necessary studies to adopt the appropriate measures.

All this effort has produced positive results a sign of which is the data on the fall in emissions in recent years. Total greenhouse gas emissions in Spain between the years 2011-2015 were reduced by 5.5%. And diffuse emissions were reduced in the same period by 10.75%. Thus, Spain has met the first commitment period of the Kyoto Protocol (2008-2012) and is on the right track to meet the second commitment period (2013 to 2020), while continuing to work to design actions that allow low and resilient carbon development in the climate to be developed in the medium and long term to fulfil the commitment assumed in the Paris Agreement.



Graph: Percentage of aggregate greenhouse gas emissions in Spain 1990-2015. Source: National Inventory of Greenhouse Gases, 2017. MAPAMA

Spain, as a member country of the European Union, is aware of the commitment it assumed with the ratification of the Paris Agreement and wants to lead the transition of the economy towards a low carbon model, in order to contribute to the fulfilment of the objective of keeping the increase in the average global temperature below 2°C with respect to pre-industrial levels, and even below 1.5°C, if possible.

In the context of the Paris Agreement, Spain, as a Member State of the European Union, takes on the ambitious commitment of the Union to reduce greenhouse gas emissions by at least 40% by 2030, compared to 1990. And it is putting into practice policies to fulfil the commitment that all countries promoted in Paris, a global and unanimous commitment of the entire international community: the transition towards a low-carbon development model that has no way back, and which Spain wants to lead.

Spain, in principle, must reduce its emissions of greenhouse gases in the diffuse sectors by 26% by the year 2030, and participate in the objectives of promoting renewable energy and energy efficiency.

Therefore, it is necessary to define a medium and long term framework to guarantee an orderly transformation of the economy towards a low carbon economy. The main objectives are clear: on the one hand, decarbonising the main production sectors while promoting economic growth and increasing the generation of employment and, on the other, reducing the risks of the impacts of climate change on more vulnerable sectors and populations. In the public debate on the choice of climate policies it is necessary to assess the additional and not the strictly environmental benefits in terms of reducing emissions or improving air quality. And thus quantifying, among other things, the advantages of reducing the energy dependence of Spain, the new jobs generated by a green economy and energy savings, are key to the successful design of the country strategy for the coming years. The Commission's proposals for a «Clean Energy for all Europeans» plan to mobilise up to 177 billion euros of public and private investment per year starting in 2021, to generate an increase of up to 1% of GDP over the next decade and create 900,000 new jobs.

In this sense, work is being done on the preparation of a «Law on Climate Change and Energy Transition» to comply with the objectives set out in the Paris Agreement and in the framework of the European Union in the medium and long term on climate and energy issues. It is an ideal moment to promote this Law.

In the context of the European Union, since 2015 the legislative proposals of the Commission to achieve the climate and energy objectives of the 2030 Framework have been on the negotiating table.

- In 2015, the proposal to reform the Emissions Rights Trade Regime was presented in order to guarantee that the energy sector and high energy consumption industries could achieve the necessary emissions reduction: 43% by 2030, with respect to 2005.
- In the summer of 2016, the Commission presented proposals to accelerate the transition towards a low-carbon economy in the other key sectors of the European economy (sectors with a reduction target of 30% in 2030 compared to 2005).
- Finally, the 30 November proposals regarding «clean energy for all Europeans» include the remaining elements for a full implementation of the framework of action of the European Union on climate and energy until 2030. In particular, in the field of energy efficiency and renewable energies.

In this context, the Law should promote actions with greater capacity for commitments at the lowest possible cost. So that the energy and climate change policy might favour economic activity, competitiveness and employment and ensure the financial sustainability of energy systems in our country.

The Law will act as a legal framework in the medium and long term in order to effectively respond to the challenge we face, which establishes a certain framework for administrations, the private sector and citizens, and allows

them to plan their actions both from the point of view of management, and from the planning of the production and the management of demands. This requires efforts in many areas, from domestic to large industrial facilities and, of course, that these be sustained over time. That is why the Law is proposed as a Law for all and with a strong vocation for permanence. And for its preparation, an open and participatory process unprecedented in our country has been launched. We are working with all the ministerial departments, Public Administrations and remaining levels of the regional and local Administration. It is also being ensured that there is an open debate that allows the participation of relevant players in the fight against climate change, such as the scientific community, the academic world, trade unions, the business sector and NGOs.

In parallel, the Inter-ministerial Work Group was set up to coordinate the preliminary Bill on Climate Change and Energy Transition and the Integrated National Plan for Energy and Climate, with the aim of providing the State General Administration with a structure of inter-ministerial coordination to support the process of drafting the aforementioned Bill and the Integrated Energy and Climate Plan. Given the transversal nature of climate change policies, this Group has representatives from the Ministry of Agriculture and Fisheries, Food and Environment; of Energy, Tourism and Digital Agenda; of Foreign Affairs and Cooperation; of Economy, Industry and Competitiveness; of Development; of Finance and Public Function; of Health, Social Services and Equality; of the Presidency and for Public Administrations; and of the Economic Office of the Prime Minister, to try to continue integrating the fight against the climate change in the Spanish Administration and thus count on the participation of the different players involved.

The functions of the Inter-ministerial Work Group include promoting and coordinating the actions of the bodies of the General State Administration in drafting the Bill on Climate Change and Energy Transition, and in preparing the National Integrated Plan for Energy and Climate. In the same way, the Group will promote and coordinate the actions within the General State Administration for the preparation of the Strategy for the Decarbonisation of the Economy by 2050, in order to contribute to the fulfilment of the commitments assumed in the United Nations Framework Convention on Climate Change and the Paris Agreement. This Group must inform the Delegate Commission of the Government for Economic Affairs of the corresponding proposals of the Bill, of the Integrated National Plan and the Strategy, as well as the revisions or updates, prior to its submission to the Cabinet. Finally, among the functions of the Group, it should be noted that this should also promote a strategy and roadmap for compliance with the international climate finance obligations of Spain assumed in the context of the Convention and the Paris Agreement.

The fight against climate change is part of the equation of another of the great challenges of our time, which is energy transition. The achievement of climate objectives will depend on the degree of development of different energies such as wind, photovoltaic and energy storage systems, as well as the development of new competitive renewable energies.

It is not the first energy transition that we have experienced and the passage from coal to oil is not so far in the past, but unlike other energy transitions, this time it is about improving the welfare of citizens by using less energy and with a smaller climate footprint.

In Spain this transition has already begun, in 2015 our country had a larger penetration of renewables than most of our surrounding countries, reaching 17.3% compared to 5.8% in the Netherlands, 8.2% in United Kingdom, 14.6% in Germany and 15.2% in France.

These data place Spain 3.5 points above the path of compliance expected for renewable energy targets by 2020 (20% of the final energy consumption from renewable sources by 2020)

However, additional efforts are necessary to meet the 2020 targets, which will place us at a more favourable starting point for complying with the next round of targets by 2030. Energy policy has thus set the following priorities: energy efficiency, deployment of renewables, competitive prices for consumers, sustainability of energy systems and interconnections.

Along this line, Spain advances in the deployment of new renewable generation through auctions to introduce new renewable power in our system. In 2017, 6,000 megawatts were awarded, which will help achieve the 20% renewable energy target by 2020. Along with this measure, there are also aid plans for the purchase of cars with alternative energy.

As a complement to this, work is being done on planning the main emitting sectors to identify what the efforts to reduce greenhouse gases of each of them should be. In this context, the most relevant due to its weight in emissions and in the design of the country's economic strategy will be the «Integrated National Plan for Energy and Climate» for the period 2021-2030, which is one of Spain's main obligations in the context of the 2030 Energy and Climate Framework and a key tool to ensure coherence between the energy and climate policies of European countries, in which national objectives will be established as well as the necessary policies and measures to achieve the European objectives in the fight against climate change and energy by 2030.

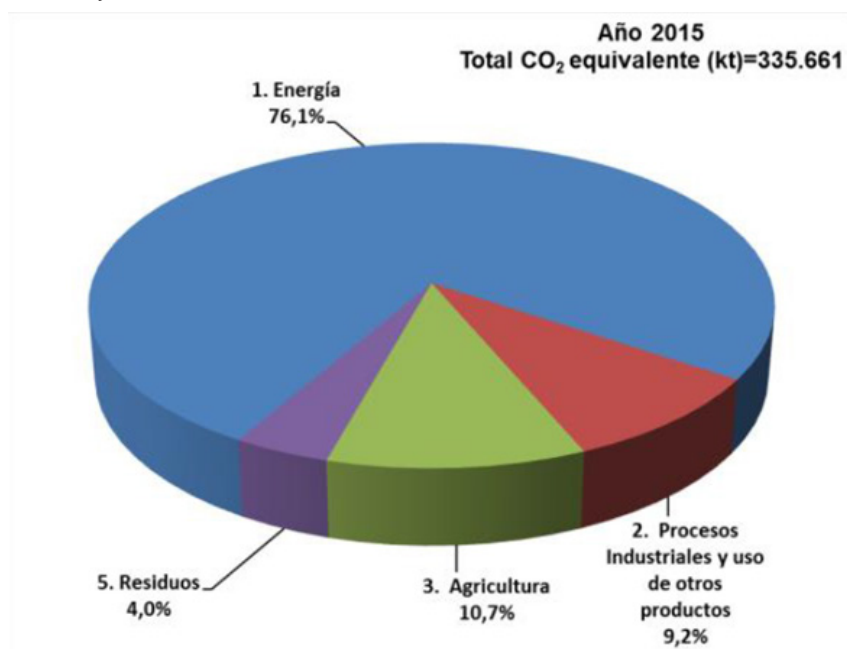
The Integrated National Energy and Climate Plan must therefore reflect each Member State's contribution to the achievement of the commitments presented by the Commission at Community level regarding the reduction of greenhouse gas emissions (at least 40% with respect to 1990 levels), renewable energies (27% of renewable energy sources in final energy consumption), energy efficiency (a 30% improvement in energy efficiency) and electrical interconnections (15%).

On the other hand, agriculture will be one of the key sectors for compliance with the Paris Agreement, especially taking into account that the sector is responsible for 10% of national emissions. In this area, the Government is working to develop a «Strategy of Agriculture, Climate and Environment»,

which will be incorporated into the forest sector, in order to align the objectives of agricultural policy with the fulfilment of the international commitments assumed by Spain on climate and the environment.

Likewise, as required in Paris, Spain will prepare a «Strategy for the decarbonisation of our economy by 2050», which will include Spain's contribution to the goal of climate neutrality and contribute to the fulfilment of the objectives of the Roadmap of the European Union towards a low carbon economy by 2050, which shows that the greenhouse gas emissions of the European Union should be reduced between 85% and 90%, with respect to 1990. This means that the 2050 scenario is a scenario where most of the production sectors have to be decarbonised.

In the field of sectors not regulated by the European Emissions Trading System, known as the diffuse sectors (transport, residential, waste, agriculture, fluorinated gases and small industry), work is already being done within the Coordination Commission of Climate Change Policies on the «Roadmap of the diffuse sectors to 2030». The objective is to identify the measures with the greatest capacity to achieve emission reduction objectives at the lowest possible cost, so that the climate change policy favours and highlights the additional benefits of environmental policies such as savings, benefits in health, improvement in the balance of payments, generation of economic activity, reduction of foreign energy dependence, improvement of competitiveness and creation of employment, as well as the assurance of the sustainability of our economy.



Graph: Distribution of greenhouse gas emissions by sector in Spain. Source: National Inventory of Greenhouse Gases, 2017. MAPAMA

With the primary objective of reducing emissions of greenhouse gases, the Ministry continues to encourage economic activity and private investment with the implementation of the «Climate Projects and Environmental Promotion Plans (PPE)» that show the important role played by the private sector in the fight against climate change and how in Spain it is possible to boost economic activity while protecting the environment.

«Climate Projects» are domestic projects to reduce greenhouse gas emissions in diffuse sectors, which generate economic activity in sectors associated with the fight against climate change, facilitating the fulfilment of the emission reduction objectives while generating growth and employment. The Carbon Fund for a Sustainable Economy (FES-CO2) acquires the reductions generated by these projects in the first 4 years of activity, thus encouraging the start-up of new low-carbon activities in our country.

Since 2012 five Climate Project calls have been resolved in which over 250 projects have been selected that will represent a total reduction of CO₂ emissions equivalent to more than 7.4 million tons. The Fund plans to hold periodic calls for the implementation of annual projects.

For their part, the «Plans to Promote the Environment (PPE)» are a tool for the promotion of measures that contribute to the improvement of the environment. The different PPEs also have a positive effect on economic development and the promotion of employment in Spain. To date, the following plans have been launched:

- PPE Sun (promoting the refurbishment of hotels to improve energy efficiency).
- PPE Land (promoting the renewal of the farm tractor fleet).
- PPE Air (promoting the renewal of the commercial vehicle fleet with more efficient models).
- PPE Transport (promoting the scrapping of vehicles for the transport of goods and passengers).
- PPE Adapt (for adaptation projects in different areas of the coast, public hydraulic domain, national parks and ecosystems).
- PPE Waste (promoting actions for better waste management, indirectly reducing greenhouse gas emissions).
- PPE Enterprise (promoting the implementation of actions in those companies that are registered in the Carbon Footprint Registry).

Another line of work is the «carbon footprint, its calculation, reduction and compensation».

The Carbon Footprint Registry is a tool that allows organisations with activity in the national territory to register their carbon footprint in a voluntary

registry officially recognised at national level. The importance of the Registry is emphasised, not only in calculating but also in reducing emissions, so that organisations that register their carbon footprint must also submit an emissions reduction plan. If it is finally demonstrated that they have achieved a reduction, the Registry grants them that recognition.

Likewise, it enables organisations to go beyond calculation and the reduction, allowing them to offset their emissions through repopulations that have taken place in the country.

As a platform for disseminating the commitment of Spanish organisations in the fight against climate change, the organisations registered in the Registry receive an official stamp that reflects whether they have calculated, reduced and/or offset their carbon footprint.

The Carbon Footprint Registry in its first three years of operation has achieved 521 organisations registering one or several carbon footprints in it, making a total of 952 footprints.

It is a tool with great potential for the mitigation of climate change which, if properly integrated into organisations, can become a strategic and competitive element for entities competing in global markets.

The Ministry of Agriculture and Fisheries, Food and Environment began to calculate its footprint in 2011, and it has proven to be a tool that has positively helped to reduce Department emissions. In 2015, emissions were reduced by 57% compared to 2010.

In the field of adaptation, Spain was one of the first European countries to establish, in 2006, a strategy for adaptation, through the «National Plan of Adaptation to Climate Change» (NPACC). This Plan is the framework instrument in which all the adaptation actions carried out in Spain are included.

The ultimate objective of the NPACC is the integration of adaptation in the planning and management of all sectors vulnerable to climate change, in order to minimise the impacts and, where appropriate, benefit from new opportunities.

The NPACC is implemented through work programmes, which specifically define the activities to be carried out. To date, two work programmes have been developed, the first valid in 2006-2009; the second, 2009-2013 and, at present, the Third Work Programme (2014-2020) is under way⁵.

In this line of work, progress is being made in the integration of adaptation in the different sectoral policies, while at the same time promoting concrete actions to assess the impacts and vulnerability due to the effects of climate

⁵ http://www.mapama.gob.es/es/cambio-climatico/temas/impactos-vulnerabilidad-y-adaptacion/3PT-PNACC-enero-2014_tcm7-316456.pdf.

change, including extreme events in numerous natural systems and socio-economic sectors in Spain.

In July 2017, the «Strategy for Adaptation to Climate Change of the Spanish Coast» was approved and the Ministry is making progress in the work to develop the Strategy for the Protection and Management of Natural River Reserves, with special attention to adaptation to climate change.

On the other hand, and with a view to strengthening the governance of adaptation to climate change and increasing resilience to climate change in Spain and Portugal, the «LIFE-SHARA Project» (*Sharing Awareness and Governance of Adaptation to Climate Change in Spain*), is being developed in line with the Europe Adaptation Strategy.

The objectives of the LIFE SHARA include the improvement of the capabilities of «AdapteCCa»⁶ (platform for consultation and exchange of information on adaptation to climate change) to improve the quality and quantity of information and facilitate its use as a tool for governance, strengthening the technical capacities to adapt and raise awareness and reinforce coordination and cooperation between key agents (with the private sector, the Spanish Administrations and with Portugal).

Likewise, work is continuing to raise awareness among citizens and make them participants of the important role they play in the fight against climate change and, in this line of action, the Ministry of Agriculture and Fisheries, Food and Environment is part of the «Community #PorElClima» task force⁷.

The initiative aims to put into practice the need to act to curb climate change and its main objective is to move from the assumption of commitments for the climate, to action, to the realisation of the committed actions that result in effective reductions in CO₂ emissions. At the same time, the initiative is intended to reinforce the message of action by uniting it with community belonging of committed people and entities who are already doing things and who want their actions to have visibility to achieve positive synergies.

With all these initiatives from public policies, Spain has no other objective than to respond to the biggest challenge we face at this time: climate change. A challenge that is called to define our times. But which, due to its environmental, social and economic consequences, we can consider without exaggeration one of the most important crossroads we have faced in history.

Climate change challenges us all with the question over the future of the planet. It gives us the responsibility of leaving a better world than that we inherited. And it calls on us to take urgent measures, since it is a process that is underway.

⁶ <http://www.adaptecca.es/>.

⁷ <https://porelclima.es/>.

The fight against climate change requires us to act with vision. And, at the same time, it opens up positive opportunities for the future. Because scientific knowledge not only guides us on the measures to adopt. It also promotes a change in the model that opens up a huge range of possibilities around which to build sustainable economic development for the benefit of all.

Video resume



Chapter four

The influence of climate change on security

María del Mar Hidalgo García

Abstract

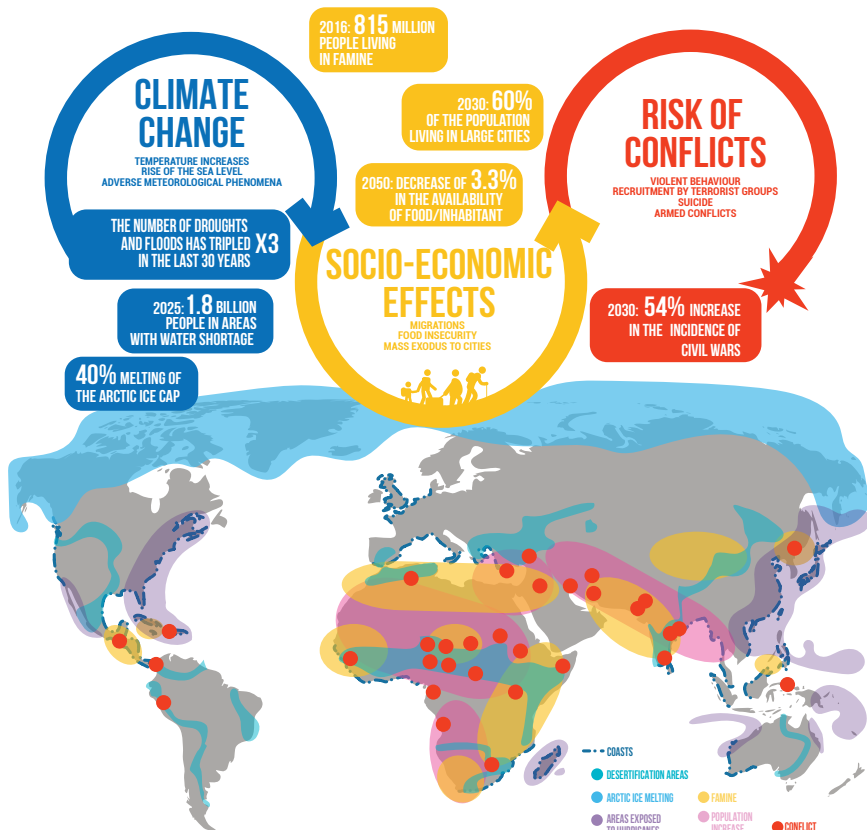
Climate change affects human security and the stability of certain areas of the planet. The relationship between climate change and the emergence of conflicts has aroused the interest of the scientific community in recent years, as many studies that are published in this respect. It is necessary to understand the processes that underlie the emergence of conflicts, such as poverty, inequality, fragile governments or the existence of historical tensions to evaluate the risks to which they are subjected societies as a result of the climate change.

Key words

Climate change, security, drought, food security, conflict.

THE INFLUENCE OF CLIMATE CHANGE ON SECURITY

The consequences of climate change have the potential to aggravate social tensions, thus inciting the emergence of conflict.



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Introduction

In 2007, Ban Ki-moon declared that climate change had been the culprit for the disaster in Darfur¹ in 2002. Since then, numerous scientific studies have been carried out that attempt to relate the consequences of climate change to the appearance of conflicts or situations of insecurity. Although this relationship is not direct, the truth is that climate change is currently considered one of the main problems affecting security.

Climate change is a global problem, but its consequences mainly affect the weakest communities in Africa and Asia, and will do so more severely in the coming years. Climate change affects human security and the stability of certain areas of the planet, contributing to ethnic tensions, migratory movements or the struggle for such basic natural resources as water. The environment is one of the seven dimensions of human security² so a change in natural or anthropogenic environmental conditions jeopardises the very survival of populations. Environmental degradation and violent conflict create a vicious circle in which each increases the vulnerability of the other group³.

Although many of the risks associated with climate change lack precise and accurate statistics on their probability of occurrence and their impact on populations, it is possible to estimate the magnitude of the consequences that can occur in the long term⁴.

From a political point of view, the negative effects of climate change are considered to be a threat comparable to terrorism. According to the IPCC approach, climate change does not inevitably cause insecurity but increases the risk of insecurity. This approach considers that the causes of the impact of climate change on security are not external, but that the consequences of climate change increase the risks that are inherent in today's society. When responding to a threat, it seeks to neutralise it, which does not happen with the consequences of climate change. The risk-based approach allows interdependencies to be established that are necessary to consider the security risks associated with climate change taking into account the vulnerability of populations⁵. That is, the impact of climate change on populations is due to factors related to the climate but also to factors not related to it, such as its political, economic and social situation. It is necessary to understand the processes that underlie the emergence of conflicts, such

¹ <http://www.washingtonpost.com/wp-dyn/content/article/2007/06/15/AR2007061501857.html>.

² The other six are: economic, health, personal, political, food and community. «Human Development Report (HDR)», 1994.

³ <http://www.efeverde.com/noticias/sequias-aumentan-riesgo-conflicto-paises-pobres/>.

⁴ «Climate-related security Risks. Towards an Integrated Approach». SIPRI. October 2016.

⁵ Ibid.

as poverty, inequalities, fragile governments or the existence of historical tensions, to assess the risks to which societies are subject as a consequence of climate change.

This impact on security will depend not only on the phenomena produced by climate change and which will be studied below, but also on the situation of vulnerability and populations' capacity to adapt. For this reason, to address the problem from the political, development and security point of view, it is important to study the political, economic and social context of the regions affected by the phenomena related to climate change in order to assess their impact on the generation of insecurity.

For many years, climate change has ceased to be a strictly environmental problem and has become one of economy and security. Some authors even raise it to a higher level to treat it as an ethical problem⁶ and contextualise it in a crisis of the human condition that is experienced today. For this reason, they suggest that it is necessary to broaden the study and extend the impact of climate change to other disciplines such as social sciences and humanities to address its social, cultural, historical and ethical dimensions.

Climate change as an enhancer of security risks: factors that increase the risk of conflict or destabilisation

The risks associated with climate change are complex because they are multiple (droughts, floods, sea level rises, adverse weather phenomena, etc.), they are multidimensional, since they range from local to global, and have short, medium and long-term implications⁷.

In recent years, there has been an increase in the scientific literature of studies that attempt to establish a quantitative relationship between the impacts of climate change and the emergence of violent conflicts. However, these studies have certain uncertainties and limitations since some of them establish statistical methods to relate a certain number of variables, leaving aside other factors that affect the relationship in a qualitative way, such as the institutional and/or economic fragility of a certain State⁸.

Some of these studies directly relate the consequences of climate change, such as changes in temperature, to the appearance of armed conflicts throughout history. In the case of Africa, some scientists⁹ have examined in

⁶ HOLM, P.; TRAVIS, C. «The New Human Condition and Climate Change: Humanities and Social Science Perceptions of Threat». *Global and Planetary Change*, 156, 2017, pp. 112-114.

⁷ «Climate-related security Risks. Towards an Integrated Approach». SIPRI. October 2016.

⁸ <https://www.climate-diplomacy.org/news/what-quantitative-analyses-tell-us-about-climate-change-and-conflict>.

⁹ BURKE, Marshall B., and col. «Warming increases the risk of civil war in Africa», *PNAS*, December 2009, vol. 106 no. 49. Available at: www.pnas.org/cgi/doi/10.1073/pnas.0907998106. Consulted 18 April 2017.

depth the relationship between temperature and the appearance of conflicts in sub-Saharan Africa in the period between 1980 and 2002, concluding that in the hotter years there was an increase in conflicts, and have even quantified it: an increase of 1°C has meant an increase of 4.5% in civil wars. With this historical series, the projections indicate that by 2030 there would be an increase of 54% in the incidence of civil wars with an increase of 393,000 victims in sub-Saharan Africa.

Other authors¹⁰ have carried out a study in which they relate the conflicts in Asia and in Africa with the appearance of droughts between 1989 and 2014. It concludes that the risk of conflict increases with each year more of drought, especially in the least developed countries. If the rest of the factors remain unchanged, the authors estimate that five consecutive years of drought increases the probability of conflicts by around 12% and 15%.

A recent study published in September 2017 also establishes a relationship between droughts and the appearance of conflicts in sub-Saharan Africa, estimating an increase in probability of between 10-50% depending on the stability of the country, its water resources or ethnicity. The authors conclude that drought is like a fuel that contributes to «igniting flames that are already alight»¹¹.

However, despite the scientific basis of these projections, some caution must be shown with these data as they do not contemplate the political and economic variables or adaptation policies that may be established in the future. In this regard, there are studies that do take into account the economic impact of natural disasters and their impact on the appearance of conflicts, instead of strictly climatic parameters such as temperature. But these studies also expose the difficulties that exist when quantifying the damages caused by climate change as they fail to directly have a bearing on the economy of a region, unlike what happens, for example, with losses in subsistence agriculture due to droughts¹².

In view of all these studies, it can be deduced that it is very difficult to establish a direct and simple relationship between climate change and the appearance of conflicts. For this reason, climate change is considered a «risk multiplier»¹³ which can aggravate political situations. This approach has the advantages of being able to consider the uncertainties that must be taken

¹⁰ UEXKULL, N., and col. «Civil conflict sensitivity to growing-season drought», *PNAS*, November, 2016, vol. 1113. no. 44, pp. 12391-12396. Available at: www.pnas.org/cgi/doi/10.1073/pnas.1607542113.

¹¹ University of Geneva «Drought: A cause of riots». *ScienceDaily*, 26 September 2017. <www.sciencedaily.com/releases/2017/09/170926090530.htm>.

¹² SCHLEUSSNER, Carl-Friedrich and col. «Armed-conflict risk enhanced by climate-related disasters in ethnically fractionalized countries». *PNAS*, August 2016, vol. 113, no. 33. Available at: www.pnas.org/cgi/doi/10.1073/pnas.1601611113. Date consulted 18 April 2017.

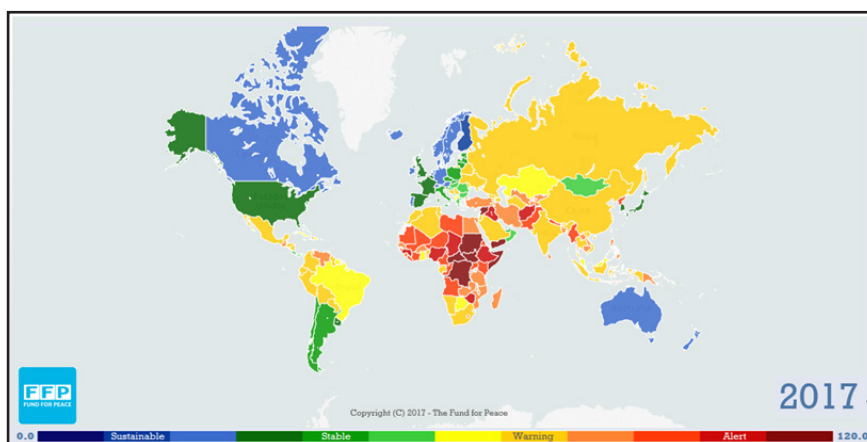
¹³ <https://www.climate-diplomacy.org/news/what-quantitative-analyses-tell-us-about-climate-change-and-conflict>.

into account when analysing the consequences of climate change and its potential to generate situations of instability. It is thus possible to establish the «hot spots» and therefore to focus efforts to prevent a violent situation caused or aggravated by the consequences of climate change.

In general, the negative effects of climate change will be felt in all countries, but with greater intensity in developing countries, small island developing states (SIDS) and areas with especially fragile ecosystems (such as arid areas, mountains and seaside). If these geographical impacts are combined with the fragility data of countries¹⁴, it is observed that many of the states that are among the most fragile are found in areas that are exposed to the negative impacts of climate change, such as the Sahel, East Africa and the Middle East.

Inequalities, lack of basic services, corruption and the weakness of governments, which characterise fragile states, are the main causes that increase the risk of climate change leading to a situation of instability or conflict in a given region. The extreme situation involves entering a loop of instability as a consequence of climate change and increased vulnerability of populations to climate change as a result of the instability situation.

In a globalised and interconnected world, the focuses of local or regional instability have a global impact not only from the point of view of security, but also from that of the economy or health. For this reason, it is convenient to identify the risk factors related to climate change that can lead or aggravate a situation of instability. It will thus be easier to ensure that actions aimed at mitigating and adapting to climate change are coordinated with actions of humanitarian aid, development and peacekeeping to reduce the vulnerability of populations and therefore contribute to global stability.



¹⁴ Fragile States Index 2016. Available at: <http://fundforpeace.org/fsi/>.

Adverse weather phenomena and natural disasters

Climate change is causing an increase in the frequency and intensity of extreme weather events, especially in the most vulnerable regions, causing severe economic losses that affect personal possessions, livelihoods and the food security of millions of people.

Adverse weather events will occur with greater intensity, frequency and severity in the coming years as a result of climate change. Although it is a global problem that will affect the entire planet, it is precisely the poorest areas that are most vulnerable to these effects. According to the *Global Climate Risk Index 2017 report*¹⁵ of the ten countries most affected by climate change, nine are developing countries and four of them are in the African continent, with Mozambique and Malawi being the first and third places due to the floods that affected almost one million people, causing the displacement of 200,000 people and the appearance of diseases such as cholera.

Other African countries such as Zimbabwe or Madagascar had to face similar situations. The report also notes that between 1996-2005 around 528,000 people died in the 11,000 extreme weather events produced in that period, which caused economic losses of around 3.08 trillion dollars.

These disasters add tension in regions that are already in a fragile situation due to the weakness of their governments or which are economically disadvantaged. In addition to the victims, natural disasters affect the economy and cause the displacement of populations. Both local and international humanitarian aid is key to minimising the consequences of a catastrophe whether produced by climate change or in a natural way. If the disaster is not managed adequately either by the local government or by international aid, conflict situations can arise, mainly if aid is not distributed fairly.

Influence on human security: food, water and energy

The lack of sustainability of the current food systems is causing significant environmental damage, with the depletion of water resources, nitrogen pollution, land degradation, overexploitation of fishery resources and the contribution to the emission of greenhouse gases. There is growing competition for resources related to food production, water being the most worrying, although land is also considered a resource on which rising pressure will be exerted in the coming years.

The latest report published by FAO on the food security situation¹⁶ warns of the increase in hunger in the world affecting 815 million people in 2016, or 11% of the world's population. The causes of this increase of almost 38

¹⁵ <https://germanwatch.org/en/download/16411.pdf>.

¹⁶ <http://www.fao.org/3/a-l7695s.pdf>.

million people over the previous year, are related to the appearance of violent conflicts and alterations related to the climate.

According to this report, a situation of food insecurity can be the triggering factor of violence and instability, mainly in environments of great inequalities or fragile institutions, since frustration and resentment can lead people to adopt antisocial behaviours. According to José Graciano da Silva: «Peace can not be achieved without addressing food security and eradicating hunger, and there will not be enough food if climate change is not addressed»¹⁷.

In addition, by 2030, up to 122 million more people worldwide may live in conditions of extreme poverty as a result of the impact of climate change on incomes in small-scale agriculture¹⁸.

Climate change weakens the four dimensions of food security¹⁹:

- Availability of food. Changes in climate conditions affect the performance of food systems, both in quality and quantity. By 2050, climate change will have reduced the availability of food per inhabitant by more than 3%, consumption of fruit and vegetables will fall by 4% and the consumption of red meat will decrease slightly²⁰. According to the UN, in Ethiopia crop production has fallen between 50 and 90% in some regions so around 15 million people will need urgent food aid because of the drought. Between October 2015 and April 2016, an estimated 450,000 heads of cattle died. This also means that milk - essential food in the diet of Somali Ethiopians, and particularly children - is also seriously lacking²¹.
- The accessibility of food. The impacts of climate change affect the global food supply, causing a rise in prices and greater volatility. A sudden increase in prices can generate protests, as happened in 2008. The development of social protests towards the appearance of a conflict is not a direct issue but depends on the situation of social discontent due to unemployment, marginalisation of social groups or the existence of latent instability in the country. Therefore, a rise in prices can push families' survival to the limit, causing the desperation of the population and igniting a spark that can be exploited by opposition groups to gain support and overthrow governments.
- The use of food. Climate change affects caloric intake especially in regions with situations of chronic food insecurity. It is also likely that climate change will affect food safety, contributing to a vicious circle of hunger-disease.

¹⁷ FAO Strategy for Climate Change, Rome, July 2017.

¹⁸ FAO Strategy for Climate Change, Rome, July 2017.

¹⁹ <https://www.wfp.org/climate-change/climate-impacts>.

²⁰ FAO Strategy for Climate Change, Rome, July 2017.

²¹ <http://www.fao.org/news/story/es/item/1029230/icode/>.

- Food stability. Climate change can produce an increase in price volatility and be a disruptive factor in the global food system. The likelihood of a situation of instability in this system depends on national policies related to subsidies to consumers and export markets²². Fragile states that depend on food imports are especially vulnerable, as in the Middle East and North Africa.

With regard to water, climate change will cause the decrease of renewable surface and groundwater resources, mainly in the subtropical dry regions. For each degree that the temperature of the planet's surface increases, about 7% of the world's population will be exposed to at least a reduction of 20% in their renewable water resources²³. As climate change affects the availability of water resources, situations of tension can occur, testing the stability of existing agreements on water access and availability.

Although water management provides many possibilities for cooperation, it can also be a source of tension, mainly in transboundary basins where agreements are usually based on the establishment of a quantity of water instead of a percentage. This influence of climate change on the flows of river basins has direct effects - caused by droughts, changes in rainfall patterns or the melting of glaciers - and indirect effects as a result of mitigation policies aimed at establishing new energy models that contribute to the decarbonisation of the economy.

Energy is also related to food production and the water sector. With a population that by 2050 will reach 9 billion, the only way to guarantee the planet's sustainability will be to consider sustainable development in the water-food-energy nexus. This nexus is subject to numerous pressure factors such as overpopulation and climate change.

Emergence and spread of infectious diseases

Climate change increases some interactions between the environment and human health²⁴ and is the greatest environmental threat facing humanity. Global warming favours the multiplication of vectors (flying and terrestrial insects) and the replication of pathogenic micro-organisms that are transmitted by them, causing serious diseases to people, animals and plants. It can also influence the temporal and spatial distribution.

These alterations have been demonstrated scientifically by studying the phenomenon of natural climatic variability of «El Niño» since it has been associated with the increased epidemiological risk of certain mosquito-

²² <https://www.climate-diplomacy.org/publications/climate-fragility-risks-global-perspective>.

²³ IPCC, 2014. Available only at [http:// www.ipcc.ch/pdf/assessment-report/ar5/wg2/WGIIAR5- Chap3_FINAL.pdf](http://www.ipcc.ch/pdf/assessment-report/ar5/wg2/WGIIAR5-Chap3_FINAL.pdf).

²⁴ http://www.oscc.gob.es/es/general/salud_cambio_climatico/impacto_salud_es.htm.

transmitted diseases like malaria. In the case of Venezuela and Colombia, this increase has reached 30%, while in Sri Lanka malaria cases have multiplied by four²⁵.

Climate change also has a health-related impact causing unexpected variations in patterns of plant and animal diseases. For example, variation in algae bloom may expose new countries to exposure to ciguatera poisoning, a serious disease that is transmitted through food. The rise in temperatures and humidity are also increasing the risk of fungal growth and therefore the contamination of cereals and legumes stored by mycotoxins. This implies a decrease in the amount of food produced and food contamination through their intake.

The prevention and control of these health problems could generate an increase in plaguicides and the use of antimicrobials. The uncontrolled use of these compounds and their presence in the environment could have very negative consequences on human health since it could cause the expansion of resistant micro-organisms with the consequent loss of efficacy of these products²⁶.

In the case of Spain, the emergence of vector diseases could be enhanced by climate change as it is a transit point for migratory birds and people. Vector diseases susceptible to being influenced by climate change in Spain would be those transmitted by flies, such as dengue fever, West Nile encephalitis, Rift Valley fever, malaria and leishmaniosis; those transmitted by ticks such as Crimean Congo fever, tick encephalitis, Lyme disease, boutonneuse fever and recurrent endemic fever; and those transmitted by rodents. Although the greatest and most feasible threat would be the establishment of the *Aedes albopictus* mosquito, which would be capable of transmitting viral diseases such as West Nile encephalitis or dengue²⁷.

Increase in sea level

One of the most worrying consequences of climate change is the rise in sea level that will result from the flooding of coastal areas and the infiltration of saline water into crops.

Egypt is also an area especially vulnerable to climate change. The rise in sea level will directly affect the infrastructure and agricultural production of the Nile delta, where 25% of its population is concentrated. Floods and saline intrusion will have a direct impact on Egypt's economy²⁸.

²⁵ http://www.scielo.org/scielo.php?script=sci_arttext&pid=S1135-57272005000200006.

²⁶ <http://www.who.int/drugresistance/use/es/>.

²⁷ http://www.scielo.org/scielo.php?script=sci_arttext&pid=S1135-57272005000200006.

²⁸ <http://adaptation-undp.org/gcf-approves-us314-million-undp-supported-project-enhance-climate-change-adaptation-north-coast-and#.WdKVSTRpKXw.linkedin>.

An example of a country extremely vulnerable to the effects of climate change due to the risk of flooding is Bangladesh, the eighth most populous country in the world with 160 million inhabitants of which 80% live in the vicinity of coastal zones at sea level. It is estimated that by the end of the 21st CENTURY the sea level will have increased by one metre in that area, which would mean that almost a fifth of the country will be flooded, especially the most vulnerable areas such as Khuna, Satkhira and Bagerhat, bordering on India²⁹.

Cyclones that occur during the monsoon rainy season - which starts in June and lasts until the end of September or October - also increase the risk of flooding, such as the most recent in August 2017 and also that suffered by Nepal and India with a balance of 1,200 deaths, 41 million affected people and millions displaced³⁰.

River erosion and the entry of seawater into farmland also endanger the livelihood of a large part of the population.

Influence of the Arctic melting

The Arctic region has undergone a rapid and drastic change as a result of global warming. In this region, the average temperature increase is almost double the average of the rest of the planet, causing almost 40% of thaw³¹.

This thaw has allowed the establishment of new commercial routes and opens up the possible exploitation of natural resources, mainly oil and gas, which are present in the area. The Arctic can therefore be one of the main focuses of conflict of the TWENTY-FIRST CENTURY because there are many divergent interests in the area, both from neighbouring countries and those thousands of miles away.

Environmental migration movements

The first IPCC report issued in 1990 warned that one of the main consequences of climate change would be an increase in migratory movements caused by land degradation, floods, droughts or the rise of the sea level. The report estimated the appearance of tens of millions of these kinds of migrants.

Quantifying the number of people displaced by climate change is a task that is practically impossible since migratory phenomena are complex and multi-causal. Even so, according to UNHCR, it is estimated that in 2050 there could be between 150 million and 1 billion people displaced as a result of climate change, although the figure that is most cited is around 200 million people³².

²⁹ http://www.slate.com/articles/health_and_science/green_room/2010/12/the_great_wall_of_india.htm.

³⁰ <http://www.bbc.com/mundo/noticias-internacional-41096613>.

³¹ <http://www.saisjournal.org/posts/climate-change-and-power-shifts-in-the-arctic-region>.

³² <https://www.iom.int/complex-nexus#problem>.

The migratory phenomenon is so complex that the very displacement of people can be considered as much as a measure of adaptation to climate change as a possible source of tension with the receiving population.

If we take into account the direct relation between a situation of food insecurity and a migratory phenomenon, the World Food Programme establishes that for every 1% increase in food insecurity there is an increase of 1.9% in the people who migrate, and 0.4% more for each year of conflict³³.

Although it is very difficult to establish a direct relationship between climate change and a specific migratory phenomenon, there are estimates that suggest that the number of people who are forced to move for these reasons is much higher than those who are forced to move as a consequence of a conflict or a violent situation. For example, in 2008, around 20 million people moved as a result of adverse weather events, compared to 4.6 million people who were displaced by a conflict situation³⁴.

Although it seems evident that changes in environmental conditions and natural disasters have caused population displacements throughout history, political, economic, demographic and social factors must also be taken into account.

This multicausality leads to the fact that there is no present consensus when it comes to defining the people who are forced to move due to the alteration of their lifestyles as a consequence of climate change. In literature and in discourses, several terms are used indistinctly: 'Environmentally displaced', 'climate refugees', 'environmental refugees', 'climate migrants', 'environmental migrants' or 'migrants as a result of climate change'. And if to this variety in the terminology is added the temporary or permanent, voluntary or forced or internal or transboundary nature of the displacements, it is easy to deduce the extreme difficulty that exists when establishing a direct cause-effect relationship with climate change³⁵.

Of all of them, the most questioned and problematic from a legal point of view are those that refer to the concept of «refugees». Article 1 of the Convention Relating to the Refugee Status of 1951 applies the term refugee to any person who «due to well-founded fears of being persecuted for reasons of race, religion, nationality, belonging to a particular social group or political opinions, are out of the country of their nationality and can not or, because of such fears, do not want to benefit from the protection of that country; or that, lacking nationality and, as a result of such events, being outside the country where they previously had their habitual residence, can not or, because of such fears, do not want to return to it...». According to this definition, a person

³³ <https://phys.org/news/2017-05-food-insecurity-global-migration.html#jCp>.

³⁴ <https://www.iom.int/complex-nexus#problem>.

³⁵ Hidalgo, M. and Mora, J.A. «The incidence of climate change on migration and security». *Tiempo de Paz*, no. 120, Spring 2016

who crosses a border exclusively due to environmental degradation in their country of origin can not be considered a refugee and would therefore be excluded from the Convention. For this reason, UNHCR does not include it in its mandate, although it monitors the migratory movements related to climate change.

On the contrary, the IOM defines environmental migrants as: «People or groups of people who, because of sudden or progressive changes in the environment and which negatively affect their lives or living conditions, are forced to leave their homes or decide to do so, either temporarily or permanently, within their territory or outside of it.

The difficulty of contextualizing a migratory phenomenon exclusively within the scope of climate change hinders the implementation of specific measures to address the problem. However, the reality is that the number of storms, droughts and floods has tripled in the last 30 years, with devastating effects on the weakest communities, mainly in developing countries. It is estimated that in this period, the population affected by droughts and storms has doubled, going from 718 to almost 1.6 billion people³⁶. Lack of water and environmental degradation cause migrations and changes in ways of life, and little by little constitute a focus of social disputes that can end in an armed conflict.

Small island developing states (SIDS) are an extreme case of the impact of climate change. The rise in sea level can endanger one of the basic attributes of the state, which is its territory, and lead to situations of statelessness³⁷. The islands of the Pacific, south, south-east and north-eastern Asia are the most vulnerable areas. In fact, small islands are already disappearing in the Pacific area like in the Solomon Islands, or are causing internal displacement like in Vanuatu or Tuvalu. The SIDS show their concern whenever they have the opportunity, either at the climate summits or at the UN General Assembly itself. One of the options proposed by the rulers of affected states is the acquisition of land to relocate its citizens. For example, in 2004 the Government of Kiribati bought 20 km² in the Fiji Islands and Maldives is considering buying land in Australia, India or Sri-Lanka³⁸.

The response to migration movements for environmental reasons is very complex because it is conditioned by the economic, political and social situation of both the place of origin and destination. According to Koko Warner, head of the migration section for environmental reasons of the United Nations University, a holistic approach to the problem is necessary. That is, to consider the causes at origin: a problem of insecurity, environmental risks or demographic pressures. To determine the destination's attraction factors such as workforce or the

³⁶ <https://www.iom.int/complex-nexus#problem>.

³⁷ <http://www.acnur.org/que-hace/cambio-climatico/>.

³⁸ YASUBAGA, M. «Small island developing states and climate displaced people». Opinion Document 110/2016 of the IEEE. Available at: http://www.ieee.es/Galerias/fichero/docs_opinion/2016/DIEEE0110-2016_Estados_Insulares_MayumiYasunaga.pdf.

improvement of living conditions. And finally, to establish measures to prevent it, improving adaptation to climate change, and helping to maintain it by promoting sustainable development and supporting initiatives to reduce risks from natural disasters. And if, finally, the migratory movement is inevitable, it is necessary to help people to migrate in a dignified and safe way, fostering conflict mediation strategies and identifying institutional frameworks³⁹.

Climate change is a global phenomenon as no region is immune to its effects⁴⁰. However, in populations exposed to natural disasters and that do not have the capacity or the necessary resources, there is a greater risk of displacement. For example, in 2015, 85% of the displaced people were in South and East Asia, among them the floods of the southern Indian states of Tamil Nadu and Andhra Pradesh caused the displacement of 1.8 million people, while cyclone Komen and floods caused by monsoons in Myanmar and India caused the displacement of 1.6 and 1.2 million people, respectively⁴¹. If the figures of the displaced are relativised according to the inhabitants of the country, there can be such worrying situations as Vanatu, when cyclone Pam forced almost 55% of its population to move⁴².

When populations lose their means of subsistence, they are forced to move, which can generate situations of conflict over resources in the areas where they settle due to the appearance of competitiveness between newcomers and the already settled population. There are many examples that fit this pattern. These include Lake Turkana, where many nomadic herders from northern Kenya had to change their activity as a result of the drought to turn to fishing, which led to conflicts with fishermen from Ethiopia.

Displacements to urban environments can also be sources of tension, mainly in fragile contexts of inequalities and with few options to find a job. In the absence of integration and income, young people may be forced to join armed groups or engage in illegal activities, such as drug trafficking.

Conflicts with herders

Within these displacements attention must also be paid to changes in the mobility patterns of herding activity in some regions, mainly in Africa. Herders move their livestock according to the environmental conditions to guarantee the survival of their cattle that constitute their means of subsistence. Among the factors that cause these changes are those related to the environment

³⁹ <http://www.unhcr.org/4df9cc309.pdf>.

⁴⁰ <http://www.acnur.org/noticias/noticia/preguntas-frecuentes-sobre-el-desplazamiento-causado-por-el-cambio-climatico-y-los-desastres-naturales/>.

⁴¹ <http://www.acnur.org/noticias/noticia/preguntas-frecuentes-sobre-el-desplazamiento-causado-por-el-cambio-climatico-y-los-desastres-naturales/>.

⁴² Vanatu and Tuvalu were hit hardest in 2015, when Cyclone Pam displaced 55 and 25 percent, respectively, of the populations of each country.

and also to social factors. In fact, conflicts between herders and farmers are not a new phenomenon, but they are expected to intensify as a result of climate change, mainly due to the prolonged droughts that are occurring.

Conflicts between herders and farmers have been the seed for generating conflicts, some of them especially bloody such as the Rwandan genocide in 1994. In general, this conflict is considered an example of ethnic conflict between the Hutu majority and the Tutsi minority. However, there are few who know the true meaning of both groups. Hutu means that they are people who dedicate themselves to agriculture and Tutsi those who have their own livestock so the cause of the conflict must be related to the management of resources and the unequal distribution of land.

Situations of tension between herders and farmers are very frequent in West Africa and can cause transboundary conflicts. For example, almost 60% of nomadic herders in southern Burkina Faso live on the other side of the border in Ghana.⁴³

In their established routes, herders negotiate access and comply with the legislation that regulates access to resources. However, when these routes are changed, there are conflicts - in some cases very violent - over water and grass with other groups already present in the area. Examples of these conflicts can be found in Kenya, Ethiopia, North Sudan and South Sudan.⁴⁴

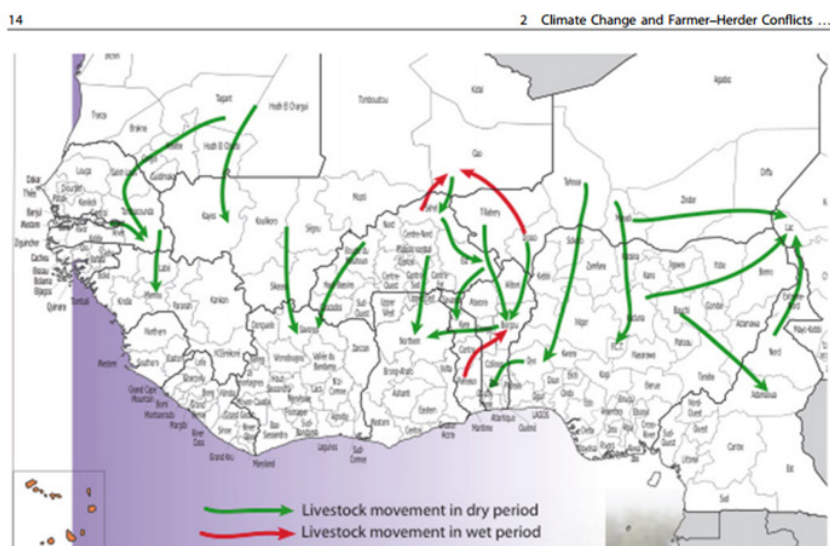


Fig. 2.1 Cross-border transhumance routes in the Sahel and West Africa. Source SWAC-OECD/ECOWAS (2008). The permission to use this figure was granted on 23 January 2013 by Ms. Dounia BOUTAMDIA, OECD, Public Affairs and communications Directorate

Livestocks movements in the Sahel. Source: www.oecd.org/swac/publications/41848366.

⁴³ www.springer.com/cda/content/.../9783642292361-c2.pdf.

⁴⁴ <https://www.sipri.org/sites/default/files/Policy-brief%2C-Climate-change-and-violent-conflict%2C-April-2016.pdf>.

The Sahelian zone is a very representative example of the relationship between climate change and the emergence of conflicts between herders and farmers⁴⁵. The intensity of droughts, land degradation and desertification have caused the nomadic group called Fulani to extend its routes to southern Mali and northern Burkina Faso, to Nigeria, Benin, Ghana, Cameroon and Ivory Coast⁴⁶.

Bangladesh

In Bangladesh, in the next two or three decades the coastal population will not be able to live on agriculture or fishing, so millions of people will be forced to live in cities like the capital, Dhaka. This city is now considered the third worst city to live in, behind Tripoli and Damascus. In just 325 km², 14 million people live amidst an infrastructure that is on the verge of collapse and where the lack of water and sanitation spreads water-transmitted diseases such as diarrhoea and typhoid⁴⁷. In addition to these internal population pressures, Bangladesh is also the country where the Rohingyas migrating from Myanmar go. The statelessness of this population and the saturation of the refugee camps can generate a situation of instability that can affect the whole area of South-East Asia, reducing the prospects for economic growth expected in this region.

The dry corridor

In recent years, the countries of Central America have also been affected by a severe drought as a result of the El Niño phenomenon accentuated by climate change. Guatemala, Honduras and El Salvador are part of the region known as «the dry corridor», an area especially vulnerable to the effects of climate change and where around 1.6 million people have food security problems⁴⁸.

The main consequence of this drought is the reduction in agricultural production with losses of basic grain crops of around 50% and 90%⁴⁹. This fall in production also creates a risk of depletion of resources, and decreases the diversity and energy intake of the diet. The result is the loss of livelihoods, impoverishment and migrations to urban centres. In fact, in this area, hunger is the first cause of migration to the United States⁵⁰. The majority of this migrant population are young adolescents.

⁴⁵ <http://www.nsrp-nigeria.org/wp-content/uploads/2017/03/Land-Conflict-and-Climate-Patterns-in-Nigeria.pdf>.

⁴⁶ www.springer.com/cda/content/.../9783642292361-c2.pdf?.

⁴⁷ <http://www.climatechangenews.com/2015/11/25/bangladesh-capital-faces-future-influx-of-climate-refugees/>

⁴⁸ <http://www.fao.org/3/a-br092s.pdf>.

⁴⁹ Ibid

⁵⁰ http://www.oas.org/en/media_center/press_release.asp?sCodigo=E-065/17.

In 2016, in almost half (47%) of the households in the dry corridor, at least one of its members had emigrated due to a situation of food insecurity, which shows that there is a clear relationship between food insecurity and migratory movements.

Somalia

According to declarations by the UN Secretary General, the combination of conflict, drought and disease is a nightmare⁵¹. Somalia, Nigeria, Yemen and South Sudan are clear examples of these situations of humanitarian crises.

South Sudan has already declared a famine⁵², while Somalia has not yet done so although the situation is deteriorating at great speed. More than 6 million Somalis, who account for almost half of the population, suffer food shortages mainly due to droughts that have affected agricultural production and the conflict that has hindered access to humanitarian aid. In addition, this situation has been complicated by the appearance of an outbreak of cholera.

Since the conflict began in 1991, almost one million people have left the country and another one million are internally displaced⁵³. Changes in climate have affected economic and social development. Approximately 70% of Somalis depend on agriculture and herding practices that are conditioned by climate. Growing uncertainty about the amount of rainwater, rising temperatures and loss of livelihoods dependent on overexploited ecosystems will increase the movement of people in the region and intensify the fight for resources, including water⁵⁴.

Effect of climate change on current conflicts, on radicalisation and on the appearance of new situations of instability

Climate change and ethnicity

The disruptive power of natural disasters caused by climate change can open cracks, revealing the vulnerability of certain ethnic groups⁵⁵. A common factor in many internal conflicts is that armed groups are made up of

⁵¹ <https://www.usnews.com/news/world/articles/2017-03-07/un-chief-in-somalia-on-emergency-visit-to-focus-on-famine>.

⁵² This designation assumes that at least 30% of the population is malnourished and that 2 adults or 4 children out of every 10,000 die each day. <https://www.state.gov/r/pa/prs/ps/2017/02/267757.htm>.

⁵³ https://www.washingtonpost.com/world/africa/new-un-chief-confronts-the-nightmare-of-somalias-food-crisis/2017/03/07/4081bc9a-0044-11e7-9b78-824ccab94435_story.html?utm_term=.507b1c90b1dd.

⁵⁴ <https://undp-adaptation.exposure.co/before-the-famine>.

⁵⁵ SCHLEUSSNER, Carl-Friedrich and col. «Armed-conflict risk enhanced by climate-related disasters in ethnically fractionalized countries». *PNAS*, August 2016, vol. 113, no. 33. Available at: www.pnas.org/cgi/doi/10.1073/pnas.1601611113. Consulted 18 April 2017.

young people whose expectations for a better life have been cut short by a worsening in their livelihoods. Joining a certain armed group can give them greater social recognition, especially when group leaders convince them that their situation of poverty is the fault of their ethnic or political class or their geographical location⁵⁶.

Ethnic division is one of the main risks that give rise to an armed conflict. Almost two thirds of the civil wars that have occurred since 1946 have had an ethnic component⁵⁷.

Although each conflict is the result of a specific situation in a given context in which several factors are involved, it can be said that ethnicity has played a very important role in the emergence of situations of instability. Almost two thirds of the civil wars that have taken place since 1946 have had a component of ethnic division⁵⁸. This increase in ethnicity as a factor that leads to situations of conflict is related to selective access to political power, differences in access to resources or settlement in a specific geographical location.

The risks of conflicts arising in populations with ethnic problems and fragmented societies can not be tackled from a development perspective alone, in order to eliminate poverty and inequalities. It is necessary to carry out a global, integrative and inclusive approach adapted to each specific region to reduce the vulnerability of certain ethnic groups to natural disasters caused by climate change. Generally, in more fragmented societies, a given group tries to impose its conditions on another group, increasing inequalities and vulnerability to the adverse effects of climate change.

The most ethnically divided countries are found in Africa and Central Asia. In the case of Africa, the twenty most ethnically divided countries are in this continent⁵⁹.

When the management of resources is effective and equitable, the risk of a situation of instability or conflict arising as a result of climate change is less. However, when there are inequalities in access to resources, any situation that puts pressure on access or their availability can lead to situations of instability.

⁵⁶ https://www.researchgate.net/profile/Jon_Barnett/publication/222550602_Climate_Change_Human_Security_and_Violent_Conflict/links/00b4953c8c122cbcb9000000/Climate-Change-Human-Security-and-Violent-Conflict.pdf.

⁵⁷ <http://www.climatechangenews.com/2016/07/25/climate-disasters-linked-to-inter-ethnic-conflict/>.

⁵⁸ DENNY, EK and WALKER, BF. «*Ethnicity and civil war*». J. Peace Res, no. 51 (2), pp. 199-212, 2004.

⁵⁹ ALESINA, Alberto F.; EASTERLY, William; DEVLEESCHAUWER, Arnaud; KURLAT, Sergio and WACZIARG, Romain T. «Fractionalization» (June 2002). Harvard Institute Research Working Paper No. 1959. Available at SSRN: <https://ssrn.com/abstract=319762> or <http://dx.doi.org/10.2139/ssrn.319762>.

The influence of global warming and violent behaviour

In addition to droughts, floods, adverse weather events, global warming has less well-known consequences such as social or psychological consequences, both related to aggression and violent conflicts. Some studies point out that rapid global warming can encourage violent behaviour with three different causes.

The first is that a hot environment increases people's irritability and foments physical aggression. Some researchers have even established that an average temperature increase of 1°C in the coming decades can increase violent crimes by 6%. In addition to this direct effect of heat, there are two indirect ways in which rapid climate change increases the risk of violence. One refers to its influence on children and young people in the generation of potentially conflictive adults. Climate change can generate situations of food insecurity and malnutrition in babies and children can cause antisocial and violent behaviour in adulthood. A study of malnourished three-year-old children in Mauritania showed that a decade later, the children showed more aggressive and violent behaviours, with behavioural disorders compared to children who had been well nourished⁶⁰.

Climate change is also related to an increase in suicides. This is particularly worrying in India, where a fifth of suicides worldwide occur. In this country, it is estimated that the increase in temperature that has occurred in the last three decades is responsible for 59,000 suicides, representing 6.8% of the global trend. According to the studies carried out, this increase in the number of suicides only occurs at the time of crop growth when the heat reduces the harvests⁶¹.

Recruitment by terrorist groups

Many of these factors related to climate change also have an influence on the recruitment of terrorists. Hunger and the destruction of traditional means of life lead young people to fall into the hands of terrorist groups, perceiving that it is the only option to have a decent life free of want. This is the case of Daesh in Iraq⁶², Boko Haram in Nigeria or al-Shabab in Somalia.

In Somalia, droughts are becoming more frequent and last longer. Climate change is contributing to aggravating the conflict in Somalia by pushing one of the world's toughest communities to the limit. In a hot and dry country where the average rainfall is 15%, hunger and despair are causing massive

⁶⁰ http://www.psychologicalscience.org/observer/global-warming-and-violent-behavior#.WJQ_DeQzUdU.

⁶¹ CARLETON, Tamma A. «Crop-damaging temperatures increase suicide rates in India», *PNAS*, 15 August 2017, vol. 114, no. 133.

⁶² <https://alshahidwitness.com/isis-poverty-hunger-children-mosul/>.

displacements to cities, refugee camps and what is more worrying, affiliation to terrorist groups such as al-Shabab⁶³, a group affiliated to al-Qaeda.

Al-Shabab is trying to improve its reputation by offering food in some regions of central and southern Somalia that are suffering the consequences of the prolonged drought in the country⁶⁴. This situation has meant a change of action in the terrorist group, since during the famine of 2011 it blocked humanitarian aid and even killed the aid workers. This way of acting together with the improvement in the training of the local forces as a result of the peace missions carried out in the region, had meant a weakening of the group. This change in strategy, as a consequence of its expulsion from Mogadishu, can contribute to a reinforcement of the armed group thanks to the greater acceptance of the population by alleviating the situation of famine. In both cases, Al-Shabab has used the hunger suffered by the population as a consequence of the drought to strengthen itself as an armed group and achieve its purposes⁶⁵.

Droughts and hunger are threatening millions of people in the Lake Chad region. In addition to the humanitarian drama, one of the main concerns is the opportunity that Boko Haram is taking to increase the number of its militants. In the most vulnerable areas, climate change is having serious consequences for agriculture and livestock, causing conflicts over the resources, including water. Under these conditions, the population is more receptive to Boko Haram's messages, both because of the direct economic contribution and because of the role that this terrorist group plays in offering basic services that weak states can not give their citizens, thus achieving a certain legitimacy.

The control of resources is one of the main sources of funding for these groups and it is precisely this economic power which has the greatest effect on hungry populations deprived of their means of survival, a situation that is aggravated by change climate.

Organised crime

The recruitment of militants taking advantage of situations of population famine and poverty is not only a method used by terrorist groups but also by organised crime networks. This occurs, for example, in Central America, where the economic situation of the countries depends on agriculture and therefore on climate change. Guatemala is the country most affected by adverse weather events.

⁶³ <http://thegroundtruthproject.org/somalia-conflict-climate-change/>.

⁶⁴ <http://www.pbs.org/newshour/updates/al-shabab-militants-try-food-win-hearts-minds-somalia/>.

⁶⁵ <http://www.nation.co.ke/news/There-s-need-to-engage-with-Al-Shabaab/1056-3786106-13jt48d/index.html>.

Other examples of the relationship between the loss of resources due to climate change and its relationship with organised crime are human trafficking networks in Bangladesh or the opium trade in Afghanistan⁶⁶.

Emergence of conflicts

Climate projections indicate an increase in the number of natural disasters related to climate change in these areas, which is precisely where there are countries characterised as vulnerable and with little capacity for adaptation. The conflicts in Syria and Somalia have had a social origin as consequences of the prolonged droughts suffered by both countries. In addition, this instability can spread to the north and east of Africa, due to migratory movements towards neighbouring countries or the European Union itself.

Syria

The western region of Asia and North Africa are regions that are highly vulnerable to natural disasters. In recent decades this region has suffered the increase in the number and severity of the weather phenomena caused by climate change, with the consequent economic losses and the generation of social instability since the most vulnerable areas are also the most populated. It is estimated that in the Arab region there are almost 55 million people who are in a situation of high stress in the face of drought, while 91.3 million are moderately vulnerable⁶⁷.

The conflict in Syria is an example of how a prolonged drought can be a catalyst for a conflict if the appropriate measures are not taken in time to deal with the problem.

In the decade between 1995-2005, Syria suffered a water deficit of approximately 651 million m³ due to the prolonged drought suffered by the country, where rainwater represents 68.5% of the available water. In 2008, there was a 30% drop in rainfall - the worst drought the country had suffered in forty years - with serious consequences in the north-eastern region, where 75% of families depend on agriculture. The herders of the region lost almost 85% of their livelihood and even the Al-Khabour river, one of the main tributaries of the Euphrates, dried up⁶⁸.

The impact of the drought was greater due to the policy followed by the government to encourage the cultivation of cotton, the use of inefficient irrigation techniques and the extensive extraction of water from aquifers. In addition, the Government abolished certain subsidies that caused the increase of fertilizers and diesel, preventing many families from living

⁶⁶ <https://www.euractiv.com/section/climate-environment/news/climate-change-exacerbates-threat-of-terrorism/>.

⁶⁷ http://www.unisdr.org/files/23905_droughtsyriasmall.pdf.

⁶⁸ http://www.unisdr.org/files/23905_droughtsyriasmall.pdf.

on agriculture and forcing them to move to urban centres. This situation, together with the increase in the price of wheat and other cereals, left almost one million Syrians unemployed and in a situation of food insecurity. In 2011, the situation was so tense that the opposition to the government took advantage of it to begin a series of protests that gave rise to a particularly bloody, complex civil war with international repercussions.

Although the armed conflict may end, drought will continue to be a major challenge for development and peace in Syria if proper management of water resources is not carried out and measures to adapt to climate change are not implemented.

The case of Syria is a recent example of how a community can become vulnerable to drought. The overexploitation of water resources to grow cotton has led to land degradation. The cancellation of subsidies for fuel for irrigation pumps, the dismantling of micro finance networks and the lack of implementation of the National Strategy for drought that had been approved in 2006, led the country to a situation of instability that ended in a serious conflict, still unresolved⁶⁹.

In the case of the conflicts appearing in East Africa, models have been established that relate the availability of resources, their distribution, property rights and the role of the State. In these models, climate change has affected the survival of herders, which has led to an increase in aggression and reprisals in the region.

Afghanistan

Terrorism and climate change are the main challenges facing the country⁷⁰. For a decade, drought and floods have alternated throughout Afghanistan threatening the food security of the poorest and generating conflicts at local level over access to basic resources such as land and water.

Over the next 45 years, scientists predict a decrease in rainfall and an increase in average temperatures of up to 4°C compared to 1999 values. Droughts will be the dominant trend in 2030 and will cause land degradation and desertification⁷¹.

Around 80% of Afghans depend on rainfed agriculture and yet only 12% of territory is adequate for this. Afghanistan is a country punished by internal conflicts and its stability will not be possible if the resilience of the communities is not strengthened and the risks to the impacts of climate change are reduced.

In addition, climate change also influences the fighting season and its intensity. With the arrival of snow, fighting used to be paralysed and resumed in the spring. Now it is more continuous.

⁶⁹ <https://phys.org/news/2017-07-syria-climate-war-links-drought.html>.

⁷⁰ <http://www.arabnews.com/node/1011396/world>.

⁷¹ http://www.af.undp.org/content/afghanistan/en/home/operations/projects/environment_and_energy/ClimateChange.html.

The importance of adaptation to climate change as a factor of local, regional and global stabilisation

According to the FAO, there is a relationship between the emergence of a situation of food insecurity and climate change. Both local and international community interventions that are aimed at improving food security and nutrition can therefore help maintain peace, i.e. «harvesting peace by improving food security and nutrition»⁷².

In the case of Africa, the increase in temperature has a negative impact on agricultural production, either due to evapotranspiration or accelerated crop development, which results in losses of 10-30% per year for each degree Celsius of increase. Bearing in mind that in Africa the majority of the population depends on the rural environment and that among the poorest population 60% and 100% of their income depends on agriculture, a temperature increase of 1°C can endanger economic security and food, generating situations of instability⁷³.

These projections can serve to raise awareness among the international community of the need for greater political involvement in reducing the risk of conflict in Africa by improving agricultural systems to cope with extreme heat. Local governments and donor countries can carry out specific actions such as: promoting the development and use of new varieties of crops, introducing improvements in irrigation systems, the implementation of an adequate insurance system to protect the poorest populations, warning systems to detect when there is a risk of the appearance of an outbreak of violence based on climate indicators or to reinforce local economic conditions in order to avoid conflict⁷⁴.

Some countries have included migratory movements within their adaptation proposals. According to the International Organisation for Migration (2015), twenty-four countries have included migration in their national contribution decisions (NCD)⁷⁵.

The Sendai Path for Disaster Risk Reduction 2015-2030 establishes a series of international objectives to prevent natural disasters. The Sendai path encourages countries to collaborate to strengthen governance in disaster management, to investigate risk reduction and increase resilience as well as a rapid return to normality in the event of a disaster⁷⁶.

⁷² <http://www.fao.org/3/a-l7695s.pdf>.

⁷³ BURKE, Marshall B. and col. «Warming increases the risk of civil war in Africa», *PNAS*, December 2009, vol. 106 no. 49. Available at: www.pnas.org/cgi/doi/10.1073/pnas.0907998106. Consulted 18 April 2017.

⁷⁴ BURKE, Marshall B. and col. «Warming increases the risk of civil war in Africa», *PNAS*, December 2009, vol. 106 no. 49. Available at: www.pnas.org/cgi/doi/10.1073/pnas.0907998106. Consulted 18 April 2017.

⁷⁵ Report: NAVIGATING COMPLEXITY: Climate, Migration, and Conflict in a Changing World, Office of conflict management and mitigation, November 2016. Available at https://www.wilsoncenter.org/sites/default/files/ecsp_navigating_complexity_web_1.pdf. Consulted 28 August 2016.

⁷⁶ <https://germanwatch.org/en/download/16411.pdf>.

Conclusions

The effect of climate change is global and can be considered a threat or a risk. Climate change by itself, will not cause a change of power within the international system but it can influence the increase in the vulnerability of certain countries that can cause imbalances and situations of instability that can affect the balance of power among the great powers.

Climate change influences a series of factors that in certain contexts may increase the risk of an armed conflict or a situation of instability.

Both water and land are resources related to climate change, so the food system must be prepared to adapt. The variations that can occur in agriculture and its economic consequences are the most common way of relating global warming to the appearance of conflicts, mainly in Africa.

In recent years the establishment of a quantitative relationship between climate change and conflicts has been a topic of growing interest within the scientific field. However, it is still an incipient discipline and not without limitations, both for obtaining data and the difficulty of applying statistical techniques when quantifying aspects such as population vulnerability.

Therefore, it would be wrong to state categorically that the natural disasters caused by climate change are directly related to the emergence of violent conflicts. It is more correct to say that the consequences of climate change, such as droughts, rising sea levels, rising temperatures or the more frequent appearance of adverse weather events have the potential to heighten social tension by fostering the emergence of conflicts in regions that are prone to destabilisation. The vulnerability of the populations, the presence of ineffective institutions and the lack of essential services are the critical factors that determine whether there is a risk of armed conflict in the face of the impacts of climate change.

Agricultural and food systems have great potential to adapt to climate change, and can contribute to increasing the resilience of production and food supply while protecting and improving natural resources. Research into adapting the food system to climate change should be a priority.

The fight against climate change must be approached in a holistic way, addressing not only the scientific aspects of climate change, but also taking into account its impact on security and terrorism. Addressing the adaptation to it mainly in the agricultural sector and fostering the resilience of populations are ways of dealing with current security problems that are characterised by unpredictability and indiscrimination.

To avoid future conflicts, the factors that condition the vulnerability of a given region to the consequences of climate change must be addressed. A drought can be devastating for one community and, nevertheless, have hardly any consequences for another.

Floods and droughts will be more severe and frequent so it is necessary to find solutions that reduce farmers and herders' dependency on the increasing variability of rainfall. Hunger is more dangerous than a situation of insecurity.

Migratory phenomena are multi-causal, and there is sometimes a blurred line between their voluntary or forced nature. Natural disasters caused by climate change can displace people, either due to their immediate effects such as floods, hurricanes or cyclones or the effects sustained over time such as droughts. An extreme case of this repercussion is the risk of a situation of statelessness faced by some populations of the so-called small island states.

Displacement caused by natural catastrophes is one of the greatest humanitarian challenges of the 21st century. Countries need to carry out long-term adaptation plans to avoid uncontrolled movements of populations. Improving subsistence and creating climate-resilient habitats in rural settings will reduce population pressure on cities.

Climate change will have a strong impact on urban systems, especially in the Asian region. Adaptation and the increase of resilience in large cities will be one of the main challenges faced by humanity.

The unsustainable overpopulation of cities as a result of these uncontrolled displacements of people affected by the effects of climate change can create situations of overloading and congestion, generating conflict situations in the medium and short-term. Building resilient and inclusive cities should be one of the priorities of governments.

In recent years the focus of the problem of climate change has transcended its strictly environmental dimension to be considered an economic and security problem and more recently a problem of the human condition itself in its need to adapt to the changes of the 21st century.

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Chapter five

Climate Change and Armed Forces. The culture of permanent transformation

Ignacio García Sánchez

«If we picked up one of the many questions faced by Washington and were asked to give our opinion on how to deal with this world full of uncertainty..., we would see that this puzzle is being solved with great surprises and marked characteristics of the time in which we live..., pressing the most important companies in the world with the so-called «dilemma of innovation», or how the concepts on which they are based do not allow them to adapt to the new... It is very human to say that the more confused we are, the more we cling on to old ideas. Maybe they still work, we think. It was always like this. In fact, the more important and powerful the figure, the more difficult it seems to get rid of the inherited structures. In the world of international relations today, at the level where the most important and pressing questions about war and peace are debated..., the group most concerned about this is, of course, the military. They are, after all, where the *shock* of what is new will hit first»¹.

Abstract

Climate Change is a global challenge for all society sectors, and certainly also for the future of the planet we inhabit. It is one of the fundamental axes

¹ COOPER RAMO, Joshua, «*The Seventh Sense: Power, Fortune, and Survival in the Age of Networks*», Hachette Book Group, New York, 2016, pp. 60-62. Translation by the author.

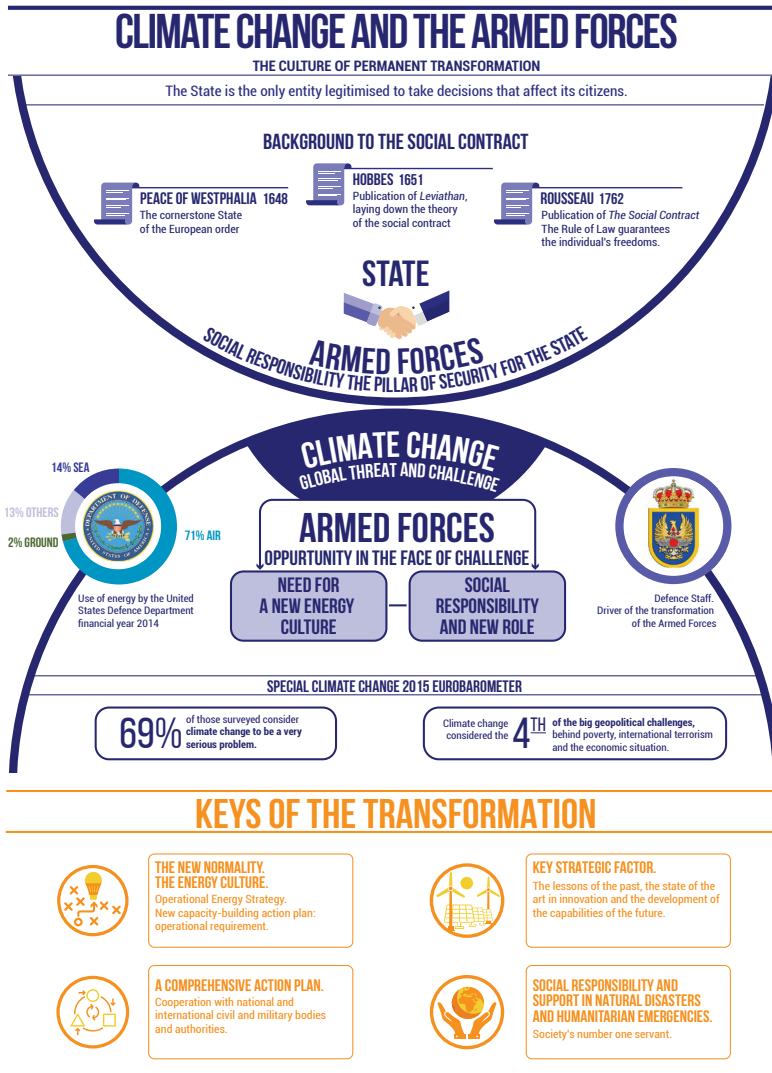
on which the geopolitical framework that structures international relations will evolve. A framework which, from the peace of Westphalia (1648) and the publication of the work of political philosopher Thomas Hobbes, *Leviathan*, (1651), is based on the concept of security and the only legitimate structure for the use of force, in its theoretical and practical level, the State and its judicial, military and police apparatus,.

A configuration that will hardly change in the distant future. However, we can assume that, at least, in Climate Change related implications, we will continue to see increasing pressures throughout the present century on these two institutions, in the sense of being able to prevent and react in all the areas in which their effects are manifested.

In this scenario of growing media impact, progressive degree of social sensitivity and high level of uncertainty, this chapter intends to show how the military wants and must be exemplary in the social effort on mitigation and adaptation, to remain the backbone of an increasingly just, free, and prosperous society, capable of facing the future with responsibility and optimism.

Keywords

Climate Change, Geopolitics, State, Military, Security, Energy, Innovation, Technology



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Introduction. A window of opportunity before the great challenge of our time

«We know that humanity has always had to face natural calamities, be it floods, droughts, storms or earthquakes. But, at present, disasters are due both to the activity of man and to the forces of nature. Certainly the term «natural» is increasingly equivocal. A wide variation in the number and intensity of natural phenomena is normal and probable. However, what we have seen in recent decades is not natural variation, but a clear upward trend caused by human activity»².

The practical framework. The State at the controls of the system

«The peace of Westphalia represented a 180-degree turn in the history of nations because the notions it established were not very complex but comprehensive. The State - not the empire, the dynasty or the religious confession - became the cornerstone of the European order. The concept of sovereign state was established... The Westphalian concept adopted multiplicity as a starting point and marked out a variety of multiple societies, each accepted as a reality in itself, in the search for a common order. By the middle of the 20TH CENTURY, this international system already worked on all continents, and continues to be the framework of the international order as we know it today»³.

The Peace of Westphalia, as Henry Kissinger (1923-) clearly expresses in his last work, *The World Order: Reflections on the nature of countries and the course of history*, «has acquired a special resonance in our time as the initiator of a new concept of international order that has spread throughout the whole world»⁴. After the devastating European thirty-year war, the more than 235 official envoys and their assistants established a framework of international relations that seems difficult to replace. The last three and most important ideological struggles suffered: national-socialist imperialism that resulted in World War II; Communism, through the Soviet Union and its corollary of the Cold War; and the current one, with the birth of the caliphate of the universal Islamic State, proclaimed from the mosque of Al Nuri in Mosul by Abu Bakr Al Baghdadi (1971-), as the caliph Ibrahim, on 29 June 2014; they have all been destined to fail. No wonder that the famous and debated work of the famous

² *New York Times*, «An Increasing Vulnerability to Natural Disasters.» By Kofi A. Annan and International Herald Tribune, 10th September 1999. Translation by the author. <http://www.nytimes.com/1999/09/10/opinion/an-increasing-vulnerability-to-natural-disasters.html> Visited 6 August 2017.

³ KISSINGER, Henry. *The world order: reflections on the nature of countries and the course of history*, Penguin Random House, Third edition, Barcelona, 2016, translation by Teresa Arijón, pp. 38.39.

⁴ *Ibidem*, p. 35

American political scientist of Japanese origin Fancis Fukuyama (1952-), *The end of history and the last man*, remains fully valid.

A peace achieved through an eminently practical sense, without universalist ideologies, one would say, the triumph of reason based «on strategic interests»⁵; on an always unstable balance of egalitarian sovereign entities with a clear objective, the defence of their «own interests and prestige..., [establishing] the intrinsic equality of sovereign states, regardless of their power or national system»⁶.

Without entering into the debate between the different trends within realism and idealism⁷ (Liberalism in Saxon terminology), and between them, to try to explain how this framework of relationships is articulated, it does assume a universally accepted geopolitical view of the world. The State becomes the cornerstone of international law, the only entity legitimised to take decisions that immediately affect its citizens. The only one with the power to legislate, transferring its precepts as an obligation to all its social body within its own doctrinal framework and, perhaps more importantly, with legitimised institutions to impose the application of that legal framework. Thus, in Westphalia the right was affirmed of each State present in the negotiations to choose its own internal structure, ideology, and religious orientation.

«The brilliant thing about this system, and the reason it spread throughout the world, was that its provisions were procedural, not substantial. If a State accepted these basic requirements it could be recognised as an international body capable of maintaining its own culture, politics, religion and internal policies, and protected from any external intervention by the international system»⁸.

But the complex instrument of the balance of power emanating from the peace of Westphalia, originally instituted to prevent war, did not succeed. And it does not seem to be especially well designed to manage the global challenges of universal dimensions that now affect us. Risks that do not disturb all the States of the system equally, and which in their origin it seems not everyone has the same aliquot part of responsibility. Climate change could be the paradigm.

However, despite all the limitations imposed by a complex system of international relations, the State still feels that it is the best player to tackle the problem. Even recognising the importance of other non-governmental players, organisations, private companies, lobbies..., and other administrative

⁵ Ibidem, p. 36

⁶ Ibidem, p. 37

⁷ On this particular issue, I go into more detail in the first chapter of the Spanish Institute of Strategic Studies, Strategy dossier no. 184, *A global strategy of the European Union for difficult times*, in its first chapter, «Quo Vadis Europe? From the Solana document to the Global Strategy», pp. 35 to 67.

⁸ Ibidem, KISSINGER, *The world order*, p. 38

entities, such as cities, autonomous communities, federal states...; the ultimate responsibility for the economic and legal management and, even more importantly, the supreme authority legitimately recognised for the legal use of force, which implies the direction and control of their armed forces (FAS), continues to grant them the title of main player. As an example, the Paris agreement (22 April 2016), where another of the essential elements of the Westphalian system, diplomacy, managed to achieve the intended goal.

«Diplomatic exchanges, including the appointment of representatives resident in the capitals of the other states (a practice that until then was generally fulfilled only by the Venetians), tended to regulate relations and promote the arts of peace. The parties viewed future conferences and meetings on the Westphalian model as forums for resolving disputes before they engendered a conflict»⁹.

The theoretical framework. The doctrine of the social contract

«Hobbes [1588-1679] starts from the equality between all men. He believes that everyone aspires to the same thing, and that when they do not succeed, enmity and hatred ensue; he who does not get what he wants, mistrusts the other and attacks him in defence. Hence Hobbes's pessimistic conception of man; *homo homini lupus*, man is a wolf for man. Men have no direct interest in the company of their fellows, but only in so far as they can submit them. The three motors of discord among humans are: competition, which provokes aggression for profit; mistrust, which causes men to attack to achieve security, and vainglory, which makes them enemies through rivalries in reputation.

This natural situation defines a state of perpetual struggle, war of all against all (*bellum omnium versus omnes*), according to Hobbes's tremendous formula. But these are not acts of struggle, but of a state, [] a permanent disposition in which there is no security for the contrary.

Man is endowed with a power which he has at his disposal. [] As everyone knows this attitude, they mistrust each other; the natural state is attack. But man realises that this situation of insecurity is unsustainable; this state of struggle leads to misery, and man is forced to seek peace. Hobbes distinguishes between *jus* or law, which he interprets as freedom, and *lex* or law, which means obligation. Man has freedom - that is, the right - to do what he can and wants; but with one right three things can be done: to exercise it, to renounce it or to transfer it. When the right is transferred mutually, this is called agreement, contract or *covenant*. This leads to the idea of the political community.

⁹ Ibidem, p. 38

To achieve security, man tries to substitute the *status naturae* for a *status civilis*, through an agreement in which each one transfers his right to the State»¹⁰.

If the expression of the State as a basic element of international relations has a practical start during the complex negotiations that led to the signing of the three agreements that make up the so-called Westphalian peace, the theoretical framework of political philosophy that makes it possible begins at the end of the Middle Ages, with the religious crisis and the appearance of national feeling. In the Renaissance, the concern for the State begins from the perspective of rationalism and its application to man and nature. And from this birth, according to Julián Marías (1914-2005), his «radical vice» is born, as the «anti-historical» rationalism, the thought about society and the State, «which are historical realities» are born without this perspective.

Thus Nicolas Machiavelli (1469-1527) states in *The Prince* that the State «is not subordinated to any superior, religious or moral instance.» But it is in English empiricism, as opposed to the rationalist idealism of the European continent, where the modern era is shaped, focusing on the «State philosophy» from an approach of knowledge and sensitive experiences. What Julián Marías calls «sensualist empiricism».

«From the English thinkers of the sixteenth to the seventeenth come the ideas that have perhaps most intensely influenced the transformation of European society: sensualism; the criticism of the faculty of knowing, which in some cases becomes scepticism; the ideas of tolerance; the liberal principles; the spirit of the Enlightenment; deism or natural religion; finally, as a practical reaction to metaphysical scepticism, the philosophy of *common sense*, utilitarian morality and pragmatism»¹¹.

A set of ideas that seek to legitimise a regime in which, as argued by John Rawls (1921-2002) in *Lectures on the history of political philosophy*, the social and political institutions are reasonable for each and every citizen. This required normalisation connects with the thinking of that time in relation to the social contract. A contractual justification, Constitution, which amalgamates the three basic categories of institutions of a liberal democracy in «stable equilibrium», which Francis Fukuyama establishes in his work, *The Origins of the Political Order: from Prehistory to the French Revolution*, namely: the State, the principle of legality and responsible government.

But behind this social contract is natural determinism, where morality must be integrated into its environment making it independent of all other content. Whether the intrinsically good nature of man is considered, Rousseau (1712-

¹⁰ MARÍAS, Julián. *History of Philosophy*, Alianza Editorial, Madrid, 17th edition, 2016, pp. 240.241.

¹¹ Ibidem, pp. 237 and 238.

1778), or bad, Hobbes (1588-1679), the community must harmonise society with its natural environment. «Using Ortega's terminology, one could speak of a State as a skin that replaces a State as an orthopaedic device»¹². Thus, Montesquieu (1689-1755), thinker of the Enlightenment, which according to Julián Marías is the intellectual movement that guides the theory of society and the State towards history, forming the core of the «theoreticians of the idea of progress», highlights the influence of climate on the three forms of constitution that are repeated throughout history: «First, despotism, in which there is no more than fearful obedience, and then two forms of State, in which it unveils a motor of history different for each of them. In monarchy, the main engine is honour; in the republic, virtue»¹³.

Rousseau¹⁴, who publishes *The social contract* in 1762, considers this pact tacit like the origin of the society in general and the State in particular. The individual, who is prior to society and has a good nature, accepts an agreement that brings together three wills: the individual, with strong contradictions due to development and progress, all the so-called vices of civilisation; the general, «the majority will, [which] because it is so, is the will of the community as such, that is, also of the dissenters, not as individuals, but as members of the State», with a clear imperative, «the return to nature»; and that of all, the sum of the individual wills, almost never unanimous and that looks at the private interest.

Rousseau also predicts a beginning and an end to the States¹⁵, when the will of the government moves away from the general will, when it moves away from the natural ecosystem in which it is framed and that endows it with the main value to be protected, freedom. Well, that general will presses the State more than ever if it wants to honour the contract and be a respectable part of the commitment to return to citizens their original state of freedom, integrated in the natural environment to which they belong.

It is this original value of the State and its commitment to the natural environment that leads us to assess the report of the Eurobarometer on climate change¹⁶. Carried out in May and June 2015 and published in November of the same year, it establishes without any doubt that the

¹² Ibidem, p. 245

¹³ Ibidem, p. 252

¹⁴ For a quick reading on the contradictions of the most influential enlightened philosopher in modern times see the article, «The Enigma of Rousseau», by María José Villaverde, Professor of Political Science at the UCM, https://elpais.com/elpais/2012/11/26/opinion/1353958342_852665.html Visited 9 August 2017. Rousseau drew up the constitution of Corsica; though annexed by France he never got to promulgate it and collaborated in the writing of that of Poland.

¹⁵ The ideal for Rousseau is the city.

¹⁶ It can be downloaded from:

<http://ec.europa.eu/commfrontoffice/publicopinion/index.cfm/Survey/getSurveyDetail/instruments/SPECIAL/surveyKy/2060>. Visited on 9 August 2017.

environment remains a key concern in the European context. Thus, 91% (95%)¹⁷ of respondents consider it a serious problem and 69% (79%) very serious, with 15% (8%) considering it the most important facing humanity. It is the fourth of the great geopolitical challenges¹⁸, behind poverty (30% - 51%), international terrorism (19% - 8%) and the economic situation (16% - 26%), demanding collective action (93% - 95%), in which the main responsibility is the national governments (42% - 42%), the private sector (35% - 31%) and the European Union (35% - 31%); the latter is that which most increases with respect to the previous study carried out in 2013. There is also a high degree of individual awareness in relation to changes in the way of life and carrying out specific actions (94% - 93%).

The social pact and the new legitimacy for the natural environment

«Let us suppose that men have reached such a point that the obstacles that damage their conservation in the state of nature overcome through their resistance the forces that each individual can use to keep themselves in this state. In such a case its primitive state can not last any longer, and the human race would perish if its mode of existence did not change.

But since men can not create new forces by themselves, but rather unite and direct those that already exist, they are only left one method to preserve them, which consists of forming by aggregation a sum of forces capable of overcoming the resistance, putting these forces in motion by means of a single moving force and make them act in agreement»¹⁹.

Francis Fukuyama at the end of the story, to establish his theory of political order -considers that all theory must be inferred from the facts and not the other way around- based on the historical dialectic of Hegel in the conquest of respect and the right to personal dignity. However, in the two volumes dealing with political development²⁰, he relies on biological evolution, and Charles Darwin's theory of natural selection. He thus considers that its origin is biological, with two basic characteristics, competitiveness and sociability²¹

¹⁷ The second percentage in brackets is the Spanish case, while the first is the European average.

¹⁸ In the Spanish case, the second is the economic situation and the third, equal, international terrorism and climate change.

¹⁹ ROUSSEAU, Jean Jacques. *The social contract, that is, principles of political law*, Universal Virtual Library, 2003, p. 9.

²⁰ We have already cited one, *The origins of the political order; from prehistory to the French Revolution*, and now we will cite the second that follows, *Order and decadence of politics; from the industrial revolution to the globalisation of democracy*, Ediciones Deusto, Barcelona, 2016, translation by Jorge Paredes.

²¹ Both, from my point of view, come from the only basic instinct in all living beings: survival (this concept is used by the realists to transfer it into the theory of international relations,

which, taking into account Darwinian evolution built around the principles of variation and selection, «organisms undergo random genetic mutations and those best adapted to their environments survive and multiply»²², form the general framework to understand political development. However, he establishes a significant difference, the concept of «culture», instead of genetics, and another concept, the «conservatism inherent in human institutions», although in this last case it would be necessary to ask whether it does not also exist in all ecosystems and it is a biological characteristic of all species.

The famous theory of political development that defends the construction of European states through the need to wage war, supported among others by Charles Tilly (1929-2008), contains broad reminiscences of Plato's theory of the State (427-347 BC); of small dimensions, the Greek *polis*, and ruled by justice, with three large social classes: «The people - made up of merchants, industrialists and farmers -, the vigilantes and the philosophers»²³. Each connected to a virtue of Platonic morality: the first, because it is the most sensual, requires moderation, which is why it is associated with temperance; the second, the affective, of the warriors, strength; and the third, the rational part has to be endowed with wisdom or prudence. The three in turn must keep a stable balance, so they are amalgamated with the fourth of the virtues, «supreme virtue,» justice, which represents the natural relationship of the social community with each other and with the State. Four virtues that Julián Marías points out in the aforementioned work «have passed as cardinal virtues, even to Christianity: prudence, justice, strength and temperance, according to the usual denomination.»

But this idea, which underlies a deep subordination of the individual to the community with a strong sense of justice, arises from a «displacement of the axis of philosophy»²⁴ bringing two principles into opposition, humanism

anarchic as lacking in superior authority and in continuous conflict for survival, i.e. the so-called vital interests, namely: sovereignty, independence, integrity and constitutional order) with two associated primary instincts, food and procreation. See GARCIA SÁNCHEZ, Ignacio. «The culture of peace, security and defence, and the armed forces; the vital signs of the European Union and Spain», *lee bulletin (bie³)* no. 5 p. 197, Ministry of Defence, Technical General Secretariat, Madrid, March 2017.

²² Ibidem, FUKUYAMA, *The origins of political order*, p. 52

²³ Ibidem, MARÍAS, *The History of Philosophy*, p. 83

²⁴ «The sophists carried out a spiritual revolution in the strict sense, shifting the axis of philosophical reflection from the *physis* and the cosmos to man and even what concerns the life of man as a member of a society. It is understood then that the dominant themes of sophistry were... what we would today call the culture of man. Therefore, it can be accurately stated that thanks to the sophists the humanist period of ancient philosophy begins». REALES, Giovanni; ANTISERI, Dario. *History of philosophical and scientific thought, I, Antiquity and Middle Ages*, Herder, Barcelona, 1988, translation by Juan Andrés Iglesias, p. 75

(law) and nature (moral)²⁵, that lasts until our days and that counterpoises the two tendencies in the development of the political philosophy that up to the present day dispute the reality of climate change²⁶. Thus, the naturalistic tendency of sophistry expressed in the fifth century BC. that «nature unites men, while the law often divides them. Thus the law is devalued when it opposes nature and to the same extent that as opposes it».²⁷ And he has its counterpoint in Aristotle (384-322 BC) who is able to combine society and nature, with a guiding idea «society is nature and not convention; therefore, something inherent to man himself, not simply stated»²⁸. In this line, he establishes the origin of society in the family, whose goal is to survive, while the village, the group of families seeks well-being, to achieve the perfect community, the *polis*, where both tendencies are integrated in the same nature of the man as a political animal.

These dialectics, as we see, constant historical²⁹, and which currently confronts, in relation to the phenomenon of climate change, the «deniers» and the majority of the scientific community, over the mitigation of its known causes and the various forms of adaptation to the multiple impacts associated with it, leads us to the concept of legitimacy. A major issue in the matter that concerns us, as would be the element of balance of the three fundamental pillars of society according to Fukuyama³⁰.

²⁵ Nature is understood as: «a) the source and origin of all things, b) the outlet or the ultimate term of all things and, c) the permanent support that governs all things.» Ibidem, p. 37

²⁶ For a detailed analysis of the development of the debate between these two tendencies in American society, read the fictionalised account of: SABIN, Paul. *The bet, Paul Ehrlich, Julian Simon, and our gamble over the Earth's future*, Yale university press, New Haven & London, 2013.

²⁷ Ibidem, p. 81, 82.

²⁸ Ibidem, MARÍAS, *The History of Philosophy*, p. 104

²⁹ John Stuart Mill (1806-1873), one of the great authors of British empiricism and the utilitarian movement describes it: «the creed that accepts «utility» as the foundation of morality», or «the principle of maximum happiness,» sustains that actions are good insofar as they tend to promote happiness, and bad inasmuch as they tend to produce the opposite of happiness. «Happiness» is understood as pleasure and absence of pain; and «unhappiness», pain and deprivation of pleasure». In this sense, «In a society of barbarians, despotism would be legitimate,» provided that its purpose was the progress of the society in question and that the means were justified by effectively leading to that end». But when civilisation has developed to a certain point, the principle of utility requires the individual to enjoy full freedom, except for the freedom to harm others.» COPLESTON, Frederick. *The history of philosophy*, vol. VIII, from *Bentham to Russel*, Editorial Ariel, Barcelona, 1994, pp. 43, 50 and 51.

³⁰ The State, power and authority with a sufficient level «to defend themselves externally and internally and to enforce compliance with generally agreed laws»; the principle of legality, the law, which regularises, normalises and structures that power and defines the limits of authority; and responsible government, the idea of serving the interests of the community in its integrity and plurality, the social responsibility of all institutions. Ibidem, FUKUYAMA, *Order and decadence of politics*, pp. 55 and 56.

A legitimacy that gives citizens, as outlined by Max Weber (1864-1920), in the third chapter, «Sociology of power: the types of domination», of his work, *Economy and society*³¹, «The reason for obedience considering the power of the one issuing the mandate legitimate»³² and that is based on the contract, social agreement, or double contract, of the society among its members and society with the government, as defended by the Jesuit Francisco Suarez (1547-1617) in his work, *De legibus*³³, where he reveals his legal philosophy, and the political theory and the conditions of rebellion and tyrannicide³⁴:

«But it is a necessary condition for the legitimacy of such a rebellion that the king's government be manifestly tyrannical, and that the rules corresponding to a just war be observed. Suarez refers to St. Thomas in that matter ... Suarez thus affirms the right to resistance, which is a logical consequence of his doctrine of the origin and transfer of sovereignty. Undoubtedly he did not encourage any unnecessary revolts; but it is easily understandable that his work on the Catholic faith seemed offensive to James I of England, who believed in the divine right of kings and the principle of legitimacy.»³⁵.

The challenge posed by the phenomenon of climate change offers an opportunity to recast society with itself, and in relation to its natural environment as a legitimating principle. As Hanna Arendt (1906-1975) warns, «The law was not of divine origin either in Rome or in Greece. In Rome what was legitimating was the act of foundation. And that is the path that the American Revolution took. The men of the revolution considered themselves «founding fathers», according to the Roman spirit implied in the [Latin] word *condere*»³⁶. A model of transformational thinking that must overcome the «denigration of man in many revolutions and [] the poverty of political life even in economically developed countries.»

Also, the globalisation and transcendence of its impact constitutes an important argument in the legitimization of the action of the State and, therefore, that of the monetary institution as the backbone of its sovereign function, strengthening the bonds of solidarity among all the institutions³⁷, among which the armed

³¹ See the edition and translation.

³² WEBER, Max. *Sociology of power: the types of domination*, Alianza Editorial, Madrid, 2012, Edition and translation by Joaquín Abellán, p. 13

³³ COPLESTON, Frederick. *The history of philosophy*, vol. III, from Ockham to Suarez, Editorial Ariel, Barcelona, 1994, pp. 332 and 333.

³⁴ «In his defence of the Catholic and apostolic faith, Suarez considers the particular issue of tyrannicide.» Ibidem, p. 379

³⁵ Ibidem, p. 379

³⁶ HIRSCHBERGER, Johannes. *History of philosophy - III: philosophy of the twentieth century*, Raúl Gabás Pallás, 2011, p. 298.

³⁷ «The institutions are «stable, appreciated and recurring patterns of behaviour» that last beyond each government of individual leaders; they are in essence permanent rules that forge, limit and channel human behaviour.» Ibidem, FUKUYAMA, *Order and decadence of politics*, p. 16

forces occupy the historical centrality of the value of cohesion, as the backbone of the role of the State at the service of the society to which they are responsible, whether or not they have been the origin of the States.

But above all, after the deep crisis suffered by the political and economic institutions during the financial crisis after the bankruptcy of Lehman Brothers on 14 September 2008, which caused situations unimaginable at the beginning of the century and keeps all the political community affected by continuous scandals and challenges of a universal nature on the very essence of existence. So, according to the «theory of consensus» by Jürgen Habermas (1929-), it would be necessary to forge «a bridge between solidarity and justice, [] which makes us concretely in solidarity with other men, and the strictly universal pretensions of rational argumentation.»

The armed forces as part of the problem. From self-reference to social responsibility

«Currently, power in the world is distributed according to a model that looks a lot like a three-dimensional chess game. On the top of that chessboard, military power ..., in the middle, economic power ..., in the lower part, the dominance of transnational relations that cross borders without government control ... This chessboard also includes new global challenges such as pandemics and climate change ... Whether rooted in human nature as in the classical realism of Thucydides and Machiavelli, or in powerful systemic forces expressed by modern structural realism, the military capabilities that allow war to prevail conventionally represent the most important form of power in international relations. In fact, in the 19TH century, the definition of great power meant the ability to win at war and certainly war persists today. But ... the world, since the 19th century, is increasingly complex and the realistic model is no longer adapted in all places in the same way.»³⁸

Political, social and technological development on the back of the military institution

«... intelligent power would occupy the central element of a strategic culture capable of mastering the three geostrategic lines of action proposed by the American political scientist [Joseph S. Nye Jr. (1937-)], in clear harmony with the subdivision of power of Bertrand Russel (1872-1970):

³⁸ NYE, Jr., Joseph S. *The future of power*, Public Affairs, New York, 2011, pp. xv, 28.

commanding changes, the ability to force others to change their behaviours against their initial preferences;

controlling agendas, the ability to condition the preferences of others, so that they want what you want, shaping their expectations, or what is legitimate or possible;

establishing preferences, promoting ideas and values that change the perceptions and preferences of others to influence their intentions subliminally.

However, he considers that the political culture and institutions of the United States have a certain tendency to favour the first phase of power, which since Thucydides and Machiavelli has been considered political realism: «War was the definitive game in which the letters of international politics were placed on the tables»³⁹.

If we analyse the evolution and development of humanity up to our days from a geopolitical perspective, we would inevitably have to conclude on the complexity and variability of the factors that have been involved. According to the definition we use in the Centre for Higher Studies of the National Defence (CESEDEN), five factors are analysed:

- The physical, where geography, the environment, climate ..., play an essential role;
- The human, with demography, migrations, ethnicity, religion, culture, education ..., vital realities of the history of peoples;
- The sociopolitical, in which structures and systems, together with thought, communication, influence, leadership ..., impose a reality in power relations at every moment;
- The economic, enabling and a fundamental driving force of all future, with its natural and energy resources, trade, finance ...;
- And the military, for which the concepts of peace, security, conflict, war and technological developments, proliferation ..., serves as the context of their influence.

An integral scenario, the military, where nothing is irrelevant, either as a player, spectator or victim of the drama of power, domination, progress and survival itself. An institution, the military, with a final goal, a supreme objective, peace, which is doomed to war within the framework of the abstract concept of «reason of State», as explained by José García Carneiro and Francisco Javier Vidarte in his work, *War and philosophy: conceptions of war in the history of thought*:

³⁹ GARCÍA SÁNCHEZ, Ignacio José. «On power, the art of war and military capabilities: the dilemma of perpetual peace», *lee bulletin (bie³)* no. 1, Ministry of Defence, Madrid, 2016, pp. 212, 213.

«Clausewitz [1780-1831] tries to remove from conflict, from war, all the responsibility immanent in, or constitutive of, a «natural state» consubstantial with the social group or prior to its creation or formation. In his book, *Vom Kriege (Of war)*, he insists, among other things, on apprehending the rationality of war, on demonstrating that war has a reason for being (a reasonable cause) and that this is none other than politics. From that moment on, this affirmation is accepted as legal tender and is perpetuated until today..., this conception, «war is nothing more than the State's policy pursued by other means», «politics makes a simple instrument of the indomitable element of war», has an immediate effect as a rationalising principle of war, justification of the use of war in relations between peoples, in other words, by subordinating war ... to politics... war is given as right by virtue of the rationality of politics»⁴⁰.

This, from the studies carried out with chimpanzees, explains the centrality of the structures of the control of violence, their organisation, preparation, capacities and strategies in the development and evolution of the political order. The military institution is a transversal element to all other geopolitical areas, sometimes as a mere user of its potential as a factor of advantage, and sometimes as a creative instinct and the main driver of a decisive transformation in social progress and development. Paradigmatic of these two positions are two critical moments that definitively transform the geopolitical framework and radically modify its geostrategic lines of action:

- «..., savings and energy efficiency are consubstantial to the nature of the armed forces and a key strategic factor. In 1912, Winston Churchill, who was responsible for the British Navy as the first Lord of the Admiralty, decided to transform the fleet ships with propulsion systems that used coal as an energy source, to new systems that used oil; a decision that initiated the so-called oil era that has dominated geopolitics and guided the geostrategy of the 20th CENTURY. One hundred years [2011] after this important decision, which meant a strategic advantage factor in both operational and logistical aspects, we are on the threshold of a new era, post-oil»⁴¹.
- On 16 July 1945, the nuclear age begins. This is when the first nuclear device in history, with a power of 21 kilotons, was detonated in the test area of the Alamogordo desert in New Mexico. As Natividad Carpintero writes in her thesis, «*Historical and philological analysis of the beginnings*

⁴⁰ GARCÍA CANEIRO, José; VIDARTE, Francisco José. *War and philosophy: conceptions of war in the history of thought*, Tirant lo Blanch, Valencia, 2002, pp. 96, 97.

⁴¹ GARCIA SÁNCHEZ, Ignacio José. «Climate change: implications for security and defence», [in Strategy dossier no. 150, *Security, energy model and climate change*, directed by Manuel Marín González], Ministry of Defence, Madrid, 2011, p. 214.

of nuclear fission,» the discovery of nuclear fission will occupy one of the most transcendental and dramatic chapters of our contemporary history and, ultimately, of the history of humanity since its origins ... The discovery took place in Berlin, in 1938, in the midst of a Germany in full political turmoil and also on the dawn of World War II ... This pre-war situation was enough for the United States, Germany and the United Kingdom to try to develop a nuclear explosive to use during the war ... which culminated in the tragic bombings of Hiroshima and Nagasaki [6 and 9 August 1945, respectively]».

«The industrial military complex»⁴², A runaway horse, again?

«The important differences [military power] between the great powers [1890-1938] that were occurring are more clearly seen when the industrial productions of the steel sector are examined in detail. Iron and steel production have been considered one of the main indicators of military power at that time, as well as its industrialisation»⁴³.

«The French Government proposes that the entire Franco-German production of coal and steel be submitted to a high common authority in an organisation open to the other countries of Europe ... The solidarity of production that is thus created will make it clear that any war between France and Germany is not only unthinkable, but materially impossible»⁴⁴.

According to the International Energy Agency, in 2010, of the total CO₂ emissions, 21% would correspond to industry, while of the 25% corresponding to the production of heat and electricity, industry would be considered responsible for 11%. Percentages which, as an example, and taking into account the duration of the processes of removal of carbon dioxide from the atmosphere, would indicate a degree of responsibility of the most developed countries in the current situation of CO₂ levels and a demand for the future.⁴⁵

⁴² A description coined by President Eisenhower (1890-1969), during the farewell speech of his second presidential term, on 17 January 1961, when he announced: «We must protect ourselves from the acquisition of unjustified influence, whether or not it is sought, by the military-industrial complex.» THOMPSON, Loren. *Eisenhower's «military-industrial complex» shrinks to 1% of economy*, Forbes, May 8, 2017.

⁴³ KENNEDY, Paul. *The rise and fall of the great powers: economic change and military conflict from 1500 to 2000*, Random House, New York, 1989, p. 199. Translation by the author.

⁴⁴ Statement by Robert Schuman, 9 May 1950. https://europa.eu/european-union/about-eu/symbols/europe-day/schuman-declaration_es Visited 16 August 2017.

⁴⁵ «The concentration of a greenhouse gas in the atmosphere depends on the ratio established between the emission rates of the gas into the atmosphere and the duration of the processes that remove it from the atmosphere. For example, there is an exchange of carbon dioxide (CO₂) between the atmosphere, the ocean and the land through processes such as the transfer of gases between the ocean and the atmosphere and chemical processes (for example: wilting) and biological processes (for example: photosynthesis). While more than

We are currently in a situation similar to that which preceded the first and second world wars, although in a more dispersed way. Globally, power is much more distributed, more balanced, and political positions, strategic alliances, prior historical relationships are not taken for granted, so the geopolitical debate is in the environment. Economic and military weight begins to be redistributed considerably, which, together with the prevailing geostrategic instability, means that defence investments multiply and the defence industry rubs its hands in a voracious, but increasingly competitive, market.

No region will accumulate more than 20% of world economic output, with a tendency to equal the per capita income of developed countries in relation to emerging countries, announces the PWC report, *The long view: how will the global economic order change by 2050?*⁴⁶. By 2050, according to the report, China will accumulate 20% of the world's wealth, while the United States and the European Union will fall to 12% and 9% respectively from the current 16% and 15%, and India will reach 15%. In 1995, the economies of the E7⁴⁷ were half of those of the G7⁴⁸; by 2015 they were already the same size, and by 2040 the situation will have completely reversed. In this situation, the market growth forecasts of the defence industry show slight symptoms of a change in trend. A decline marked by the so-called dividends of peace, after the end of the cold war, and which in recent years, with the financial crisis, had not managed to recover. A fundamental factor was the cut in the US defence budget, with the constant threat of activation of the *sequestration* mechanism⁴⁹. A scenario in which, in fact, the countries that produce energy

half of the CO₂ emitted takes a century now to be removed from the atmosphere, a part of the CO₂ emitted (close to 20%) remains in the atmosphere for many millennia. As a result of the slow process of elimination, the CO₂ in the atmosphere continues to increase in the long term, even though its emission is substantially reduced compared to current levels. Methane (CH₄) is removed from the atmosphere by chemical processes, while nitrous oxide (N₂O) and some halo carbons are destroyed in the upper atmosphere by solar radiation. Each of these processes operates on different time scales ranging from several years to millennia. One measure of this is the permanence of a gas in the atmosphere, defined as the time it takes a disturbance to reduce to 37% of its initial amount. Although it is possible to accurately determine the permanence in the atmosphere of CH₄, N₂O, and other oligogases such as hydro chlorofluorocarbon-22 (HCFC-22), a refrigerant fluid, (about 12 years for CH₄, 110 for N₂O, and 12 for HCFC-22), the permanence of CO₂ in the atmosphere can not be defined». https://www.ipcc.ch/publications_and_data/ar4/wg1/es/faq-10-3.html. Visited 16 August 2017

⁴⁶ <https://www.pwc.es/es/publicaciones/economia/assets/pwc-world-in-2050-final-report.pdf>. Visited 16 August 2017

⁴⁷ E7: China, India, Indonesia, Brazil, Russia, Mexico and Turkey.

⁴⁸ G7: USA, UK, France, Germany, Japan, Canada and Italy.

⁴⁹ According to Deloitte in its annual reports on the defence aerospace sector, in 2016 it forecast a relaunch of the sector, *2016 global aerospace and defence sector outlook: poised for a rebound*; and in 2017 it maintained the feeling of optimism, *2017 global aerospace and defence sector outlook: growth prospects remain upbeat*, with an expected growth of 2%, with the defence subsector at 3.2% growth. The sector in Europe would grow 2.5% and profits would rise to 12.7% while in the US, the growth would be smaller, 1.7%, but the gains would surpass an increase of 12.75.

resources increased their defence spending thanks to a rise in the price of a barrel of oil never seen before.⁵⁰ (figure 1).



Graph 1 Price of a barrel Brent oil during the financial crisis.

In a scenario of economic improvement and geopolitical instability, «world military expenditure in 2015 was 1.676 billion ⁵¹dollars, a figure that represents 2.3% of the world gross domestic product or 228 dollars per person. Total spending was 1% higher in real terms than in 2014»⁵², with a sharp increase in Asia, Oceania and Eastern Europe⁵³. According to the ESPAS report⁵⁴, *Global trends to 2030: can the EU meet the challenges ahead?*, according to data from SIPRI, the increase in defence spending of the 9 main countries ⁵⁵would go from 1.399 trillion dollars in 2012, to 3.976 trillion dollars in 2012 prices. In this context, the SIPRI document evaluates the increase in the volume of international transfers of large armaments at 14% between 2006/10 and 2011/15 (see figure 2), with the USA having 33% of the market, Russia 25% and the main European countries 23%. The flow of these weapons to the Middle East increased by 61%, and by 26% and 19% towards Asia/Oceania and Africa respectively. A market that, «following the trend of recent years, again disappointed in terms of transparency»⁵⁶.

⁵⁰ The price of a barrel of Brent oil was quoted on 11 July 2008, at \$147.02 <https://www.theguardian.com/business/2008/jul/12/oil.commodities>. Visited 17 July 2017

⁵¹ Trillion: a million million, which is expressed by the unit followed by 12 zeros

⁵² SIPRI, *Yearbook 2016: armaments, disarmament and international security*, summary in Spanish, p. 17 SIPRI (Stockholm International Peace Research Institute) www.sipriyearbook.org.

⁵³ According to SIPRI *yearbook 2016*, the increase in Asia and Oceania had been 5.4% and in Eastern Europe, 7.5%. Deloitte estimates that the budgets allocated to the navies in China and the Pacific States would increase by up to 60% by 2020, compared to 2011 levels, due to ongoing naval programmes.

⁵⁴ *European Strategy and Policy Analysis System*.

⁵⁵ USA, China, India, Russia, United Kingdom, France, Japan, Germany and Brazil.

⁵⁶ *Ibidem*, SIPRI *yearbook 2016*, p. 21.



Graph 2

In Europe, as we have seen, the defence industry is one of the main industrial sectors. It employs around half a million people and generates up to 1,200,000 indirect jobs. It created a wealth of 97.3 billion euros in 2014, becoming one of the largest contributors to growth in the region. The sector has more than 1,350 small and medium enterprises that are critical in the supply chain, mainly based in: France, Germany, Italy, Spain, Sweden and the United Kingdom. Another of the main assets of the sector in Europe is its potential to innovate, in addition to its focus on engineering and high-end technologies focused primarily on the sectors of electronics, space and civil aviation. Aspects that remove it from the most polluting environments and move it towards the most productive sectors. According to a McKinsey survey in April 2015 among executives of the defence industry for the next three years, it is considered necessary for companies to balance defence and commercial products. They also considered that there would be greater competition in cybersecurity, unmanned systems and satellite launches.

The carbon footprint, the stigma of power

«In October 1918 [World War I], Germany's situation with respect to oil was desperate ... The armistice or peace treaty was signed at 5 o'clock in the morning of 11 November 1918 and came into effect 6 hours later, ending the war. The impact of oil on the war is eloquently summed up by [British Foreign Minister] Lord Curzon, «The Allied cause had floated to victory over a wave of oil,» and by Senator Bérenger of France, «Oil, the blood of the earth, was the blood of victory ... Germany had boasted too much about its superiority in iron and coal, but had not sufficiently

taken into account our superiority in oil.» ... As oil had been the blood of war, so would it be the blood of peace»⁵⁷.

Coal first, oil later, from the industrial revolution fossil fuels with a greater carbon footprint became the real backbones on which mobility and military combat power were structured. During the First World War, in the last allied offensive on the western front, 12,000 barrels of oil were consumed each day⁵⁸. World War II witnessed the outbreak of the Pacific conflict, with the air attack on Pearl Harbour, due to the oil embargo imposed by the United States on Japan in response to the invasion of Manchuria. Also, at the end of the War, Joseph Stalin is given a toast, paraphrasing Lord Curzon, to the American oil, in which victory had «floated»⁵⁹ over Nazi Germany and imperial Japan. A situation that the nuclear era has not been able to change, but that climate change may radically transform.

Thus, the report of Oil Change International, March 2008, *A climate war: the war in Iraq and global warming*⁶⁰, concludes that, from a very conservative point of view, war since March 2003 has put 141 million metric tons of carbon dioxide into the air. According to the report, this would amount to the emissions of 25 million cars in one year; the emissions of a country between New Zealand and Cuba; or the reduction planned by the state of California from 2009 to 2016.

It is interesting to highlight in this respect that the 1997 Kyoto Protocol specifically left the emissions produced by the Armed Forces of any country out of its regulatory framework. A demand from the United States negotiating team led by Al Gore, although the country would never sign it. In relation to Paris, unlike Kyoto, the agreement does not exhaustively exclude military emissions, but does not specify anything about them. That is, the word military does not appear. It is true that the agreement is more lax, less regulatory than that of Kyoto and therefore a decision that is left to the will of governments.

What there is no doubt about is the formidable carbon footprint that the armed forces produce (see figure 3); for example, the multi-purpose fighter F-16 consumes in one hour what a normal use of a car would consume in three years⁶¹.

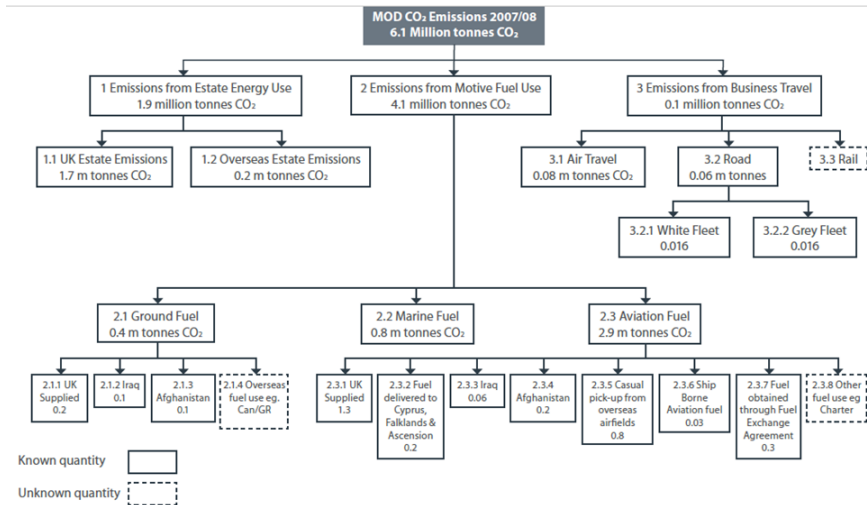
⁵⁷ <https://www.e-education.psu.edu/egee120/node/233>. Visited 17 August 2017

⁵⁸ NATO Energy Security Centre of Excellence, *Energy in conventional warfare*, Vilnius, 216 Energy in conflict series, p. 14.

⁵⁹ SHEA, Jamie. Lecture 4 - Energy security: is this a challenge for the markets or for the strategic community as well? http://www.nato.int/cps/en/natohq/audio.htm?query=lectures+Jamie+Shea&keywordquery=*&date_from=dd.mm.yyyy&date_to=dd.mm.yyyy. Visited 18 August 2017

⁶⁰ REISCH, Nikki; KRETZMANN, Steve. *A climate war: the war in Iraq and global warming*, Oil Change International, advanced edition, March 2008.

⁶¹ http://therealnews.com/t2/index.php?option=com_content&task=view&id=31&Itemid=74&jumival=15284 Visited 18 August 2017.



Graph 3 United Kingdom MD CO2 emissions 2007/2008. 6.1 million metric tones.

Thus, it is considered that the North American Armed Forces are the most polluting organisation on earth⁶². Something that the Pentagon accepts, not just as a responsibility as a net contributor to the global warming of the planet, but also because of the serious vulnerabilities it entails. So, in a video⁶³ published on 6 June 2017, the former secretary of the US Navy during the two Obama administrations, 2009 to 2017, Ray Mabus, said that the reality of climate change is «the new norm, you do not have to convince anyone ever again, it has become part of our culture». While claiming that the Department of Defence⁶⁴ is the organisation that consumes most fuel in the world, with 2% of total oil and gas in the United States⁶⁵, he stated

⁶² A report to Congress in 2012 said that the DoD had consumed about 117 million barrels of oil, just a little less than all the fuel used by the British automobile fleet in the same year.

⁶³ MABUS, Ray. *An eye to the future: how the United States Navy is managing climate change*, Harvard Business School, 6 June 2017. <https://www.youtube.com/watch?v=owZsQcdGHiU&feature=youtu.be>. Visited 18 August 2017

⁶⁴ «With more than 1,300,000 active duty members and 792,000 civilians, the Department of Defence (DoD) is the nation's largest employer. More than 811,000 people serve in the National Guard and Reserves. More than 2 million retired military and their families receive benefits. Our military, civil servants and workers operate in every time zone and in every climate, and more than 450,000 give service abroad. As one of the nation's largest health services, the DoD TRICARE programme serves approximately 9.4 million beneficiaries. The DoD manages a multimillion dollar global supply chain, with an inventory of 5 million items and a base budget of just over \$520 million in the 2016 fiscal year. The DoD is one of the largest property owners of the federal government, managing a global portfolio consisting of almost 572,000 facilities (buildings, structures and linear structures), located in more than 4,900 locations worldwide and covering more than 106,900 km²». FY2016 annual performance report.

⁶⁵ The British Ministry of Defence, in its first strategy on climate change, December 2008, estimated that the department's emissions, 6.1 million metric tons, accounted for 70% of all emissions from the Central State Administration, and 1% of the country's total (figure 3).

the vulnerability of the logistics chain in Afghanistan, which on average caused one marine to die or fall wounded for every 50 convoys. Thus, the goal to achieve in 2020 is that 50% of the energy consumed should come from non-fossil sources⁶⁶. Also, in the North American Air Force, which consumes approximately 50% of the fuel of the Department of Defence, ⁶⁷one of its objectives is to improve energy efficiency by 10% by 2020 compared to 2011; while the Army, traditionally little concerned about energy consumption⁶⁸, aims by 2025 to use renewable sources in 25% of its energy balance⁶⁹.

In this line of effort, the US Department of Defence has to publish a report each fiscal year in which it reports «consumption, progress in implementing the *Operational Energy Strategy*⁷⁰, support for contingency operations and investments in alternative fuels»⁷¹. In the last fiscal year, 2016, consumption was almost 86 million barrels of fuel, which is 57% of the total of the federal government. To minimise the logistics chain, 54% was purchased outside the USA and always as close as possible to the area of operations. However, due mainly to the smaller involvement of US forces in conflicts abroad, but also to the continued improvements in energy efficiency plans and programmes, consumption has continued to decrease since its peak in 2007, by more than 30% (see graph 4).

Although, as recognised by the *Operational Energy Strategy* of the United States Department of Defence, «the reduction in energy consumption is an essential component of the energy strategy, it will not always be an option. The Department must remain focused on improving its combat power as a primary objective, while supporting and promoting those programmes and initiatives that reduce consumption and improve sustainability precisely as a means of increasing combat capacity. After improvements in its capabilities,

⁶⁶ The Navy does not reach 30% of the total consumption of the Department of Defence. Its use is divided into: air components 40%, ships 38%, expeditionary forces 16% and facilities 65%.

⁶⁷ Within the Air Force, 86% is consumed by its air components, 11% by its facilities and the remaining 3% by land transport vehicles.

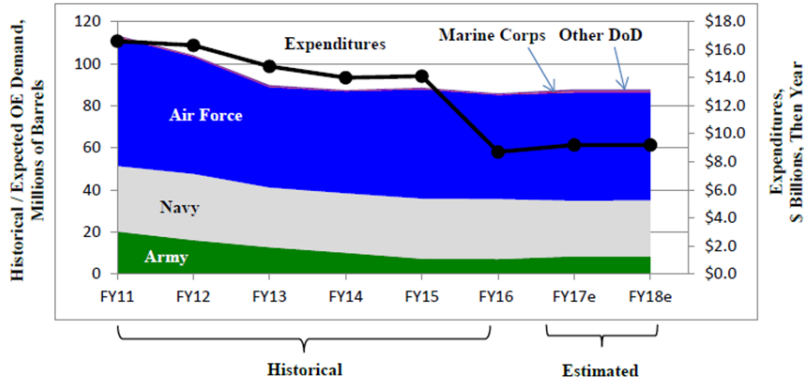
⁶⁸ «In the conference «The energy sustainability programme of the army» Richard G. Kidd IV, Undersecretary of the Army for Energy and Sustainability, declared that «energy and energy security had historically been undervalued» and «energy had unintentionally been treated as a free resource»». KENDING, Richard J., *Evolution of the operational energy strategy and its consideration in the defence procurement process*, Naval Postgraduate School, Monterey, California, 2016, p. 56 Translation by the author.

⁶⁹ It has launched the «Army's Net Zero» initiative that aims to improve federal objectives in terms of energy, water and waste at its bases both in the Americas and in support of the general objective of use. See: *Army Net Zero: energy roadmap and program summary* (FY 2013) and recently the update *2015 Progress report: Army Net Zero initiative*, October 2016.

⁷⁰ So far, two operational energy strategies have been published, the first in 2011 and the second in 2016.

⁷¹ Department of Defence, *Fiscal Year 2016: annual operational energy report*, Office of the Undersecretary of Defence for Procurement, Technology and Logistics, Washington, 24 July 2017. Translation by the author.

Figure 1: DoD Operational Energy Demand, FY 2010 – FY 2017⁹



⁸ Standard DLA Energy fuel prices can be found at <http://www.dla.mil/Energy/Business/StandardPrices.aspx>

⁹ Updated analysis of expenditures may lead to different results from previous Operational Energy Annual Reports. Expenditures are not adjusted for inflation; data on historical demand may not capture final end use nor account for fuel transfers between the Services; Historical and Estimated Demand include Base and Overseas Contingency Operations (OCO) funding and purchases using Transportation Working Capital Fund (TWCF).

Graph 4

Table 2: DoD Operational Energy Demand by Service

		FY11	FY12	FY13	FY14	FY15	FY16	FY17e	FY18e
Operational Energy Demand, Million Barrels	Army	20.2	16.1	12.7	10.1	7.3	7.1	8.4	8.4
	Navy	31.1	31.5	28.4	28.2	28.5	28.5	26.4	26.6
	Air Force	61.3	55.7	47.8	48.6	52.0	49.6	51.5	51.3
	Marine Corps	0.3	0.2	0.2	0.2	0.2	0.2	0.5	0.5
	Other DoD	0.5	0.4	0.7	0.3	0.5	0.4	0.9	0.9
	Total Demand	113.5	103.9	89.8	87.4	88.6	85.7	87.7	87.7
	Expenditures, \$ Billions	\$16.6	\$16.3	\$14.8	\$14.0	\$14.1	\$8.7	\$9.2	\$9.2

the Department should identify and correct the risks, regardless of the level of mitigation, and be able to use these operational and logistical risks to inform investment priorities. Finally, the Department should increase training and education in energy efficiency and its practical implementation in the use of energy in current operations.»⁷²

⁷² Department of Defence, *2016 Operational Energy Strategy*, Office of the Undersecretary of Defence for Energy, Installations and Environment, Washington, 3 December 2015, p. 10 Translation by the author.

The armed forces as part of the solution. The sense of duty of a society with a future

«That's right, Lord, what we were explains what we are. The history of the construction of our Spain is read along with its military history. And thus we continue, making history, making armed forces and making Spain»⁷³.

The state of the art of integral transformation

«Climate change is a very serious threat to global security and an immediate risk to our national security; and have no doubt, it will profoundly change how our military defends our country.

-President Barack Obama, 20 May 2015-»⁷⁴.

«The term «military transformation» could be understood simply as a «profound change» in military affairs. Which would not imply a quick or general change, or discard what is still working well. The changes, however, should be dramatic rather than mere tweaks in the margin, such as modest improvements in aircraft, tanks or ships. Transformation is a process without a known endpoint»⁷⁵.

Joseph Nye (1937-) in his book, *The future of power*, deals with the relevance of the military apparatus in an imaginary and always impossible algorithm, measuring the relative power of the states in the world we live in and their possible future development. And he is sceptical of the relevance of military force and its combat capacity in issues such as the world of finance and climate change; and also of the power that non-state players are gradually acquiring, and uses terrorism as an example⁷⁶. A statement that not only seems questionable, but can become a real nightmare for the government that decides to use it, if we take into account the financial and environmental cost involved.

Undoubtedly, a statement that seems to understand the armed forces from a static perspective, without the ability to react and seek solutions to the challenges of the present with a constant look to the future. In this sense, the brochure, *The General Staff of Defence, driving force of the transformation of the Armed Forces*, emphasises in the introduction that: «The world evolves,

⁷³ DE COSPEDAL, María Dolores. «Speech of the Military Festival 2017», Ministry of Defence, Royal Palace of Madrid, 6 January 2017, p. 2.

⁷⁴ Quoted by, SCOTT, Shirley V.; KHAN, Shahedul. *The Implications of climate change for the military and for conflict prevention, including through peace missions*, ASPJ Africa and Francophonie, 3rd Quarter 2016. Translation by the author.

⁷⁵ DAVIS, Paul K. *Military transformation? Which transformation, and what lies ahead?* RAND Corporation, National Security Research Division. Translation by the author.

⁷⁶ *Ibidem*, NYE, *The future of Power*, pp. 4, 5.

and does so giddily. In this context, for the armed forces to maintain their capacity to respond to the new (and very diverse) threats presented to them, it is necessary to establish a process of constant transformation, which not only provides solutions to the present, but also grants the organisation the necessary flexibility to also adapt to the new changes that the future will surely bring. It is, in other words, a question of feeding the «culture of permanent transformation» that allows us to evolve to the pace of events and respond to the new tasks assigned to us»⁷⁷. In its seven interior pages, there is a brief summary of the fundamentals of change, the key elements and some of the basic characteristics of the future of the armed forces, ending with one, «our social responsibility», that shows the link between security, freedom, well-being and development, stressing that «national defence is an essential common good, the investment that guarantees it is great», which requires an effective and rigorous management of the public funds used, but that transcends «other concepts linked to it such as environmental awareness, energy saving, the prevention of occupational risks, the total integration of women or the non-discrimination of people ...»⁷⁸.

Moreover, as an organisation within the society it serves and a necessary, though not sufficient, element of the structure of the State, it has a permanent obligation to serve as a reference to citizenship, but not only as guarantors of a framework of coexistence or holders of the features that represent the culture that identifies them, but, and most importantly, as a value of the future, as a symbol of confidence in the ability to face the challenges of tomorrow. The Armed Forces must spur society to prepare for the most adverse conditions that may arise, improving their resilience, and leading their capacity for adaptation and change through example. They should encourage study and research in the human, social and technical sciences, serving as a forum for debate, experimental laboratory, test field and the first line of effort of a society that has to be projected into the future; and not only because the capabilities thought of today are to be used in 20/25 years.

Cooper Ramo (1968-) explains in chapter 5, *Fishnet -in which we learn why networks spread so quickly-*, from the book, *The seventh sense*, how the resolution of a military problem marks the beginning of a whole social and technological revolution. «In 1959, a young electronic engineer named Paul Baran ..., arrives on his first day of work at a modern building next to Santa Monica beach. RAND - an elegant acronym of the 50s for *Research and Development* - had been established by the American Air Force and the *Douglas Aircraft* company with the aim of putting pressure on the best minds in mathematics and science to win the Cold War»⁷⁹. The problem to solve; the best kept secret by the United States;

⁷⁷ It can be downloaded at (visited on 20 August 2017): http://www.emad.mde.es/EMAD/novemad/noticias/2014/02/140201_motor_transformacion_FAs.html. http://www.ieee.es/Galerias/fichero/Varios/EMAD_Folleto-JEMAD.pdf.

⁷⁸ Ibidem, p. 8.

⁷⁹ Ibidem, COOPER RAMO, *The seventh sense*, pp. 125-143.

if the Soviet Union launched a nuclear attack, there would be no response from the American side. The communication system that should start the counter attack would not survive the explosion. «After two years of patient studies in RAND, Baran begins to develop the bases of the solution. In a series of talks and discussions with Air Force officers starting in the summer of 1961, he paves the way to the answer, talk by talk, equation by equation.» The main obstacle, the telecommunications system designed by AT&T, which not only saw threatened «the annual cheque of \$2 billion from the Department of Defence, but also saw a whole way of thinking disappear in Baran's *fishnet*». The solution, a network without central control, resilient, with innumerable connection routes, growing as more nodes were incorporated, impossible to cut. «The first large network built according to the Baran principles was called ARPANET (Advanced Research Projects Agency Network), a mesh of connections that even today serves as the backbone of some parts of the Internet.»

With this same spirit of search for solutions to security problems, the US security strategy has, since 1991, during the presidency of George HW Bush, continuously included the phenomenon of climate change in its paging. At the beginning «the need to assess climate change is established as one of the most complex, non-traditional issues affecting security»⁸⁰, in 1997, with Bill Clinton in the presidency, to define it «as a transnational threat, with terrorism, drug trafficking and organised international crime», to one year later relate it to energy security and economic development, supporting the adoption of mitigation measures.

Dealing with this concern, prior to the conference of the parties, COP 15, in Copenhagen, December 2009, the Pentagon, supported by civil society committed to security and defence issues through its centres of thought and universities, began a considerable effort to raise society's awareness of the risks and threats associated with the development of the phenomenon. Paradigmatic was the report of the military advisory council⁸¹ of the CNA⁸², *National security and the threat of climate change*, published in April 2007, as a result of the work of 11 retired three and four star generals and admirals, and which, among other results, popularises the name of the phenomenon as *threat multiplier*, which our first two national security strategies (2011, 2013) introduced as «risk enhancer and threat multiplier»⁸³.

⁸⁰ Ibidem, GARCÍA SÁNCHEZ, *Climate change*, p. 201.

⁸¹ <https://www.cna.org/mab/reports>. Visited 21 August 2017

⁸² The Centre for Naval Analysis (CNA, although on its website, accessed on 21 August 2017, <https://www.cna.org/centers/cna/> a note is made in which CNA it is not considered an acronym and can be correctly referenced as «CNA, organisation for non-profit research analysis located in Arlington, VA») of the US Navy and as such financed with federal funds was founded in 1942.

⁸³ Strategy dossier no. 159, *The risk enhancers*, of the Spanish Institute of Strategic Studies, coordinated by the former minister Eduardo Serra Rexach, Ministry of Defence, Madrid, February 2013. http://www.iecee.es/publicaciones-new/cuadernos-de-estrategia/2013/Cuaderno_159.html.

In the first national security strategy of President Obama, 2010, the phenomenon is mentioned on 23 occasions and is described as «a real, urgent and severe danger»⁸⁴. In the second and last, 2015, the reduction of greenhouse gas emissions in 2015 between 26% and 28% in relation to the 2005 levels is already established, highlighting that it was the country that most reduced these emissions in the previous 6 years⁸⁵. It should be noted that in the document, *Strategy for a deep decarbonisation of the United States for the middle of the century*, of November 2016, the federal government establishes a reduction target of 40% for all its agencies by 2025⁸⁶.

Another example of long-term strategic thinking that has led the military world to raise awareness about the phenomenon of climate change also takes place in the preludes of the Copenhagen summit (2008), and is related to the publication of the book⁸⁷, *The wars of the climate, the struggle to survive in an overheated world*. The author explains how, through a friend in Washington, he meets with several Pentagon officials, at that time under the presidency of George W. Bush. These officers explain that they want him to write this book. Under the Bush presidency, the Pentagon is very constrained to bring the threat of climate change to public debate and considers a global effort to reduce the emission of greenhouse gases essential. The approach they make is as follows; if there is no universal effort and global warming follows the predictive models made by scientists, the most likely situation is that, sooner or later, its impact on the Central American region, especially its dry corridor⁸⁸, will gather momentum, causing an increasingly large number of migrants pressuring the southern border of the United States with Mexico. The time could come when the pressure would be of such magnitude that Congress would order the army to close the border. At some point in that mission it might be necessary to open fire on the desperate masses. With that order the army, with troops mostly of Hispanic origin, could refuse out of conscience to shoot on people of their same race and culture; but what could

⁸⁴ Ibidem, GARCÍA SÁNCHEZ, *Climate change*, p. 202.

⁸⁵ The contribution of the European Union in the Paris agreement is at least a 40% reduction compared to 1990 levels by 2030.

⁸⁶ The White House, *United States mid-century strategy for deep decarbonisation*, Washington, November 2016, p. 83.

⁸⁷ Presentation of the book by the author, Gwynne Dyer, Canadian, at the NATO Headquarters, on 14 January 2010. http://www.nato.int/cps/en/natohq/audio.htm?query=climate+wars&keywordquery=*&date_from=dd.mm.yyyy&date_to=dd.mm.yyyy. Visited 21 August 2017

⁸⁸ Central American Dry Corridor. A group of ecosystems located in the ecoregion of the dry tropical forest of Central America. This ecoregion begins in Chiapas, Mexico and continues along the lower areas of the Pacific side and the central pre-mountain region of Guatemala, El Salvador, Honduras, Nicaragua and part of Costa Rica (to Guanacaste). In Honduras, the corridor stretches through the centre and west of the country, until it approaches the Caribbean coast. Source: FAO, 2012. Characterisation study of the Central American dry corridor. CA-4 countries. Volume 1. Action against Hunger, European Union, United Nations Food and Agriculture Organisation. Viale delle Terme di Caracalla, 00100 Rome, Italy .

be worse, in a society such as the United States, which at that time could have a majority minority of the Hispanic population exceeding 25%, there could be a civil war or the dismemberment of the federation of states that make it up today.

The centrality of energy, a battle to win

«The leader of the progress, development and growth of our societies, both from the industrial and social point of view, is energy, which acts as an element of centrality»⁸⁹.

The centrality of energy is something that seems beyond doubt, although it is usually associated with a «trilemma», in which it depends on the sources, the vertices vary considerably (see figure 5).

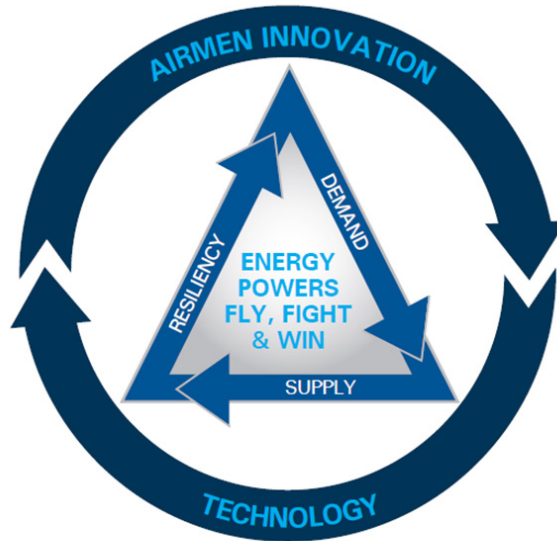


Figure 1: Air Force Approach to Energy

Figure 5 USAF Energy Flight Plan 2017-2036.

For example, continuing with the quote that opens the section, the World Energy Council has opened a programme it calls «Energy Trilemma»⁹⁰,

⁸⁹ CAMACHO PAREJO, Marta. «The energy trilemma», Separata of no. 38 of Cuadernos de Energía. Spanish Energy Club, Spanish Energy Institute, 2012, Cited by GARCÍA SÁNCHEZ, Ignacio. «The rise of China and its energy supply», from Strategy dossier no. 166, *Energy and geostrategy 2014*, Ministry of Defence, Madrid, May 2014, p. 232

⁹⁰ <https://www.worldenergy.org/work-programme/strategic-insight/assessment-of-energy-climate-change-policy/>. Visited 21 August 2017

where it defines the three dimensions as: security, equity and environmental sustainability. The UN, in the year of sustainable energy, 2012, established three complementary objectives: universal access, efficiency and renewable energies. It later became the 7th goal of sustainable development, «energy is central to almost all the great challenges and opportunities that the world is currently facing»⁹¹. The International Energy Agency was founded during the 1974 oil crisis with three fundamental objectives, focused, of course, on energy: security, economic development and environmental protection. The European Union focuses on security, climate and competitiveness, with a more integrated, interconnected and resilient market. NATO focuses on security⁹² with three basic objectives: critical infrastructures; the transit areas and communication lines; and cooperation and consultations among its members. While Spain, in its *National Energy Security Strategy*, establishes as «vectors or components»: environmental and economic supply and sustainability.

But the vision of the Armed Forces that includes all of the above as an essential element of society, goes much further, «fostering a culture that values energy as a strategic resource ..., and which inculcates an integral management of good practices»⁹³. In this sense, the concept of operational energy of the North American Department of Defence is included (see figure 6).

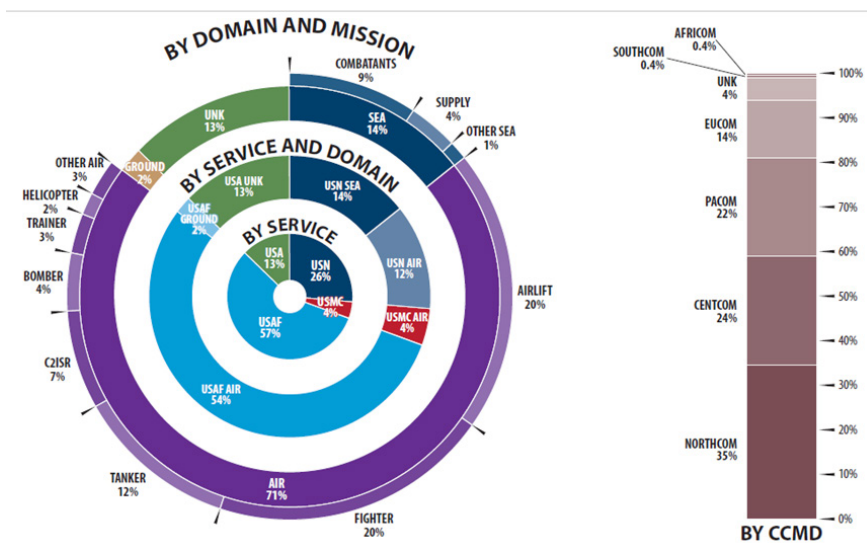


Figure 6 Source: figure 1: Operational Energy Use, FY 2014. 2016 Operational Energy Strategy.

⁹¹ <http://www.un.org/sustainabledevelopment/es/energy/>. Visited 21 August 2017

⁹² See: <http://www.natolibguides.info/energysecurity>. Visited 23 August 2017

⁹³ U.S. Air Force, *Energy Flight Plan 2017-2036*, Department of Facilities, Environment and Energy, 6 January 2017, p. 3.

The new energy culture must leave behind the old models where there was only one approach, the combat capacity. Today, the new integral soldier has to adopt the holistic view of the circular economy which, fully informed by the society he serves, fulfils the entrusted mission (see figure 7).

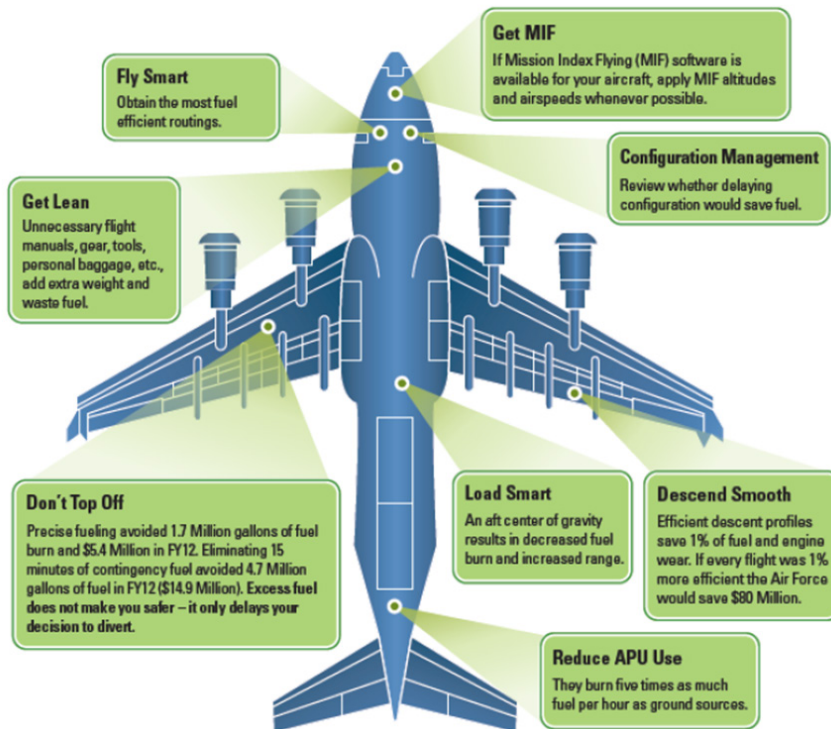


Figure 7 Source: «Do Your Part», Practical Examples of Air Force Energy Reduction Initiatives. Source: U.S. Air Force (2015). Air Force initiatives to improve energy use in airlift and tanker aircraft DOD 2016 Operational Energy Strategy. USAF Energy Flight Plan 2017-2036.

A new military energy culture that puts into question a system totally dependent on oil products, which has lasted for more than 100 years, without compromising the combat capacity and therefore the life of its components and the people who it defends, and therefore mobility and projection capacity in any area of operations, is a formidable but essential task. In this sense, the concept of «operational energy» is important, in contrast to the rest of the energy used by the Department of Defence, called «facility energy». In the North American case, the figures of the latter show

a cost that exceeds 20% of the total; in fiscal year 2015 approximately 3.9 billion dollars⁹⁴, and 30% of consumption⁹⁵ (see figure 8).

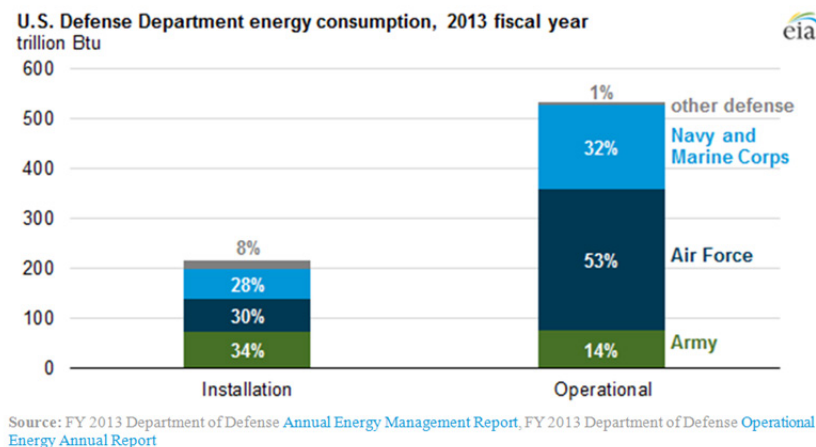


Figure 8. Percentages of energy consumption for facilities and operational energy.

The facility energy implementation programme leads federal policies in relation to energy efficiency, except for some strategic considerations⁹⁶. The annual execution report for the fiscal year 2016⁹⁷ presented to the president, the Congress and the American citizenship, is a true document of social responsibility, since «it allows the reader to evaluate the effectiveness of the Department of Defence in relation to its missions as well as efficiency in the rigorous management of public resources». It is divided into three strategic purposes which, in turn, are subdivided into 12 strategic objectives according to the four-year strategic plan in line with the four-year defence report (QDR), published in 2014, so the strategic plan covers the fiscal years of 2015 to 2018. The 12 objectives result in 53 measures that establish the execution criteria. Of these 53 measures: three are not available when the report is published; in 37 of 50, 74%, exceed the imposed goals, while 26%, 13 of 50, do not achieve the proposed goal. In addition, of these 53 measures, 35 are associated with APG (*agency priority goals*), one of which

⁹⁴ U.S. Department of Defence. *Annual performance report fiscal year (FY) 2016*, Washington, 14 December 2016, p. 68

⁹⁵ Ibidem, KENDING. «Evolution of the operational energy strategy», p. 6

See also, EIA, «Defence Department energy use falls to lowest level since at least 1975». Visited 21 August 2017, <https://www.eia.gov/todayinenergy/detail.php?id=19871>.

⁹⁶ Ibidem, GARCÍA SÁNCHEZ. *Climate change: implications for security and defence*, p. 218

⁹⁷ <http://dcmo.defense.gov/Portals/47/FY%202016%20Annual%20Performance%20Report.pdf?ver=2017-05-26-172231-263>. Visited 22 August 2017

is energy. Of these priority objectives, 25, 78%, exceed the imposed targets, while 7, 22%, show a lower than expected performance.

Energy (APG 3.5.2) meets the 2nd priority in the 3rd purpose: «to acquire dominant capabilities through innovation, technical excellence and institutional defence reform»; and the 5th objective: «to improve performance in general, to enhance the commercial management of operations, and to achieve efficiencies, efficacies and cost reduction that can be transferred to needs with a higher priority». The goals are broken down into the calls: facility energy or facilitator⁹⁸ and operational energy⁹⁹. Regarding the first, the goal to achieve would be to reduce the energy intensity by 2025 by 25% compared to 2015. The annual goal is to reduce by 2.5%, having reduced by 19.9% in 2015, compared to 2003, and in 2016, 5.10%. With regard to operational energy, the goal for the end of this cycle, September 2018, is to include the concept fully (100%), in the process of strength development; for which, three indicators have been established that, in September 2016, were at 96%, 75% and 92% respectively.

In addition, in the document, there are other federal objectives that are identified with the acronym CAP (*cross-agency priority*), of which the Department leads two: cybersecurity and strategic resources; and contributes to another 11, among which is climate change. In relation to the latter, CAP 3.5.8, the DoD «has doubled the federal target -20% in 2020- of electricity consumption from renewable sources and improved energy efficiency in all its facilities, including 4 billion dollars in contracts as part of the federal strategy to reduce direct greenhouse gas emissions by 28% by 2020, and indirect emissions by 13%, compared to 2008»¹⁰⁰.

In this framework, the effort related to operational energy is exposed to an increase in the complexity of the geopolitical environment, as is the emergence of new players who want to have their role in a scenario of characteristics closer to any of the three versions of the realistic model of international relations: classical, structural and offensive, according to the theories developed by Hans Morgenthau (1904-1980), Kenneth Waltz (1924-2015) and John Mearsheimer (1947-) respectively; than to the neoliberalism represented by the model of complex interdependence of Joseph Nye (1937-) and Robert Keohane (1941-); or idealism, exemplified in the idea of collective security, which comes into being with the perpetual peace of Immanuel Kant (1724-1804), has a continuation with Woodrow Wilson (1856-1924) and the League of Nations, and more recently with the Kupchan brothers Charles (1958-) and Clifford; or the school of Critical Theory that has its origins in Kant, Georg Wilhelm Friedrich Hegel (1770-1831), materialises with Karl Marx (1818-1883), and continues the Frankfurt school with Marx Horkheimer

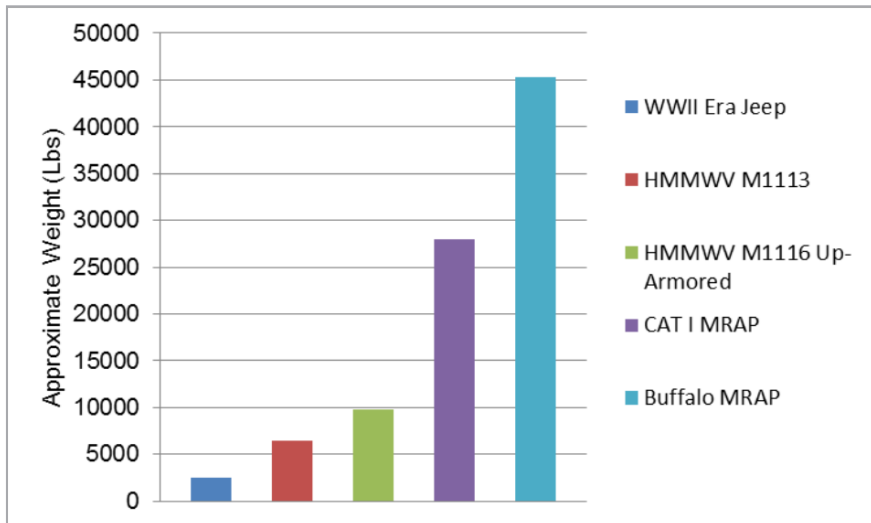
⁹⁸ http://www.acq.osd.mil/eie/IE/FEP_index.html Visited 23 August 2017.

⁹⁹ http://www.acq.osd.mil/eie/OE/OE_index.html Visited 23 August 2017.

¹⁰⁰ Ibidem, p. 75.

(1895-1973) and whose maximum exponent at present is Jürgen Habermas (1929-)¹⁰¹. In addition, the North American strategic rebalancing towards the Asia-Pacific scenario, recently renamed Indo-Pacific, imposes a large logistical constraint on its armed forces. However, cultural transformation is considered a critical element to remain prevalent in the new geostrategic environment.

Thus, the document, *Evolution of the operational energy strategy and its consideration in the process of acquisition of the Defence*, explains how the analysis of weapons systems and increasingly heavy operational platforms (see graph 9) that increase the consumption of fuel without increasing combat capacity in the same proportion, reports a request from the Logistics, Technology and Acquisitions division to the Scientific Council of the Department of Defence in 1999 to form a work group to study technologies



Graph 9. Evolution of the weight of the main vehicle used by the US Army since the Second World War.

that improve the energy efficiency of those platforms and weapons systems.

The group published its work in January 2001, *Greater combat capacity through a reduction in fuel load*. In addition to identifying numerous technologies, the document puts its finger on the institutional wound: bureaucratic barriers, cultural conformism, the pressures of the military industrial complex that undoubtedly lead to inefficiency, with an excessive consumption that

¹⁰¹ See, GARCÍA SÁNCHEZ, Ignacio José. «War between States? The balance of power and realistic logic?» in, Spanish Institute of Strategic Studies, *Geopolitical Panorama of Conflicts 2016*, Ministry of Defence, Madrid, December 2016. And, «Quo Vadis Europe? From the Solana document to Global Strategy», in Strategy dossier 184, *A global strategy of the European Union for difficult times*, Ministry of Defence, Madrid, February 2017.

can endanger the fulfilment of the mission. In short, 5 conclusions with 5 associated recommendations:

1. Energy efficiency is not valued or specified in the Department's requirements during the acquisition process. Recommendation: base investment decisions on the cost of fuel consumed and the benefits on combat capacity.
2. The real cost of fuel is not considered a factor in the decision process. Recommendation: integrate combat capabilities and fuel logistic requirements in war games and through new analytical tools.
3. Resource allocation and accounting processes do not reward energy efficiency or penalise inefficiency. Recommendation: provide leadership that encourages energy efficiency throughout the Department.
4. The models of energy needs are not linked to the processes of the acquisition programmes or to the development of their technical specifications. Recommendation: establish specific objectives related to the improvement of energy efficiency.
5. High-performance, low-consumption technologies that improve combat capacity and operational efficiency (2001) can now be developed through investments in science and technology and systems design. Recommendation: explicitly include energy efficiency among the requirements in the acquisition process.

In 2006, again, the Scientific Council was asked to form a working group to «analyse opportunities to reduce the energy consumption of the DoD, identify the institutional obstacles on their implementation and evaluate potential security and commercial benefits»¹⁰². The subsequent document, *More combat capacity-less fuel*, is published in February 2008 concluding that:

1. The recommendations of the previous document have not been implemented. Recommendation: accelerate efforts to implement key performance parameters (KPP) and full blown cost of energy (FBCE)¹⁰³.
2. The Department of Defence lacks the strategy, the policies, the algorithms, the information system and the organic structure necessary to manage energy risks in an appropriate manner. Recommendation: establish a strategic plan that sets measurable objectives, creates a management process structure for the recommended changes in 2001 and implements processes with responsibilities and tasks.
3. Efficient technologies are currently available from the energy point of view, but are devalued, so their implementation is slow due to inade-

¹⁰² Ibidem, KENDING, *Evolution of the operational energy strategy*, p. 20.

¹⁰³ To see its implementation in NATO: CRIADO DE PASTOR, Héctor. «Energy generation technologies», in Spanish Institute of Strategic Studies, *Security and Defence Documents 74, Economic intelligence, technology and logistics: a transversal vision*, Ministry of Defence, Madrid, April 2017, pp. 208, 209.

quate investments in science and technology. Recommendation: invest in energy efficiency and technologies that allow the use of alternative energies at a level commensurate with their operational and commercial value.

This new view has extended and the energy culture has permeated all sectors of the military institution. And so, the QDR 2010 established the criteria and formulated the necessary guidelines for the publication of the first operational strategy in 2011, of which an update was published in 2016, necessary for the new scenario in which the Asia-Pacific pivot context prevails, recognising the challenge represented by a priority theatre with a much more widespread logistics chain that limits the requirements for the availability of operational energy. In addition, the new adversaries with increasingly sophisticated capabilities: «Anti Access and Area Denial», (A2/AD in its English acronym), represent a threat to its viability and sustainability.

NATO in turn¹⁰⁴ echoed this trend at the Chicago Summit in 2012, encouraging its members to work «to substantially improve the energy efficiency of our military forces» and funded a work group «Smart Energy Team (SENT)»¹⁰⁵ from January 2013 to May 2015. The final report highlights that only 50% of its members submitted their responses to the questionnaire sent. At the Warsaw Summit in 2016, the need to «improve the energy efficiency of our military forces by establishing common standards, reducing dependence on fossil fuels and implementing military solutions» is re-emphasised.

In short, an energy culture¹⁰⁶ absolutely essential for a future where the geopolitical demands on the military factor are extreme in all areas, physical (geographic), human, economic and socio-political, within its cross-sectional conceptualisation, demanding a long-term geostrategic vision, exemplary and brave leadership, an efficient structure and an energy and environmental culture that permeates the entire organisation, its plans and programmes, in a process of permanent transformation.

New challenges, new missions, a new society

«The «global commons» are those areas of the world shared by all States; they can be classified into two large groups depending on the

¹⁰⁴ See: <http://www.natolibguides.info/smartenergy>. Visited 23 August 2017

¹⁰⁵ The final report of the work group, «SENT Comprehensive report», 6 May 2015, can be downloaded from: http://www.natolibguides.info/ld.php?content_id=18110194. Visited 23 August 2017

¹⁰⁶ Examples in the DoD are the annual awards of excellence for facilities, environment, the month of energy, October, events for Earth Day, 26 April ... <http://www.acq.osd.mil/eie/>. And, in NATO, the specific events that are regularly scheduled under the direction of the Emerging Security Challenges Division (ESCD), created on 4 August 2010 in the International General Staff. <http://www.natolibguides.info/smartenergy/calendar>. Visited 23 August 2017

challenge they represent: strategic and environmental. The «common strategic» areas include the domains of the sea, air, space and cyberspace, as well as the nuclear domain with regard to the control of nuclear proliferation. The «common environmental» areas include the geopolitical implications of the management of water sources, the Arctic and global climate change ... Global climate change is the last component of the «common environmental» areas and the one of greatest geopolitical impact ... The protection and exemplary management of «global commons» –sea, air, space, cyberspace, nuclear proliferation, water security, the Arctic and the environment– is imperative for sustainable global economic development and basic geopolitical stability»¹⁰⁷.

The geopolitical impact of climate change establishes new challenges to the continuous process of transformation of the Armed Forces in all its areas¹⁰⁸. The changes that are currently noticed will continue, depending on the success of the mitigation policies in progress. Another feature of the phenomenon is its uncertainty¹⁰⁹. In spite of the scientific advances, the ever more perfected predictive models and the deep commitment of the international scientific community in its research, there are numerous inaccuracies and dilemmas that, in some cases, allow positions such as the negation of the phenomenon itself to be defended. An aspect that accentuates the natural difficulty to establish global strategic trends with horizons of 25 to 30 years and the future operating environments, 20 to 25 years, that allow a concept of military use to be established and the capabilities that facilitate it to be designed.

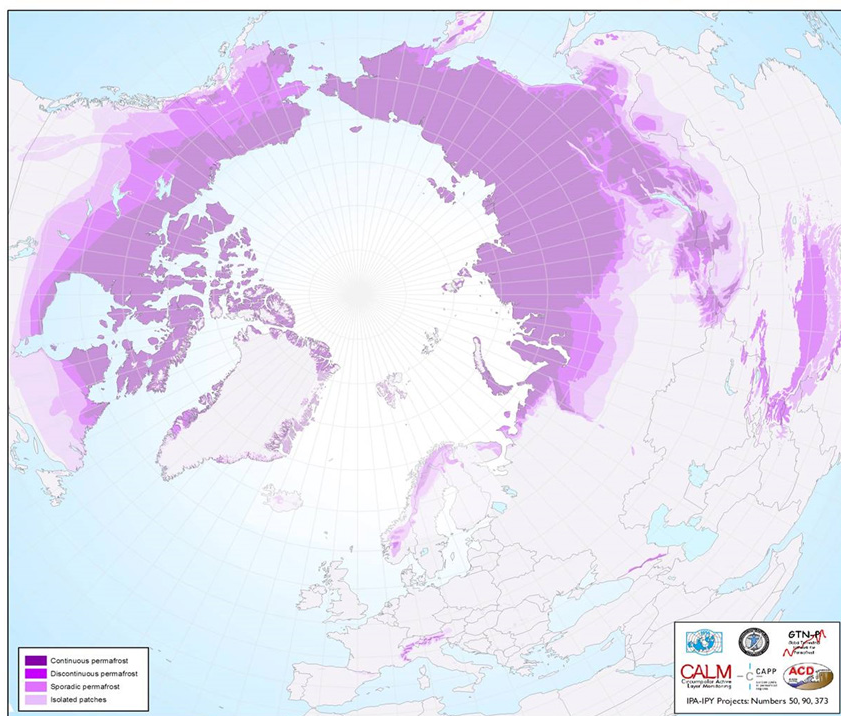
It is the geophysical aspect that is perhaps the one with the greatest direct influence. The global increase in temperature, especially in the oceans, with the consequent melting of sea and continental ice, requires immediate action, especially for those countries with military installations that see how the permafrost that supported their buildings begins to weaken (see graph 10)¹¹⁰.

¹⁰⁷ BRZEZINSKI, Zbigniew. *Strategic vision: America and the crisis of global power*, Basic Books, New York, 2013, pp. 110, 118, 119. Translation by the author.

¹⁰⁸ NATO uses the acronym DOTMLPFI: *doctrine, organisation, training, material, leadership, personnel, facilities and interoperability*;

¹⁰⁹ See, US Department of Defence, *Assessing Impacts of climatic change on coastal military installations: policy implications*, Strategic Environmental Research and Development Program, (SERDP) January 2016, Consideration 7, p. 31 For more information about US Department of Defence environmental research programmes see: <https://www.serdp-estcp.org/>. Visited 24 August 2017.

¹¹⁰ See: *Loss of permafrost: impact on DoD lands in Alaska*, <https://www.serdp-estcp.org/News-and-Events/In-the-Spotlight/Loss-of-Permafrost-Impact-on-DoD-Lands-in-Alaska>. <https://www.theguardian.com/cities/2016/oct/14/thawing-permafrost-destroying-arctic-cities-norilsk-russia>. Visited 23 August 2017



Graph 10. <https://ipa.arcticportal.org/images/stories/permafrost%20map.jpg>. Visited 23 August 2017 International Permafrost Association.

But without doubt, the Arctic Ocean is the new frontier¹¹¹ that opens up to the geostrategic game of the great powers and where the Armed Forces are having an ever greater presence.

The recent documents related to the increasing militarisation of the Arctic by the three heavyweights that coincide on the so-called roof of the world are clear, the European Union¹¹², United States¹¹³ and Russia. In this sense, «in the last military doctrine signed by President Putin, the Russian Federation considered NATO its main threat and accused the Alliance of practising the doctrine of containment with the aim of isolating Russia. Thus, for the first

¹¹¹ GARCÍA SÁNCHEZ, Ignacio. «The Arctic: Old or new geopolitics?», Chapter 3 in the Spanish Institute of Strategic Studies, *Geopolitical Panorama of Conflicts 2015*, Ministry of Defence, Madrid, November 2015.

¹¹² Global Strategy for the European Union's Foreign and Security Policy, *Shared vision, common action: a stronger Europe*, Brussels, June 2016. <http://europa.eu/globalstrategy/en/global-strategy-foreign-and-security-policy-european-union>. Visited 24 August 2017.

¹¹³ Department of Defence, *Report to Congress on Strategy to Protect United States National Security Interests in the Arctic Region*, December 2016. Department of Defence, *Arctic strategy*, November 2013. US Navy, *Arctic roadmap 2014-2030*. US Coast Guard, *Arctic Strategy*, Washington, May 2013.

time, it created a new joint command for the Arctic region and increased the military effort in the area. And, in the new maritime doctrine, the Arctic and Atlantic fronts are specifically pointed out as their main concerns, as well as the need to reinforce the presence of the Russian Navy in the Arctic and Crimea»¹¹⁴. Of course, the rest of the Arctic nations also develop policies for the presence of their armed forces in the increasingly disputed Arctic waters. Thus, for example, the Canadian Ministry of Defence, among other actions, will actively promote its presence in the area, will continue with the construction of the special Patrol boat for the Arctic, will finance a programme of surveillance of the area with \$133 million in five years to «Improve intelligence on possible challenges posed by foreign military forces...», will hold regular exercises in the north that will include the participation of rangers and improve the readiness to conduct operations in the region¹¹⁵.

Other aspects related to the high temperatures of both the air and the sea, have already, and will have in the future a greater influence on the operation of personnel, platforms and weapons systems and, of course, their future designs. «The change in weather conditions and the increase in extreme weather events, including high and low temperatures, drought and floods... have a significant impact on operations. These circumstances include a greater risk to life, physical security, with an increase in injuries, and a degrading effect on the performance of the mission... Numerous military studies cite weather conditions as one of the main factors in the battle, with examples from the Revolutionary War to Operation Desert Storm».¹¹⁶

In this sense we can mention here the comments of the commanders of the ships of the operation Atalanta, on the impossibility of its units reaching maximum speed to attend calls for help from vessels threatened by Somali pirate ships, due to the increase in sea temperature and, another example, with the *New York Times* recently publishing the news of mass cancellations of flights in Phoenix due to high temperatures¹¹⁷.

¹¹⁴ Ibídem, GARCÍA SÁNCHEZ. «The Arctic», p. 109. Some news about the military effort in the area: <http://www.bbc.com/news/world-europe-34391961>, «Russia builds an air defence base in the Arctic», 29 September 2015. <http://www.bbc.com/news/world-europe-39629819>, «The new Russian military base «clover» in the Arctic unveiled through a virtual tour», 18 April 2017. Visited 23 August 2017

¹¹⁵ Department of National Defence and the Canadian Armed Forces, *2017-2018 Departmental plan*, 2017.

¹¹⁶ WEATHERLY, J. W.; HILL, D. R. *The impact of climate and extreme weather events on military operations*, U.S. Army Engineering Research and Development Centre, New Hampshire, December 2004. p. 1.

¹¹⁷ WICHTER, Zach. «Too hot to fly? Climate change may take a toll on air travel», *The New York Times*, 20 June 2017. <https://www.nytimes.com/2017/06/20/business/flying-climate-change.html>. Visited 24 August 2017

Other characteristics such as acidification, salinity, density and possible modification of marine currents are important factors in underwater acoustics. Although, as the World Economic Forum of Davos says, more information has been collected from the oceans in the last two years than in the rest of the history of the planet, the sea is still unknown. «Less than 5% of the volume of the oceans is monitored comprehensively». Along this line the North American Navy on 24 March 2017 reported the establishment of a *Task Force Ocean*, to advance in the knowledge of oceanographic sciences in order to maintain the competitive edge in the sea domain below the surface. Although global capabilities are insurmountable, the gap is closing and we cannot be complacent. It is time to increase the commitment to knowledge to stay ahead of potential competitors»¹¹⁸.

Continuing with the seas and oceans, the rise in sea level presents a formidable risk for military installations near the coast, some quite threatened, especially when combined with extreme weather events such as hurricanes or large storms. A sample of the scope and concern can be seen in the video of Arnold Schwarzenegger's visit to the Norfolk Naval Air Base¹¹⁹, where the NATO headquarters of the Transformation Command is also located.

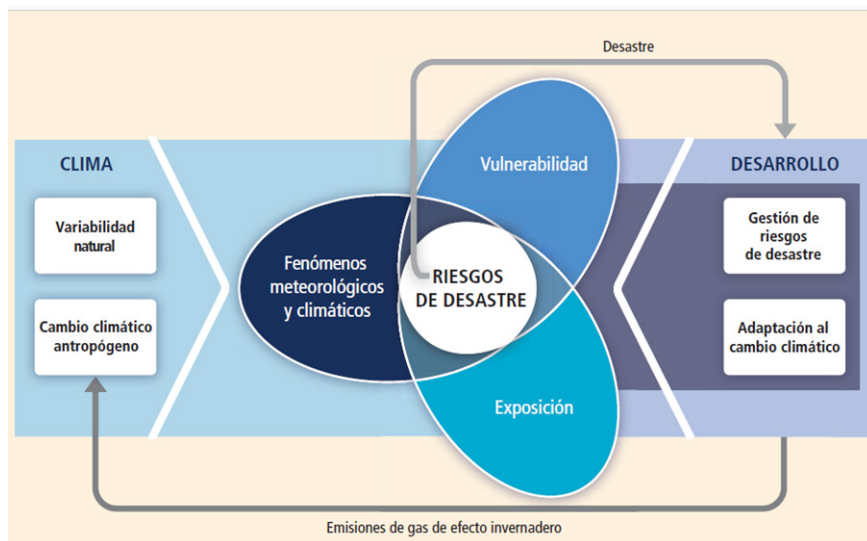
This aspect, the extreme weather phenomena, is another of great transcendence, which expands the missions of the armed forces and is very important in the perception of the military institution by society as a whole. In this sense, the retired Admiral James Stavridis in his last book (June 2017), *Sea power, the history and geopolitics of the World's Oceans*, suggests making Guantánamo an international base whose mission is to help in cases of natural disasters and humanitarian disasters in a particularly threatened region.

The special report of the intergovernmental group of experts on climate change, *Managing the risks of extreme weather events and disasters to improve adaptation to climate change*, of 2012 (see figure 11) has only been corroborated and, thus, two days before the celebration of world weather day, 23 March, the director of the world climate research programme of the UN World Meteorological Organisation declared that «even without a strong Niño in 2017, we are seeing remarkable meteorological phenomena across the globe that defy the limits of our understanding of the climate system. We are in an unexplored territory»¹²⁰.

¹¹⁸ Department of the Navy, *Navy announces launch of Task Force Ocean, plans to advance ocean science*, Office of the Oceanographer of the Navy, 24 March 2017. http://www.navy.mil/submit/display.asp?story_id=99455. Visited 24 August 2017

¹¹⁹ You Tube, *Arnold Schwarzenegger - Climate Change's Threat to the U.S. Navy*, 27 June 2017, <https://youtu.be/WzEZv1JRGA>. Visited 24 August 2017

¹²⁰ World Meteorological Organisation, «Climate breaks multiple records in 2016 with global impacts», 21 March 2017 <https://public.wmo.int/en/media/press-release/climate-breaks-multiple-records-2016-global-impacts>. Visited 24 August 2017.



Graph 11 Handling of the risks of extreme weather events and disasters to improve adaptation to climate change.

Undoubtedly, «climate change in among the future trends that will impact our national security. Increased global temperatures, changes in rainfall patterns, sea level rise and more extreme weather events will intensify the challenges of global instability, hunger, poverty and conflict. They will likely cause shortages of food and water, pandemics, disputes over refugees and resources, and destruction by natural disasters in regions around the world»¹²¹.

The increasing frequency and severity of the disasters caused by these phenomena is driving society to demand the intervention of the State which has, in its Armed Forces, a very valuable instrument for its 24/7 availability, autonomous capabilities, and ease of projection. From the struggle to contain their spread in the focus of pandemics, to the delivery of food and drinking water supply in the most remote places, through the rescue of entire populations at risk or during the materialisation of natural disasters, the supply and rehabilitation of basic social services in support of civil authorities who, time and again, are overwhelmed by the size of the events. In Spain, a paradigmatic example is the Military Emergency Unit, in this case specially organised and prepared to fight the forest fires that year after year devastate the forest mass of the peninsula and the archipelagos.

One, increasingly versatile, model followed by many nations and, moreover, in the specific case of Ibero-American countries, allows military institutions historically focused on internal security police missions to be transformed into modern national defence organisations with specific missions in support

¹²¹ Department of Defence of the United States, 2014 *climate change: adaptation road map*, foreword.

of civil authorities during humanitarian catastrophes and natural disasters, in addition to actively cooperating in peace, security and international stability, collaborating in United Nations missions and peace operations.

Regarding the human factor, without a doubt, and we are seeing it today, the Armed Forces will be required to collaborate with the civil authorities in support of the State Security Forces and Corps for the control and stabilisation of migrations. A phenomenon caused by many factors, but which, if not directly caused by climate change, is exacerbated by its consequences. In addition to the example described above, we can not fail to mention the case of operation Sofia (see figure 12)¹²²; and the NATO operation *Sea Guardian*¹²³, the evolution of the operation *Active Endeavour*¹²⁴, during the European refugee crisis. Missions that, due to their characteristics, always question the adequacy of the military forces for these purposes¹²⁵.

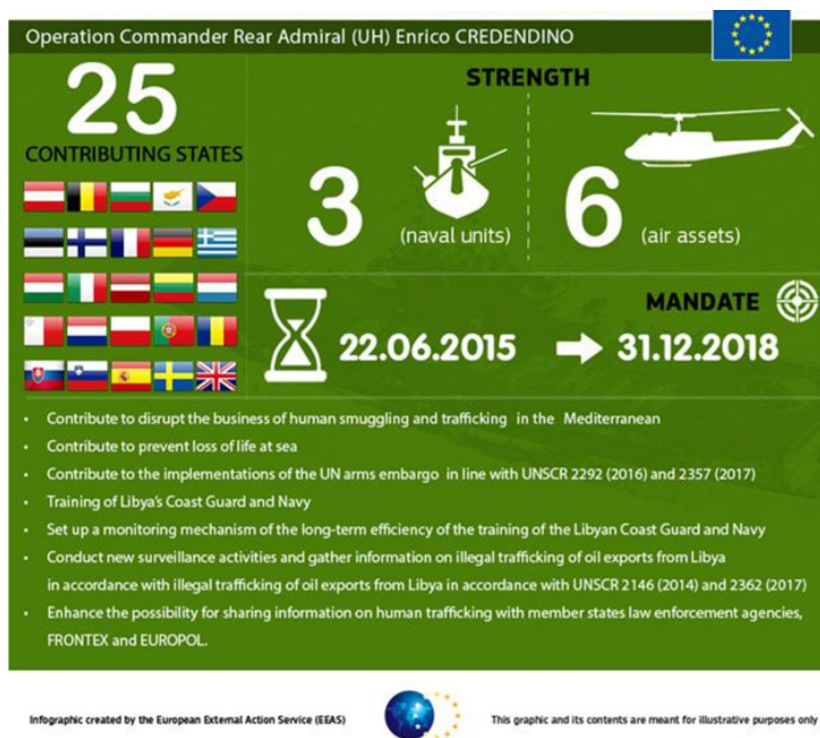


Figure 12

¹²² https://eeas.europa.eu/csdp-missions-operations/eunavfor-med_en. Visited 24 August 2017.

¹²³ <http://www.mc.nato.int/missions/operation-sea-guardian.aspx>. Visited 24 August 2017.

¹²⁴ Anti-terrorist operation in the Mediterranean, which began after the terrorist attacks in New York and Washington on 11 September 2001.

¹²⁵ DEL POZO, Fernando. «The NATO naval forces and the refugee crisis», *Bulletin of the Spanish Institute of Strategic Studies*, (Bie³) no. 2, 2016, Ministry of Defence, Madrid, September 2016, pp. 419-430.

The Armed Forces are more committed than ever to the socio-political environment that serves as their framework. Using the famous quote from Abraham Lincoln, widely used and expanded by Barack Obama, the Armed Forces must be more than ever «of society, by society, for society, and with society.» The opportunities offered by the universal challenge¹²⁶ of climate change to show the most human, social and committed face of the Armed Forces will deepen and expand; it is just a matter of asserting the principle of being the first servants of society. In addition, the change of sociopolitical paradigm moves us to a new reality where two domains, cyberspace and environment, become the scenarios of debate and uncertainty and present themselves as challenges of such magnitude that few institutions, in addition to the Armed Forces, can aspire to lead their management and guarantee a minimum degree of certainty and security that contributes to giving that social and political transformation a human sense. In line with the values that represent: «Unity, loyalty, courage, commitment, spirit of service, companionship and respect»¹²⁷, or as the social responsibility report of the US Department of Defence sets out: «duty, integrity, ethics, honour, courage and loyalty»¹²⁸.

With the global warming of the planet due to an economic system created out of the industrial revolution, the centrality of fossil fuels in a sustainable economic development is answered. A new little explored and largely unknown horizon becomes evident to society and is inexorable. A future that seems designed by military engineers and that tends to reduce the vulnerability of the logistics supply chains of fossil fuels. The autonomy, the scalability, the technological development, the interoperability, resilience, its diversification..., a whole rosary of operating advantages that should allow the effort of the public policies of research and development in alternative energies to be led.

If we started the section with the area where climate change has a more direct impact, we ended it with the institution that is most involved, most attentive and concerned over its implications. In short, with the quote with which we began the chapter, with the institution «military. They are, after all, where the *shock* of the new will strike first.»

If we analyse the implications of climate change through the DOTMLPFI spectrum of military functions, we will see that the transformation of the

¹²⁶ «Certainly, what I find really fascinating and provocative is that climate change is the mother of all threats. It is the first threat that concerns all the countries of the world at the same time, from which no continent escapes. This has never happened before. Climate change is different [from any other risk]. It is the first universal threat that can only be solved universally». Quoted by *Ibidem*, GARCIA SÁNCHEZ, *Climate change: implications for security and defence*, p. 183

¹²⁷ *Ibidem*, COSPEDAL, «Easter Military Address 2017», p. 3.

¹²⁸ *Ibid*, US Department of Defence, «FY 2016 DoD annual performance report», p. 8

institution is already a fact in many cases, but will require a much deeper and wider cultural transformation in the future, as the phenomenon develops.

The doctrine, sense and purpose of the institution evolves constantly and even more when it has to face a global challenge that has precise characteristics and many areas of uncertainty. As a risk in itself and as a multiplier of threats, climate change appears in all national security strategies and is therefore transferred to the military doctrine communicating concepts, such as resilience, strategies, like operational energy, processes and plans, and the very culture of the institution. The confirmation session of the North American Secretary of Defence, General James Mattis, under the presidency of Donald Trump, attests to this¹²⁹.

The organisation is also pressured by its most immediate effects. In addition to the creation of specific units in many cases, the need to deploy any of its units in any part of the world immediately to act autonomously implies a considerable effort in strategic, operational and tactical transport. The need for real-time information and robust command and control systems (C2ISR, for its acronym in English¹³⁰), with the capacity to integrate into civilian nodes, is another of the areas of greatest influence.

The training of forces in extreme conditions and circumstances, as well as the assistance of specialised military units for psychological support to victims, is another area that sees how it progressively receives greater attention within the specific military training of their units.

The material, the weapons systems, the platforms, the facilities..., both in their use and design, while seeking the advantage in their operational characteristics, are informed by two collateral requirements: energy efficiency and their capacity for deployment and projection. In this line, logistics, in the field dominated by the phenomenon of climate change, would be above strategy and tactics, the three main branches of the art of war according to Baron Antoine Henri Jomini (1779-1869). The need to maintain a constant flow of basic necessities at the beginning to subsequently maintain adequate distribution of goods and re-establish the essential social services, become fundamental objectives. In addition, they receive all the focus and media attention, which analyses their effectiveness and execution in real time through the media and social networks around the world.

Leadership and personnel are the basic pillars of any institution and, therefore, of its transformation process. On their professionalism, spirit of service, discipline and empathy, the indexes of trust and support to the military institution will be structured. The adaptation of its principles and values to those of the society from which it arises will be the reference of its

¹²⁹ https://www.armed-services.senate.gov/hearings/17-01-12-confirmation-hearing_-mattis.

¹³⁰ Command, Control, Intelligence, Surveillance and Recognition.

value as the basic organisation of the State; in addition to its transformation capacity to face a future in which the uncertainty of the impact of the phenomena associated with climate change will create continuous crisis situations¹³¹. In short, a process that must consolidate the institution in a position of centrality in the necessary social cohesion with which to face the future.

The infrastructures of Defence are threatened in a special way by the phenomena associated with climate change. Most of these facilities are located in very vulnerable areas due to their special functions and basic characteristics. The thaw, the rise in water levels, extreme weather events, high temperatures... In addition, an additional effort is required, as an exemplary institution, to achieve greater energy efficiency objectives and environmental sustainability criteria. Never forgetting its fundamental mission of supporting the forces that use them and civil society in emergency situations.

Finally interoperability; the ability to work in an international environment with military forces from other countries and together with civil society in a coherent, effective and efficient way to overcome the most desperate situations is increasingly a must. The planning of new operations will no longer be defined as a whole¹³² or combined¹³³; this is already an innate characteristic. It will be comprehensive, that is, together with civil organisations for humanitarian aid and reconstruction support, with emergency personnel, police forces and social assistance. All together on the same front line and never again will the civil elements be a delayed step. They will also, along with military personnel, have to put their safety at risk to help other people, anywhere in the world, under any circumstance.

Conclusions and perspectives

«... «Is humanism really human?»..., introduces us, courtesy of Cary Wolfe (1959-), to the concept of «post humanism». The professor immediately points out that it does not mean either anti-humanism, or after-humanism, or anything that means that humanity loses its centrality in relation to the world around it. But it does transcend the traditional outline of discrete domains: of the human, the animal, the natural

¹³¹ See AZNAR FERNÁNDEZ-MONTESINOS, Federico. «Civic military collaboration», and SALDAÑA GARCÍA, Juan. «Military unit of response to catastrophes», in Spanish Institute of Strategic Studies, Document of Work, *Relations and military civic collaboration*, in <http://www.ieee.es/publicaciones-new/documentos-de-trabajo/2016/DIEEET13-2016.html>. Visited 25 August 2017.

¹³² Whole refers to the integration under a single command of forces of the Armies and the Navy of a country.

¹³³ Combined refers to the integration under a single command of forces of different countries.

or the mechanical, demanding a much more transversal, multidisciplinary and integrating thought of an increasingly complex and inseparable reality. A story in which «the properly human» is only part of the story; is integrated into a greater, and in many ways, non-human set of contexts and forces»¹³⁴.

The State recognises itself before the challenge that the phenomenon of climate change represents as the fundamental actor, its main opponent. Despite the diffuse nature, the uncertainty in its development and consequences, its universal character and the heavy scientific basis that accompanies it, it does not seem that in the present century we are witnessing the birth of an international structure different from that inherited from the Westphalian peace and the philosophy of the State based on the social contract, to tackle the problem. And within that structure, one of the basic pillars of its sovereign authority, its Armed Forces.

In the judgement of history, when the State and its Armed Forces are heard in the dock of those accused of «ecocide»¹³⁵, we will have to testify against ourselves and prepare the arguments in our defence with new bonds of political solidarity, a re-foundation of society through a «*post-humanist*» culture with original forms and different practices that reconcile us with the ecosystem, and a new sense of the institutional legitimacy of the military world that transcends the «three factors that support this claim: the first, the universality of the claim, which knows no geographical limits or historical differences; the second, the characteristic of the crime that is existential, on the very essence of the meaning of humanity; and the third, that the established legal order is questioned because the responsibility is shared and can not be imputed individually»¹³⁶.

An existential, shared and universal responsibility that should not be an obstacle to recognising the social commitment of the military institution, a fundamental part in the historical development of the geopolitical framework on which the future must be shaped. The Armed Forces have to reinforce their role as guarantors of peace, the tolerant coexistence of society and the legal framework that makes it possible, as an integral part of the society it serves. The political reason that justifies its existence must be a «constant intellectual commitment» to face violence in all its forms, cultural, structural and direct, against the existence of life, «guided by the lessons and warnings of centuries of unnecessary devastation» as Hanna Arendt (1906-1975) defended¹³⁷.

¹³⁴ GARCÍA SÁNCHEZ, Ignacio José. «Power and violence: the conflict of the second half of the 21st century», *Bulletin of the Spanish Institute of Strategic Studies (bie³)* no. 7 Ministry of Defence, Madrid, pending publication. It can currently be found at: <http://www.ieee.es/contenido/noticias/2017/08/DIEEEA43-2017.html>. Visited 26 August 2017.

¹³⁵ *Ibíd.*, GARCÍA SÁNCHEZ. «Power and violence», pp. 5, 6.

¹³⁶ *Ibíd.*, GARCÍA SÁNCHEZ, «Power and violence», p. 6.

¹³⁷ EVANS, Brad. «What does it mean to be human in the 21st century?», *The New York Times*, 28 February 2017.

An integral and permanent transformation of the military institution in all its areas, from doctrine to interoperability, becomes more necessary than ever, in which leadership and personal values and attitudes will be fundamental. And over which will the all powerful energy permanently overfly with its vertebral role in the execution of any mission, demanding and decisive. Without a new energy culture, transversal in all its areas, the transformation will become a change, an evolution, a mere adaptation.

Climate change, with all its dramatic responsibility, offers an opportunity for that change of culture, for that necessary transformation of this institution that will continue to make possible its most dramatic extremes, «the continuation of politics by other means», but in this case, not only to make war against the existential challenge of other social groups, but also and perhaps more frequently, to help them and support them in the face of natural disasters and humanitarian disasters.

An example of this attitude is the 13th exchange between the armed forces of China and the US in the management of humanitarian disasters. The 2017 exercise develops a flood scenario in which the two armies are required by a third state to form part of a Multinational Centre for Coordination of support operations for civil authorities in the management of the catastrophe. In the words of General Huang Taoyi of the 75th group of the People's Liberation Army: «We are ready to work together with our friends in the US to actively implement the consensus reached by our two national leaders and make concerted efforts to make this year's exercise more practical, more integrated and thus improve the capabilities of the two institutions in support operations in natural catastrophes and humanitarian disasters»¹³⁸.

¹³⁸ U.S. Department of Defence. News articles. U.S., Chinese troops attend disaster management exchange. 11/24/2017

Video resume



Chapter six

Climate change and the Spanish Armed Forces

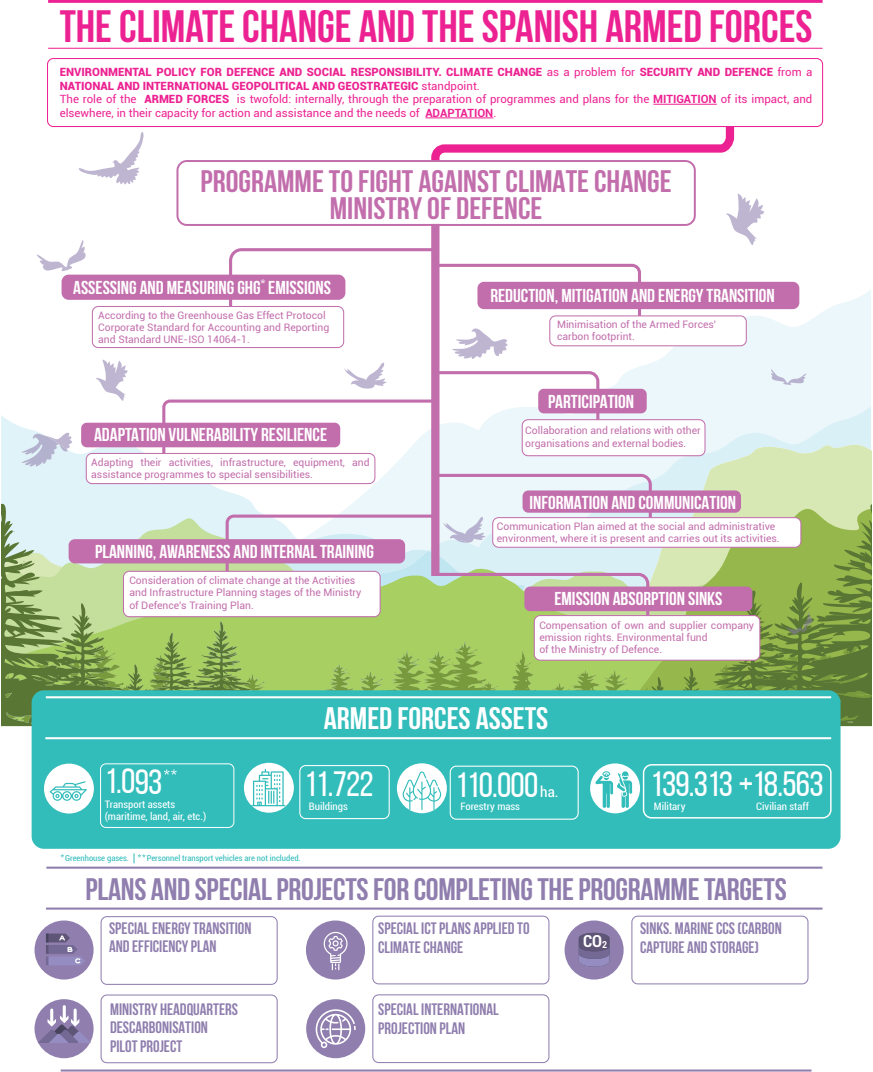
Juan Antonio Rico Palma and Francisco Rodríguez

Abstract

Ministry of defence deals with the serious problema, -environmental, social, economic and geostrategic. Of the climate change. Concern for the care and respect for the environment at the heart os the Spanish armed forces is a rising value and one of the challenges with the greatest enthusiasm is facing.

Keywords

Climate change Spanish Armed Forces, Ministry of Defence.



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The role(s) of the Armed Forces in Climate Change

Climate Change multiplies the complexity of the strategic scenario we have to face in the 21st-century, which is already marked by uncertainty.¹

That's right, Lord, what we were explains what we are. The history of the construction of our Spain is read along with its military history. And thus we continue, making history, making Armed Forces and making Spain².

The national security challenges that affect society are very complex. The dimensions that certain threats and risk acquire and their clear cross-cutting yet open and uncertain nature are factors that indicate that any response implying different national security players and instruments will be stronger and more efficient if embarked on in a coordinated fashion.

Our national security system has made a significant stride forward in terms of its regulations and structures in the last five years, with the passing of the National Security Act 36/2015 and other regulations which extend and complement it.

Within this framework, the Armed Forces participate in the structures of the national security system in multiple areas, such as maritime security, the protection of infrastructures, action in the face of catastrophe, with the Military Emergency Unit etc.

Aware of the environmental problem surrounding us in recent decades, in the 1990s the Ministry of Defence launched a series of initiatives intended to safeguard and preserve the environmental values of its bases, barracks and establishments so that future generations might enjoy a decent and healthy environment.

Concern for the care and respect of the environment within the Spanish Armed Forces is therefore an increasingly important value and one of the challenges the Ministry of Defence has been facing with most enthusiasm and determination for some years.

Furthermore, the perception of society plays a very important role in the fight against climate change. The economic, social and geo-strategic repercussions are of great importance, as the fight against climate change has a bearing on strategic areas such as the energy sector, for example. It may also lead to a change in the behaviours of society and the promotion of energy efficiency or a change in our food habits.

All of this means that the Armed Forces have to assume an exemplary role in the fight against Climate Change. The regulation of the protection

¹ Carme Chacón Piqueras. MINISTRA DE DEFENSA. Seguridad, Modelo Energético y Cambio Climático

Carme Chacón Piqueras. Ministress of Defence Security, Energy model and Climate change

² Dolores de Cospedal. MINISTRA DE DEFENSA. Discurso de la Pascua Militar 2017

of the environment in the Ministry of Defence started in 1992, when agreements were reached with the now defunct Nature Conservation Institute known in Spain as ICONA. In 1997, to mark the creation of the Ministry of Environment and the restructuring of the Ministry of Defence, which represented a series of new responsibilities for the Director General for Infrastructure, a ground-breaking, solid and effective public sector environmental policy was drawn up and set out in Ministry Directive 107/1997, which outlined a firm commitment against climate change, and one of respect and care for the environment, to be initiated in the Armed Forces.

Criteria followed as compliance with the environmental policy of the Ministry of Defence

The Ministry of Defence has already incorporated into its daily work agenda the necessary actions to grant the best policy and practice to its actions with environmental impact. The criteria that have been followed have been those included in Instruction no. 56/2011 of 30 August of the Secretary of State on Environmental Sustainability and Energy Efficiency, updated by 59/2014 of 4 December. Both are based on the Defence Minister's Directive 107/97 of 2 June:

The bases on which the environmental policy of the Department is based are:

- a) Response to environmental risk. In this sense, the Ministry of Defence will maintain a clear commitment to efficiency in the use of resources, especially in relation to energy consumption.
- b) Management of impact on the environment: The Ministry of Defence will minimise and remedy the negative effects of the impacts of its activity. Likewise, it will develop its activity seeking to generate positive effects in energy saving and efficiency, sustainable construction, eco-efficiency, conservation, protection and, whenever possible, the recovery of environmental conditions.

The principles and objectives of the Department's environmental policy will be implemented through actions related to:

- a) Awareness-raising, training, dissemination and cooperation.
- b) Energy saving and efficiency
- c) The protection of the natural environment and the surroundings.
- d) The prevention of pollution and improvement of environmental quality.

All this, without prejudice to the missions that Article 8.1 of the Spanish Constitution assigns to the Armed Forces.

The Armed Forces as an instrument

The national security challenges that affect society are very complex. The dimensions that certain threats and risk acquire and their clear cross-cutting yet open and uncertain nature are factors that indicate that any response implying different national security players and instruments will be stronger and more efficient if embarked on in a coordinated fashion.

Our national security system has made a significant stride forward in terms of its regulations and structures in the last five years, with the passing of the National Security Act 36/2015 and other regulations which extend and complement it.

Within this framework, the Armed Forces participate in national security structures in a number of areas, including action in the event of catastrophe (with the Military Emergency Unit), Maritime Security, protection of infrastructures etc.

Aware of the environmental problem that has affected us over recent decades, in the 1990s the Ministry of Defence launched a series of initiatives intended to safeguard and preserve the environmental values of its bases, barracks and establishments so that future generations might enjoy a decent and healthy environment.

Concern for the care and respect of the environment within the Spanish Armed Forces is therefore an increasingly important value in one of the challenges the Ministry of Defence has been facing with most enthusiasm and determination for some years.

Actions in the event of catastrophes

The Armed Forces have unique abilities to act in the safeguarding the safety of citizens and their properties and activities. This area of work seeks to identify what specific and special measures, systems and units are needed to ensure that action in the face of a disaster or threat caused by climate change is as rapid and effective as possible.

The creation of the Military Emergency Unit as a joint command of the Armed Forces operative structure was an important step forward. It is tasked with intervening anywhere in the country and in authorised operations abroad to contribute to the security and well-being of citizens in the event of serious risk, catastrophe, calamity or other public needs.

Armed Forces in the fight against Climate Change

Given their presence, dynamics and intense and very special activity, the Armed Forces (FAS) are generators of considerable emissions of CO₂ and other greenhouse gases (GHG) and they have or can have means (human

and material), capabilities, experience and what is most important attitude, organisation and idiosyncrasies to act from the first moment before the threat or reality allegedly attributable to Climate Change.

This is why we should consider the role of the Armed Forces in the face of Climate Change as a dual one. This is:

- Climate change in the internal environment of the Armed Forces
- Planning, programmes, training, internal awareness for the preparation of the Armed Forces so that their impact, emissions, carbon footprint or effects on the environment that can accelerate climate change is minimal and at some point the objective of «Armed Forces, Carbon 0.0» might be reached.
- Capacity for action and assistance in the event of catastrophes in the country or where its presence is needed
- The Armed Forces have unique abilities to act in safeguarding the safety of citizens and their properties and activities. This area of work seeks to identify what the specific and special measures, systems and units must be so that their action in the face of a disaster or threat caused by climate change is as rapid and effective as possible.

Carbon sinks

The land where the Armed Forces carry out shooting training and manoeuvres are spread around Spain, and the variety of their natural wealth contains a representation of most of the most important geo-biological formations of the country. The environmental concern shown by this Unit has led the Ministry of Defence to promote environmental actions in affected natural areas to prevent damage to the surroundings, facilitate its preservation and contribute to the environmental quality and the fight against climate change.

Forests in Ministry of Defence land contribute to the fight against climate change with more than 132,000 tons of CO₂ absorbed each year by 26,635 hectares of tree mass, thus meeting the Kyoto requirements.

These forests are managed with the utmost care, as highlighted, for example, by the Fire Prevention Technical Plans drawn up by the Ministry of Defence and approved by the MAPAMA according to the Hills Act 43/2003, now with 100,000 hectares of military properties included in these Plans.

Aspects of internal resilience of the Armed Forces in the face of climate change

When a country is impoverished due to its military operations, it is because of the transportation of provisions from a far-off place. If you bring them from such a place, the people will be impoverished.

If the generals are unable to take advantage, even knowing the conditions of the land, they cannot use it.

If they are commanding armies but ignore the arts of total adaptability, even though they know their objectives, they are unable to make their soldiers fight for it.³

This is not the right place to theorise on the concept of resilience, but we should discuss the style of the action that ensures resilience and that which does not. As a sign of the times, in most Armed Forces' facilities and buildings the lighting is being switched over to LED technology. This change produces low electrical consumption, with an indirect reduction in the emission of greenhouse gases. This might be seen as a way to combat climate change, but it does not demonstrate resilience. If the Armed Forces changed all of their boilers to consume less diesel in heating, a great deal of emissions could be avoided. This would also be a good way to combat climate change, although again, without providing resilience. The best way to be resilient is to be independent of the distribution networks.

For Spain, in particular, the supply of oil and natural gas has a large risk component, due to the possible instability of the producer regions. Fossil fuels and serenity did not go together when God spread his gifts over the Earth.

As far as temperature control is concerned, a good formula would be the use of biomass, which relieves us of the distribution channels and is also emissions-neutral. However, any supply from cultivated biomass would see a strong social response due to the appropriation of land and crops that would no longer be used in food production.

The use of biomass from forest treatments may be a good solution, provided the continuity of pellet producing companies can be guaranteed. Both forest treatment and transformation are undertaken by national companies.

Another approach would be to use waste to obtain either electricity or diesel. Although it seemed ridiculous and fictitious when we saw Doc fill the generator of the DeLorean with rubbish in «Back to the Future», this transformation is now possible in Spain. The Armed Forces collaborate in two different technological programmes which obtain diesel from waste matter.

Bases for a programme of actions by the Ministry of Defence as a contribution to the fight against climate change

To talk about climate change is to talk about the environment, but also about the model of energy, international cooperation and security. It is one of the factors that most determines the future of our planet and

³ Sun Tzu. El Arte de la Guerra. Sun Tzu. El Arte de la Guerra

therefore it will determine how they will live and how the societies that inhabit it will relate to them.⁴

Climate change is one of the biggest current challenges facing society. Its effects are not patent or of immediate perception, but they are degrading the environmental conditions, and by direct or indirect influence, the economic, in which the life of man and his natural resources is developed».

The Ministry of Defence is well aware of the need to collaborate and strengthen the joint action undertaken by national, European and international institutions to combat Climate Change.

The global and inclusive measure adopted by the Ministry of Defence in its positioning and response to Climate Change is to develop an **open and participatory** Programme to combat Climate Change in the two areas mentioned above and whose premises, objectives, references and actions are broken down throughout this document.

Climate Change is a global problem, in which the institutions responsible for the defence and security of our society (population, activities and the environment) can play an important role both in prevention and fight and in the relief of possible disasters.

The Armed Forces are responsible for this problem from three different points of view:

- From a direct or **personal** aspect, as citizens who are the members of the Armed Forces
- From a **legal** and **regulatory** point of view since the Armed Forces, with the exceptions given by their own defence function, have to comply with State regulations and Government commitments.
- And a third singular vision for the Armed Forces, the **strategic** one, which is to be very attentive to the events that may come from Climate Change, such as environmental disasters, human migrations, variations in energy policies or circumstances, or in short, in the consideration from a military point of view of a harmful and negative phenomenon that knows no borders and that, like few others, fulfils the assertion that «everything is related to everything» and our Armed Forces must be prepared for any eventuality, as in fact has already happened and their presence and performance is outstanding in the so-called «Humanitarian Missions» in which our Armies collaborate in different parts of the World.

The strategy addressed by the Ministry of Defence is an exercise to raise awareness of the serious problem (environmental, social, economic and geostrategic) that climate change poses.

⁴ Carme Chacón Piqueras. MINISTRA DE DEFENSA. Seguridad, Modelo Energético y Cambio Climático.

The Armed Forces have a series of very important functions in a modern society on top of their traditional role in the face of new obligations and missions resulting from the evolution of society in economic, social and, in this particular case, environmental aspects that influence or may influence not only the other two, altering the process of sustainability that is one of the objectives of the same, but much more important circumstantially and structurally, disasters with serious consequences for human populations, their means and their activities.

The Programme that the Ministry of Defence addresses in terms of the fight against Climate Change has three main guidelines or supports, the first being related to the seriousness of this phenomenon, that is:

Climate Change, as a global environmental threat that knows no borders and whose damage is practically unpredictable in its signs, but which knowledge of, attention to and prevention of can alleviate its disastrous effects through previous measures. Therefore, the first task of this Programme is to fulfil the regulations of the Government to know and minimise the carbon footprint as best as possible, to reduce its emissions, to increase its absorptions through its natural resources such as forests (more than 100,000 hectares of tree and shrub vegetation) natural carbon sinks, offsetting measures, internal training and external information, special programmes, etc., so that the Ministry in its presence, actions and activities is as close as possible to «*zero carbon*» in line with the Government's commitments in this regard.

Another consideration is that the Ministry of Defence feeds off scientific, legislative and documentary sources and references on Climate Change that have previously been clarified by consensus and institutional acceptance.

The Ministry of Defence programme of fight against Climate Change is inspired and adopts references of any kind coming from the different administrations or competent bodies and under the United Nations Convention on CC (IPCC, COP's, etc.).

From this responsible, analysing and foreseeing effort, scientific knowledge has emerged that transformed into recommendations, alarms, work groups, entities, advice, models, scenarios and later of this institutional area, are now mandatory regulations or of interest and timely attention by citizens, companies and institutions.

These regulations try to minimise the human actions that contribute to this climate change as a phenomenon that is already considered a global threat, even if it is not understood in a unanimous and uncontroversial manner. These measures are intended to raise awareness and provide society with timely and appropriate preventive and mitigating measures of the possible effects produced and which will be produced by Climate Change not only in our territories; because given that it is a global threat, the collaborations, solutions and actions have to be global.

A reference of singular importance for this work will be the guidelines that can be obtained from the documents already made or in preparation of the Armed Forces of the NATO environment.

This programme has been conceived and is being carried out with an open and participatory character.

Open to provide it a dynamic character and continuous updating with the evolution of the phenomenon of Climate Change itself and the continuous developments that occur in the scientific, social, economic, environmental and of course regulatory arena regarding this phenomenon.

Participatory, because collaboration and participation are sought of all those entities that due to their experience and technical or scientific specialisation can contribute values of improvement to this Ministry of Defence programme.

One of the most valuable participations for the carrying out of this Programme to fight against Climate Change, is precisely this document which, within the objectives of the Spanish Institute for Strategic Studies, will provide those responsible for the Ministry of Defence with a series of references, arguments and guidelines that will surely be very useful for this programme.

These large references, along with others that are considered appropriate and timely are some of the bases for the configuration of this programme which aims to collect and be the reference of what the Ministry of Defence has been doing or is doing in its fight against Climate Change in its desire to serve



Spanish society, having a modern and effective programme as a tool in the heart of the Armed Forces, with the aforementioned objectives:

Ministry of Defence's programme to combat climate change

The Ministry of Defence addresses the immediate future regarding the threat of Climate Change through the identification, organisation and coherence of actions to obtain the objectives set out in the Government's instructions on Climate Change, within the two major areas of consideration, that is, the Fight against climate change in the internal environment of the ARMED FORCES and the ability to act and help towards problems in the national territory or where their capabilities are needed.

It is clear that the priority task initially for the Ministry of Education is in that first line of the general concern for the phenomenon of Climate Change, that is, the identification and analysis of possible sources or internal actions or brought from outside of GHG emitters, their characterisation, the planning of actions and their execution in the fight against Climate Change within the Armed Forces.

The characteristics and competences of the Ministry of Defence open a wide range of resources, sectors and incidents that are directly or indirectly influenced, can influence or can have an active or passive role in the complex panorama that has emerged from the awareness of the problem of climate change and of the measures taken so far or that will be taken in the future to alleviate both the effect of human activities on that change and the effect that this change has and will have in people, in the resources they need and in their activities.

In principle, the following list of sectors and resources has been established.

- Air, water (marine, continental and subterranean), geobiodiversity, soils, waste, energy, defence territories.
- Actions, materials and products of environmental impact, specific materials of military activity.
- Economic activities. Green procurement, companies that collaborate with the Ministry of Defence in its climate change programme.
- People. Effects of climate change on the health of the personnel of Ministry of Defence, Society. Awareness, Dissemination, Environmental education and Good environmental practices. Activities for the public.

Although it seems already accepted that the problem of climate change is not only a problem related to the environment, this factor is determining in the basic and initial conception for the design of a series of measures that aim to limit the negative impacts of climatic alteration.

In turn, this programme must make it possible to:

- Identify the main sources and activities that generate the greenhouse gas emissions of the Ministry of Defence activities.
- Obtain and communicate accurate and credible information on greenhouse gas emissions.
- Allow the planning of a programme of reduction, mitigation, adaptation and offsetting of emissions.
- Provide the necessary tools and training for the Ministry personnel to participate in the periodic measurement and reduction, and
- Establish the basis for the verification and independent certification of the results of the carbon footprint measurement.

To carry it out, among others, the UNE-ISO 14064 Standard will be used and in addition, the following principles and requirements will be sought in the process that are typical of any project that claims credibility and validity:

- **Relevance:** include sources of emissions that are appropriate and relevant to the needs of the Ministry.
- **Integrity:** include all relevant GHG emissions and withdrawals.
- **Consistency:** allow significant comparisons between information related to GHG.
- **Accuracy:** reduce biases and uncertainties as much as possible.
- **Transparency:** reveal sufficient and appropriate information on the GHG reference characteristics to allow the recipients of such information to make decisions with sufficient confidence.

The standard of standardisation that will be used, ISO 14064 offers a step-by-step guide for the main tasks to be carried out when measuring and reporting a corporate carbon footprint. Examples of these steps are:

- To identify the references of the GHG emission sources and their function as such for the Ministry of Defence.
- Once those sources of emissions are identified, to classify them in:
 - **Level 1:** *Direct emissions (from GHG sources that are owned or controlled by Ministry of Defence).*
 - **Level 2:** *Indirect emissions from the use of energy (from the generation of electricity, heat or steam of external origin consumed by Ministry of Defence)*
 - **Level 3:** *Other indirect emissions (GHG emissions different from the indirect emission of greenhouse gases by energy, which is a consequence of the activities of the Ministry, but originates from*

GHG sources that belong to or are controlled by other organisations outside the Ministry).

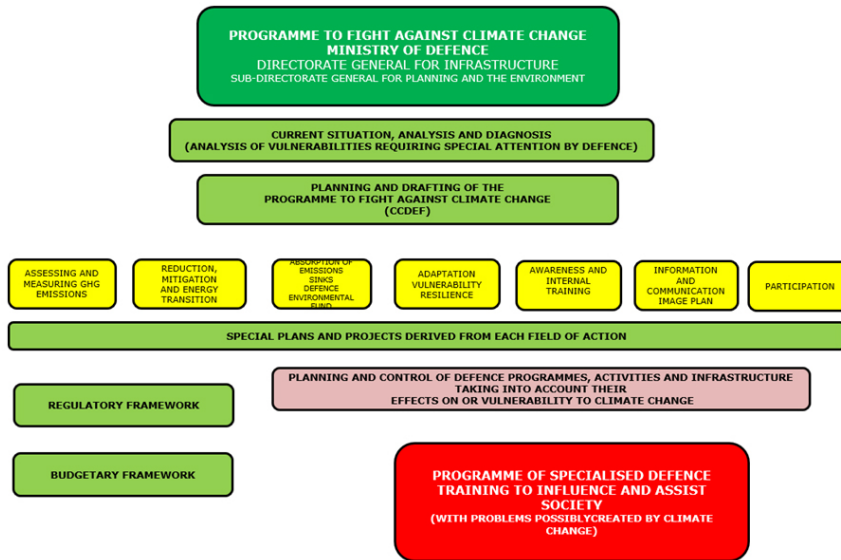
- Collection of information about sources of selected activities.
- Identification of the appropriate emission coefficients to obtain the equivalences between the activity of the Headquarters and the CO2 emissions.
- To carry out the necessary calculations and estimate the degree of confidence.
- Results Report

Given the enormous complexity and environmental, social or economic elements that can affect, and in turn can be affected by a phenomenon as global as active and serious as climate change and on the other hand in the special breadth of the presence and activity of an agency such as the Ministry of Defence, whose main mission is to prevent, be prepared and act for the defence and security of Spaniards, their activities and their socio-economic and environmental environment, it is very difficult to limit what could be elements of attention and lines of action that must be considered in a programme to combat climate change of the Ministry of Defence, both so that their actions that presumably have an impact on climate change are minimal, and so that the negative influence of this on the activities, elements, means and infrastructures that Defence must provide are safeguarded as far as is reasonable and foreseeable.

The programme that the Ministry of Defence has tackled is, first of all, to write down each and every one of those elements that may need to be taken into account in relation to climate change, so that the forecasting exercise of the armed forces is as broad, correct and efficient possible, regardless of the degree of depth that can be dedicated to each of them, which will always depend on circumstances of priority, opportunity, budget and very importantly, the collaboration and participation that can be obtained from other entities that can contribute their experience and resources to the needs of Defence in its struggle to know, reduce, mitigate, adapt or offset the effects of climate change and that none of its effects or factors might take the armed forces by surprise.

In this spirit of fulfilling its obligations to society as best as possible, the Ministry of Defence designs its programme with the criteria of «participatory» and «open», in an exercise of improvement and continuous updating in this very present and serious phenomenon of climate change.

The aspects that, in principle, Defence considers in its programme and which will be developed or continued as circumstances advise or by allowing them to be inserted in the following figure.



Basic contents of the Ministry of Defence's programme to combat climate change

The process of creation of the programme of the fight against climatic change of the Ministry of Defence and the areas of action are the following:

1. Starting point. Ministry of Defence's programme to combat climate change Analysis and diagnosis of the situation. Identification of vulnerabilities of special attention for defence.
2. Conception, design, planning and writing of the programme.
3. Identification, evaluation and measurement of greenhouse gas (GHG) emissions.
4. Reduction and mitigation of carbon emissions. Special programme of energy transition in relation to climate change.
5. Emissions absorption. Sinks. CCS. Compensation of own and supplier company emission rights. Ministry of Defence's environmental fund.
6. Adaptation to climate change. Vulnerability. Resilience.
7. Planning, information, awareness and internal training.
8. Information, communication plan and image abroad. Social media.
9. Participation. Collaboration and relations with other organisations and entities external to Ministry of Defence in relation to climate change
10. Plans and special projects derived from each area of action to achieve the objectives of the programme
11. Applicable regulation. Ministry of Defence regulation. AGE, EU, International regulations

12. Action Plan «Defence and its capacity for action and assistance in the event of catastrophes in the country or where its presence is needed»

Starting point. Ministry of Defence's programme to combat climate change Analysis and diagnosis of the situation. Identification of vulnerabilities of special attention for defence

The Ministry of Defence does not begin its actions to combat climate change with this programme. With this programme, it intends to jointly structure the numerous actions that are already being carried out in the different units of the Ministry, either by the specific ones of the Central Body within the Sub-Directorate for Planning and the Environment or by any of the units of the three forces, as well as other units that, without having a direct relationship with the environment and as a consequence seemingly oblivious to climate change, are already carrying out activities, or infrastructures that thanks to the guidelines provided by the UNE-ISO on environmental quality and on energy efficiency that are implemented and certified in more than two hundred of the 265 units of the Ministry that are scheduled, and although their direct link to climate change is not mentioned, they are in line with the fight against it, which is rationalisation and minimisation of energy consumption, treatment of waste, the treatment of the forests that Defence has, the management of the fleet of land vehicles or of the air or navy fleet, etc.

Some of these actions are directly related and contained in essential chapters of the process of combating climate change, such as the identification of sources and accounting for emissions of CO₂ and other greenhouse gases or the absorptions of CO₂ by natural sinks which are the more than one hundred thousand hectares of vegetation that are contained in the training fields of the Ministry and are mentioned a few pages further down.

And as already been mentioned and to which whole chapters are dedicated, the concern of the Ministry, and as a consequence of this programme, is on the one hand everything related to the identification of own emissions and how to minimise them, as well as their effects, and the identification of «vulnerabilities», the foresight and awareness of which will save many serious problems in the future.

Conception, design, planning and writing of the programme

Considerations for the structural organisation of the programme.

There are five most significant tasks:

1. Identification of the Ministry's objectives in the fight against climate change.
2. Identification of limits and scope of application. Its objective is to determine which sources of emissions to include or not in the measurement

of the carbon footprint (HdC) and their classification on the different levels (from 1 to 3).

3. Collection and evaluation of data. There are several objectives:
 - Identify the sources of data on the emission activity throughout the Ministry of Defence, its personnel (civil and military) and suppliers.
 - Collect activity data and ensure their accuracy.
 - Identify, justify and adopt the emission coefficients that relate activity data with equivalent CO₂ data (CO₂ equ).
4. Calculation and analysis of the carbon footprint. The main objective of which is to be able to use the activity data and the emission coefficients to generate the carbon footprint parameters and prepare the report of the same.
5. Planning of the reduction, mitigation, absorption, etc. of emissions. The objectives are:
 - To identify job opportunities in the short and medium term.
 - To define a roadmap.
 - To be able to draw up and apply a programme for the Ministry of Defence in its struggle against climate change in all the units of the Armed Forces and for all their activities.

Identification, evaluation and measurement of greenhouse gas (GHG) emissions

The broad and powerful activity of the Ministry of Defence points to it as an outstanding generator of CO₂ emissions. Of these activities, the following aspects must be identified:

- Type of emissions considered
 - By source: transport (land, air, naval), energy, waste, defence industry, institutional (people, buildings, equipment).
 - By character: localised, diffuse.
- Characteristics taken into account
 - The identification protocols and the validation and certification of GHG emissions and absorptions of Defence.
 - Carbon footprint of the Ministry of Defence. Concept, Measurement and Emission factors.
- The Computer System of Defence Infrastructures (SINFRADEF) as a possible tool for analysis and management.
- Greenhouse Effect Gases (GHG): Greenhouse gases (GHG): carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFC), perfluorocarbons (PFC), sulphur hexafluoride (SF₆)

- Possible ways to reduce emissions
 - Modification of management processes linked to energy
 - Energy efficiency measures
 - Good practices for reducing emissions

In 2012 and in the spirit of placing the Ministry at the forefront of actions related to the environment and more specifically the fight against climate change, an inventory was begun with the public company Tragsatec of possible sources of greenhouse gases (GHG).

The GHGs that were studied were: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) since, according to the Inventory of Greenhouse Gas Emissions of Spain (1990- 2009), the emissions of these three gases cover practically all of the categories that make up the energy sector.

In this work called «*Methodology for the estimation of GHG emissions derived from military activities*», those that produce GHG emissions and which can do so directly or indirectly were taken into account. The following table shows the different sources of GHG emissions which, a priori, have been identified as a type of activities that are carried out in the Ministry of Defence and that give rise to emissions of the different pollutants.

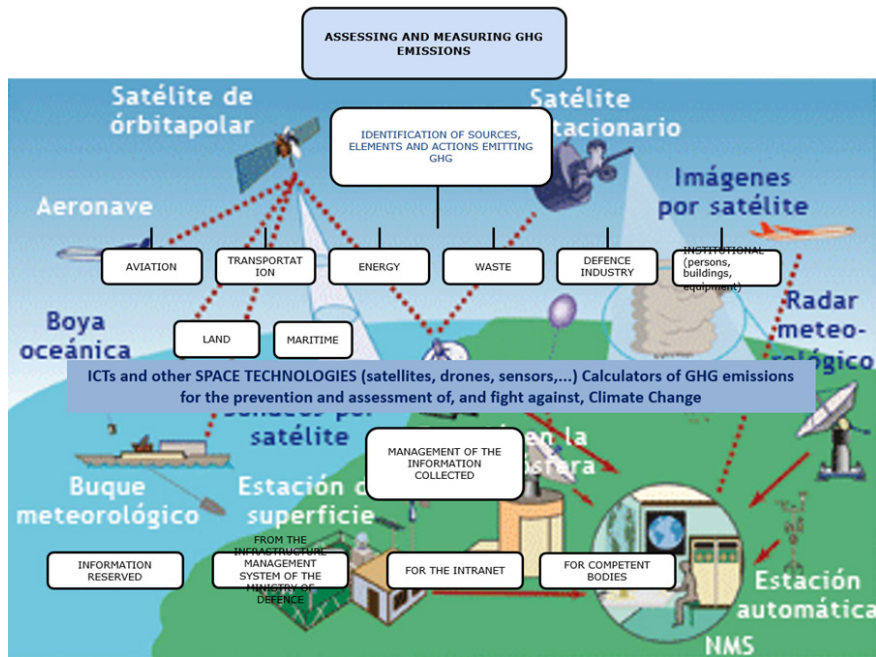
The identification of the activities that each one performs and the adding of different emission sources that can be recognised and are not contemplated in the table shown below, is left for security reasons to each of the different units of the Ministry.

It should be noted that additionally, CH₄ and N₂O emissions were expressed in tons of equivalent CO₂.

		Emission source
Direct emissions	Mobile sources	Aviation
		Maritime navigation
		Land transport
		All-terrain transport (mobile agricultural machinery)
		Mobile machinery
Direct emissions	Stationary sources	Stationary combustion
	Others	Explosives
Indirect emissions	Stationary sources	Electricity consumption

Table 1: Sources of GHG emissions derived from military activities

The methodology that was applied was drawn up according to the Greenhouse Gas Protocol. Corporate Accounting and Reporting Standard and UNE-ISO 14064-1: 2006 *Standard Specification with guidance for organisations, for the quantification and reporting of emissions and circulations of greenhouse gases*.



Reduction and mitigation of carbon emissions. Special programme of energy transition in relation to climate change

This item of the Ministry of Defence's programme is specifically dedicated to the primary task of combating climate change, which is preventive, that is, the reduction and mitigation («human intervention aimed at reducing the sources or enhancing the greenhouse gas sinks.» IPCC) of the emissions caused by the activities of the ARMED FORCES (planning of activities and infrastructures, energy efficiency programme and gradual migration to renewable energies). Minimisation of the carbon footprint of the armed forces and of the emissions acquired from the purchases, supplies and services of supplier companies.

The main activities of this role are the following:

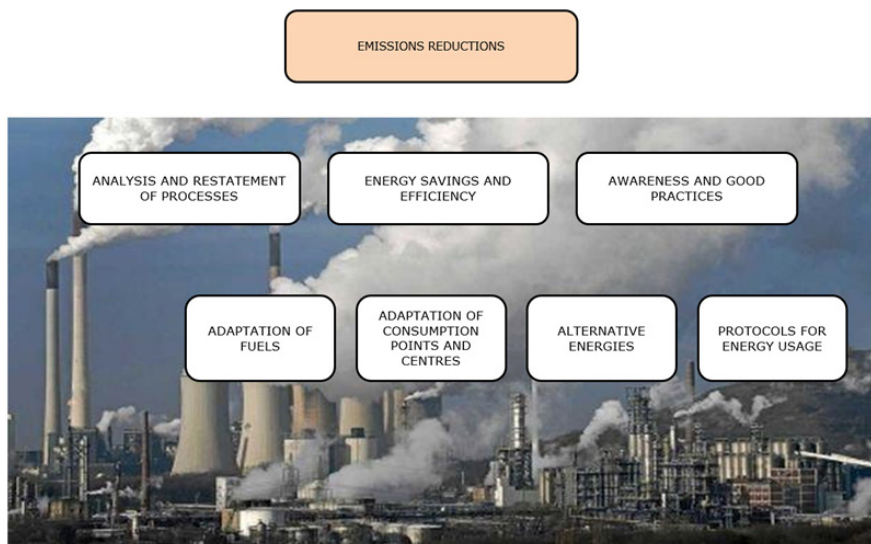
- Analysis, reorganisation and reformulation of work processes or activities.
- Special programme of energy transition in relation to climate change, which among other considerations must consider:

- The necessary autonomy and energy sufficiency.
- Rationalisation of consumption and energy efficiency.
- Plan for the gradual change from the use of fossil fuels to renewable, alternative and complementary energies with special attention to training camps biomass.
- Minimisation by the Ministry supplier companies of the carbon footprint of the products, goods and services provided by them (Marrakesh I).
- Awareness-raising and good individual and collective practices.

The Ministry of Defence, within its programme to combat climate change, assumes the reduction of both electric and fossil fuel energy consumption as one of the measures of prime importance, and of course the greater efficiency of that which has to be consumed. In the Energy Saving and Efficiency Plan that is included in the Ministry's strategy against climate change, it is proposed that the Headquarters of the Ministry itself be one of the first facilities submitted to this plan.

That is why, taking advantage of the effort that must be made within this project, the parallel, complementary and closely related development of the identification, evaluation and measurement of greenhouse gas (GHG) sources, which come precisely from the use of those energy services that are intended to be managed more efficiently, may be appropriate. This is: the definition and calculation of the carbon footprint (HdC) of the activities of the Ministry of Defence, and of the other actions related to the fight against climate change (reduction, mitigation, absorption, compensation, training...) to allow the Ministry to be an institutional benchmark in this serious global concern.

This work of effective carbon management and monitoring of greenhouse gas (GHG) emissions can help the Ministry to achieve the objectives it has set in its environmental policy.



Emissions absorption. Sinks. CCS Compensation of own and supplier company emission rights. Adaptation to climate change

According to the glossary of IPCC terms related to climate change, the term «absorption» refers to the addition of a substance of concern to a specific deposit with adequate capacity and characteristics to retain that substance. In the case of climate change, it refers to greenhouse gases (GHGs). In the same way, «sink» is any process or mechanism that makes one of these GHGs disappear from the atmosphere. A given reservoir can be an atmospheric carbon sink if, during a given time interval, the amount of carbon that enters it is greater than that which comes out of it.

The ideal thing is not to emit those GHGs, but before the actual occurrence of its emission, it is necessary to try by all means to establish absorption measures as the first auxiliary measure of those truly desirable and effective, such as those referring to reduction.

As an ideal sink for the absorption of CO₂ emissions, plant masses (trees, shrubs, herbaceous plants) play a very important role, since in their growth they absorb the carbon that is sequestered during the life of the plant, although the accounting for these absorptions is limited by the Kyoto Protocol to those that have certain characteristics.

The Ministry of Defence has more than 100,000 hectares of land dedicated to manoeuvres and defence training, with plant cover. In 2012, the Ministry with the company Tragsatec carried out the «design of the calculation of CO₂ and other GHG absorptions», which provided interesting data on the absorption capacity of these forested masses (the second phase, relative to the shrub mass, is in preparation). The wooded area that met the Kyoto criteria was 26,635.60 ha and this mass absorbs 132,741 tons/year of CO₂.

Within the special plans and programmes listed below and in relation to GHG absorption, the intention to address the following is mentioned.

- Defence's forest mass/land management programme to maximise their eligibility according to the Kyoto criteria as carbon sinks.
- Do the calculation of the absorptions of the bush masses.
- Analyse the possibilities of revaluing the coastal masses of water available to the Ministry (docks, etc.) as marine sinks of CO₂.
- Create a «Ministry of defence environmental fund» with shooting and manoeuvring fields, forests, subsoil (CAC), special crops, water and marine areas, that can be considered as sinks for the absorption of CO₂ and other GHGs.
- Encourage the supplier companies of the Ministry of Defence to use this Environmental Fund to make their offsetting of non-reduced emissions, within the possibilities provided by Spanish legislation.

Offsetting of emissions, emission rights (TCS) and flexibility mechanisms

In addition to setting emission limits for countries, the Kyoto Protocol established flexibility mechanisms to favour the fight against Climate Change and stimulate sustainable development. On the one hand, they mobilise investments, involve transfer of technology in developing countries and, on the other hand, help the most industrialised to meet their objectives; either by reducing emissions or by capturing carbon from the atmosphere in other countries. These flexibility mechanisms are the following:

- Trading of emission rights or carbon market.
- Mechanisms for Clean Development.
- Absorption of CO₂ through sinks.

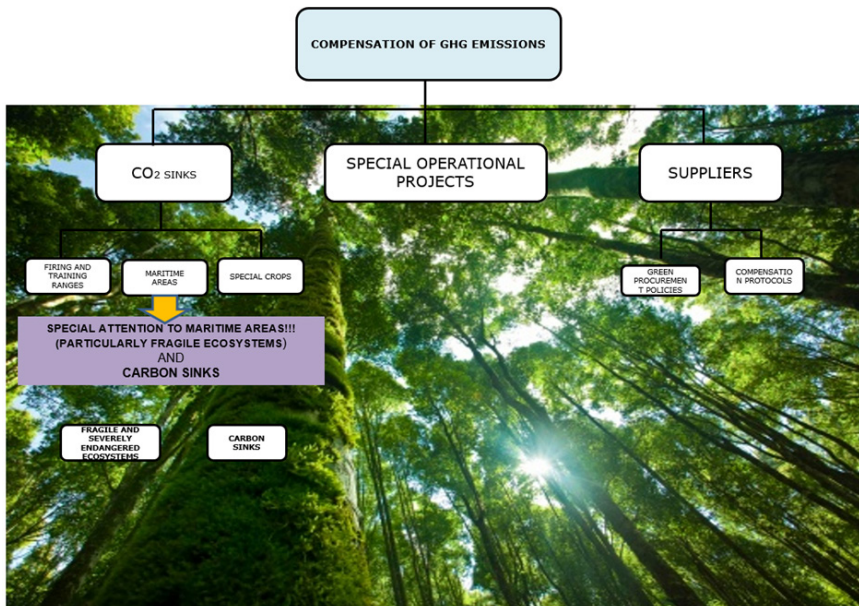
In principle, the last of these is that contemplated by the Ministry of Defence, for which it can revalue the more than 100,000 hectares it has as its own land where more than 26,000 hectares of trees can be accounted for, which absorb around 132,000 tons per year of CO₂ according to the evaluation carried out by the Ministry, as already mentioned above.

In these areas, carbon sinks are taken into account as CO₂ sequestrants, activities of forestation, reforestation, management of agricultural and grazing lands, forestry management and replanting. In this case, the absorption of a ton of CO₂ implies the emission of an absorption unit, UDA, which is taken into account when determining compliance with obligations in entities subject to emissions trading.

On the other hand, the Programme of offsetting non-reduced emissions via own means (carbon sinks in the Defence fields in its water bodies and other possible special sinks, etc.) or through offsetting mechanisms under the different national MDL or received and validated by UNFCCC (United Nations Framework Convention for the Fight against Climate Change). Technology transfer to Annex I countries in collaboration with the suppliers of the Armed Forces.

- Special Internal Compensation Operational Projects (OECC).
- Technology transfer (Article 4.5 UN Convention).
- Supplier companies of the Minis. Collaboration Agreement. Calculation and analysis of the carbon footprint protocols. Green procurement.
- Special plan for the projection and international cooperation of technology transfer on actions against climate change of the Ministry of Defence in its environment of interest (Business Program) under Article 4.5 of the UN Framework Convention on Climate Change, COP Kyoto, COP Marrakesh.

- Ministry of Defence's GHGs compensation environmental fund
 - Ministry of Defence's own emissions
 - Suppliers' emissions
 - Emission allowances
 - Clean Development Mechanisms (CDM) and other means.



Adaptation to climate change. Vulnerability. Resilience

The definition given by the IPCC for the concept of «adaptation» is as follows: «the process of adjustment to the real or projected climate and its effects. In human systems, adaptation seeks to moderate or avoid damage or take advantage of beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to the projected climate and its effects.» {WGII, III} Or also: «make the adjustment of «human systems» or natural systems against new or changing environments in response to projected or real climatic stimuli, or their effects, which may moderate the damage or take advantage of its beneficial aspects. We can identify several types of adaptation, including preventive and reactive, public and private, or autonomous and planned.»

Defence must take into account that it has to try to make a Programme and an exercise of adaptation of its activities, infrastructures, materials,

programmes of attention to special sensitivities (energy, water, migrations, displacements, supplies ...).

In the same way and particularly for the very essence of the Ministry of Defence, this must have extraordinary dedication for the earliest possible perception of what may be «vulnerabilities» (propensity or predisposition to be negatively affected) related to climate change and its impact on defence, for its analysis, knowledge and adoption of the necessary measures.

In addition, and we include it in the same section, Defence must work hard to analyse and strengthen its structures in order to take on the concept of Resilience, that is, and taking up again the definition of the IPCC, «to have the capacity of the social, economic and environmental systems to deal with a dangerous phenomenon, tendency or disturbance by responding or reorganising in a way that maintains its essential function, its identity and its structure, and at the same time maintains the capacity for adaptation, learning and transformation. {WGII, III}».

From all of this, the following tasks arise:

- Special attention to the forecasts of the 5th IPCC Report, COP 21 in Paris and 22 in Marrakesh.
- Analysis of vulnerabilities. Infrastructures, activities, transport, energy, coastal areas, mountains, agricultural areas, livestock (horse riding) media, people ... land, sea and air.
- Preparation of a special Adaptation programme following the guidelines of the National Adaptation Plan (PNACC), whose «ultimate objective is to achieve the integration of measures of adaptation to climate change based on the best available knowledge in all sectorial policies and management of the natural resources that are vulnerable to climate change, to contribute to sustainable development throughout the 21st century», with Defence intending with this to know, prevent and stop or diminish the effects, in order to protect itself from the impacts that global warming projects have and will have on the human, natural and socio-economic environment.

Among the actions of fighting against Climate Change, there are two, Adaptation and Mitigation, that have a tight connection given basically by the necessity that arises after the exercise of reducing emissions (the most important) followed by that of mitigation, which are those actions that man does in order to reduce the sources or improve the capacity to sequester emissions through systems that function as *greenhouse gas sinks*, which are mainly tree masses, certain crops and marine areas. At the same time, those emissions that have not been able to be reduced, must be treated as generators of changes in the climate and the environment, and will cause incidents to which measures to adapt to climate change must be found.

- a) Elements and sectors potentially subject to the need for adaptation measures.
- b) Technologies and opportunities associated with adaptation.

Planning, information, awareness and internal training

The Ministry of Defence's Programme to fight against Climate Change considers the following two premises of singular importance to obtain its objectives:

- The consideration of climate change in the planning phases of Ministry of Defence activities and infrastructures.
- Training plan for the appropriate personnel of the Ministry through the means that are designed as more appropriate, one of which must be the organisation of internal days on climate change and defence.

In view of the complexity of the phenomenon of climate change, the Ministry of Defence senses that in a very special way, the strategy to fight against this phenomenon must use and enhance the FORECASTING of possible incidents (rise of the sea, increase of water and air temperatures) on the environment and aspects related to Climate Change, such as reduction and adaptation in the PLANNING of the activities and infrastructures of the ministry and in the TRAINING AND AWARENESS-RAISING of the staff, who in each of their daily tasks could have an impact on these sensitive aspects of life, of which there are many more than any of us is aware.

Regardless of the origin and causes of problems, disasters and conflicts in which armies can or should intervene in relation to Climate Change and the Environment in general, military leaders must generate new formulas, strategies, means and mentalities; this is a task of INNOVATION, in which prevention and specific training in these areas can be some of the best tools to give them maximum effectiveness in the face of the conflict itself.

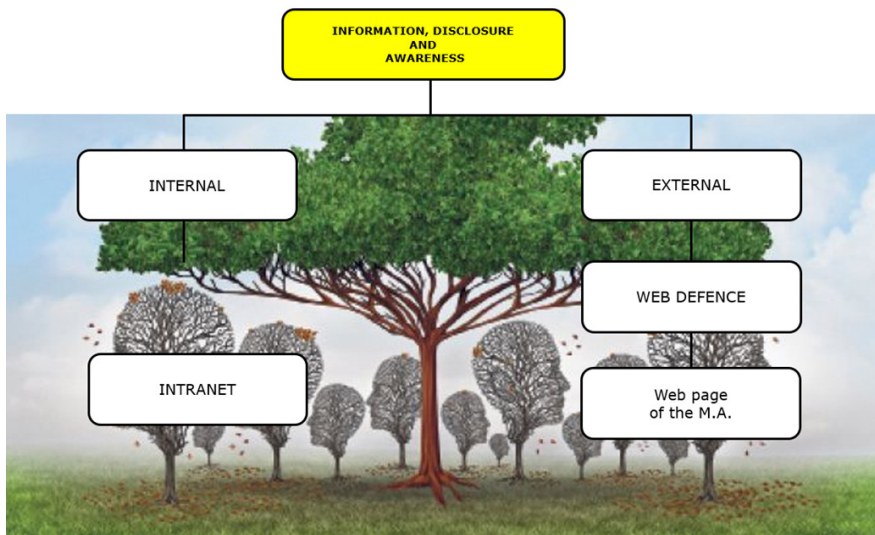
An instrument that will be created is the Ministry of Defence's «Zero Carbon» Platform, which on the Ministry's website allows information, training and management on the work of the Programme to combat Climate Change, for both internal and external staff.

Information. Information, Communication Plan and image abroad. Social media

As noted in the first pages, with this programme the Ministry of Defence intends to go a step further in its goal of highlighting the value of the Armed Forces as an example of social and environmental responsibility in the face of climate change and as an auxiliary means to mitigate the effects caused

by it. And not only does it have to do it. In order to do so, it is preparing a Communication Plan aimed at the social and administrative environment where it is present and carries out its activities, with the aim of establishing a relationship of communication that allows it to be known and project the image it wants.

In this Plan the new media and communication systems that have been created with the Internet will be very present; the source of information and the revolution in communication that is another phenomenon, which like Climate Change has activated new ways of interacting between people and institutions. If Defence wants to have a social projection as it claims, it must be present in the so-called «social networks» and be aware that social change forces it to use new technologies and with this new reality to identify what message it tries to communicate, to whom it is directed, in what way, with what resources, etc.



Participation. Collaboration and relations with other organisations and entities external to Ministry of Defence in relation to climate change

As noted by the Ministry of Agriculture, Fisheries, Food and Environment on its website, «*climate change is a global phenomenon because of its causes and its effects and consequently requires a multilateral response based on the collaboration of all countries*».

The verification of this reflection, as well as the limitation of the human and technical means available to the Ministry of Defence, and above all its

knowledge and experience in the fight against Climate Change, has naturally advised this body to request the collaboration of all those other public and private entities so that the possible experience that they have accumulated throughout all these years and that could be useful for the best adaptation and quality of this Ministry Programme, not forgetting that its purpose is the defence and security of all citizens, can be brought into it. In this sense, this programme is understood as «participatory».

Some of these bodies are the Ministry of Agriculture, Food, Fisheries and the Environment through several of its General Directorates, especially the Spanish Office of Climate Change, the Ministry of Public Works with the State Ports Authority, Ministry of Industry, etc.

Both with some entities and with others the profitability obtained from this collaboration, coordination and strengthening of the national activities related, directly or indirectly, to the climate system can be assessed according to two approaches: first, that which incorporates knowledge about the climate system and the processes that govern it in the sectorial planning of the Administrations and State entities; and secondly, that derived from the use of new or better technologies that allow the causes of climate change to be limited and its foreseeable impacts in the short, medium and long-term to be cushioned, while obtaining better economic performance in multiple sectors.

Spain, as a Member State of the European Union, participates actively in the international negotiation process, which is developed mainly through annual meetings of the Parties of the United Nations Framework Convention on Climate Change and the Kyoto Protocol. The Ministry of Defence, represented on the National Climate Council, is also responsible for the Climate Change Portfolio of the DEFNET organisation, which brings together the different Ministries of Defence of the European Union and which is responsible for being attentive to what is involved in relation to the environment in that context.

Plans and special projects derived from each area of action to achieve the objectives of the programme

Throughout these years, the immeasurable dimension of the phenomenon of Climate Change has been proven and, as a consequence, the measures that are necessary to achieve some minimally effective solution. In the conception of its programme, both with the participatory and open criterion, the Ministry of Defence addresses the multitude of possible lines of work that need to be considered for the purposes of Defence, through the identification of «special, operational, sectorial, pilot, innovative ...» plans, programmes or projects with the most suitable and, of course, possible formulation according to the means, priorities and opportunities.

This section of the Ministry of Defence's programme to combat climate change, having the status of «open» and which includes or will include initiatives that have a sectorial and operational character and are already well under way by

the Ministry or are likely to be addressed through the identification and analysis of the actions that are likely to be incorporated in a homogeneous context in any of these plans or those that may be considered appropriate in the future.

Examples include:

Special plan for transition and energy efficiency

Climate change is closely related to energy and to act on it, it is essential to change our guidelines on energy and how to use it.

The Government has launched the preparation of a standard on Climate Change and Energy Transition, which represents a commitment by the Government to meet the objectives in terms of energy and climate and as a consequence of sustainability of the European Union and those included in the Paris Agreement, seeking to define a framework in the medium and long-term to ensure an orderly transition of our economy towards a low carbon model that adapts to climate challenges.

According to the official MAPAMA website, it is a question of «developing an instrument that sets the path to achieve the international commitments made in climate change and energy and also take advantage of the development possibilities that may arise from the new economic model, at with the lowest possible cost and generating economic growth, employment and welfare for citizens».

As a great consumer of energy, the Ministry of Defence not only adopts the general thesis over this, but by its very essence it needs to minimise its dependence on energy.

Pilot project of decarbonation of the ministry headquarters

Energy management for the correct operation of the building's facilities and to optimise the energy supply of fuel and electricity (control of quality, quantity and use), guaranteeing optimal use.

Special plan for ict technologies applied to CC

The aim is to maximise the use of Ministry of Defence tools of electronic administration for the electronic management of the programme with measures such as the following:

Empowerment of the use of ICT as a substitute for travel.

- Control of emissions in localised sources.
- Collection and transfer of data.

- Management platform.
- Programme of computerised management of emissions.
- Preferential use of ICT when travelling, sending documents, faxes, etc.
- Meetings by teleconference or video conference.
- Analyse the possible savings in emissions that can be obtained with the substitute use of ICTs.

Special health and climate change plan for Ministry of Defence staff

Taking into account aspects such as the following:

- People's health
- Infrastructures and services
- Hospitals and care centres. Laboratories

Special plan for international projection

Strengthen the activities that the Ministry is already carrying out and increase them with others that could imply a qualification in the Ministry's management of the fight against Climate Change. The Ministry is currently responsible for the presentation on Climate Change in DEFNET (European Network of Defence Ministries). And the new efforts could be aimed at increasing our relations with the Ministry of Environment of the Permanent Representation of Spain in the EU (REPER), as a way to reach other NATO military institutions, and most likely the effort with some countries of Latin America would be strongly recognised.

Companies: projection and international cooperation of technology transfer on actions against climate change of Ministry of Defence in its target environment

With reference to Art. 4.5 UN Convention, COP Kyoto COP Marrakesh, the goals of this special programme would be:

1. To contribute to the international effort in the fight against Climate Change by involving the Defence Departments of the countries and in the circumstances referred to in Article 4 of the United Nations Convention on Climate Change.
2. To assess the measures that are being taken and the results that the Ministry of Defence is obtaining in its programme of reduction and mitigation of carbon emissions.

3. To establish a directory of companies specialised in sectors, technologies and products that have proven their effectiveness in the work carried out for the Ministry of Defence in works related to the change.
4. To contribute to enabling the dissemination of the experience accumulated by these companies in the international areas referred to in the United Nations Convention and the Kyoto Protocol.

Sinks. Sea CCS (carbon capture and storage). The CMT and defence territory as carbon sinks. Ministry of Defence's environmental fund

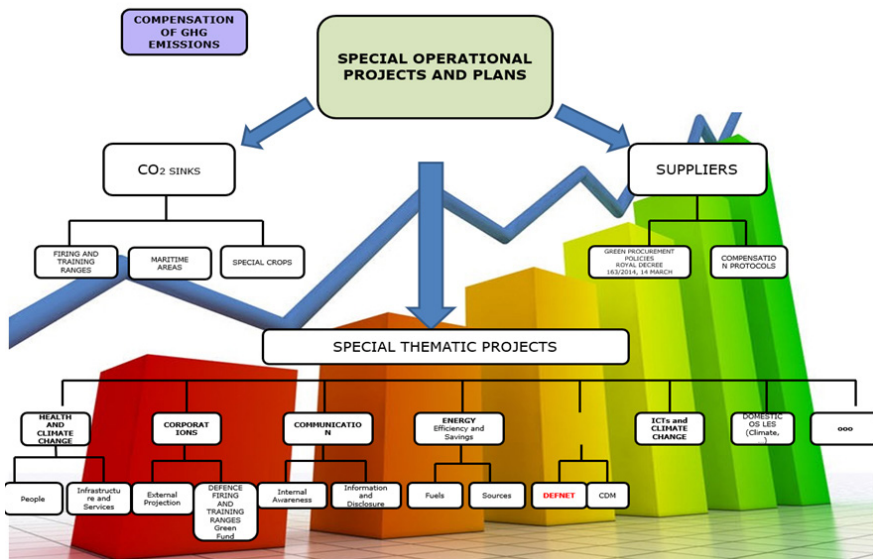
Law 2/2011 of sustainable economy of 4 March, among many other measures, promotes criteria and behaviours of environmental sustainability and energy efficiency, and devotes a specific chapter to issues related to climate change, in extension or modification of existing standards like those mentioned above.

It says, in its Chapter II on emission reduction:

Article 88. Goal to reduce Carbon footprint and greenhouse gas emissions.

The Government will promote the necessary measures for the fulfilment of the commitments and efforts that correspond to Spain within the framework of the distribution that is agreed in the European Union, to achieve the objective of reducing greenhouse gas emissions by the year 2020.

As one of the measures of interest, we can think of a plan for the transition of Defence lands with vegetation to Kyoto accounting criteria.



Applicable regulation. Ministry of Defence regulation. Age, EU, international regulations

The Ministry of Defence began its own regulations on the environment at the beginning of the 90s, establishing criteria that have subsequently been followed by the Defence Minister's Directive 107/97 of 2 June, which gave rise to Instruction no. 56/2011 of 30 August, of the Secretary of State on Environmental Sustainability and Energy Efficiency, updated by 59/2014 of 4 December.

In addition, the regulatory references are those of the General State Administration and those of the European Union in everything that has to do with climate change and always within the Framework Agreement of the United Nations.

Action Plan «Defence and its capacity for action and assistance in the event of catastrophes in the country or where its presence is needed»

The Armed Forces have unique abilities to act in safeguarding the safety of citizens and their properties and activities. This area of work seeks to identify what the specific and special measures, systems and units must be so that their action in the face of a disaster or threat caused by climate change is as rapid and effective as possible.

The Armed Forces have unique abilities to act in safeguarding the safety of citizens and their properties and activities. This area of work seeks to identify what the specific and special measures, systems and units must be so that their action in the face of a disaster or threat caused by climate change is as rapid and effective as possible.

It will be developed in two main areas:

- A. A.- Knowledge and forecasting of the possible threats to citizen safety produced by the effects of climate change.
- B. Preparation of special units of the Armed Forces (UME).

Composition of the working group

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Vice Admiral of the Spanish Navy. Deputy Director General of Planning and the Environment.

Observer and Secretary

Ms. María del Mar Hidalgo García

Analyst of the Spanish Institute of Strategic Studies.

Observers

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Professor of the Department of Industrial Organisation of the Higher Technical School of Engineering (ICAI).

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Adviser-coordinator of the Environment in the Permanent Representation of Spain in the European Union.

Ms. Valvanera Ulargui Aparicio

Director of the Spanish Office of Climate Change (OECC).

Mr. Ignacio García Sánchez

Captain of the Spanish Navy. Deputy Director of the Spanish Institute of Strategic Studies.

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Captain of the Spanish Navy. Planning and Environment SDG (Ministry of Defence).

Mr. Francisco Rodríguez Martín

Mountain engineer. Planning and Environment SDG (Ministry of Defence).

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