



SPANISH MINISTRY OF DEFENCE

STRATEGIC
DOSSIER

150-B

SECURITY, ENERGY MODEL
AND CLIMATE CHANGE



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SPANISH INSTITUTE FOR STRATEGIC STUDIES

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**SECURITY, ENERGY MODEL
AND CLIMATE CHAGE**

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FOREWORD

CARME CHACÓN PIQUERAS
MINISTER OF DEFENCE

Every year more than 250 million people are affected by climate disasters and 98% of them live in developing countries. The poorest countries are the least responsible for Climate Change, but suffer the worst consequences and are less equipped to manage its impacts. To speak of Climate Change is to speak of the environment, but also of the energy model, international cooperation and security. It is one of the factors that most influence the future of our planet and will therefore determine how the societies that inhabit it will live and relate to each other.

We all have our share of responsibility. And the Spanish Institute for Strategic Studies, an organisation devoted to fostering debate in Spanish society on all matters connected with peace, security and defence, naturally cannot evade this responsibility. The present publication commemorates two significant events: the fortieth anniversary of the founding of the institute and the 150th issue in the *Strategic Dossier* series, an essential tool for disseminating Defence culture in Spain. No subject of greater interest and significance could have been chosen for this double celebration. What is more, we are lucky enough that Manuel Marín agreed to coordinate and direct this edition. As president of Fundación Iberdrola, former President of Congress and one of the main architects of Spain's accession to the European Union, his knowledge but also his commitment made him the ideal person to address the problem from the multidisciplinary approach it requires.

Climate Change multiplies the complexity of the strategic landscape of the twenty-first century, which is already characterised by uncertainty. With a brilliant analysis of the risks and threats it entails, this *Strategic Dossier* reminds us that our future as a prosperous and responsible society calls for multilateralism, interdependence and solidarity.

INTRODUCTION

INTRODUCTION

MANUEL MARÍN GONZÁLEZ

SECURITY, THE ENERGY MODEL AND CLIMATE CHANGE

The two major events at which the international community intended to steer efforts to solve the grave problem of global warming in the right direction proved incapable of finding solutions and reaching agreements to tackle this serious issue. From Copenhagen in December 2009 to the meeting in Cancun in December 2010, the diplomacy of the United Nations was engaged in a quest for the lost treaty.

It failed to find it and the hope remains of being able to address, at the forthcoming meeting in South Africa, the final negotiation of such a longed for binding and compulsory treaty on climate change that will steer us back to the path of environmental sustainability.

The aim of this *Strategic Dossier* on climate change is risky from a conceptual and political point of view. It sets out to examine the debate on global warming from a perspective that links climate change to two prior premises: security and the energy model.

Such an approach is not usually to the liking of environmentalist thinkers, who consider that the phenomenon of global warming should be addressed from the apparently nobler logic of defence of the environment.

From the problem of biodiversity to that of CO₂ mitigation, ecology has sufficient merits and substance of its own for this problem to be tackled from a strictly environmental position. The grand design is the ongoing pursuit of «sustainable development», as stated in the Brundtland Report in 1987.

This position is ethically and morally defensible, but reality is showing that it is not sufficient when attempting to find a comprehensive solution.

The Copenhagen Summit was a practical demonstration that it is no longer possible to aim to pursue a binding and compulsory treaty using exclusively environmental arguments. Other variables related to national and international security, the energy model and the new energy interdependency have joined the debate and the solution to global warming.

Climate change is a problem that has several layers, like the classic example of an onion: economic layers; geopolitical and geostrategic layers; layers relating to the energy model; and layers relating to security. A world problem like global warming is a problem that necessarily needs to be studied in relation to the new power balances that are taking shape in the world.

The twenty-first century has left behind it for good the international power balances and relations that marked the past twentieth century. Changes have taken place at a dizzying pace. Suffice it to cite the example of what has happened in Old Europe. In barely a quarter of a century we have gone from the cold war, nuclear threat and division of the continent to a European Union that recently enlarged to take in the Eastern and Central European countries. The Berlin Wall and what it stood for is now a memory that is hard to explain to the new generations of Europeans.

Another weighty example which has become a classic expression of these tremendous changes is that fact that the largest holder of US Treasury bonds is the National Bank of China. This circumstance, which would have been inconceivable for Mao Tse Tung's Communist revolution and a genuine aberration for Ronald Reagan's unashamed patriotism, is now a reality which causes much of the world's monetary stability to hinge on the financial decisions of the new superpower, China. Consider, for example, how the attention of the international monetary exchange-rate market was fixed on the position of a country led by the world's biggest and most powerful Communist Party at the recent G20 meeting in Seoul—who would ever have imagined such a thing?!

New global spaces have emerged in recent years which have inevitably influenced the debate on the problems derived from global warming.

The logic of the first report on «North-South. A programme for Survival» led by Willy Brandt, the new report on «Our Common Future» drafted

under Norwegian prime minister Gro Brundtland, even the most demanding positions such as the Rio de Janeiro Earth Summit and the Johannesburg Sustainable Development Summit, and the subsequent United Nations summits related to a very different international context and economic and financial realities.

These new global spaces have given rise to a new interdependency which has triggered one of this century's characteristic phenomena: the shifting of the political, economic and financial centre of gravity to the Asia-Pacific region. The world is no longer Euro-centric and is basically structured around the transatlantic dialogue between Europeans and Americans. North-South dialogue has also undergone a deep change and the classic vertical relationships between rich and poor have been replaced by a cluster of emerging countries, some of which are already regional leaders and have huge growth potential.

This economic growth has in turn heightened environmental stress owing to the massive emission of greenhouse gases. The increase in energy demand and consumption to hitherto unknown levels has brought about a rise in environmental temperature that is currently one of the biggest challenges facing mankind. Growing energy demand, the impressive economic development of some emerging countries and their new world position have thus made energy interdependence a necessary reference when analysing the new power balances that are shaping the new 21st-century system of international relations.

Although we are little more than a decade into the new century, certain trends are already emerging in the definition of this new interdependency:

- *Energy resources are being progressively dominated and controlled by state-run companies.* The major multinationals that controlled oil and gas production last century now account for barely 20% of world production. The companies that currently control three-quarters of the world's proven oil, gas and coal reserves are state-run or heavily controlled by governments.

This circumstance underlines the fact that energy sources in this century are an essential part of a new system of international relations and that the producing states' control of resources is increasing steadily and rapidly.

- *The risk—which has been confirmed—of the growing use of energy sources to achieve political aims.* It is obvious that energy resources

have always had a strategic and security component. However, we are facing a new dimension which is better explained by a reality that has emerged in barely a decade. Africa and the control of its energy resources by the enterprises of the former colonial powers were the classic explanation of the phenomenon of economic neo-colonialism. This bears little resemblance to the present situation: the main energy investor in Africa is China, which obtains 29% of its energy imports from the African continent. This radical transformation has meant that China is now the dominant power in Africa. The current five-year plan establishes Latin America as a major priority. The same may occur.

- *Security is linked to the requirement of sustainable development and the phenomenon of global warming.* Climate change is not only a very serious environmental problem. It is also a question that is progressively being incorporated into the new concepts of national and international security. The failure of the Copenhagen Summit can largely be explained by two facts: one, it did not incorporate the strategic and security «layers» of the debate on climate change; and two, it used a working method that made it difficult to reach a final agreement.
- *Over the coming decades China and India will dominate the energy markets.* China and India account for one-third of the world's population and consume only 20% of world energy. In the past years 70% of global oil demand and 80% of coal demand has come from China and India. One out of every three dollars invested in producing electricity from fossil or renewable sources is located in China or India.

According to the World Energy Outlook of the International Energy Agency, China is already the world's leading energy consumer.

- *Low oil prices will not return.* The marginal costs—exploration and production—per barrel of oil will prevent a return to low prices. The large reserves discovered in deep-water areas considerably push up this marginal cost owing to the difficulties of extracting them. The average cost per barrel was in the region of +/- \$69 in 2009.

This *Strategic Dossier* has a specific aim: it sets out to confirm that security, the energy model and the phenomenon of climate change are linked in the new international order that has been emerging over the past years and are part of complicated and difficult global negotiations.

This effort leads us to attempt to clarify the backdrop of the negotiations on climate change, the main actors and the consequences failure of the negotiations would have on international security.

The starting point is the same: the realisation that energy and energy interdependence are one of the *drivers* that are shaping the new power balance in the 21st century. As in other fields of international relations, globalisation has made it necessary for us to address new realities that are developing at a fast pace and are already emerging as a fundamental part of the new power structures in the world.

The forum for the negotiation of the global warming phenomenon is the United Nations, but the negotiation framework which involves the direct political accountability of the main countries responsible for CO₂ emissions needs to be studied in a particularised manner.

The Copenhagen Summit and its paltry conclusions drew attention, on the one hand, to the choice of a dubious working method and, on the other hand, to the fact that climate change is linked to economic, geostrategic and security considerations that emerged in all their crudeness in the backroom of the summit.

Admittedly, the publication of the final work of the United Nations Panel on Climate Change created a widespread climate of opinion that allowed major hopes to be entertained about the meeting of the heads of state and government in the Danish capital. What with the publication of the Stern Report commissioned by the British government on the cost of «doing nothing», Javier Solana's report to the European Council on the European Security Strategy which included climate change among the future risks and threats, Al Gore's passionate crusade and its awkward truths, and the large-scale mobilisation of NGOs and environmental organisations that cornered the supporters of the discourse of denial, the time had come to make decisions.

What is more, the election of Obama as President of the United States and his firm commitment to environmental problems gave the impression that a great deal of pressure would be put on China to reach a commitment that everyone could honour.

The disappointment has been very considerable: Copenhagen did not work out and, as we have seen, neither did Cancun. It is true that the economic and financial crisis has substantially eroded international confidence and that the maxim of «every man for himself» has been adopted

again, as nearly always occurs in difficult and complicated situations. The international community's ability to come up with agreements suffers the effects of such situations, and when dealing with such a sensitive issue as global warming, which affects the aforementioned economic, geostrategic and security «layers», reaching a legally binding international agreement becomes even more difficult.

The Copenhagen Summit failed on account of its lack of *momentum* and inappropriate working method, the inability of the US and China to cooperate in this area and the non-entity of the European Union as a global interlocutor.

Momentum is essential in concluding difficult negotiations. It is a situation in which the various satellites in the galaxy arrange themselves, each falls into place in its own orbit and «a moment of order» is established leading to harmony. That is how a final agreement emerges.

But there was no such *momentum* either at Copenhagen or at Cancun. Neither were the satellites of the galaxy—the participating states—arranged in an orderly manner; nor did their different interests fall into place in their orbits; and nor did the necessary moment of order arise between them leading to harmony—the binding treaty.

Nor does *the working method* seem the most appropriate to establishing order in a galaxy of different positions and interests. It is evident that a legally binding and compulsory agreement on global warming can only take shape in the context of the United Nations. Only the United Nations is in a position to legitimise a treaty of this kind.

However, if the end result of this difficult negotiating process is to be approved by the United Nations, it is also appropriate to ask whether the so-called «UN method» is the best suited to creating the conditions for the «momentum» allowing the major summit to take place—a summit that can announce to mankind that in the end good sense has prevailed and that global warming will be subjected to policies and decisions that will reduce greenhouse gas emissions.

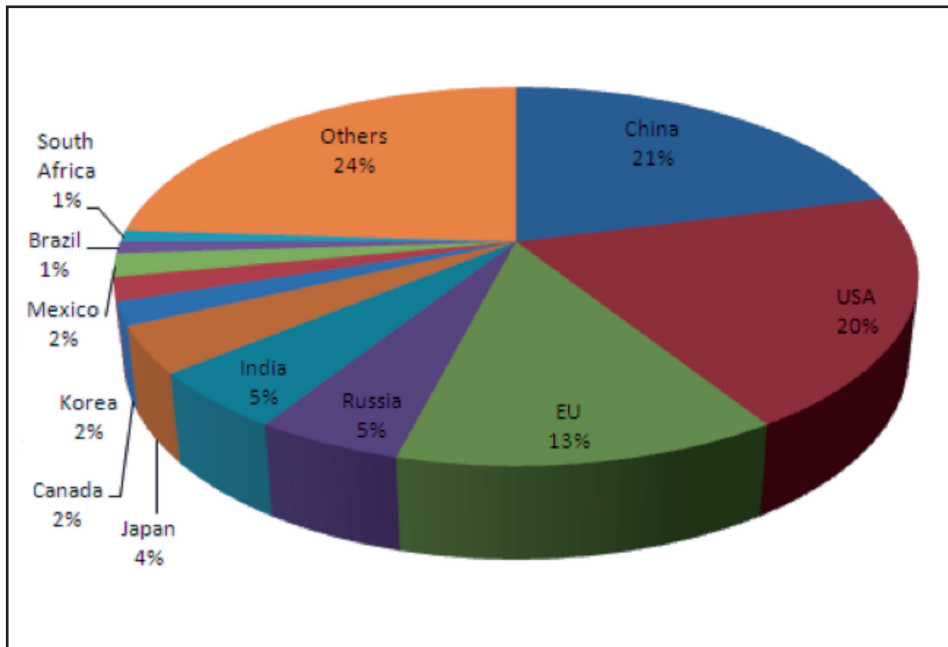
It does not appear—and Copenhagen proved this—that a General Assembly consisting of heads of state and government delivering dozens of appealing, aggressive or downright boring addresses is the best instrument for concluding an agreement of this magnitude.

That the Cancun Summit was convened only at ministerial level confirms that the aim was to avoid another situation similar to that of Copenhagen.

In difficult international negotiations the most complicated part is to define the profiles of the *negotiation framework*, that is, to determine clearly the interests to be considered and the parties interested. In the case of global warming the negotiation framework is relatively easy to establish if we bear in mind that the individual responsibilities of the top CO₂ emitters are well known and that the real interlocutors are barely a dozen countries.

Climate change is a serious problem that affects the whole of mankind, but in terms of «negotiating technique»—organising the negotiating profiles—the solution lies with a handful of political leaders. It is thus not a problem of finding a negotiation framework. *The true problem is the degree of political will and accountability of the leaders whose countries are directly responsible for the emission of greenhouse gases.*

Very specific conclusions may be drawn from the above chart:



- Only a dozen international actors account for nearly 80% of world greenhouse gas emissions.
- Three alone—China + USA + European Union—account for 54%.
- Adding a further three—Russia + India + Japan—brings us up to 68%.
- The addition of a further 5—Canada + Korea + Mexico + Brazil + South Africa—takes us to 80%.
- The remaining 20% is shared among all the countries of the world.

The cause and causers of CO₂ emissions are a very few countries and the three main parties responsible are fully identified: China, the US and the European Union.

The negotiation framework is thus easy to establish. An agreement of this troika on climate change would have such a powerful pull effect on the rest of the political leaders that it would undoubtedly facilitate a global agreement. They all furthermore belong to the G20 and meet every 6 months, climate change being one of the usual topics on their agenda. They can meet, talk, discuss and negotiate without agenda problems or occupations that divert their attention. The negotiation framework and who the actors are in these negotiations are perfectly defined. The guilty parties are known.

The European Union at least was capable of showing up at Copenhagen and Cancun with a recognisable position: the 20/20/20 package. This negotiating position is certainly the soundest and the most generous with the least developed countries, but the EU's external weakness and the refusal of China and the US to accept the «cap and trade» mechanism and create a world carbon market are succeeding in marginalising the Europeans at the major world meetings.

It should be noted that at Copenhagen especially the new G2—China and the US—blocked any possibilities of agreement and the final document was drafted with the sole support of the BRIC countries. The European Union was dramatically excluded.

While it is true that a new power balance is taking shape in the world following the fall of the Berlin Wall and the disappearance of the cold war, it should be recognised that the elements of strategic order, threats and risks are highly varied and are forcing us to reconsider and establish new strategic concepts of national and international security in the knowledge that many of these risks and threats are furthermore global.

A question that remains open concerns the interpretation of the role of energy in the development of the new security concepts. Controlling and guaranteeing access to energy sources are, as pointed out earlier, key drivers in the new system of international relations.

The tricky negotiations on climate change involve, as pointed out already, economic, geostrategic, energy model and security «layers» that are not always easy to define. This is the main reason that has spurred the Spanish Institute for Strategic Studies to analyse this issue from different viewpoints.

An initial contribution should necessarily refer to the risks and threats of climate change. This was the task of *Elena Conde*, a lecturer in Public International Law at the Universidad Complutense in Madrid, who provides an overview of the evidence that global warming is a risk and threat to security from an intellectually open stance with respect to the real impact of the phenomenon of climate change. Her article explores the possible geostrategic implications of a temperature increase and their effects on mankind's basic resources.

After this general introduction we decided to go on to analyse the position of the main parties responsible for seeking a negotiated solution, as they are also the main parties responsible for the problem itself.

The election of President Obama aroused huge expectations in the world and it seemed that at last climate change would be addressed from a constructive position. Obama tried but was unable to overcome the internal difficulties in the US Senate. What is more, the result of the recent elections has further weakened the US's margin for negotiation. We should not be surprised by what happened at Cancun. *Paul Isbell*, Director of the Energy and Climate Change Programme of the Instituto Elcano, explains what happened in the US and the possible way forward in an uncertain future.

Another global actor, the European Union, wanted to but was not able, either at Copenhagen or at Cancun. What happens to the EU in issues in which it is incapable of speaking with a single voice is a real drama. *Mariola Urrea*, a lecturer in Public International Law and International Relations at the University of La Rioja, analyses why: the EU lacks a common energy policy and therefore tends to lapse into cacophony and the now famous «every man for himself». Nonetheless, the Lisbon Treaty offers, for the first time, the possibility of progressing towards the defini-

tion of a Common Energy Policy. It will not be a smooth ride but at least we are on the right path.

Although they do not stand for a common and homogenous interest, the so-called BRIC countries—Brazil, Russia, India and China—are now more than just emerging countries. They play an increasingly more substantial role in the world agenda and in some issues their position is a determining factor. Such is the case of China in the grave problem of global warming. *Fatih Birol*, Chief Economist of the International Energy Agency, offers us an overview of the forecasts and trends for the coming decades, underlining the major importance of the new energy interdependence and how these forecasts confirm that energy is a key driver in the new system of international relations.

If we speak of risks and threats it is because there is a real possibility of conflict. National and international security can be seriously affected by the consequences of global warming. Globalisation and the new risks and threats have made it necessary to rethink the strategic concepts of security both in military organisations and in the countries regarded as advanced democracies. Spain is doing so through its National Security Strategy. *Ignacio José García Sánchez*, Lieutenant Commander and..., introduces us to this field, discussing how National Defence views environmental issues.

Is Spain doing a good job? It was necessary to end this *Cuaderno de Estudios Estratégicos* with an analysis of the energy policy developed in our country. The Spanish energy model is currently vague and it does not appear that the longed-for and badly needed Energy Pact can be concluded, despite being a national necessity. *Antonio Cuevas*, President of the Industry Committee of Spanish Congress, examines the desired and necessary National Energy Policy in the 2030 horizon. It is certainly an issue that is sparking lively debate.

The current economic and financial crisis is not allowing us to devote full attention to this issue. The drama of the immediate situation, particularly unemployment and lack of economic growth, is making it necessary for us to deal with day to day affairs, postponing issues that are considered impossible to settle until the crisis is over. Better days will come and then the time will be right, we are told.

But when those better days are here, we will be told that now that economic growth has recovered it is still not the right time to introduce restrictions on economic growth, which could halt job creation.

Global warming is one of these issues which are being pushed off the political agenda and attempted to postpone until things start looking up. That is a serious mistake. Let us hope that one day we will be willing to conduct ourselves like «fair and charitable» citizens, as the idealists who drafted the Spanish Constitution of 1812 aimed, and accept that certain issues cannot be postponed.

CHAPTER ONE

RISKS AND THREATS OF CLIMATE CHANGE

RISKS AND THREATS OF CLIMATE CHANGE

ELENA CONDE PÉREZ

SUMMARY

Climate change in relation to a global consideration of «security» has been very precisely defined as a «threat multiplier». Climate-related threats to security could be divided into four groups: a) basic resources (water, agriculture and food); b) social effects (health, risk of massive migrations, human rights at risk); c) political effects (possible increase in what are commonly known as «failed states»); and d) political and economic effects (economic inequalities, «energy security», wars over access to energy resources). All these aspects show that climate change, whatever its origin—although there is evidence that anthropogenic influence is a major factor—is a challenge not easily tackled without multilateral action; but at the same time, human and individual action is required, starting with changes in our patterns of consumption.

Key words: climate change, global warming, security, conflicts, «threat multiplier», «hot spots», scenarios, food security, health, migration, human rights, failed states, energy, «energy security».

ABSENCE OF POLITICAL CONSENSUS CONCERNING THE INTERNATIONAL REGULATION OF CLIMATE CHANGE AND GROWING SOCIAL CONCERN ABOUT THIS ISSUE

In view of the threat of global warming triggered by the uncontrolled emission of greenhouse gases, the Framework Convention on Climate Change was adopted at the Rio de Janeiro Conference of 5 June 1992, its praiseworthy aim being:

«[...] stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.» (1)

To achieve this end, the States parties (more than one hundred and sixty) created a flexible framework for the progressive achievement of executive agreements. The most frequently mentioned of these agreements would be the one adopted at the third conference of the parties, the Kyoto Protocol (10 December 1997), whereby the aforesaid parties undertake individually or jointly to prevent the emissions of six particular gases from exceeding a certain limit during the period spanning from 2008 to 2012. The special consideration given to developing countries and rules for making their compliance flexible have made the Protocol an improvable and harshly criticised instrument, (2) albeit not as much as the minimum agreement—largely forced by the Chinese government's attitude—reached at the Copenhagen Summit in December 2009, which was intended to be the successor to the Kyoto Protocol but merely establishes voluntary emission reduction targets for preventing a global temperature increase of more than 2°C. (3)

Social concern—which has now lost ground to more tangible problems such as the economic crisis—about the challenges climate change poses and its security implications, all of which are widely divulged, has translated not so much into binding global international agreements as into a host of reports on the subject by international intergovernmental bodies (United Nations (UN), European Union (EU), Organisation for Security and Cooperation in Europe (OSCE), North Atlantic Treaty Organisation (NATO), among others), states or non-governmental organisations, think tanks and pressure groups.

(1) Article 2

(2) I should point out briefly, in defence of its many criticisms, that so-called International Environmental Law is a young branch that is still being formed, and which is largely made up of instruments which are not legally binding—termed soft law in International Law. Vid. PAOLILLO, F., «Fuentes y evolución del Derecho Internacional del medio ambiente», *Cursos Euromediterráneos Bancaja de Derecho Internacional*, Vol. II, 1998, pp.349-429.

(3) Vid. MARIÑO MENÉNDEZ, F., «La protección internacional del medio ambiente (I)» in DÍEZ DE VELASCO, M., *Instituciones de Derecho Internacional Público*, pp.781-783.

While I do not intend to mention all these studies, most of which are very significant, scientifically sound and clarifying, I should point out, as a basic reference point, the report of the Secretary General to the 64th session of the United Nations General Assembly bearing the far from insignificant title «Climate change and its possible security implications», (4) which in turn took the baton from an earlier Resolution of the General Assembly on «Climate change and its possible security repercussions». (5) However, even in 2004, the High-Level Panel on Threats, Challenges and Change in its report «A more secure world: our shared responsibility» (6) also dealt with the challenges posed by environmental degradation to international security. Despite the attempts of some UN Member States—particularly the United Kingdom of Great Britain and Northern Ireland—to ensure that the Security Council, as a body whose chief purpose is the maintenance of international peace and security, would address the issue, many other States (India, China and the Group of 77 (G77)) held that climate change, as a matter linked to socio-economic development, should be discussed by the Economic and Social Council or the General Assembly, or else in connection with the Framework Convention on Climate Change. (7) And so, once again politics prevailed over the facts: (8) the developing states criticise the first-world countries for shamelessly being worried now about a climate change for which we recog-

(4) A/64/350, 11 September 2009.

(5) A/RES/63/281, 11 June 2009.

(6) A/59/565, 2 December 2004.

(7) Vid. on the developments in the security implications of climate change implications among intergovernmental bodies the interesting report «Shifting Bases, Shifting Perils. A Scoping Study on Security Implications of Climate Change in the OSCE Region and Beyond», Office of the Coordinator of OSCE Economic and Environmental Activities, Adelphi Research in cooperation with Chatham House, Citera, Berlin 2010, pp.47-54. (Lent by R. Daussa).

(8) In 2004, the report «A more secure world: our shared responsibility» by the High-Level Panel on Threats, Challenges and Change identified environmental degradation as one of the serious security threats today's international society faces and recognised that «International institutions and States have not organized themselves to address the problems of development in a coherent, integrated way, and instead continue to treat poverty, infectious disease and environmental degradation as stand-alone threats. The fragmented sectoral approaches of international institutions mirror the fragmented sectoral approaches of Governments: for example, finance ministries tend to work only with the international financial institutions, development ministers only with development programmes, ministers of agriculture only with food programmes and environment ministers only with environmental agencies. Bilateral donors correctly call for better United Nations coordination but show little enthusiasm for similar efforts on their own account» . A/59/565, 2 December 2004, para. 55.

nise our blame and which is calling for sacrifices for all round, for both powerful states with resources and poor states without them. And it should be recognised that even though it may seem irresponsible, as climate change poses serious threats to everyone that are much more burdensome and difficult to endure for the weak, they are not far wrong. (9)

POINTS OF DEPARTURE FOR THE PRESENT STUDY

Before going on to specifically analyse the risks and threats of climate change, it is necessary to establish basic references regarding the concepts to be dealt with, two of which are:

The idea of «change» with respect to normal parameters of climate behaviour.

This article would be pointless if the author were to question the idea of «climate change» espoused by the leading international organisations in their periodic reports and by the agencies, independent groups and research centres which have produced detailed studies on the subject of this article. This idea is largely based, to use non-scientific terms, on the influence of human activity, specifically the increase in the emissions of CO₂ and other gases on the so-called «global warming» which in turn leads to «climate change». In other words, as the author of this essay, I am convinced of these data, but in a study of this nature I believe it is appropriate to begin by pointing out at least the voices that call for down-playing the alarmist and disaster-mongering information surrounding the fact of climate change. (10) Indeed :

(9) Nonetheless, climate change policy is not a choice between high-growth/high-CO₂ emissions and low growth/low CO₂ emissions. In Africa, for example, mitigation of the harmful effects of climate change involves more sustainable forest and agricultural management, clean energies (geothermal or hydrological) and the creation of sustainable means of urban transport. Tempering the effects of climate change in a deeply undeveloped continent like Africa is thus compatible with greater development. The same is true of Latin America. Cf. »Changing the Climate for Development«, World Development Report 2010, pp.1-2.

(10) Sceptics or those who refute climate change deny the existence of conclusive scientific proof of three general assumptions, namely that:

1. Climate change is unusual in comparison with historical records.
2. Human greenhouse gas emissions have a dangerous impact on the climate.
3. The scientific models used by the Intergovernmental Panel on Climate Change (IPCC) are reliable indicators of the future climate.

«[...] the question that leads us to consider climate change a problem is not the observation of local warming and climate changes but 'how would our climate system react to an evolution in CO₂ and other greenhouse gas emissions as abrupt as the one that would occur if we do not modify our conduct as to energy, demography and economic development?».(11)

Therefore, despite firmly believing that climate change exists and that we humans have significantly influenced this fact—which is the point of departure for the following pages—I wish to begin by pointing out the existence of scientific studies that question the certainty of climate change and its impacts and remind the reader that any scientific study can be used for a political purpose, sometimes good sometimes not. (12)

Having said this, I believe it is now fitting to point out a personal perception supported by data that are not scientific but merely sensitive: although some scientists warn that climate change is not something subjective that is related to the experience of the climate and its changes, (13) it is a fact—albeit surrounded by uncertainty and hypotheses (14)—

(11) Cf. DE BALAIRÓN, «Mitos y realidades del cambio climático», Estudios económicos, nos. 3 and 4, Madrid, 2006.

(12) Vid. among the Spanish scientific doctrine that questions the certainty of the data used to support the idea of «climate change», SANZ DONAIRE, J.J., «Precisiones a las bases científicas del cambio climático» in Cambio climático y su repercusión en la economía, la seguridad y la defensa. Documentos de seguridad y defensa no. 26, CESEDEN, 2009, pp.5-45; SANZ DONAIRE, J.J., MARTÍN VIDE, J. and PÉREZ GONZÁLEZ, M.E. in «Mitos y realidades del cambio climático», Estudios económicos, nos. 3 and 4, Madrid, 2006.

Various expressions are used to question the certainty of the scientific data that support climate change, such as «the climate change conspiracy theory» or, more simply, «denial of anthropogenic climate change». Indeed, although there is solid scientific consensus concerning human beings' influence on climate change, it is necessary to stress that 150 scientists from 15 countries (a far from negligible number) set up the so-called «International Climate Science Coalition» (ICSC) in December 2009 and urged the UN and, specifically, the International Panel on Climate Change (IPCC) to present sufficient scientific evidence that greenhouse gas emissions are a cause of global warming. A «Climategate» has also been reported, with accusations that the IPCC has exaggerated data on warming. It should likewise be pointed out that these denunciations are not as philanthropic as they should be, as there are normally economic interests at stake.

(13) SANZ DONAIRE, J.J., «Precisiones a las bases científicas del cambio climático», Loc. Cit. p.12.

(14) Vid. GROVE, A.T. and LOPEZ-GUNN, E., «Uncertainty in Climate Change» (WP), RIE, 2010 at http://www.realinstitutoelcano.org/wps/portal/rielcano_eng/Content?WCM_GLOBAL_CONTEXT=/elcano/Elcano_in/Zonas_in/DT25-2010 (last visit 20-09-2010).

that within a relative short space of time we have all noticed substantial changes with respect to the climate we knew as children. Indeed, I am writing these lines only a month after flooding and landslides caused by monsoon rain struck north east Pakistan and Pakistani Kashmir and subsequently spread southwards, killing at least 1,600 people and affecting 20 million and sparking growing discontent among Pakistan's population—who have plenty of reasons to be unhappy as it is—about the government and its mismanagement of humanitarian assistance. I am furthermore writing after a much hotter summer than those of 15 or 20 years ago in Spain's Cantabria region.

Climate change, whatever its origin, poses challenges which require action. If, in addition, it is largely due to human activity, we must not only act on these challenges but also change established patterns of conduct in order to prevent greater ills. (15)

The idea of security in its relationship with climate change

Owing to its flexible nature, the concept of security can be interpreted from different viewpoints. From a classical perspective, this question is linked to the integrity of the sovereign state in the framework of international law, and this concept underpins the whole system of collective security laid down in the United Nations Charter which, in contrast, is based on the idea of military threat.

Nevertheless, the end of the Cold War and the multipolar phenomenon of globalisation have also turned security into a multipolar concept that goes beyond military threat and has complex political, economic, socio-cultural and also ecological origins. In 1994 the United Nations Development Programme (UNDP) introduced the idea of «human security» in accordance with which economic or health crises are now considered potential threats in the same measure as violent conflicts are. (16) The UN

In his report on Climate Change and its possible security implications, the UN Secretary General likewise states that «[...] While climate modelling has made considerable advances in forecasting the future behaviour of natural systems over long time spans, the science of climate change and its physical impacts still confronts a number of uncertainties—for example, with respect to the magnitude, geographical extent and timescale of given impacts.», A/64/350, paragraph 8, p.5.

(15) Vid. «Stern Review: The Economics of Climate Change», 2006.

(16) Vid. «Climate Change as a Security Risk», German Advisory Council on Global Change (WGBU), 2008, pp.19-20.

itself has espoused this trend towards a revision of the term «security», as the report «A more secure world: our shared responsibility» by the High-Level Panel on Threats, Challenges and Change stated the following in 2004 concerning the idea of security, which is very relevant to the subject we are dealing with:

«Any event or process that leads to large-scale death or lessening of life chances and undermines States as the basic unit of the international system is a threat to international security. So defined, there are six clusters of threats with which the world must be concerned now and in the decades ahead:

- *Economic and social threats, including poverty, infectious diseases and environmental degradation;*
- *Inter-State conflict;*
- *Internal conflict, including civil war, genocide and other large-scale atrocities;*
- *Nuclear, radiological, chemical and biological weapons;*
- *Terrorism;*
- *Transnational organised crime.»(17)*

For its part, establishing the relationship between security and climate change, the OSCE-sponsored report «Shifting Bases, Shifting Perils» identifies three levels, which interact jointly:

1. Human or individual security: this level relates to the satisfaction of basic needs such as food, water and shelter.
2. Internal security: relates to the extent to which the impacts of climate change influence inter-state conflicts between different population groups or between the state in question and a social group or groups.
3. International security: this level includes potential conflicts or interests over the use of water, changing borders due to sea-level rises, as well as destabilising events that may come about as a result of the collapse of states or violent conflicts within states. (18)

Above and beyond these three levels, the report concludes that climate change also entails a change in global, regional or national security, as from a tactical perspective it increases the risk of extreme weather events, which can affect supply routes and troop movement; from a stra-

(17) A/59/565, 2 December 2004, p.12.

(18) Vid. «Shifting Bases, Shifting Perils. A Scoping Study on Security Implications of Climate Change in the OSCE Region and Beyond», Loc. Cit., p.13 Box 2 .

tegic perspective, repeated effects of climate change at the domestic level prevent a country from developing its potential or projecting its true power; and from the perspective of distributive justice, climate change can have asymmetric effects, benefiting some and harming others, usually those who are already disadvantaged. (19)

Based on the foregoing, this article adopts a vision of «environmental security» that is related to the security risks which stem from environmental issues, specifically climate change, and constitute a threat both to traditional states and to societies and their individual members. (20) The report «Climate change and its possible security implications (21) points out several channels through which climate change is linked to security, namely:

1. Climate change is a threat to human rights, specifically the right to life, to health, to food, to water and to housing. (22) Climate change is a threat to economic development, especially for developing countries.
2. The effects of climate change can be a threat by exacerbating tensions or triggering wars over resources.
3. The effects of climate change can endanger one of the foundations of the existence of the state as stable territory and, in some cases, its very survival.
4. The effects of climate change can bring about changes in the availability of natural resources and access to them. (23)

It may easily be deduced from the above statements on security and climate change, however conservative it may seem, that security is linked to stability: «[...] one reason human civilizations have grown and flourished over the last five millennia is that the world's climate has been relatively stable».(24)

(19) Vid. Ibid. p.9.

(20) In its very extensive report «Climate Change as a Security Risk», the German Advisory Council on Climate Change (WGBU) makes the very timely observation that environmental conflicts rarely entail a clash of interests between organised groups, but give rise to disputes between people or groups of people whose ultimate aim is to safeguard their subsistence means, Loc. Cit., p.20.

(21) A/64/350

(22) Vid. «Report of the Office of the High Commissioner for Human Rights on the relationship between climate change and human rights», A/HRC/10/61, 15 January 2009.

(23) A/64/350, paragraphs 14-18, pp.7-8.

(24) Cf. «National Security and the Threat of Climate Change», The CNA Corporation, 2007, p.13.

Indeed, one of the characteristics of climate change is that it turns constants into variables, rocking the socioeconomic foundations of society. An example: one of the widespread effects of climate change is a rise in sea level, which in turn leads to maps and in many cases traditional borders of states having to be redrawn. This in turn affects infrastructures (ports, airports, highways, whole cities...) and creates major legal problems, such as the delimitation of boundaries (as established by International Law: land, air, sea) between states. As if this were not enough, climate change converges with other global trends such as overpopulation, depletion of resources and uncontrolled urbanisation, often exacerbating them. As a result it has deservedly been labelled a «threat multiplier», as although there is relatively broad scientific consensus concerning the fact that climate change itself does not lead to conflict. (25) it does act as a catalyst of conflict depending on the circumstances and on its interaction with other factors. (26)

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Normally simplified as a rise of about 0.74°C (27) in the average world temperature in the past century, climate change involves many other variables, some of which are a consequence of this temperature increase.

(25) Vid. SALEHYAN, I., «From climate change to conflict? No consensus yet», *Journal of Peace Research*, vol. 45, no. 3, 2008.

(26) Vid. «Shifting Bases, Shifting Perils...», *Loc. Cit.*, pp. 7-16.

(27) Data used by the IPCC, 2007, «Summary for Policymakers». «Climate change 2007: impacts and vulnerability». Contribution of Working Group II to the Fourth Assessment Report of the IPCC. The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) to analyse the scientific information needed to address the problem of climate change and assess its environmental and socioeconomic consequences. Since its establishment it has produced a large number of reports. A Synthesis Report (SYR) released at Valencia on 17 November 2007 sums up the conclusions of the three reports of the working groups and provides a synthesis of the aspects of interest to policymakers in the sphere of climate change: it confirms that climate change is a now reality, owing chiefly to the effect of human activities; it illustrates the impacts of global warming that are already occurring and society's potential to adapt in order to lessen its vulnerability; and finally it provides an analysis of the costs, policies and technologies involved in stemming the extent of future changes. If greenhouse gas emissions continue at the current pace, the increase in the average world temperature could be greater, between 1.8°C and 4.0°C, in the twenty-first century.

The most salient but not the only ones are a sea-level rise, loss of glacier and polar ice-sheets, increased cyclonic activity and more extreme weather events. If any or several of these phenomena occur—as seems virtually certain, very likely or likely according to the terminology used by the IPCC in its *Fourth Assessment Report*, (28) major threats to human and, indirectly, international security will arise, as well as *hot spots* (29) or *scenarios* in which the effects of the changes may be particularly acute or pose more pressing problems. (30)

Basic resources: water, agriculture and food

The increase in the average temperature of the planet as a consequence of climate change will cause divergent effects in relation to water:

- A rise in sea level (salt water) (31) owing to the acceleration of the melting of ice-sheets, ice-caps and glaciers and rapid Arctic sea-ice decline.
- Thawing of major glaciers and of the snow and ice accumulated in major mountain ranges (Himalaya, Andes) will initially cause an increase in river run-off and even serious flooding; however, when ice reserves become depleted, in the long term it will lead to drought (freshwater).
- Increases in the amount of precipitation are very likely in high altitudes, leading to a risk of flooding, but the real problem will be in mid- and low latitudes, especially in areas with arid soil, where decreases in the amount of precipitation, together with temperature

(28) Ibid.

(29) «[...] areas where the impacts already appear highly likely, are large in magnitude, unfold relatively swiftly, have potentially irreversible consequences (the concept of «tipping points»), impose high costs on human life and well-being, and may require innovative approaches because of their unprecedented nature [...]» A/64/350, para.10, p.5.

(30) The so-called scenarios and regional assessments are mechanisms that can provide valuable foresight into climate change-related risks. Drawing on available scientific data, they are aimed at illustrating what the world will be like in the near future. «Shifting Bases, Shifting Perils...» Loc. Cit., pp.16-20.

(31) 3.4 mm/year in the past 15 years. Towards 2100 the sea-level rise could well be more than one metre; what is more, the sea level will continue to rise for centuries, even if global temperatures stabilise. Vid. «The Copenhagen Diagnosis. Updating the World on the Latest Climate Science, 2009» at http://www.ccr.unsw.edu.au/Copenhagen/Copenhagen_Diagnosis_LOW.pdf (last visit 19-10-2010)

rises, will lead to the desertification and salinisation of arable land, affecting 35% of the world's population and approximately half the people who live in poverty by 2080 (32) (freshwater).

The document «Rising Temperatures, Rising Tensions. Climate change and the risk of violent conflict in the Middle East» (33) identifies the number-one threat of climate change in the Middle East as increased competition for access to water resources which, in turn, will make it more complicated to reach peace agreements in the area. The distribution of water sources has been a constant feature of peace agreements in the region: an entire annex of the peace treaty between Israel and Jordan deals with their distribution; the peace negotiations between Israel and Syria in 2000 were broken off owing to the issue of access to the waters of the Sea of Galilee; and the question of access to water, one of the issues over which Israel and Palestine are divided, is so problematic that it was decided to put it on the back burner until negotiations on the Palestinian State have been concluded. Indeed, the settlement of this issue will be one of the bases of a lasting agreement between the two countries. (34)

Water—in this case freshwater—and its abundance or scarcity can cause positive or negative effects on *agriculture*: in the right measure and even with a hotter climate than in past periods, human groups (normally in northern latitudes, the majority with few development problems) may benefit from better crop production, which will in turn lead to social stability and thriving international trade. In contrast, lack or shortage of water will lead to loss of arable land, shortage or absence of crop production, social unrest if the population has the strength for it, serious food crises, dependence on external assistance, war (Darfur), (35) major

(32) A/64/350, para. 33, p.13.

(33) Vid. BROWN, O. and CRAWFORD, A., «Rising Temperatures, Rising Tensions. Climate change and the risk of violent conflict in the Middle East», International Institute for Sustainable Development, Ministry of Foreign Affairs of Denmark, 2009, pp.20-21. Vid., also, «El agua como factor de cooperación y de conflicto en las relaciones internacionales contemporáneas», XXII Jornadas de la Asociación Española de Profesores de Derecho Internacional y Relaciones Internacionales, Murcia, 20-22 September 2007, Gutiérrez Espada, C. et al. (coords), Instituto Euromediterráneo del Agua, Murcia, 2009.

(34) Vid. BROWN, O. and CRAWFORD, A., «Rising Temperatures, Rising Tensions. Climate change and the risk of violent conflict in the Middle East», Loc. Cit., p.21.

(35) Black African ethnic groups coexist with populations of Arab origin in the Darfur region. The most important African ethnic group is the Fur, after whom the territory is

social differences, forced migration, loss of habitat and permanent underdevelopment, among other things.

Closely tied to this subject is the issue of *food security*: (36) crop production is especially sensitive to climate change in that this phenomenon is a factor that contributes considerably to increasing pests (fungi, bacteria, viruses and insects) and affects crop stability as a result of nutritional deficiencies, atmospheric pollutants and extreme temperatures. In turn, climate change can be a risk factor in animal food products (cattle and fisheries), as extreme weather events and rising temperatures are an excellent breeding ground for infectious diseases. (37)

Social effects of climate change

— Health

Climate change can have two types of effects in relation to human health:

- The main one will be largely negative, for both an excess of water (as a result of flooding) and shortage (as a result of droughts and high temperatures) will cause very harmful effects on human health. In the first case the effects are diarrhoea or the spread of cholera, as has occurred in the recent flooding in Pakistan (summer 2010); in the second, the spread of infectious diseases such as dengue fever, malaria and salmonella, but also heat stress and

named, but there are several more such as the Zaghara and the Masalit. These black tribes are chiefly farmers and share the territory with several minority ethnic groups of Arab origin who arrived in the area later; known as the Baggara (literally «those of the cows»), they are mainly nomadic cattle herders. The interethnic conflicts in the region are due above all to competition for its scant resources, particularly freshwater, and have intensified over the past decades on account of the substantial population increase and adverse weather conditions, as the long periods of drought led to the loss of much of the arable and grazing land. The nomadic tribes migrated southwards in search of water and grazing land, and this triggered the conflicts with the tribes of farmers who occupied those territories. All this, coupled with a population explosion, serious tribal, ethnic and religious differences and the struggle for land, deteriorated into violence. http://es.wikipedia.org/wiki/Darfur#El_conflicto_de_Darfur (last visit 27-10-2010).

(36) The term became legitimised during the World Food Summit, FAO, 1996.

(37) Vid. On food security and climate change the very technical report, «Climate Change: implications for food safety», FAO.

an increase in cardiovascular diseases. Children and the elderly are particularly vulnerable to these effects. (38)

- The only positive effect of the temperature rise resulting from climate change is a reduction in deaths from cold, but not even this is certain, as extreme weather events (cold or heat waves, tropical storms, hurricanes...) are also common features of climate change and it is likewise a common misconception that climate change will be gradual: sudden changes in temperature, sea level or precipitations are perfectly possible. (39)
- *Risk of mass migration and social conflict*

Coastal areas where approximately one-third of the world's population lives are particularly vulnerable to sea level rises due to climate change; this will cause serious damage to transport infrastructures, industrial facilities, energy production and resource distribution. In the case of small island states, the situation may become so untenable that they cease to be viable as states—Maldives, Madagascar—giving rise to a legal (and vital) problem for their nationals, who would become stateless. (40) The predictions of the IPCC indicate that between now and 2080 millions more people than now will suffer flooding every year. (41) Most of the deltas of the world's main rivers—Niger, Mekong, Yangtsé, Ganges, Nilo, Rhine, Mississippi—are densely populated as large megalopolises have sprung up around them, with very deficient land development in some cases, making the population of many of the waterside cities especially sensitive to climate change as it is particularly poor. (42)

(38) Vid. «Protecting Health from Climate Change. Connecting science, policy and people». World Health Organisation (WHO), 2009.

(39) Vid. «Shifting Bases, Shifting Perils...», Loc. Cit. , p.18.

(40) «Según datos del ACNUR correspondientes al año 2007, puede haber cerca de doce millones de personas que carecen de nacionalidad. Y no son pocos los efectos negativos que ello conlleva para los afectados, pues la apatridia puede impedir poseer bienes o viajar legalmente e imposibilitar también el acceso a la educación, al mercado laboral, a la atención médica y sanitaria o a la asistencia jurídica y legal, entre otras consecuencias». Cf. JIMÉNEZ PIERNAS, C., «Introducción al Derecho Internacional Público. Práctica española», Tecnos, Madrid, 2009, p.371.

(41) Vid. «Summary for Policymakers». «Climate change 2007: impacts and vulnerability». Contribution of Working Group II to the Fourth IPCC Assessment Report.

(42) Vid. «Climate Change, Environmental Degradation and Migration: Addressing Vulnerabilities and Harnessing Opportunities». Permanent Mission of Greece, Geneva, and International Organization for Migration, IOM, OIM, 2009.

The underlying reasons for this *mass migration* are many, but without a doubt one of the clearest since the beginning of time is environmental change: it is logical that if water or food is scarce, people will seek better places to live and sometimes the conflicts and ethnic or religious tension caused by population migration stem from underlying environmental reasons (Darfur region, Sudan).

It should be remembered that the migrants of rural areas tend to be poor. This leads them to establish fragile settlements that are especially vulnerable to climate change, and so the chain starts over and over again.

Three types of mass or forced migration as a direct or indirect result of climate phenomena are generally distinguished: (43)

- a) The so-called «internally displaced people», who remain in their own country. Hurricane Katrina, which hit the Mississippi riverbank, caused a great deal of internal migrants. Poor political management of the event, despite its taking place in a country that is the major world leader, sparked unrest not only among the displaced people themselves, many of whom have still not been relocated, but also among US citizens as a whole.
- b) Some migrants cross international borders, often illegally, thereby posing a challenge to the states which take them in or have to decide what to do with them—for example, the recent gypsy crisis in France. This sometimes triggers a response to the phenomenon from regional organisations (such as the European Union) that is coordinated but not always in keeping with the high standard of human rights protection that is also characteristic of Europeans. In this connection it is not amiss to point out what is known as the «Return Directive», (44) widely criticised by intellectuals, non-governmental organisations and governmental organisations such as MERCOSUR, the Andean Community and UNASUR; (45) common border management through FRONTEX; and the often shameful

(43) Vid. «National Security and the Threat of Climate Change», Loc. Cit., p.18.

(44) Parliament and Council Directive 2008/115/EC of the European Parliament and of the Council 16 December 2008 on common standards and procedures in Member States for returning illegally staying third-country nationals. OJEU L 348, 24 December 2008, pp.98-107.

(45) I myself joined in this criticism in my article «TEDH- Sentencia de 28.02.2008, Saadi c. Italia 37201/06- Artículo 3 CEDH- Prohibición de torturas y penas o tratos inhumanos o degradantes- Terrorismo v. Tortura», Revista de Derecho Comunitario Europeo, no. 32, pp.275-290.

border fences separating Israel from the West Bank—declared unlawful by the International Court of Justice in its advisory opinion—(46) or the United States from Mexico (popularly known as the «Tortilla Wall» as part of «Operation Guardian» against illegal immigration in the United States), to cite a few examples.

In this connection it is important to realise that,

«people moving for environmental reasons are not ‘climate refugees’, even though the media continues to use this term because of its strong emotional connotation and the compassion it generates. Words do have a meaning, and the 1951 Convention Relating to the Status of Refugees clearly states that the notion of persecution is central to the eligibility of people for this status. This limits the possibility of granting a refugee status in the content of environmental degradation to few very special cases. In a few countries Temporary Protection Status (TPS) was established to assist foreign populations affected by natural disasters. Hurricane Mitch led the United States to offer temporary protection, an example followed by Sweden and Finland with different conditions of eligibility». (47)

- c) A third form of migration is that in which the people involved not only cross international borders but travel huge distances: such is the case of South-North migration in which the prosperous countries (of the North, or the West—for example we could include Australia, which although in the south is «Western») take in migrants from Africa, Asia and Latin America. (48)

Although migration itself is not necessarily a conflict factor, it often is, as when it takes place on a mass scale, as generally occurs as a result of a weather event, it usually affects people without economic resources. This adds a stress factor in the country of destination, not only on the

(46) Conséquences juridiques de l'édification d'un mur dans le territoire palestinien occupé, avis consultatif du 9 juillet 2004, Recueil 2004.

(47) Cf. BONCOUR, Ph, «Adapting to climate change», Migration. Autumn 2009, p.4, <http://www.iom.org>

(48) International migration linked to climate change appears to be a very limited phenomenon for the simple reason that migrants require financial resources and/or community networks in the destination countries, which the poor and «landless» do not usually have. Cf. BONCOUR, Ph, Loc. Cit., p.4, <http://www.iom.org> (last visit 19-10-2010)

state structures which may already be weak but by triggering clashes and tensions between the native and migrant populations.

— *Underdevelopment and human rights*

The associated effects of climate change—loss of crops owing to droughts, the consequent repercussions on the health and nutrition of the affected populations, reduction in human and animal productivity, degradation of lands and damage to infrastructures—lessen the productive potential of economies: the countries which are the most exposed to these effects, even though all are sensitive to change, are small island states and developing countries. (49)

While the World Summit on the Millennium Development Goals is taking place (20-22 September 2010), it is not amiss to quote the UN Secretary General in relation to the security implications of climate change:

«Differences of power, wealth and geography do determine what we perceive as the gravest threats to our survival and well-being. Differences of focus lead us to dismiss what others perceive as the gravest of all threats to their survival. Inequitable responses to threats further fuel division. Many people believe that what passes for collective security today is simply a system for protecting the rich and powerful. Such perceptions pose a fundamental challenge to building collective security today. Stated baldly, without mutual recognition of threats there can be no collective security. Self-help will rule, mistrust will predominate and cooperation for long-term mutual gain will elude us.

What is needed today is nothing less than a new consensus between alliances that are frayed, between wealthy nations and poor, and among peoples mired in mistrust across an apparently widening cultural abyss. The essence of that consensus is simple: we all share responsibility for each other's security. And the test of that consensus will be action».(50)

The physical effects of global warming cannot be classified as violations of human rights, because climate change-related harm is generally not due to an action or omission of the state. The effects of climate change on the effective enjoyment of human rights can be direct, to the extent that extreme weather events may pose a threat to the right to life,

(49) Vid. A/64/350, paragraph 45 et seq., pp.16-18.

(50) A/59/565, 59th session of the General Assembly, 2 December 2004.

but they are usually indirect (greater economic pressure on health systems and vulnerabilities related to climate change-induced migration). Some population groups are especially vulnerable to climate change, such as children, women, the elderly and people with disabilities, as climate change can exacerbate discrimination and inequality in power relations. (51)

Political effects: failed states.

— Failed states

The term «failed state» does not exist as such in International Law; rather, it is a political expression which has gained ground in the media and now in common language. It denotes states which are «weak or fragile» with respect to their basic structures—according to International Law these are territory, population and political organisation (whatever the kind, whether democratic or otherwise), all lumped together under the idea of sovereignty—chiefly the governance aspect, rendering them incapable of providing basic services to the population, ensuring public order and protecting the territorial integrity of the state. (52)

(51) Vid. «Report of the Office of the High Commissioner for Human Rights on the relationship between climate change and human rights», A/HRC/10/61, 15 January 2009.

(52) Bearing in mind that the term «failed state» has become popular, especially since the terrorist attacks of 11 September 2001, and that, despite the long lists of states purported to fit into this category, they are not all exactly that, a study has established the following qualitative categorisation:

- a) Consolidated states: modern national states in which all three basic powers (legislative, executive and judicial) are safeguarded. This group is represented primarily by the members of the Organisation for Economic Cooperation and Development (OECD). May also include consolidating states undergoing a sustainable transformation progress towards a democratic structure and market economy (Costa Rica, Chile, Estonia, Latvia, Lithuania, Slovenia, South Africa).
- b) Weak states: those in which the monopoly on the use of force is still largely safeguarded but which display grave deficiencies in fulfilling the welfare and rule of law functions (Eritrea, Uganda, Venezuela, Macedonia and Albania). Authoritarian Islamic regimes may fall into this category, as despite appearing strong in that they provide stability and public services, they do not properly fulfil the rule of law and welfare functions (Saudi Arabia, Egypt, Iran).
- c) Fragile states: Here the state performs rule of law functions and provides welfare to its population. However, its monopoly of the use of force is either severely restricted or non-existent, and it does not have full control over its territory or external borders. Such is the case of many states which are formally democratic but cha-

The influence of climate change in the emergence of a failed state has not been studied explicitly but it has indirectly—that is, to the extent that the exploitation of natural resources (oil, precious stones) can influence the emergence of these weak structures and of groups that challenge the state's power. Nevertheless, bearing in mind that we are dealing with hypotheses, it can be affirmed that several intense climate changes can act as destabilising factors, (53) which is particularly dangerous if the territory is home to key energy resources that could fall into the hands of clans, warlords or terrorist groups, who would thus have the possibility to blackmail all the states that depend on the extraction or distribution of these resources. (54)

Studying the structural causes of the development of piracy off the Somalian coasts since the 1990s, F. Fernández Fadón underlines the loss of fishery resources on which the fishing communities depend as a livelihood and source of food, drawing on the report of the United Nations Somalia Monitoring Group (SMG). This author states that, according to the

llenged by separatist forces (Colombia, Sri Lanka, Indonesia, Georgia) and of some authoritarian states (Sudan, Nepal).

d) Failed states/state collapse: A state may be regarded as failed if none of the three powers develops correctly. As shown by the example of Somalia, this category does not necessarily imply chaos or anarchy, generally because relatively powerful non-state actors emerge in place of the failed state and substitute its functions (Somalia, Afghanistan, Iraq, Democratic Republic of Congo). This category does not apply to processes in which several new states are formed from a predecessor state, either peacefully (Soviet Union in 1991, Ethiopia/Eritrea in 1991, Czechoslovakia in 1993), or by violent secession (Pakistan/Bangladesh in 1971, Yugoslavia in 1995).

Cf. «Climate Change as a Security Risk», German Advisory Council on Global Change (WGBU), 2008, p.42, Box 4.2-1.

(53) Ibid. p.44.

(54) Bearing in mind the lists drawn up by various think tanks and international organisations, the German Advisory Council on Climate Change (WBGU) has compiled the following list with fallibility indices from 1 to 4:

- Sub-Saharan Africa: Burundi, Chad, Central African Republic, Ivory Coast, Democratic Republic of Congo, Liberia, Nigeria, Sudan (4 each), Angola, Ethiopia, Guinea, Sierra Leone, Somalia, Zimbabwe (3 each), Cameroon, Guinea-Bissau and Malawi (2 each).
- Central America and the Caribbean: Colombia and Haiti (3 each).
- Middle East: Iraq (4), Yemen (3), Lebanon, Saudia Arabia and Syria (2 each).
- Eastern Europe and Central Asia: Afghanistan (3), Russia and Uzbekistan (2 each).
- South and Southeast Asia: Myanmar (4), Bangladesh, Indonesia, Laos, North Korea, Pakistan and Sri Lanka (2 each).

Ibid., p.45.

European Commission, more than 50% of all catches in Somalia, Liberia and Conakry Guinea are illegal. Furthermore, most of the fishery sector in Somalia is controlled by foreign companies.

«Actions which squander wealth in the marine ecosystem of the Horn of Africa are not limited to overexploitation of marine species but also include dumping of all kinds of toxic waste, including nuclear waste, as suspected by the UN Food and Agriculture Organization. [...] The objective fact that Somalian fisherman are able to catch increasingly less has a decisive effect on the already fragile coastal economies and partly explains the origin of piracy in the area and its use by pirate groups in Somalia as a rhetorical argument to justify their actions».(55)

Politico-economic effects: increase in economic inequalities, energy resources and possible conflicts in the scramble for them

-Increase in economic inequalities

The effects of climate change on international trade remain speculative, but the UN Secretary General, while recognising this fact, points out a few by no means inconsiderable consequences in his report on «Climate change and its possible security implications»: (56)

- Need for investment in the building of flood defences around ports;
- Need to relocate industries that could be affected by rising sea levels;
- Need to build sturdier means of transport and offshore oil and gas installations.

Developing countries will bear the brunt of the cost of climate change. This is due to several factors: their productive sectors are heavily de-

(55) Cf. FERNÁNDEZ FADÓN, F., «Piratería en Somalia: «mares fallidos» y consideraciones de la historia marítima», Documento de Trabajo (DT), Real Instituto Elcano, 2009 at http://www.realinstitutoelcano.org/wps/portal/rielcano/contenido?WCM_GLOBAL_CONTEXT=/elcano/elcano_es/zonas_es/mediterraneo+y+mundo+arabe/dt10-2009 (last visit, 22-09-2010). Vid., also on failed states, specifically the case of Somalia, JIMÉNEZ PIERNAS, C., «Los Estados fracasados y el Derecho internacional: el caso de Somalia», *Revista Española de Derecho Internacional*, Vol. LXII 2010, 1, pp.17-59 and LÓPEZ MARTÍN, A.G., «Los Estados fallidos y sus implicaciones para el ordenamiento jurídico internacional. El paradigma de Somalia» in *Cursos de Derecho Internacional de Vitoria-Gasteiz 2010*, UPV, Bilbao (in press).

(56) Cf. A/64/350, para.50, p.17.

pendent on nature; a good part of their population lives in areas that are greatly exposed to climate change and in very precarious living conditions; and their capacity for institutional and financial adaptation is greatly limited. (57) Although the effects of climate change will have impacts on all the world's economies, it is evident that the phenomenon will widen the already huge gap between the developed and developing worlds.

Article 3 of the United Nations Framework Convention on Climate Change—known as the «equity article»—establishes the developed

(57) The report «Changing the Climate for Development» distinguishes 6 areas of potential development but whose economies are deeply affected by climate change:

- Sub-Saharan Africa: a naturally fragile region (two-thirds of its surface area is desert or dry land) exposed to floods and droughts. The region's economies depend on natural resources. Infrastructure is completely inadequate, despite the region's abundant resources.

- East Asia and the Pacific: a major cause of vulnerability in the region is the large number of people living in coastal areas and low-lying islands. Heavily dependent on agriculture. Substantial growth in population, rapid urbanisation and industrialisation with consequent environmental degradation. Heavy dependence on marine resources, which are endangered by industrial pollution, over-fishing and runoff of agricultural pesticides.

- Eastern Europe and Central Asia: the region is weighed down by a lingering Soviet legacy of environmental mismanagement, to which is added fragile and antiquated infrastructure. It appears that climate change will lead to the disappearance of the Southern Aral Sea. The melting of Central Asia's glaciers will initially increase river flow and even flooding, but in the long term will result in serious droughts and shortages of freshwater.

- Latin America and the Caribbean: the region's most fragile ecosystems look set to disappear: the tropical glaciers of the Andes (leaving 77 million people without fresh water by 2020 and without energy to produce electricity); disappearance of the coral reefs in the Caribbean, which host nurseries for approximately 65% of all marine species in the area; serious damage to the Gulf of Mexico's wetlands, making the area more vulnerable to hurricanes; dieback of the Amazon rain forest, converting vast areas to savannah.

- Middle East and North Africa: it is already the world's driest region, but per capita water availability is predicted to half by 2050. Heavy concentration of population and economic activity in flood-prone coastal zones. Social and political conflicts that climate change will heighten.

- South Asia: high levels of population density and poverty. The effects of climate change on the monsoon and melting of Himalayan glaciers will endanger the availability of fresh water. Rising sea levels make this area especially vulnerable, with densely populated coastlines, agricultural plains threatened by saltwater intrusion and many low-lying islands (Maldives).

Cf. «Overview: Changing the Climate for Development», World Development Report 2010, p.6 Box 1.

countries' responsibility towards the developing world in respect of climate change, stating as follows:

«[...]1. The Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the developed country Parties should take the lead in combating climate change and the adverse effects thereof.

2. The specific needs and special circumstances of developing country Parties, especially those that are particularly vulnerable to the adverse effects of climate change, and of those Parties, especially developing country Parties, that would have to bear a disproportionate or abnormal burden under the Convention, should be given full consideration.»

— *Energy resources and possible conflicts in the scramble for them.*

As pointed out earlier, the economic consequences of climate change affect multiple productive sectors, in turn triggering a rebound effect on the supply and demand for goods and services: for example, after hurricane Katrina struck, the loss of oil refinery capacity—a developed industry in the area—led to an increase in the price of crude oil and, in turn, the use of biofuels as a substitute for crude oil pushed up food prices.

In any event, it seems likely that climate change will have impacts on the production and supply of energy, with positive effects in some cases (wind or solar power) and negative in others (hydroelectric energy in areas where water shortages are expected). (58) Furthermore, it is evident that a great deal of the developed world depends on energy resources obtained from reserves in countries that will not only be affected by climate change but are currently politically unstable, prone to join the group of the so-called «failed states», overrun with terrorist movements, among other problems. It is likely that the effects of climate change will exacerbate these trends, thereby endangering energy security or the security of the energy supply to much of the world unless we change our patterns of consumption.

The reason for raising this question in the present study on the risks and threats of climate change is that currently, as stated, a good many of the countries and regions where raw materials are concentrated are politically unstable. This instability could be exacerbated if the countries find

(58) Cf. «Climate Change as a Security Risk», Loc. Cit., p.72.

themselves forced to allocate a large portion of their resources to combating the effects of climate change or, to put it more simply, the effects of climate change can in themselves pose a threat to the security of energy supply—consider floods or hurricanes that render the producing countries incapable of supplying, placing consumers, who are a majority, in a precarious situation.

In this respect the basic energy resources continue to be oil and gas, and the countries that consume them—such as the United States, China, Japan, India and the members of the European Union—will continue to depend on the output of Russia, the Caspian Sea and the Persian Gulf in the near future (up to about 2050). As for the European Union, there is a risk that Member States, in their efforts to ensure *energy security*, may abandon the common project and adopt national energy strategies that compete with each other. Precisely in order to avoid this situation in which energy relations are increasingly politicised, the European Union has tended to include energy issues not only in the sphere of external trade (a classic Community competence) but also in the Common Foreign and Security Policy, to the extent that an uninterrupted flow of energy towards the European Union will depend on the political and economic stability of the producing regions, something on which an appropriate European foreign policy can have decisive influence. (59) North Africa, the Persian

(59) Vid. in this connection the following documents: Decision 98/181/EC, ECSC, Euratom: Council and Commission Decision of 23 September 1997 on the conclusion, by the European Communities, of the Energy Charter Treaty and the Energy Charter Protocol on energy efficiency and related environmental aspects; COM 769 final, 2000, «Towards a European strategy for the security of energy supply»; Communication from the Commission to the Council and the European Parliament, 17 July 2002 Energy cooperation with the developing countries COM (2002) 408 final; Communication from the Commission to the Council and the European Parliament, 7 March 2001, «Enhancing Euro-Mediterranean cooperation on transport and energy»; Communication of the Commission to the Council and the European Parliament, 26 October 2004, on the future development of the EU Energy Initiative and the modalities for the establishment of an Energy Facility for ACP countries COM (2004) 711 final; Communication from the Commission to the Council and the European Parliament, 6 October 2006, «Mobilising public and private finance towards global access to climate-friendly, affordable and secure energy services: The Global Energy Efficiency and Renewable Energy Fund» COM (2006) 583 final; Communication of the Commission, 25 January 2006, entitled: «External Action: Thematic Programme For Environment and Sustainable Management of Natural Resources including Energy COM (2006) 20 final; COM (2007) 1 final, «An energy policy for Europe»; Communication of the Commission to the Council and the European Parliament, 11 April 2007, «Black Sea synergy, a new regional cooperation initiative» COM (2007) 160 final .

Gulf, the Caspian Sea area and Russia are thus neighbouring areas of an enlarged European Union and also rich in energy sources that the Union consumes: it is thus in Europe's interests to pursue a neighbourhood policy with these regions that fosters their political stability. (60)

Bearing in mind these questions, without wishing to provide an exhaustive list of all the regions potentially affected by climate change, in this section I will point out a few hotspots and possible sources of tension or conflict as a result of the challenges climate change will pose to the supply of different types of energy:

a) Southern Mediterranean region (Algeria, Egypt, Israel, Lebanon, Morocco, Palestine, Syria and Tunisia):

The geopolitical importance of the region can be explained by many factors, although I shall concentrate on only one, the abundance of fossil fuels: Algeria and Libya are major exporters to the European Union; Turkey, for its part, as an eternal candidate for EU membership, can play a crucial role in its relations with the Union as far as energy supply is concerned, as it is a transit country for oil and gas from Russia, the Caspian Sea region and the Persian Gulf and is also a prominent player in relations with Middle Eastern countries.

Climate change is expected to have particularly devastating effects on the area, particularly with respect to access to water, which is already a problem today: it seems very likely that the temperature rise will substantially diminish the flow of the great rivers that cross the region (Jordan, Tigris, Euphrates, Nile), leading to a fall in agricultural production which will in turn trigger population displacements in addition to those already taking place in the area as a result of the frequent armed clashes between neighbours. The effects of climate change add a stress factor to the region's weak economies: the countries that export fossil resources will have to invest in infrastructure and damage repair and may be tempted to put pressure on the consumer countries (especially the European Union), demanding trade advantages or raising energy prices.

b) The Eurasian belt (Azerbaijan, Armenia, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan):

(60) Vid. the very extensive «Study on Energy Supply, Security and Geopolitics», Final Report, January 2004.

This area's geostrategic importance stems from the fact that it is the neighbour of a major power, Russia, which aspires to assert its role in international relations, and also of the Middle East and Afghanistan. Owing precisely to this location, the region is a necessary transit route for Western-bound fossil fuel; nor should it be forgotten that the Caspian Sea—over which the coastal states are involved in territorial disputes—is rich in resources. This geostrategic importance is also a result of counter terrorism efforts. Bearing in mind these facts, the area is under scrutiny by major powers like the US, Russia—we should recall the latter's armed intervention in Georgia in 2008—and China.

The chief problem burdening this geographical area is its instability and proneness to conflict, owing largely to the lack of legitimacy of the political institutions that emerged in the post-Soviet era and their inefficient management of public affairs, not to mention widespread corruption. Climate change can add a greater stress factor to the area's already impoverished economies. Bearing in mind the major powers that have their eyes on the area—or, like Russia, have not taken them off it—third-party intervention does not seem unlikely.

c) The Amazon Rainforest (Brazil, Bolivia, Peru, Colombia, Venezuela, Ecuador, Surinam and Guyana):

The great dilemma of this region is constant deforestation which, coupled with the likely trends of climate change, will lead to the «savannisation» of the area. Rising temperatures, more frequent droughts and soil degradation will have impacts on agriculture. Fisheries, despite already being overexploited, will suffer further consequences. Infrastructure, already deficient, will suffer the effects of climate change: river levels may drop alarmingly, turning water into mud and making highways impassable, with harmful effects not only on trade and industry but also on the population's health.

Brazil is the most significant country for the region's economic development, but its economic exploitation of the Amazonian Rainforest is controversial. The region's great wealth of resources is being eroded politically in countries that are instable or whose structures are greatly improvable, as is the case of Peru, Colombia and Venezuela, which are overrun by terrorist movements.

The effects of climate change in this geographical area can do even further damage to political structures, leading to a new intervention of

nearby third countries in pursuit of resources (the United States) or to odd alliances (Venezuela-Iran) which inevitably erode fundamental rights, particularly those of the most underprivileged people.

d) Sub-Saharan Africa and southern Africa:

The effects of climate change will be particularly marked in this vast, resource-rich area, adding to or exacerbating the already very serious problems burdening the African continent. One of the most feared but possibly most certain predictions is the terrible impact of climate change on the already badly afflicted African continent, especially sub-Saharan Africa. The loss of arable land as a result of drought will cause famine and grave social tension, placing further burdens on the already weak governments of sub-Saharan Africa which will be faced, in such conditions, with problems such as forced migration, economic collapse and crises that can develop into civil or international wars. This in turn can give rise to mass-scale social unrest that is a breeding ground for extremist groups, terrorists and so-called «failed states». In both sub-Saharan and southern Africa the effects of climate change are expected to heighten internal and cross-border tension, sparking violent conflicts over access to the most basic resources.

e) The Arctic:

The vast Arctic region is formed by frozen ocean surrounded by treeless lands and permanently frozen subsoil (permafrost) and is particularly sensitive to climate change for several reasons: the ice and permafrost are melting fast as a result of global warming; this in turn is eroding the northern coast of Alaska, as a result of which the Arctic thaw may speed up global warming.

In turn the Arctic thaw makes this ecosystem a geostrategic hotspot of primary importance for the following reasons:

1. The thaw will open up new routes for trade and also for the distribution of resources. Indeed, the opening up of the inter-oceanic passages,(61) at least during the summer months but probably

(61) There would be two major inter-oceanic passages in the Arctic: the Northwest Passage along the Arctic coast of the USA and Canada towards the northern coast of Greenland; and the Northeast Passage from the North Cape of the Eurasian coast of Siberia to the Bering Strait. The international legal status of the waters of the inter-oceanic passages is under discussion—internal waters, territorial sea or international straits for international navigation. Vid. ALCAIDE FERNÁNDEZ, J and CINELLI, C., «La 'cuestión ártica' y el Derecho Internacional», *Revista Española de Derecho In-*

soon throughout the whole year—the Arctic is the fastest thawing region in the world and this is triggering an interaction in the rest of the ecosystems—is creating an unbeatable navigation route, reducing the cost of transport and, accordingly, of international trade, by bringing Europe and Asia closer together. Therefore, from a trade perspective, the opening of the Northeast Passage as a result of climate change is good news.

2. Studies conducted in the area so far hail the Arctic as one of the world's major reserves of gas and petroleum, not to mention other resources such as «gas hydrates» and precious minerals. This paves the way for a possible conflict—legal at least—over the distribution of the respective marine spaces among the coastal states of the Arctic (Canada, Denmark (through Greenland), Norway, Finland, Iceland, Sweden, Russia and the United States of America).⁽⁶²⁾ On Friday 17 September 2010 ⁽⁶³⁾ the press reported the conclusion of an agreement between Norway and Russia to share out an area of 175,000 square metres, although their dispute continues over the underwater range known as the Lomonosov Ridge, to be settled according to the system provided for in the United Nations Convention on the Law of the Sea of 1982. An important feature of the Russo-Norwegian Treaty on the delimitation of maritime jurisdictions and cooperation is that it stipulates that any deposit that straddles the delimitation lines can only be exploited jointly and as an indivisible whole, in an attempt to prevent the exploitation of resources being ground to a halt by territorial quarrels. Most gas and oil reserves are located on the Russian side, but the country's firms are in no position to exploit them in deepwater

ternacional, Vol. LXI, 2009/2, pp.394-397. Vid. LÓPEZ MARTÍN, A.G., *International Straits. Concept, Classification and Rules of Passage*, Springer, 2010.

(62) The Russian Federation is gathering scientific and technical information in order to revise the proposal for delimitation it submitted to the Commission on the Limits of the Continental Shelf in 2001 (article 76.8 and Annex II of the United Nations Convention on the Law of the Sea of 1982). Denmark and Canada are also awaiting the compilation of data in order to submit their proposals to the aforementioned Commission. As it is not a party to the Convention on the Law of the Sea, the United States is debating becoming one or accepting, without being party to this instrument, as international common law, the continental shelf being delimited beyond 200 miles, thereby avoiding the recommendations of the Commission. Particularly controversial is Norway's proposal (of 27 November 2006) to the Commission, as the Commission made certain statements about Norway's claims. *Ibid.* pp.386-390.

(63) Cf. FERNÁNDEZ, R., «Rusia y Noruega trocean su Ártico para extraer el gas y el petróleo», *diario El País*, Friday 17 September 2010, p.36 (print edition).

areas without Norwegian help. The possibility that the exploitation of resources may be an opportunity for new strategic alliances, such as between Russia and China, has also been toyed with.

3. As the Arctic ice sheet recedes, new possibilities emerge for the exploitation of fishery resources, along with the associated risk of loss of biodiversity in the area.

CONCLUSIONS: IS THERE A CHOICE?

Although some refute the evidence of anthropogenic influence on climate change, it is patently obvious that human behaviour during the centuries following the major industrialisation of the nineteenth century—often predatory, exterminating and highly self-centred—has had a lot to do with the situation of change we face today: in some cases the effects of climate change have ceased to be merely «potential» and are now a fact.

The challenge seems impossible to address even for the prosperous developed states which, although bearing the brunt of responsibility for climate change, also occupy a privileged position with respect to much of the world that is underdeveloped and clearly at a disadvantage—even geographically—with respect to global warming.

Do we have a choice? In view of the many reports and studies that currently exist on this subject it seems that we do not, although from all levels—intergovernmental organisations, states, local authorities, the media and even supermarkets—we are being invited as *world citizens* to adopt consumer habits that are more efficient, responsible and respectful of the environment in which we live, in order to palliate, mitigate or slow down the unstoppable process.

Indeed, the means of mitigating the effects of global warming are numerous and involve scientific tests—*geo-engineering* (64)—seeking alternative, cleaner energy sources (nuclear, solar, wind, tidal) and concerted action (for isolation is not only possible but also useless) through legally binding commitments adopted in the framework of universal international organisations. This is all very well, but ultimately it is down to each of us humans who live on planet Earth.

(64) «Climate engineering», more popularly known as geo-engineering, is the amalgam of techniques designed to manipulate the climate artificially in order to counter the harmful effects of climate change. These techniques have been criticised for being ineffective, incomplete, a source of potential side-effects or simply on moral grounds.

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CHAPTER TWO

ENERGY POLICY AND FIGHTING CLIMATE CHANGE: AMERICA'S COMPLICATED CROSSROADS

ENERGY POLICY AND FIGHTING CLIMATE CHANGE: AMERICA'S COMPLICATED CROSSROADS

PAUL ISBELL

SUMMARY

The energy and climate policy of the Obama Administration has been knocked off course by internal politics in the United States. In the wake of the midterm elections and on the eve of the Cancun Summit on Climate Change, it appears that cap-and-trade is dead, at least in the US and at least for the time being. The financial and economic crisis, together with the political controversy generated by Obama's health care reform, have created great difficulties for his policies, and his many goodwill gestures to the Republican opposition and his opponents in the traditional energy industries have yet to stimulate a more genuinely collaborative disposition on their part. In any event, given the peculiar distribution of power in Washington and across the states in the wake of the midterm elections, there still is a good chance that the Administration will be able to reconstruct – perhaps in a slightly less ambitious form – a useful new version of the bipartisan energy and climate pact that Obama had so meticulously constructed during 2008 and 2009. The most likely scenario is one in which the Congress passes legislation for a new Clean Energy Standard (CES), similar in nature to the Renewable Energy Standard of the European Union (20% less CO₂ emissions, compared with 1990, by 2020), but significantly different too in that it would consecrate the position and role of both nuclear power and clean coal by including them within the framework of the standard as «clean» energies.

Key words: Obama, climate change, Clean Energy Standard (CES), Cancún summit, Copenhagen accord, CO₂ emissions, Waxman-Markey, energy and climate policy, cap-and-trade

LEGISLATIVE EFFORT: FROM VICTORY TO STALEMATE

During the winter of 2009, the new US president, Barack Obama, faced fairly good prospects of seeing his new energy policy come to fruition.⁽¹⁾ No sooner had Obama moved into the White House than he signed several executive decrees boosting efficiency standards in automobiles and home appliances. Scarcely a month later, Obama secured Congress's approval for his «Stimulus Plan», the American Recovery and Reinvestment Act (ARRA). The «stimulus» included more than 80 billion dollars of public support (tax cuts, subsidies, other direct sources of financing, and government-backed loans) for the expansion of indigenous energy sources (particularly, but not exclusively, renewable energies), the renewal of the energy infrastructure to support this national expansion (a smart grid, for example) and more research into new technologies (better batteries, second-generation biofuels, clean coal, etc.) for a new low-carbon economy.

In just a few months, US energy policy had progressed more than during any other period since the 1970s. In any event, the Administration and its allies in Congress decided to propose healthcare reform legislation before pushing forward the new energy and climate legislation. For better or for worse, the firm support Obama enjoyed during the first six months of his tenure waned considerably as a result of media coverage of the healthcare reform debate, hampering not only his efforts to push through energy and climate legislation but also the possibilities of a victory for the Democrats in the midterm elections of November 2010.

The Waxman-Markey bill is passed by the House

Although the bitter debate on the healthcare reform sapped much of Obama's energy when it came to setting in motion his new energy policy, in July 2009 — no doubt with the calendar of the post-Kyoto process and the Copenhagen Summit at the end of the year in mind — the House of Representatives managed to pass a bill (the American Clean Energy and

(1) For an earlier analysis of the Obama Administration's energy policy, see Amy Myers Jaffe, «Energy policy in the Obama Administration: A Year in Review» James A. Baker III Institute for Public Policy, Rice University, June 4, 2010; Paul Isbell, «A Preliminary View of Obama's Future Energy Policy» Real Instituto Elcano, Working Paper 2/2009, 13 January 2009; «La política energética de la Administración Obama: ¿Dónde estamos después del primer año?» in *Tratado de Energías Renovables*, Aranzadi Civitas-Iberdrola, Madrid, 2010; and «La política energética de Obama después de un año», *Economía Exterior*, 2010 winter, 51, pp. 29-40 (Madrid).

Security Act, ACES, dubbed by the press as the Waxman-Markey bill) that included not only considerable new support for low-carbon energies and technologies but also the creation of a new emissions market (called cap-and-trade, and similar to — though much less demanding than — the ETS, the EU Emissions Trading System) .

Cap-and-trade would provide a main source of funding (by auctioning emissions rights) for increased state assistance for a broad range of energy technologies, both conventional and renewable. The Waxman-Markey bill also included a legal requirement that the US reduce its carbon dioxide (and other greenhouse gas) emissions to 17% below 2005 levels by 2020. The bill was passed by only seven votes — owing to the opposition of nearly all the Republican congressmen and a notable minority of conservative Democrats (the so-called Blue Dogs, many of them representatives of coal-dependent states).

Stuck in the Senate

A similar bill (known as Boxer-Kerry) was already under preliminary debate in the relevant committees of the Senate. In any event, the Senate could not debate and take a final vote on the Boxer-Kerry bill at a plenary session until it had finished debating the healthcare reform — in full swing during the autumn of 2009 — and taken its final vote.

Nevertheless, even if Obama were unable go to Copenhagen with his US emissions reduction commitments underpinned by new national legislation, he would at least be able to point out that Congress was already moving in that direction, and that he would probably be able to sign the new legislation in the spring or summer of 2010. This partial progress on the part of the US might just be enough to catalyse a global agreement at Copenhagen enabling clear and firm commitments to be established towards the reduction of emissions by the key national emitters, including those of emerging market economies like China, India and Brazil.

THE US VIS-À-VIS COPENHAGEN: LACK OF CREDIBILITY AND SQUANDERED LEADERSHIP

An Indispensable Commitment

But the international community had long awaited a clear sign of firmer US commitment towards the international effort to reduce carbon dioxide

emissions. Without the full and clear involvement of the US in establishing the global economy's new game rules in order to ward off the more destabilising effects of climate change, and in bringing about a change in the world energy model, China and the other emerging market economies would not have sufficient incentive to countenance a moderation in their growth rates — an indirect consequence, if not a necessary requisite, of the essential efforts to reduce their current and future emissions. And if the US and China failed to show clear signs of channelling future resources into a new low-carbon economy, the private sector simply would not commit itself to investing sufficient scarce resources in the incipient sectors of renewable energy and low carbon technologies. The interaction between this uncertain investment horizon, on the one hand, and the structural advantages enjoyed by the fossil fuel industries, on the other, generates a political and economic context in which changes to the energy model are not being made fast enough to mitigate climate change sufficiently in time. (2)

After all, the US accounts for 19% of annual global emissions (nearly 19 tons per capita). It is true that for the past two years China has been emitting more carbon dioxide than the US in absolute terms (equivalent to 22% of global emissions); in per capita terms, however, the Chinese emit just over 25% of the US average (5 tons per capita). (3) What is

(2) The hydrocarbons (oil and gas) sector is one of the largest and most powerful in the global economy, second only to the international financial «industry». Its profits (and political influence) are rivalled only by those of the world's major banks. Both sectors use their deep pockets to influence the development of legislation in the various key countries of the world, applying the strategy of «arbitrage» between national markets — so effective at achieving their aims (however they are defined) in the financial sphere — to international politics, still characterised by nationalist tendencies and as such highly vulnerable to the practice of «arbitrage» between national powers. In 2009, the hydrocarbons sector spent 154 million dollars on lobbying, an annual record according to the New York Times (2 February 2010). During the most recent US midterm election campaign alone, according to the Center for American Progress Action Fund, the petroleum sector spent nearly 70 million dollars. At the same time, according to the latest World Energy Outlook (2010) of the International Energy Agency (IEA), the fossil fuel industry continues to receive more than 300 billion dollars in state subsidies (indirect, at least) every year, generally subsidising the middle and wealthy classes' consumption of these polluting energies. In this regard, it is significant that at their September 2009 meeting the G-20 leaders undertook to gradually abolish and rationalise the inefficient subsidies that are excessively favourable to the fossil fuel industry and undermine the ability to formulate and update the coordination of national energy policies on a world scale in order to combat climate change effectively. See the International Energy Agency, World Energy Outlook 2010, Paris, November 2010, 55-56.

(3) Ibid., 390.

more, the US is responsible for the lion's share — 30% between 1990 and 2005 compared to only 8% in the case of China — of the current total stock of greenhouse gases in the atmosphere. (4) If the American people — who produce nearly four times as much carbon dioxide per person as the global average — are not going to reduce their emissions through their democratic legislative processes, then who will?

As we know, this commitment to a new energy model, to which the traditional energy sectors are so resistant, entails certain financial, economic and political risks that are by no means negligible from either a market perspective or a global geopolitical viewpoint. Without the involvement of the largest and most influential states (like the US and China) in designing the roadmap — and in clarifying the game rules — for a low-carbon energy future, the boundaries of strategic opportunities and the limits of financial risks will remain too vague to generate sufficient investment to steer the energy status quo away from its strong «path dependence», anchored as it is to the current model by the economic weight and physical extension of the fossil fuel infrastructure, and by the historical economic and political centrality of its respective industries (hydrocarbons and coal).

Squandering of US Leadership

The squandering of US leadership has been considerable to date. During the Clinton Administration, US negotiators reached a minimal agreement with their UNFCCC partners, sufficient enough for the US to sign the Kyoto Protocol. But President Clinton never submitted this international treaty to the Senate for ratification, as the Democratic Party did not have a sufficient majority in the upper chamber to ensure its passage. (5) What is more, Clinton was losing credibility and political influence, at least at the national level, as a result of the «Lewinsky affair», which eventually led to his impeachment by the House of Representatives. Clinton spent every last drop of the political capital he had left after the *Lewinsky affair* on winning round senators to his side to avoid being impeached by the Senate, which would have led to his legal removal from the presidency.

(4) AIE, World Energy Outlook 2007, Paris, November 2007, 201.

(5) A supermajority of 60 votes would be needed to prevent its outright rejection by means of a bizarre mechanism of the Senate known as filibustering, a hangover from the antebellum period in the US whereby, through a technical and legal process of delaying by the opposition, any important or controversial bill requires a such a super-majority in order to be passed.

The political and economic price for the US has been the steady erosion of its leadership in global climate change diplomacy and in the political economy of energy on a global scale.

Although the Clinton Administration was aware of the strategic threat implicit in the US economy's high level of dependence on fossil fuels —from both an ecological and geopolitical perspective— in the end it did not wield enough political sway to bring about a real change in the direction of the US. Nor could his vice-president, Al Gore (future champion of the fight against climate change), make a second attempt to steer national policy toward an international treaty, with which the US could have exercised leadership positively. The Supreme Court ruling in favour of George W. Bush in January 2001 —awarding him victory in the November 2000 presidential election— put paid to this possibility.

Of course, Bush Administration (2001-2009) did not do much to change the situation. The Administration's first move in the energy field was the report of the Energy Taskforce —headed by the new vice-president, Richard Cheney— which outlined a new national energy strategy. Its central strategic objectives included: (1) increasing national «energy independence» (that same rhetorical chimera —void of any strategic sense in an increasingly globalised and integrated world— touted by all US presidents for more than two generations); (2) heightened state support for traditional and conventional energies (oil, gas, coal and nuclear power); and (3) the forging of strategic alliances with non-OPEC petroleum producing countries. (6)

Renewable energies and other low-carbon technologies received only secondary attention, while climate change was scarcely mentioned in the controversial report (compiled after several meetings with the private energy sector, the identity of whose representatives Cheney never wished to disclose). Indeed, the Bush Administration was late in acknowledging the reality of climate change. Even upon returning to international negotiations to reduce greenhouse gas emissions, it preferred to negotiate outside the Kyoto Protocol framework, setting up the Major Emitters Group in an attempt, in principle, to secure agreements prior to the UNFCCC summits in Bali and Copenhagen.

(6) National Energy Policy: Report of the National Energy Policy Group, White House, Washington, D.C., May 2001 (<http://f11.findlaw.com/news.findlaw.com/hdocs/docs/energy/bushpolicy51601.pdf>).

The Bush Administration showed no enthusiasm for promoting an emissions market or for supporting renewable energies, despite the minimal progress made by the two major energy acts (the Energy Policy Act of 2005 and the Energy Independence Act of 2007) which were passed by Congress during his tenure. Its strategy pursued only short-term American interests (and often those of the US petroleum sector, which is largely concentrated in Texas, President George W. Bush's adopted state).

Bush's energy policy gradually changed over the course of his two terms in office: from the initial attempt to forge an oil alliance with Russia and a few African countries (such as Equatorial Guinea and Sao Tomé) to the invasion of Iraq and the development of a new «great game» centred around Caspian Sea petroleum and gas; from the wish to open the Arctic National Wildlife Refuge (ANWR) to private sector oil exploration to the consideration of the Arctic as a new frontier for the petroleum industry and for world geopolitics.

In short, the Bush Administration preferred to prioritise non-OPEC oil—to the extent of proposing the exploitation of deep water areas of the Arctic—leaving off the political agenda the fight against climate change, along with the deep transformation of the US and the world's energy sector, so essential to this international struggle.

Is the US Moving Backwards?

From the start of the Kyoto process up to the election of Barack Obama — who claimed during his presidential campaign that energy and climate change policy would be his administration's number one priority — the world had awaited a new, credible US policy that would help establish a global price for carbon emissions. Although nearly all economists were calling for—and still are—a tax on carbon dioxide, it appears that this possibility died during the Kyoto Protocol debate of the 1990s in the US. Conventional wisdom stated then, and still does, that the US electorate would never tolerate more taxes on its energy consumption.

Indeed, the solution that was negotiated with the private sector (particularly the energy, automobile and refinery sectors, among others) was precisely to create an emissions market—in principle more efficient and less punitive in economic and business terms than a set tax on CO₂ production or consumption. To prevent the political battle implicit in a carbon dioxide tax, a consensus was reached in favour of carbon markets

as the most feasible political solution in both the US and Europe. For its part, the European Union already has its emissions market (the ETS), now well into its second phase (meanwhile, the third phase has nearly been agreed upon by Member States. The US, for its part, still has no national emissions market, although the country does have two regional carbon markets along with several state initiatives.

The Disappointment of Copenhagen

The result of the Copenhagen Summit—although not considered a total failure—was clearly very disappointing. Despite certain progress in other areas of the UNFCCC (such as financing developing countries' efforts to mitigate and adapt to climate change; measurement, reporting and verification (MRV) of greenhouse gas emissions; and the development of deforestation and land use initiatives, such as REDD+) the agreement does not entail—at least not yet—a legally binding obligation for the major emitters of the OECD to make national commitments to reduce their emissions to between 25% and 40% below 2005 levels by 2020, and to 80% below these levels by 2050 (reduction levels considered necessary to prevent a temperature rise of more than 2 degrees Celsius with respect to the pre-industrial era).

A total commitment was made by the developed countries to provide the developing countries with more than 100 billion dollars annually from 2020—the chief «success» of the summit—and another for 30 billion dollars up to the end of 2012. (7) But the Copenhagen Accord defined neither the sources of this funding nor the mechanisms by which it might be channelled and efficiently absorbed. What is more, the accord fails to deal with the medium term financing issue (that is, the period from 2013 to 2019).

The formal commitments offered by the major emitters (both developed and developing) at Copenhagen (and set out in Annex I of the Copenhagen Accord) merely suggest global cuts of between 12% and 18%, in total, by 2020. (8) Such reductions in global emissions—if complied with—signify a temperature rise of 3.5 degrees Celsius by the end of this century with respect to the pre-industrial era. (9) What is more, some of

(7) See LAZARO, Lara, «Después del mal arranque de Copenhague», *Política Exterior*, Madrid, November-December 2010, vol. XXIV, no. 138, 152.

(8) *Ibid.*

(9) AIE, *op. cit.*, 53.

the commitments were, and still are, lacking in credibility and cast doubt on the paltry achievements of the Copenhagen Accord. For example, the formal commitment of the US at the Copenhagen Summit included a 17% reduction in its emissions with respect to 2005 levels by 2020 (the same obligation set out in the *Waxman-Markey Bill*). But this commitment represents only a 4% reduction with respect to 1990 levels (even less than the 5.2% which Clinton undertook to achieve by 2012 when signing the Kyoto Protocol), whereas the EU has committed itself to reducing levels by 20% with respect to that year. (10)

In addition, the international community can only view the US's commitment as not only weak, but also as highly fragile, particularly given that it was based solely upon the House's approval of the Waxman-Markey bill. A battle had yet to be fought in the Senate over its equivalent (at the time the Boxer-Kerry bill). Furthermore, the non-binding commitments of many emerging countries (those not included in Annex I), such as China, India and Brazil, are expressed only in very broad ranges and the targets are expressed in terms of reducing the energy intensity (or carbon intensity) of their economies and not explicitly in terms of reducing emissions. What is more, they use benchmarks (such as the highly vague business-as-usual projection) based upon assumptions that are not clarified.

As Fatih Biroh, chief economist of the IEA, states in another chapter of this book, the ambiguity of the Copenhagen Accord makes for a very broad range of different possible emission levels in 2020, equivalent to a possible difference of nearly 4 Gt of emissions produced (or not produced) by the major emitters that year. This uncertainty range is equivalent to more than 12% of the maximum level of global emissions in 2020, compatible with an eventual stabilisation of CO₂ levels at less than 450ppm. (11) The end result of this equation is a margin of error of more than 10% in calculating the possible impact of the current weak commitments alone, not to mention another more than likely margin of error in the pace and strictness of their implementation.

While the Copenhagen Accord did establish the goal of limiting the global average temperature increase to two degrees Celsius with respect to pre-industrial levels, it failed to map out the path for achieving it be-

(10) BIELLO, David «US Commits to Greenhouse Gas Cuts under Copenhagen Accord», Scientific American, 29 January 2010 (<http://www.scientificamerican.com/article.cfm?id=us-commits-to-greenhouse-gas-cuts-under-copenhagen-accord>)

(11) See also IEA, op. cit. 55, 381-383.

yond 2020. Copenhagen also left too many critical issues unresolved, such as medium-term financing or the need to set up major international carbon markets leading to the establishment of a world carbon price that reflects real emission costs.

To make matters worse, at Copenhagen the major emerging economies (like China, India, Brazil and South Africa) staged a sort of diplomatic coup when they met on their own, without inviting the US to take part, to discuss their respective positions with a view to establishing a common agreement that could notably shape the result of the summit and the future direction of the negotiations process. President Obama managed to interrupt them and gate-crashed the meeting, insisting that the US be included in the talks. Yet, he scarcely managed to save face.

A CHANGE IN THE WINDS AND THE PERFECT STORM: THE RISE AND FALL OF OBAMA'S AMBITIOUS ENERGY PACT

Obama's Bipartisan Energy and Climate Pact

For better or for worse, the prospects of the Senate approving a major legislative package on energy are so far not very good (at least not for any legislation including a cap-and-trade system or compulsory short- or medium-term target for the US to reduce emissions), either during what remains of this Congress (the so-called lame duck session) or during the forthcoming Congress that begins in January 2011. It seems that «cap-and-trade» is dead in Washington, having fallen victim to a «perfect economic and political storm».

During the election campaign Obama laid the groundwork for a major energy pact between Democrats and Republicans. This pact was to be underpinned in principle by firm state support for a broad range of energies, both conventional and new technologies—a policy that Obama himself described as «non-ideological». (12) In the summer of 2008, when the price of oil had passed the \$100/bbl mark and was rapidly soaring to its peak of US\$147/bbl at the end of July, Obama proposed the possibility of opening certain US offshore areas for oil production if the expansion of offshore exploration were part of a wide-ranging legislative package that included a national emissions market, a binding emissions reduction target and more support for new energy sectors. On 31 March,

(12) Myers Jaffe, op. cit., 3.

only weeks before the BP oil spill in the Gulf of Mexico, the Administration opened some federal offshore areas, particularly along the Atlantic coast, formerly protected from oil exploration. This executive decree was one of the many gestures Obama has made to the Republicans to win their confidence and support for his energy policy.

Basically the pact would include government support—considered key to securing sufficient votes within Congress—for conventional energies (oil, gas, «clean» coal, nuclear, etc.) together with a major push in the research, financing and development of renewable energies and other low-carbon technologies, and the creation of a new emissions market. (13) Indeed, in February 2009, Obama set up a Task Force for Carbon Capture and Storage (CCS), which was entrusted with devising a strategy for developing this «clean coal» technology—the only long-term hope for the coal industry—and getting 10 demonstration plants up and running by 2016. (14) That same month the Administration offered several billion dollars more to the nuclear industry government-backed loans.

The following year, Obama reiterated his support for nuclear expansion in his annual State of the Union Address. The Energy Secretary, Steven Chu, also insisted to the Senate Energy Committee that the government would have to increase its government-backed loans to the nuclear industry above and beyond the \$18.5 billion currently available (as established by Congress in the Energy Policy Act of 2005). Otherwise, financial investors—crucial actors in the nuclear renaissance—will not feel sufficiently confident that new nuclear plants could be built on time to schedule and without runaway budget overruns. (15)

Obama and his Administration made many goodwill gestures of this kind to the conventional energy industry—both the hydrocarbon sector and the nuclear and coal sectors—in order to assure them of their future role in the US energy model (even if somewhat less prominently than in the past) and to achieve sufficiently bipartisan consensus for Congress

(13) For a more complete analysis of Obama's major energy pact, see Michael Leahy and Juliet Eilperin, «How politics spilled into policy», *The Washington Post*, October 13, 2010, pp. A1, A8-A9.

(14) For an analysis of the technological, economic and political horizon of the CCS processes, see ÁLVAREZ PELEGRY, Eloy «La captura y almacenamiento de CO₂: una solución eficiente para luchar contra el cambio climático» Documento de Trabajo (DT) 20/2010, Real Instituto Elcano, Madrid, 28 June 2010

(15) Myers Jaffe, op. cit., 4.

to approve a wide-ranging, non-ideological reform of energy and climate policy.

The Administration even expressed its willingness to give in, at least for a time, to the political pressure from the ethanol sector (mainly concentrated in the farming states of the Mid West and the Great Plains). This sector wanted—and still wants—to maintain both the flows of federal subsidies into the agricultural sector and the national tariffs that protect it against imports of Brazilian ethanol, which is cheaper, more efficient and cleaner (and more defensible to the WTO) than the more dominant US variety, a consequence of the comparative advantage enjoyed by Brazilian ethanol (because it is produced from sugar instead of maize).

In March 2009 President Obama's longed for «non-ideological» bipartisan pact still seemed politically feasible. But the political winds in the US had already begun to blow in different directions and at increasingly volatile and differentiated speeds.

The First Headwind: The Financial Crisis and The Great Recession

Even at the end of winter of 2009-10 there was still a possibility of pushing the most recent bipartisan version (the Kerry-Lieberman-Graham bill) of Obama's preferred legislation through the Senate. Nevertheless, by the beginning of 2010, nearly all the tailwinds which had driven forward Obama's energy policy during his election campaign had already begun to be transformed into headwinds. The first change of political direction came with the financial crisis and the great recession. The financial crisis had the effect of cutting off the flow of funds to the new low-carbon sectors, while the recession put a brake on global energy demand (chiefly among developed countries). As a result of this slowdown in global energy demand, the price of oil fell precipitously (reaching \$35/bbl by the end of 2009, only to rise again in 2010 and to stabilise at about U\$75/bbl-\$80/bbl), significantly dampening incentives to invest in new energy technologies.

Indeed, after increasing from 17 billion dollars in 2004 to 126 billion dollars in 2008, global investment in renewable energies plummeted (particularly in the biofuels sector) in the first quarter of 2009, the worst moment of the economic and financial crisis in the US. Although the level of global investment recovered and stabilised throughout the remainder of 2009 and the first half of 2010 (at around 32 billion dollars per quarter), this global figure conceals the fact that investment in renewable energies

slumped significantly in all regions (but especially in the US) with the exception of China, where investment in renewable energies has grown so fast that it has completely offset the considerable slowdown experienced within the western countries. Whereas in China investment in renewables increased by more than 50% (from 22 billion dollars to 33 billion dollars) in 2009, in the US this investment dropped to 14 billion dollars, less than half of the 2008 figure. (16)

What is more, the economic and financial crisis itself — along with the accompanying sensation of a quasi-national emergency— provided the Obama Administration with sufficient influence and political mandate to approve the Stimulus Plan (the American Recovery and Reinvestment Act, or ARRA). From the perspective of renewable energies and other clean technologies, the Stimulus Plan represented a very welcomed cushion against the impact of the crisis. Some key tax benefits for the wind and solar industries were extended for longer (they were due to expire at year end) and the tax cuts for investment in wind and solar energy were converted into cash grants, injecting a cash flow that was essential to many companies in the renewable sector at the time. (17)

However, the Stimulus money, which began to be channelled through the energy sector, was designed as a short-term instrument with a specific duration and, as such, was insufficient to continue to drive the expansion of the new industries in the medium term, especially if financial credit failed to return to the market during the lengthy period of economic recovery. There was a possibility that new legislation on energy and climate change could come out of Congress (then still controlled by Nancy Pelosi and Harry Reid, the two Democratic leaders with the most powerful roles in the House and Senate, respectively). But in a high-unemployment environment (with a rate of around 10% in the US from winter-spring 2009, the highest in nearly 30 years), the debate on the expansion of renewables remained tremendously sensitive to arguments that attempted to link the expansion of these energies to the creation (or destruction) of net employment.

During the presidential transition and the first two months of the Administration, Obama himself sold his energy policy relatively successfully

(16) Data from Bloomberg Energy Finance, quoted in AIE, op. cit., 285-286.

(17) Iberdrola Renewables received 975 million dollars for 13 wind power projects in nine different American states, Juliet Eilperin and Steven Mufson, «Clean energy industry looks ahead», The Washington Post, October 24, 2010, pA3.

using several arguments (including several mentions of Spain, among other countries like Germany and Japan, as a template for energy policy and a leader in the field of renewable energies on a world scale). But one argument in particular hit home with the public at the time: that renewables create good jobs and locally. Indeed, in July 2010, the White House published the report of the Council of Economic Advisers, which judged the Stimulus Plan to have been a great success, particularly with regard to energy: nearly 90 billion dollars in new expenditure and future tax benefits have been channelled through the ARRA to new energy sectors to create 190,000 new «green» jobs. Another study by the Lawrence Berkeley National Laboratory concluded that the 5.4 billion dollars in investment tax credits already channelled by the ARRA have created or saved 50,000 jobs in the renewables sector. (18)

The Stimulus Plan was a major success of Obama's policy. It also marked a significant step forward for energy policy and the development of new clean energies. However, this success did not prove to be lasting. Despite the significant impetus the ARRA gave to the renewables sector and despite the nearly 200,000 jobs it created, from the spring of 2009 onwards a growing portion of the US electorate began to oppose any and all aspects of the Administration's energy policy.

Second Headwind: The Political and Media Attack on Renewable Energies

While the first «headwind» in this perfect storm originated from the economic and financial crisis, the next change of wind came about as a result of the political and media attack on the deployment of renewable energies. It began to grow strong in the spring of 2009 and joined in the storm that erupted over the debate on the healthcare reform in summer.

From President Obama's swearing-in ceremony on, the Administration grounded itself in tactics summed up very well by the memorable words of Emmanuel Rahm, then Chief of Staff to the President: «Never let a good crisis go to waste». This explains the tactic of including substantial support for the clean energy sector in the Stimulus Plan, whose public expenditure was considered essential to preventing a very dangerous collapse in aggregate demand and, as such, a much deeper and longer recession.

(18) Ibid.

According to this logic, the crisis was an opportunity—and a catalyst—for the President's energy policy. The Stimulus could help the deployment of new energies, and this expansion of the sector would create jobs in order to combat the recession and climate change simultaneously. If the recession called for a strong (that is, involving a lot of spending) Stimulus Plan, why not include significant support for renewable energies and new technologies, as Obama needed to equip himself progressively with diplomatic tools for the Copenhagen negotiations? The Administration continued with this policy and had created more than 200,000 jobs a year later, despite the disappointing results of the Copenhagen Summit.

But during the spring of 2009, the recession pushed the unemployment rate up to 10%, its highest level since the early 80s, bringing the number of jobless up to nearly 15 million. The electorate was nervous about the dire economic situation, and, compared to 15 million unemployed, the 200,000 new jobs created in the new energy sectors were never going to alleviate the social unrest. Public opinion was very vulnerable to any argument which claimed that either prices or unemployment would rise if Obama's energy legislation prospered.

Just when the US was experiencing this national vulnerability, a «study» conducted in Spain—then a world leader in the wind and solar power sectors and frequently quoted in Obama's speeches as a possible template for US energy policy—began to circulate among the US media and spread through the whole media machinery with an almost viral effect. Eventually known in the US as «the Spanish study», it was directed by Gabriel Calzada, then a little known adjunct professor of economics at the Universidad Rey Juan Carlos, a private university in Spain. (19) The central conclusion drawn by the «study» was that for every job Spain created in the renewables sector with state support, 2.2 were destroyed in other sectors. It recommended that the US should not support the renewable energy sector if it wished to prevent an even deeper and protractee recession.

Calzada's «study», originally written in English, began with a direct warning to the Obama Administration, which can be summed up as

(19) See «Study of the effects on employment of public aid to renewable energy sources», University Rey Juan Carlos, 2009) Research director: Gabriel Calzada Álvarez PhD; URJC researchers: Raquel Merino Jara, Juan Ramón Rallo Julián; Technical Consultant: José Ignacio García Bielsa, March 2009. <http://www.juandemariana.org/pdf/090327-employment-public-aid-renewable.pdf>

follows (and respecting its character as a political treatise disguised as supposed economic science): if you are looking to Spain as political and economic inspiration for the expansion of renewable energies in the US through increased state support, think again, Calzada implied, because subsidising job expansion in renewable energy sectors destroys jobs in net terms.

Its methodology was unworthy of a supposed academic research paper and accordingly unfit to be used as a reference in public debate. It was chiefly based on a crude version of the old crowding out theory, which upholds the following argument: if the government increases public spending, directly subsidising some particular sectors (in this case renewable energies, particularly wind and solar) and increasing public debt (through the issuance of state bonds to finance this increased expenditure), the effect desired by the government—intensification of economic growth and net job creation—will not occur because this spending, being public and not private, would have to compete (as it is financed) with other possible private economic activities, pushing up interest rates and edging out of the credit markets (and even from the business itself) many projects financed by private investment, which is supposedly more efficient than public spending in contributing to growth and creating net employment.

But the Spanish system of state aid to renewable energies is not based on the granting of subsidies to renewable energy companies but on direct state intervention in the pricing of the electricity generated by renewable energies (the favoured sector) on the wholesale market. Intervention grants the sellers of electricity generated from renewable energies a premium (similar to a feed-in tariff) on the prevailing price in the wholesale market (which is only partially deregulated).

This special system (the *Regimen Especial*) has the effect of prioritising the injection of renewable energies into the electricity grid (and their incorporation into the energy mix) and of channelling higher income to companies in the sector of renewable energies, ensuring them sufficiently high returns to justify their previous investments and stimulate sufficient future investment. But these flows to the renewable energy sector are not financed by the issuance of public debt on the credit markets (because the state does not pay them) but by the higher prices that buyers on the wholesale market (chiefly the major electricity utilities which are largely still based on traditional energies) have to pay for sending electricity from the grid to their distribution systems.

To a certain extent, the premiums paid under the Spanish special system «internalise» the externalised costs of the carbon dioxide emitted by the electricity companies. But it is even more important to stress that the premium does not function as a subsidy. Its distorting effect on the economy is different from that of a state subsidy. Whereas public subsidies can, in theory, have the undesired effect of raising interest rates, slowing the pace of economic investment and destroying jobs in net terms (it only indirectly and always under certain conditions, (20)) the premiums are directly added to the costs (inevitably called «extra costs») of electricity companies. This is precisely the effect desired by the policy of the *Regimen Especial*. (21)

Calzada combines his principal argument (*crowding out*) with the use of a simple ratio—the main and only quantitative component of the study—which merely compares the intensity of the K/L ratio (capital to labour ratio) of the conventional energy sector with that of the wind and solar energy sector. Because on paper, the figures suggest that in Spain there was more labour per unit of capital in the conventional energy sectors than in the renewable energy sectors, the study abruptly jumps to the conclusion that any investment in renewable energies destroys employment in net terms because it would create fewer jobs than it would destroy owing to the crowding out of equivalent investments in the con-

(20) Indeed, the economic conditions required in order for an increase in public expenditure to produce the undesired effect of crowding out economic investment (and its possible negative impact on employment)—that is, an economy producing close to its non-inflationary potential—did not exist at the time the «Spanish study» was published or during the subsequent debate it sparked among the US media. On the contrary, the spring of 2009 saw the greatest slump in aggregate demand and was characterised by growing overcapacity of productive forces, both labour and capital. The apparent shortage of financial capital was not due to the crowding out effect but to reluctance to invest in new production before aggregate demand had fully recovered. In this respect, the state support included in Obama's Stimulus Plan (which, unlike the Spanish premiums, consisted of subsidies or tax cuts of the same type) might have had a certain crowding in effect, but not one of crowding out.

(21) The Spanish system of premiums is not perfect and still needs to be modified. Indeed, there has lately been much controversy over the Régimen Especial, particularly in relation to the supposedly high premiums (which are supposedly not consistent with fiscal discipline) and the so-called tariff deficit (considered burdensome by the electricity companies and supposedly stemming from the obligation of having to pay the high premiums without being able to raise the end prices of electricity in compensation, given that end prices are still subject to state regulation).

ventional energy sectors. Yet, the study never showed that any job had been destroyed by state aid to renewable energies in Spain or in the US.

It would be extremely difficult to show such an effect, as the central conclusion of the study hinged on the assumption that each euro of «extra cost» to the electricity companies (under the Spanish system) would cause an equivalent fall in their investments, or at least one significant enough to cause the negative effect on employment referred to in the study. This assumption is not convincing, especially if we consider that, for years, the energy companies have generally been using their substantial profits to maximise the returns of their shareholders (who require at least the same rate of return they could get from investing their capital in other activities) and not so much to invest in the infrastructure of the future (and even less so with respect to infrastructure for future low-carbon energy).

For all these reasons, the version of the crowding out theory on which the study is based is not applicable to the case to which the study sets out to apply it—at least not strictly in intellectual terms. But for better or for worse, this lack of rigour does not mean that the study is not of interest and use to the media. The first US headline to refer to the «Spanish study» (in Bloomberg, 27 March 2009, set the demagogic tone of the subsequent debate in the US media: «Job Losses from Obama Green Stimulus Foreseen in Spanish Study». (22)

The «news» was backed and legitimised by a column (not signed) in the prestigious *The Economist* (2 April 2009) and several other articles and comments in the *Wall Street Journal*. (23) As a result, this headline was bandied about incessantly by the US media during the spring and summer of 2009, without being properly scrutinised, turning the electorate, beset by high unemployment and an uncertain future, against Obama's energy policy. This storm in the US media—which was hardly felt in Spain, where the controversy lasted a couple of weeks before dying down—reached its apotheosis when the star of Fox News, celebrity Glenn Beck, invited Calzada (constantly described in the US media as an economics professor at «one of the most prestigious universities in Spain») to be interviewed on his programme, which has a mass following

(22) Gianluca Baratti, «Job Losses from Obama Green Stimulus Foreseen in Spanish Study», Bloomberg, 27 May 2009.

(23) «The grass is always greener: Saving the planet and creating jobs may be incompatible», *The Economist*, April 2, 2009.

in the United States (on 4 May). Thereafter the catchphrase that swept across the media during the spring and summer—until the major debate on the healthcare reform began—was that renewable energies destroy jobs and that climate change is merely a cover for a quasi-socialist conspiracy that is based on a dubious science and serves the interests of the new supposedly non-competitive renewable sectors.

Both the National Renewable Energy Laboratory (NREL) and the Center for American Progress (CAP), the think tank of John Podesta, one of the most important American strategists in the diplomacy of climate change (and the mentor of Todd Stern, the current chief of the US delegation in the international negotiation process) published their own analyses taking apart the assertions and «conclusions» of the «Spanish study». Even *Wall Street Journal* writer Keith Johnson, who is among the most respected and well-versed journalists in Spanish affairs, concluded that the «study» was spurious and that the lead author had fairly clear connections with the oil industry and with the community of «sceptics» about the role of fossil fuels in climate change. (24)

But the worst economic environment since the Great Depression was not the most conducive to maintaining public opinion's support for Stimulus spending on renewable energies, or to preventing the electorate from being seduced—before the Stimulus Plan could have tangible and notable effects—by the argument that cap-and-trade would significantly raise the prices of the gas, diesel and electricity consumed in American cars and homes. The Democrats in the House scarcely managed to scrape the minimum majority needed to pass the Waxman-Markey bill early in June. But once the media debate on the healthcare reform got off the ground at the end of the summer, only the slightest possibility re-

(24) See Eric Lantz and Suzanne Tegen, «NREL Response to the Report Study of the Effects on Employment of Public Aid to Renewable Energy Sources from King Juan Carlos University (Spain)», White Paper NREL/TP-6A2-46261, August 2009; Kate Gordon, Julian L. Wong, and JT McLain, «Out of the running? How Germany, Spain and China are Seizing the Energy Opportunity and Why the United States Risks Getting Left Behind», Center for American Progress, March 2010 (http://www.americanprogress.org/issues/2010/03/pdf/out_of_running.pdf); Keith Johnson, «Green Jobs, Olé: Is the Spanish Clean Energy Push a Cautionary Tale?» WSJ Blogs: Environmental Capital, 30 March 2009 (<http://blogs.wsj.com/environmentalcapital/2009/03/30/green-jobs-ole-is-the-spanish-clean-energy-push-a-cautionary-tale/>). Gabriel Calzada is founding chairman of the Instituto Juan de Mariana (which subscribes to an extremely liberal school of economic thought) and Senior Fellow of the Center for the New Europe (neoconservative in its political outlook).

mained that its equivalent in the Senate (then the Boxer-Kerry Bill) would attract the 60 votes it needed to be passed. In the end, the proximity of the midterm elections of November 2010 made this possibility even less likely.

Third Headwind: Post-Copenhagen Depression, From the Oil Spill to the Tea Party

The failure to get the Boxer-Kerry bill through the Senate in the autumn of 2009 —(or, for that matter, even any other version of the legislation, such as the Kerry-Lieberman-Graham bill which emerged during the spring of 2010), coupled with the disappointing result of the Copenhagen Summit, plunged into a deep depression the promoters of the low-carbon sectors and the world leaders committed to achieving an international treaty for regulating and reducing greenhouse gas emissions. Several meetings have taken place in the context of the UN-FCCC (three in Bonn during the spring and summer, and one in Tianjin in the autumn) in the wake of Copenhagen in order to pave the way for a stronger and more binding agreement at the Cancun Summit (December 2010), but progress has been limited. With the US economy not yet showing signs of tangible recovery for the great majority of the jobless, and with midterm elections looming even closer on the political horizon, the possibilities for even the Kerry-Lieberman-Graham bill— the last vestige of Obama's strategy for constructing a large-scale bipartisan pact on energy and climate policy— completely vanished by the end of spring.

The BP Oil Spill in the Gulf of Mexico

For a brief spell in May 2010 —, for a few quick weeks after the BP oil rig *Deepwater Horizon* exploded in the Gulf of Mexico — and with television channels everywhere churning out images of oil gushing from the sea floor, it seemed that public opinion might turn against the oil sector for once and for all. But this sensation was very short lived, at least in the US.

The Obama Administration responded to the Gulf of Mexico oil spill by negotiating some 20 billion dollars from BP for compensation for environmental damage and economic losses in the Gulf, to be deposited into a special fund, allocated and distributed by Kenneth Feinberg, the senior government official who now administers the fund. He also declared a

six-month moratorium on drilling in deep waters areas if the Gulf (with an exemption for the great majority of activities in shallow waters).

This measure sparked discontent in the US oil sector, which tried to argue that the problem of security in deep waters was a problem that concerned only BP or, at least, not the US oil companies. The sector wanted to prevent Obama from putting an indefinite moratorium on deep water activities and, if possible, to press him to lift the provisional moratorium immediately. BP supposedly favours the interests of its shareholders above everything else, by systematically reducing costs in a radical manner. This practice is a basic component of a corporate strategy (known as the shareholder value model) which, as an inherent result, puts at risk the physical, ecological and economic security (by reducing security measures) of the US Gulf states (the so-called cost of doing business, or the ubiquitous «transaction cost»). In contrast, the US oil companies are supposedly more responsible. Actually the criticism levelled at the Obama Administration by the US oil industry over the moratorium was basically aimed at preventing the BP spill from spurring the public to demand stricter governmental regulation of the oil industry in its entirety.

The moratorium was also received with certain misgivings by the Gulf states in the southern US. The perception in the south that the President was slow in responding to the Gulf situation added to the economic anxiety of the southern states, triggering a fierce reaction against the moratorium. While the electorate of the southern states—and their elected officials—criticised the Obama Administration for not putting enough pressure on BP to take faster measures to control the spill and to be more generous in paying for the damage and losses it caused, they also criticised Obama for decreeing the moratorium: a responsible precautionary measure according to the Administration, but a symbol of an even more uncertain and menacing future for the Gulf, a regional economy heavily dependent on fishing and oil.

From the outset the population (and especially the electorate of several southern states) expected the federal government to intervene in BP (but not across the whole oil industry) with an iron fist. What is more, the population expected the government to guarantee that all the ecosystems would be restored and that compensation would be provided for all economic losses. They also expected their economies to be put back into shape—and all with BP's money.

The Gulf population also expected that its economies would be rebuilt to exactly how they were before: that is, on the same antiquated foundations — (fishing and oil). This requirement would entail: (1) rescuing the fishing industry (previously weakened by recession and now by the closure of the waters to commercial fishing during what is traditionally the most active season) on the basis of BP's money; and (2) a rebirth of the possibilities of the US oil industry (and, to a great extent, of its local dependent economies) through a new national energy policy that would have an even more laissez faire attitude towards the petroleum industry than before (when, during the previous presidency of George W. Bush, the relevant regulator, the Minerals Management Service (MMS), operated more as the «partner» of the oil industry than as a regulatory authority of the state). But the main objective of the sector is the formal opening of more offshore areas for the exploration and production of oil and gas—both in the Gulf of Mexico and in other (ecologically) sensitive and (politically) controversial areas such as the Arctic National Wildlife Refuge (ANWR) or the very Arctic Sea. Obviously a moratorium on prospective drilling was not the policy that the US oil industry and the Gulf states would have preferred.

It seemed that if these expectations—which were possibly too great—could not be met, the Gulf states were prepared to brand the episode of the BP spill as «Obama's Katrina». With these expectations and these attitudes dominating the public discourse among the Gulf states, President Obama was always going to find his energy policy plans thwarted even further by the spill and its aftermath, regardless of how he responded to the *Deepwater Horizon* disaster.

While Congress began its own investigations into the BP spill, on 22 May President Obama set up a National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling to investigate what happened and provide the government with recommendations on the future policy towards deep water oil. Throughout August and September, after BP finally managed to cap the spill and began to collaborate in cleaning and recovery tasks, the news that came from several groups of scientists in the Gulf was that some microorganisms had already processed and eliminated much of the spilled oil, allaying the concern the public had shown while the spill continued to be aired on television.

The fact that the US media began to focus on the midterm elections also allayed national voters' concerns about the conduct of BP and, by

extension, that of the other oil companies operating in deep water areas. Political pressure to ban oil activities in US waters, strengthened by the spill scare and by US public opinion, vanished as quickly as the oil from the Gulf waters. And so did the electoral impetus to impose a stricter regulatory framework on the oil sector aside from the changes the Obama Administration made to the MMS immediately after the spill, renaming it Bureau of Ocean Energy Management and Enforcement (BOE) (separating its various functions to prevent conflicts of interest and making it responsible for marine-related renewable energies such as tidal energy and offshore wind power).

The Tea Party

The Obama Administration lifted the moratorium at the end of October 2010, just before the midterm elections, but too late to achieve sufficient consensus to cement the bipartisan energy and climate pact or to change the almost head-on opposition of the South over the imposition of the moratorium. Meanwhile, the new populist movement called the Tea Party, which was fairly decentralised and united only in its opposition to President Obama's policies, continued to consolidate its strength, identity and media attention throughout the year. And later, during the election campaign, it enjoyed a wave of financing.

The Tea Party had originally taken shape as a result of the chaotic and confusing healthcare reform debate (which the US media never managed to clarify with much success) during the summer and autumn of 2009. Its supporters then focused their criticism on President Obama's wish to limit US carbon dioxide emissions and create an emissions market. The leaders of the movement, such as Sarah Palin, call this initiative «cap-and-tax», referring to the possible (but highly debatable) increase in energy prices in the US that could result from introducing such a market (despite the generous protection of and grants to consumers envisaged in the Waxman-Markey and Boxer-Kerry bills). To the followers of the Tea Party, an emissions market is merely a tax that is imposed on energy consumption at a time of economic weakness.

Finally, having blocked any wide-ranging energy reform in the Senate, the Tea Party centred its electoral rhetoric on fiscal conservatism, explaining the US's historically high fiscal deficit (more than 10% of GDP in 2009, and still around 9% in 2010) almost exclusively as the result of Obama's Stimulus Plan and calling for both rapid cuts in public spend-

ing—but particularly in state aid to renewable energy, and despite continued economic weakness—and less tax on business activity and citizens' income (which would not necessarily help trim the public deficit in the short or even the medium term).

To the extent that the US economy—with a long, hard deleveraging process still ahead of it—did not manage to set the job creation machinery in motion, Obama's possibilities of preventing a resounding defeat by the Democrats in the midterm elections to Congress progressively faded, and his prospects of achieving the longed-for energy and climate consensus were almost completely shattered. After a promising start, his energy and climate proposal almost came to a complete standstill in the autumn of 2010—just when Obama's team was defining its position and negotiating strategy for the Cancun Summit and just when the first bipartisan catchphrase in the US for a long time began to be heard: «Cap-and-trade is dead».

Energy Policy, the EPA and the Courts

However, the legislative route is not the Obama Administration's only option for limiting greenhouse gas emissions. Following a Supreme Court ruling in 2007 (*Massachusetts v. Environmental Protection Agency*), the Environmental Protection Agency, known as the EPA, now has the authority to directly regulate the emitters of these gases in the US. (25) At the end of last year, the EPA handed President Obama its so-called endangerment finding, whereby it confirmed that carbon dioxide emissions were a serious threat to Americans' health and wellbeing. The White House set 2 January 2011 as the date for the formal start of the EPA's authority to enforce emitters' compliance with curbing emissions.

It had initially been thought that giving free rein to this executive mechanism—made possible by the Supreme Court ruling in *Massachusetts v. Environmental Protection Agency*—would equip the President with an effective lever for pressuring Congress to pass legislation for creating an emissions market and establishing a legal and binding obligation for emitters to curb their emissions by 17% with respect to 2005 levels

(25) In response to the appeals of 12 states and several cities demanding that the EPA regulate emissions of carbon dioxide and other greenhouse gases, the Supreme Court ruled in *Massachusetts v. Environmental Protection Agency* (549 U.S. 497, 2007), by five votes to four, that the Agency is competent to regulate the emission of such gases according to the Clean Air Act.

by 2020 (more or less in line with the version of the Waxman-Markey legislation already approved by the House). The alternative for Congress would be what the Republicans tend to call command-and-control intervention (which in the US means a mechanism for state control), a regulatory possibility that much of the American private sector (energy and otherwise) did not and does not want to consider. Conventional wisdom then advocated a relatively useful and positive response on the part of Congress (even among Republicans and «moderate» Democrats) and was expecting the approval of legislation similar to that which finally got through the lower house at least (Waxman-Markey).

It might also have served—in the event that the Senate would fail to pass its own legislation before the Copenhagen Summit (which it failed to do—as another key tool in Obama’s negotiation kit, possibly allowing him to present a national commitment (in relation to a post-Kyoto framework) that was reasonably credible to the Chinese and, also to an extent, to the Europeans. But by then the Chinese had already surpassed the rest of the world (in national terms at least) in nearly all areas related to the deployment of renewable energy and the manufacture of low-carbon equipment and components—and even in the development of low carbon technology. Meanwhile, the Europeans had just committed themselves to curbing their carbon dioxide emissions to 20% below 1990 levels by 2020. Compared to these significant and historic commitments on the part of the other two major global economies, the US’s current formal commitment—obviously adapted to the current US political reality—entails curbing its emissions by only 4% with respect to 1990 levels (the real equivalent of the formal commitment implicit in the Waxman-Markey bill, which establishes a target of 17% below 2005 levels by 2020).

There had always been a consensus of opinion in the US that it would be much better—precisely for the private sector energy companies—to pass moderate legislation negotiated in Congress (where in principle it could be made flexible, if not watered down) for the creation of a relatively strict emissions market in the US. Vis-à-vis the option of direct state regulation, which was possibly more burdensome in economic terms (given its inefficiency in both «static» - as it fails to equalize the marginal costs of companies) -, and «dynamic» term, — as it does not entail an innovative impetus a priori), the private sector would support the creation of an emissions market via the legislative route. But those who opposed the Administration’s policy, after successfully thwarting its legislative plans,

are now fighting directly to neutralise the EPA's new authority in the field of CO₂ emissions.

There are currently numerous appeals in more than 35 states which are calling for the courts to declare the EPA's new powers «unconstitutional». In the Senate several Republicans are set on blocking or at least delaying the entry into force of these powers. Although they did not manage to achieve their aim during the lame duck session of that Congress, it is more than likely that the Republicans will stage a political counterattack when the new session opens in January.

With their new wide majority in the House (which entitles them to the controlling positions in the various House committees in charge of drafting the legislative agenda in general and that of energy legislation in particular) and with their position in the Senate strengthened, the Republicans could attempt to postpone for several years the entry into force of the EPA's authority to regulate greenhouse gas emissions. If they are able to enlist sufficient support from the Democratic senators of the states where coal production or combustion is an important economic activity, they might even pass legislation that completely annuls this new competence of the EPA.

However, although it is highly likely that the new Congress will attempt to block the EPA's direct intervention in the field of emissions, it is very unlikely that the Republicans will achieve their goal in this respect, for two reasons. First, although Congress may pass legislation delaying the entry into force of the new power vested in the EPA by the White House (as the result of a Supreme Court ruling), the president will be entitled to veto such a bill. Congress could get round Obama's veto with the votes of two-thirds of the legislators, but while the President is likely to veto it, it is not very likely that two-thirds of the Congress would reach an agreement on overriding the presidential veto in this case.

Second, despite the various appeals lodged by more than 30 states against the EPA's new powers, nearly all the states are complying with EPA standards, at least for the time being. Only Texas has not prepared to issue permits to emitters in accordance with EPA rules. Nor is it likely that the Supreme Court, in the last instance, would rule against the EPA's competence to regulate emissions, as it was only a few years ago that it ruled in its favour.

The Energy and Climate Policy of the New Congress

In January 2011 the new Congress (number 112) opened its first session. The Democrats lost 5 seats in the Senate in the November elections, which reduced their majority: the new Senate will have 51 Democrats (plus 2 «independents» who generally vote with their Democrat colleagues) versus 47 Republicans. In the House, in net terms, the Republicans won 63 seats, turning what was previously a wide Democrat majority (255-179) into a Republican majority (242-193) that is almost just as strong. At the start of its life at least, the chief aim of the new Republican Congress will no doubt be to annul the healthcare reform so fiercely defended by Obama and the Democrats' leadership in Congress. In any event, it seems that the new Republican majority will also attempt to neutralise the Obama Administration's energy policy (symbolised by the now obsolete Waxman-Markey Bill) and, if possible, steer it towards other goals. (26)

The House of Representatives

Less than a month after the elections, John Boehner, Speaker of the House from January, announced that his party will abolish the Select Committee on Energy Independence and Global Warming (until then headed by the Democrat Edward Markey), branding it «unnecessary». The Democrats' energy policy—especially its backbone, cap-and-trade—was touted as one of the Tea Party's most topical political targets during the recent elections. It is more than likely that the followers of this movement in the House of Representatives will reject any initiative to fight climate change. Indeed, nearly half of the new Republicans in Congress (43 out of 98) declared themselves to be sceptical about the science of climate change, its conclusions with regard to our consumption of fossil fuels and the worrying implications for the planet. (27)

Early in December 2010, the leaders of the Republican Party in Congress proposed that Fred Upton, Republican representative for the state of Michigan, replace the Democrat Henry Waxman as the new chairman of the powerful House of Representatives Committee on Energy and

(26) See Cornerstone Government Affairs, «The 2010 Elections: Initial Analysis by Cornerstone Government Affairs», Washington, D.C., 3 November 2010.

(27) David A. Fahrendthold and Juliet Eilperin, «GOP win dims prospects for climate bill, but Obama eyes Plan B ahead of U.N. talks», Washington Post, 21 November 2010, A5.

Commerce. Although Upton is not held to be such a radical conservative as his Tea Party colleagues, he believes that the Republican mandate in the House will give him free rein to achieve his party's objectives in the field of energy policy. These include—in addition to doing away with cap-and-trade for good—more support for offshore oil and nuclear energy and fierce defence of the coal sector. Upton has already announced that his committee will investigate the programme of federal guarantees for loans to the energy sector, the expenditure of the ARRA (especially in the renewable energy sector) and the various areas of action of the EPA (including its new power to regulate carbon emissions). (28)

Another committee that is relevant to energy policy is the Committee on Natural Resources. The new Republican majority has appointed Doc Hastings of the state of Washington as the new chairman of a committee that may become a very valuable ally of the petroleum sector. It seems that the first item on the agenda will be an attempt to repeal the bill—already passed by the House during the last session, in response to the BP oil spill—that would set the new security standards for hydrocarbon sector activities, raise the maximum level of liability for economic damages for companies in the event of a spill, and eliminate certain exemptions to the payment of royalties for oil companies. They argue that these measures would have the effect of another tax on US energy production and would be detrimental to the many small companies in the sector and, by extension, to jobs. (29)

Although the moratorium on offshore oil activities ended in October, given the fury of the oil sector and US Gulf states in general, Hastings looks set to remain a strident ally of the sector. He also has plans to open as much federal lands and waters as possible for on and offshore oil production (including the Arctic National Wildlife Refuge) and unconventional oil drilling in the Rocky Mountains. (30)

The Senate

Democrat Senator Jeff Bingaman (New Mexico) will continue to chair the Senate Committee on Energy and Natural Resources. In addition, Alaska Republican Lisa Murkowski will hold on to her post as rankin

(28) E&E News, 7 December 2010.

(29) See Jennifer Scholtes, «Guide to the Next Congress», CQ Roll Call, Thursday, 4 November 2010, 68-69.

(30) Anne L. Kim, *ibid.*, 72.

Republican on the committee. They will have to draft a response to the National Commission appointed by Obama six months ago, which is expected to publish its conclusions on the BP oil spill and the future of off-shore oil in January. Both Bingaman and Murkowski consider themselves moderate and pragmatic politicians, as well as experts on energy matters; this raises the possibility of bipartisan collaboration in the Senate, at least in a limited manner.

An Alliance between Bingaman and Murkowski would probably attempt to dash any attempt by the Republicans in the House to use the legislative route to annul the EPA's new power to regulate the emissions of plants and major energy companies. They will put up even greater opposition to any manoeuvre by the Republicans in the House to make cuts to the EPA's Budget. If it cannot be directly abolished through legislation, an attempt can thus be made to erode gradually its capacity to comply with its regulatory duty. This is the only manner of achieving the aim of the most radical Republicans in practical terms faced with the likelihood of the president vetoing any legislation repealing the EPA's regulatory powers in this field.

Indeed, the most likely scenario under the Bingaman-Murkowski leadership in the Senate is that the House Republicans only pass legislation that delays for a further two years, for example—and does not annul—the entry into force of these powers. This is the only circumstance in which it is possible to imagine Obama signing the bill instead of vetoing it. If the Bingaman-Murkowski leadership is able to channel the rage (whether or not justified) of the new Republican majority in the House in a constructive and bipartisan way towards less extremist and more pragmatic objectives, the political foundations may well have been laid for developing a bipartisan legislative collaboration capable of achieving its aim of strengthening the country's policy on energy and climate issues.

In this connection the congressional actors who are most important to the future of US energy policy are in the Senate and not the House of Representatives, where the legislators are more ideologically oriented and extremist in their approaches and agendas than the more pragmatic senators, who must respond not only to local or regional political pressures, but also to pressures coming from the sphere of national and international politics. The obligation to devise policies that juggle with the various interests of the population—where class and professional interests clash with geographical and ideological interests and faith concerns—

requires the continual pursuit of highly complex and fragile balances that makes the senators more pragmatic than the House representatives when it comes to drafting legislation and, basically, more inclined to seal fairly rational pacts both between allies and between political adversaries. If, in the end, Republicans and Democrats collaborate effectively on energy policy during the next Congress, this collaboration will come from the Senate (as in the last Congress, in which the only true bipartisan collaboration emerges between Senators Kerry (D)-Lieberman (I)-Graham (R)), and it will be captained by Bingaman and Murkowski.

A new bipartisan collaboration?

The conventional wisdom that currently prevails in Washington tells us that there will be even more obstacles to bipartisan collaboration—the key to getting legislation passed during the next Congress given the new distribution of seats—over the next two years. This prediction is based on the growing ideological and partisan tension between Democrats (for the time being on the political wane) and Republicans (increasingly more vociferous and ambitious, not to mention extremist) since the hot summer of 2009. Nevertheless, a minority of the cognoscenti of Washington believe that it is possible to carry through bipartisan energy legislation.

This prediction foresees more bipartisan collaboration in the next Congress precisely because the Democrats came off even worse in the new distribution of power resulting from the midterm elections, without the slightest possibility of securing the 60 votes needed to pass legislation on the basis of their own votes and those of a couple of Republicans in the Senate. (31) Given the possibility that the new political power balance may block any type of legislation requiring a balanced exchange of sacrifices between groups with clashing interests, and aware of the growing likelihood that the lower houses will do nothing to bolster energy security or to curb carbon dioxide emissions over the coming two years, the more sensible Republicans may agree to collaborate with the Democrats in a feasible manner.

For the time being, the signs are pointing in the direction of the first of the two possibilities. What looks to be on the cards for Congress now is a fierce, head-on battle waged by the Republicans with the chief aim

(31) As the Democrats had successfully secured the three Republican votes of Snowe (R-ME), Collins (R-ME) and Specter (R-PA, who later defected to the Democrat party), for example, in the Senate's final vote on the Stimulus Plan in the winter of 2009.

of ensuring Barack Obama's defeat in the 2012 presidential election at any cost. In this case the script will follow the same line of argument as that of the President Clintons «case study». After being defeated in the first midterm elections of his presidential term, Clinton tempered his discourse and adapted his ambitions and goals, taking advantage of public opinion's strong reaction of displeasure with the radical obstructionism of the Republicans on budget issues, which in this case brought about the closure of the federal government for more than three weeks at the end of 1995 because the Republicans in the House overstepped the limit acceptable to Americans, using their power to cut off the daily financing of the federal bureaucratic apparatus. Clinton came off politically stronger and, although no further major legislative progress was made in US politics during 1995 and 1996, he was re-elected in November 1996 with a much bigger margin than in 1992.

According to this scenario, Obama would moderate his discourse even more from now on (as observed in his political conduct since the elections, such as his new willingness to accept an extension of the tax cuts for wealthier citizens dating from the Bush era). He will cease to start up major legislative projects and will rely on his executive powers in foreign policy and other areas. As a result, he will have to redesign his energy and climate policy strategy to ensure that the construction of a low-carbon economy continues on the ground, especially if there is no legislative alternative. In this context it is more than possible that Obama will win the elections again in 2012. In any event, in order for this more likely scenario to be transformed into another that is less likely (of bipartisan collaboration in the field of energy and climate change), leadership and collaboration in good faith will be essential, primarily between Bingaman and Murkowski and in second place between Kerry (D-MA) and Graham (R-SC), the main authors of the only important bipartisan energy bill in the Senate during the last session.

If, under the leadership of Bingaman and Murkowski—and with the legislative endeavour of a Kerry and a Graham—the Senate manages to ease the confrontation between the aggressive agenda of the Republican majority in the House and the small—but existing—majority of the Democrats in the Senate, what kind of legislation could be expected? In first place, any legislation coming from Congress will be much less ambitious and more minimalist. It will be passed in «pieces», as Obama has suggested lately. Such legislation will not be designed around global bills aimed at carrying out complete and final reforms (such as Waxman-

Markey, for example, or Boxer-Kerry), but based on modest initiatives (such as increased support for renewable energies and other low-carbon technologies, or for energy infrastructure of all kinds) on which it is possible to generate sufficient consensus. In second place, it will not include an emissions market (for many in the US the infamous «cap-and-tax» system). As mentioned earlier, for the time being—or at least until its not so expected resurrection—“cap-and-trade is dead».

Clean Energy Standard

In the wake of the midterm elections, the only consensus one might glimpsed upon the horizon, capable of being translated into legislation (but not necessary set to do so), would be a new version of the minimum portfolio standard for renewable energies in the energy mix (known in the US as Renewable Portfolio Standard, or RPS). An RPS of 20% by 2020 was included in the Waxman-Markey bill passed by the House in June 2009. Of the 10 energy- and climate-change-related bills submitted to Congress since the winter of 2009, four have included some sort of RPS. The bipartisan consensus has always been too frail to pass cap-and-trade legislation, but in principle a sufficiently broad and deep consensus could be achieved to pass a national RPS.

Such a compulsory federal requirement would be a major step forward for the US, to an extent making up for its inability to pass cap-and-trade legislation. If cap-and-trade, at least for the time being, has become electoral anathema to the Republicans, an RPS is viewed as being less controversial and more acceptable to many Republicans, who may see the positive side of any legislation that stimulates investment and creates jobs in their districts or states. During the midterm election campaign and later, during the lame duck session of the outgoing Congress, both Bingaman and Murkowski submitted new bills to the Senate to back the expansion of renewable energies and establish some variant of the RPS.

But there are two key conditioning factors that will determine whether any legislation for an RPS will come out of Congress. To secure sufficient support in the House, which is now controlled by Republicans, Obama will probably have to negotiate a two-year postponement of the entry into force of the new powers of the EPA, as many Republicans and even some Democrats are now calling for. To win the support of enough «moderate» Senators (both Republican and Democrat) in order to secure the 60 votes required, any RPS that is proposed will have to become a

new minimum requirement for the share of «clean energies» (not simply «renewable» energies) in the energy mix.

This new Clean Energy Standard (or CES) will have to give enough space to nuclear energy and clean coal (using carbon capture and storage techniques). Indeed, at the beginning of the summer of 2010, Senator Lindsay Graham of South Carolina—a key Republican interlocutor in energy matters and one of the three authors (together with John Kerry and Joseph Lieberman) of the American Power Act, the bipartisan proposal with the greatest chances of success during the last Congress—pulled out of this project, which would have created an emissions market for the electricity companies and industry together with a new tax on fuels, claiming that ultimately the project did not give sufficient support to conventional energies (but in particular nuclear). By including nuclear energy and clean coal with CCS, the new CES will have to set a global minimum as a percentage of the mix that is much higher than has been envisaged in the past (that is, 30-35% in 2020 instead of 20%), simply because nuclear energy and coal already account for a large percentage of the country's electricity mix.

If the Bingaman-Murkowski duo works; if the more moderate and influential Republican senators are able to channel the actions—still extremist and fairly emotional—of the House; and if the Democrats agree to the inclusion of nuclear energy and coal with CCS in a new CES requirement (and possibly even natural gas), then it would be possible to envision by no means negligible progress in US energy and climate policy during the next Congress. If, in the end, cap-and-trade is dead in the capitol, perhaps a CES, a complementary tool, still stands a chance. And if there are not enough votes in Congress to pass legislation based on Waxman-Markey (which envisages both an RPS and an emissions market), then perhaps the momentum climate policy is gaining among states—two-thirds of which have already adopted their own versions of the RPS—would make it possible to transform the sensation of inaction in Washington into a new endeavour to move forward in the global fight against climate change.

Developments in energy and climate policy in the states

Generally speaking, the states have taken the lead in energy and climate policy in the US. With the major national ideological battles distorting the dynamics of the policy in Washington and hampering Obama's

attempts to introduce energy and climate legislation that could lend credibility and influence to his negotiating position at Copenhagen and Cancun, the states—whose governments operate at a level much closer to their voters (and are therefore more exposed to the consequences of not catering to their demands, particularly in times of economic difficulty)—are advancing at a fast pace. After all, it may be the states which pressure (from below) the national government and, especially, Congress, to complement and codify a very widespread but at the same time highly varied and not entirely compatible collection of energy and climate laws at state level, which already exist and in many cases are stricter and more demanding than the national laws currently in force.

We have already seen this dynamic in the Supreme Court case *Massachusetts v. Environmental Protection Agency* in 2007. In this episode a dozen states successfully sued the EPA in order to force it, under the Clean Air Act, to regulate the emitters of greenhouse gases. The same may be happening with the RPS. Some 39 states have some sort of RPS (four already have something similar to the CES) and a further five have adopted specific targets for renewable energies. Although these commitments show different compulsory penetration levels for renewable energies for a broad range of different deadlines, the typical state RPS tends to establish a target of a 20% share of the electrical energy mix by 2020, more or less in line with the Waxman-Markey RPS. In addition, 23 states already have set binding targets (14) or voluntary targets (9) for the reduction of emissions. The past few years have seen the creation of two regional carbon emissions markets—the Regional Greenhouse Gas Initiative (RGGI) in the east, and the Western Climate Initiative (WCI) in the west—in which several states already take part.

Some states, such as California, have been exemplary in their leadership in this field and in their endeavour to pressure the federal government to do more in energy transformation and in fighting climate change. Apart from being involved in the effort to get the EPA to regulate carbon emissions, California was one of the first states to adopt a legal target for the reduction of carbon emissions (limiting them to 1990 levels by 2020) and one of the first to establish an RPS (in general the northeast states acted more promptly than the rest). Indeed, in 2009 California raised its legal target for renewable energies (20% of the electricity mix by 2010) to 33% of the electricity generated by 2020. During the recent midterm elections, an initiative failed for a referendum (Proposition 23) that would have suspended Act AB 32 of

2006, also known as the Global Warming Act, until the unemployment rate (currently at 12%) drops to 5.5% for four consecutive quarters, something that has not occurred more than three times in California since 1980.

While the opposition of the conventional energy industries has managed to stop much of Obama's energy and climate policy from getting through the national Congress, it has not succeeded in doing so in the states, particularly California, which is the most influential in this dynamic on account of its physical size and economic might. Although a victory for the promoters of the referendum had initially been expected, in the end the «no» (that is, defence of the current global warming act in California) easily won by 62%-38%. All this suggests that in the end, sooner or later, Congress will follow the footsteps of the states that are more active and forceful in fighting climate change.

US ENERGY AND CLIMATE STRATEGY AT A CROSSROADS

Even before the end result of the midterm elections was known, two different reactions began to spread. On the one hand, anticipating a Republican victory that would further hinder the effort to achieve an international treaty for the reduction of greenhouse gas emissions, the political and economic sectors that support the post-Kyoto process, already disappointed by the lack of significant progress at Copenhagen, were plunged into deep political disorientation. On the other, some sectors of the political elite considered the possibility of designing a national policy of R&D in «climate engineering» as a Plan B.

However, when the midterm elections were over, some of Obama's advisors for these matters began to outline what the US's energy and climate policy should be from now on. The direction the Obama Administration will probably take will involve abandoning its goal of establishing cap-and-trade and instead giving priority to specific, well defined objectives on which it is possible to achieve consensus between Republicans and Democrats relatively soon.

The Center for American Progress, one of the think tanks closest to Obama, has designed what could be the pillars of this new strategy. The CAP is calling for less ambition and more pragmatism in Obama's policy, identifying a deployment-focused, investment-centred strategy as a basis for a possible future consensus on the financing of clean energies

and the reform of the regulatory framework. (32) If no bipartisan agreement comes out of Congress for the establishment of a CES, the most likely scenario is one in which the Administration follows the strategy suggested by the CAP. But if such an agreement prospers, another scenario (somewhat more useful in the UN negotiations on climate change) begins to appear feasible.

This scenario would allow the resurrection of Obama's major bipartisan energy and climate pact, although perhaps in a somewhat less ambitious form than in its previous incarnation. The new consensus would be underpinned by this strategy—a minimum compulsory share of alternative energies (including nuclear energy, clean coal and possibly natural gas) in the electricity mix (or a Clean Energy Standard)—and more support in general for all indigenous energies, both conventional and renewable. It might possibly include even a binding target for curbing carbon dioxide emissions by 2020 in order to bolster the credibility of the US's policy and commitment in time for the Durban Summit at the end of 2011.

Nevertheless, this strategy depends on the need for greater understanding—in addition to pragmatic collaboration—between the interests tied to conventional energies (generally represented by the Republicans) and the new renewable energy sectors and the many promoters, activists and supporters of the fight against climate change (generally represented by the Democrats). However, it is by no means clear whether this will be possible in the short term.

Although the Obama Administration had complied with its electoral offer to the Republicans and the oil industry by opening certain national waters for petroleum activity in March 2010, and despite lifting the moratorium on oil activities—following the BP oil spillage—in deep water areas of the Gulf in October, just before the midterm elections, the oil industry has not tempered its almost out and out opposition to Obama's energy and climate policy. The Administration's latest decision on offshore oil, announced by Interior Secretary Ken Salazar at the start of the Cancun Summit, maintains the ban on oil exploration and production in the eastern Gulf of Mexico near the state of Florida. For years the oil industry had

(32) Bracken Hendricks, Lisbeth Kaufman, Ken Berlin, Monty Humble, Reed Hundt, Alex Kragie, Gerry Waldron, «Cutting the Cost of Clean Energy 1.0: Toward a Clean Energy Deployment Plan for Jobs, Security, and Broad-Based Economic Growth in 2011» Center for American Progress, Washington, D.C., 16 November 2010. (<http://www.americanprogress.org/issues/2010/11/cleanenergycosts.html>)

petitioned, sometimes aggressively, for these waters to be opened for oil activities.

Despite all his attempts, the offshore oil issue continues to hamper Obama's energy and climate policy. The Administration will have to involve the oil industry more intensely in the negotiations prior to—and in the subsequent redrafting of—a new bipartisan energy pact, if it wishes to transform what is currently a poisoned dynamic between the oil industry and the Administration and its allies into one that is more pragmatic and capable of producing solid agreements for the minimum legislation needed to stimulate the deployment of low-carbon technologies and to support a sufficiently credible commitment on the part of the US in order to elicit positive reactions in the international negotiations on greenhouse gases.

The way to achieve this may well be through the formal shaping, within the Administration's energy and climate policy, of a legitimate and essential role for the oil industry in the national energy strategy *in the short term*; the corresponding commitment on the part of the industry would be its pragmatic collaboration in designing a roadmap for the future of the oil industry. Indeed, Amy Myers Jaffe of the James A. Baker Institute of Public Policy of Rice University in Houston—a veteran oil expert and one of the shrewdest and most sensible voices of all those that live off the money generated by the sector—has underlined a certain lack of attention to the short term in Obama's energy and climate policy, although she recognises its coherence and aptness with respect to the medium and long term. (33) Such a lack of attention also neglects the possibilities of involving the oil industry in its own regulation and of enlisting its support for a strategy which, in the long term, envisions a future of less prominence, economic weight and political influence for oil. Framing the possible short-term clash of interests in this manner is the Administration's best chance of achieving its most important energy and climate policy goals.

CONCLUSION: CANCUN, THE US AND THE IMPLICATIONS FOR THE REST OF THE WORLD

The US position towards Cancun

Following the rise and fall of Obama's bipartisan energy pact, the US arrived at the Cancun Summit with a fairly pragmatic negotiating strategy

(33) See MYERS JAFFE, op. cit.

that was not so ambitious as at Copenhagen and more in line with its modest offer (which has not improved since Copenhagen) of committing itself to reducing its emissions to only 4% below 1990 levels by 2020.

The team made up of Todd Stern and Jonathan Pershing concentrated its limited political capital on achieving minimum progress in: (1) deepening and strengthening the basic elements of the Copenhagen Accord; (2) keeping alive the process of the Kyoto Protocol—which expires at the end of 2012 unless a framework is negotiated to succeed it—for another year at least (as Japan declared at the start of the Cancun Summit that it was going to withdraw from the Protocol because at this stage in the game it only covers less than 40% of annual world emissions); (3) confirming the amounts the developed countries will earmark to financing mitigation and adaptation efforts in the developing countries; (4) specifying the mechanisms for channelling these funds; (5) reaching an agreement with China on protocol for verifying its emission reductions; and (6) achieving an agreement on how to compensate the countries which sacrifice the economic exploitation of their forests in order to prevent deforestation, another threat that can trivialise all the efforts of the other countries to «de-carbonise» their economies, as the destruction of this carbon dioxide absorption capacity could raise the level of CO₂ in the atmosphere at a faster rate than the reduction of fossil energies in the world energy mix can remove it.

The Cancun Agreements

It is possible that the result of the Cancun Summit—agreements signed by 193 countries complementing the Copenhagen Accord—may reflect the durability of US leadership and its surprising ability to be exercised effectively even when it is perceived to be in decline. After all, the Cancun Agreements contain concrete if modest progress in nearly all the negotiation fronts and represent more or less the point that the US negotiators wished—and thought it was possible—to arrive at.

For the first time, the emission reduction targets of the developed countries have been recognised within the multilateral process of the UN, and these countries have committed themselves to devising plans for the deployment of low-carbon energy and to developing market mechanisms to spread it. Developing countries' actions in emission reduction have also been recognised within the UN, and they will have to publish reports on their progress every two years. It has been agreed to go ahead with

negotiations on the framework to replace the Kyoto Protocol, although the final decision on its future has been postponed. The Clean Development Mechanism (CDM) has been reinforced in order to catalyse more investments in projects aimed at reducing the emissions of developing countries and stimulating their economic development.

Several initiatives and institutions (Cancun Adaptation Framework) were also created to help developing countries—especially those most vulnerable to climate change—with the task of mitigation and adaptation. The developed countries confirmed their financing commitments (30 billion dollars up until 2012, and 100,000 dollars per year from 2020 on), and a Green Climate Fund was established with the shared participation and control of the developed and developing countries in structuring and channelling the funds already committed. There were also agreements on the effort to shape a multilateral framework for defence against deforestation. Finally, a new mechanism was established (Climate Technology Center and Network) to stimulate technological cooperation.

The Cancun Agreements amount to modest but real progress. There is still a possibility of achieving an international treaty in the relatively near future, and even if such a treaty never materialises, the international negotiation process in the framework of the UN is continuing to facilitate the energy transformation that is needed, with or without an international treaty. After seeing its energy and climate plans thwarted, the Obama Administration continues to seek a means of pushing this change forward as quickly as possible from the US. Despite the so-called «Copenhagen disappointment», the modest progress made at Cancun gives President Obama the chance to reconstruct a new bipartisan energy and climate consensus that can be of great help in taking these first steps in the global fight against climate change.

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CHAPTER THREE

THE EUROPEAN UNION'S ENERGY POLICY IN THE LIGHT OF THE LISBON TREATY

THE EUROPEAN UNION'S ENERGY POLICY IN THE LIGHT OF THE LISBON TREATY

MARIOLA URREA CORRES

«If left unaddressed, by 2030 the energy situation in Europe will be one of increasing need and declining supply. Dependency on high priced imports of oil, gas and coal from third countries will increase from its current 50 per cent to about 60 per cent while fossil fuels could represent up to 80 per cent of Europe's energy mix. On top of this, supplies will be drawn from some of the world's most politically volatile areas. Given the sheer energy intensity of our economies, the scope for vulnerability and turbulence is immense»

A report to the European Council by the Reflection Group on the Future of the EU 2030.

May 2010.

Summary: European Communities Constitutive Treaties didn't rule the energy policy, more than the simple attention given to coal and nuclear energy in the CECA and EURATOM Treaties. In fact, the energy question had an important element of national policy that was quite difficult to be ruled at european level. The Single European Act and Maastrich Treaty reforms neither gave the European Union a competence in energy, although they included it as another element in the internal market, the environmental policy, the research and innovation policy, etc. It has been finally the Lisbon Treaty the one that has incorporated, for first time, an own title for energy, where the aim of this new european competence is delimited, the purposes to be fulfilled, and the procedure of adopting decisions. The Treaty keeps, nevertheless, into the national competences, the capacity to decide about the conditions of development of energetical resources, the choice between several energy resources, and the general structure

of the energy supply. In resume, this is the condition to be paid by the European Union in order to get, at last, a shared competence in energy policy.

Keywords: energy, European energy policy, energy package, principle of solidarity, energy supply, European Union, Lisbon Treaty

INTRODUCTION

Shaping an energy policy for the European Union is an economic, environmental, security and of course political imperative of which the Member States are already fully aware. However, many circumstances have complicated the task of designing the incipient—and as yet imperfect—common European Union energy policy as we know it today. Indeed, to the legal conditioning factors stemming from the absence of an autonomous legal basis for regulating energy matters in the founding treaties (1) should be added the requirements that have always been imposed by the different preferences expressed by the governments of the Member States concerning the design of their own national energy policies. (2)

Bearing in mind the aforementioned legal conditioning factors and political requirements, devising a *common* energy policy for the European Union has proved to be a goal that is very difficult (if not impossible) to achieve. Indeed, even though the Union's institutions have progressively drawn up a host of documents and adopted important energy regulations, by no means may it be said that the Union has sufficient capacity of action to design a sufficiently coherent and well-structured *corpus iuris* on this

(1) PETIT, Y.: «A la recherche de la politique européenne de l'énergie», *Revue Trimestrielle de Droit Européen*, 2006, vol. 42, no. 4, pp. 592-620, en pp. 595-597.

(2) Although this essay does not set out to analyse the differences in Member States' energy policies, we feel that the studies by authors who have analysed this aspect in detail are extremely interesting. See, among others, GEDEN, O.: «¿Hacia una política común en energía? Preferencias de Alemania, Francia y Reino Unido», in KÖLLING, M./FERNÁNDEZ SOLA, N./TUDELA ARANDA, J. (Eds.), *Las relaciones internacionales de las regiones: energía e infraestructura. La nueva agenda internacional*, Prensas Universitarias de Zaragoza, Zaragoza, 2008, pp. 97-109; PALAZUELOS, E./VARA, M.J.: «Unión Europea: diferencias entre los sistemas energéticos nacionales y obstáculos para una política energética común», in PALAZUELOS, E. (coord.), *El petróleo y el gas en la geoestrategia mundial*, Akal, Madrid, pp. 95-126.

matter to allow us to speak of a genuine common policy.⁽³⁾ Nevertheless, this technical impossibility of designing a common energy policy has not prevented the Union's institutions from making related decisions through recourse to areas in which the Union does have competences, such as the internal market, trans-European networks and even the environment. Therefore, although the Union has not been able to equip itself with a genuine European energy policy, it has nonetheless managed to put together a more or less systematic set of energy regulations.

In the context described above, the aim of this article is to trace, from a certain historical perspective, the development of the European Union's (intended) energy policy from the origins of the European Communities to the current Treaty of Lisbon. In particular, it sets out to analyse how the treaties' silence on energy matters has progressively conditioned the emergence of a host of regulations driven by the Union's institutions. Indeed, although these regulations cover a broad range of energy-related issues (for example, the liberalisation of gas and electricity markets, environmental matters, energy security, etc.), they not only lack a common legal underpinning but also the necessary coherence and coordination to be anything more than a bunch of energy regulations. They have yet to be shaped into a genuine European policy that clearly identifies the targets to be achieved, the degree of intensity of the Union's action and, if necessary, that of States, as well as the procedures for adopting decisions to guide European action (II).

In order to address this shortfall which the EU has suffered from since the origins of the treaties, the amendments introduced by the Lisbon Treaty include an energy title (Title XXI of the Treaty on the Functioning of the European Union) whereby the Union has its own competence and, in short, capacity to act in this area without needing to have recourse to other Union

(3) The treaties establishing the European Communities provided for only three common policies, namely the Common Agricultural Policy, the Common Transport Policy and the Common Trade Policy. Although the treaties do not give a definition of what is understood by common policies, there are two defining features. First, the Union has sufficient competences to be able to intervene globally in the area in question. Second, the Union's determination to intervene is sufficiently intense as to cause the competence originally exercised by the State to practically disappear, if necessary. For a detailed study of the European Union competences and the characteristics of the Union's common policies, see MARTÍN y PÉREZ DE NANCLARES, J.: «El reparto de competencias entre la Unión Europea y los Estados miembros», in BENEYTO, J. M. (coord.), *El Derecho Comunitario Europeo*, Thomson, Madrid, 2009, pp. 425-486; MARTÍN y PÉREZ DE NANCLARES, J.: «Las competencias comunitarias», in LÓPEZ ESCUDERO, M./Ib., (Coords.), *Derecho Comunitario Material*, McGraw Hill, Madrid, 2000, on pp. 11-23.

policies or, failing that, to the recurring catch-all clause in the now repealed article 308 of the TCE.⁽⁴⁾ Aside from the autonomy the Union gains in energy matters through the recognition of a competence like the one envisaged in the new article 194 of the TFEU,⁽⁵⁾ it is worth noting, as one of the features of the new policy, the effort made by the Lisbon treaty to *constitutionalise* the goals pursued by the Union's new energy policy, as well as the attempt to convert a political principle, that of solidarity, into a legal obligation. Similarly, an analysis of the new legal basis will require us to focus on the decision making procedure envisaged in the treaty, as by examining it we will find answers to the questions of the Union's capacity for action and the residual power that states continue to wield in energy matters (III).

The essay ends with a final reflection which draws a number of conclusions on the direction in which the energy question of the Union has been moving from the founding treaties to the Treaty of Lisbon, and also highlights some of the questions that the new energy regulations have yet to settle. In our opinion these questions are one of the main challenges that the European Union will have to address if it is to ensure success in the immediate future (IV).⁽⁶⁾

(4) The aforementioned catch-all clause has existed since the beginning of the founding treaties in order to establish a certain flexibility in the system of European Union competences. The catch-call clause was examined at the Intergovernmental Conference of 1996, and its usefulness was even questioned once the legal nature of the competences was clarified between the Union and the Member States. Although the clarification of the competences took place in the Treaty of Lisbon, the catch-all clause continues to be regulated in the new article 352 of the TFEU.

(5) Article 4 of the Treaty on the Functioning of the European Union specifies in detail for the first time the list of competences shared by the Union and Member States. Paragraph 2(i) of the article expressly mentions energy. For a detailed study of the system of European Union competences, see above all GOUCHA SOARES, A.: *Repartição de competências e preempção no direito comunitário*, Cosmos Direito, Lisbon, 1996, as well as MARTÍN Y PÉREZ DE NANCLARES, J.: *El sistema de competencias en la Comunidad Europea*. Germen iusinternacionalista versus vocación federal, McGraw Hill, Madrid, 1997. See also the more recent article by MARTÍN Y PÉREZ DE NANCLARES, J.: «El nuevo sistema de competencias en el proyecto de Constitución europea», *Cuadernos Europeos de Deusto*, 2004, no. 30, pp. 75-114 and VON BOGDANDY, A./BAST, J.: «El orden competencial vertical de la Unión Europea», en GARCÍA DE ENTERRÍA, E. (dir.), *La encrucijada constitucional de la Unión Europea*, Civitas, Madrid, 2002, pp. 19 et seq.

(6) To confirm this reflection it is sufficient to note the importance attached to the energy question ("Energy security and climate change: a new industrial revolution") in the Report to the European Council by the Reflection Group on the Future of the European Union 2030. The aforementioned report is available at http://www.consilium.europa.eu/uedocs/cmsUpload/Reflection_ES_web.pdf

THE PROGRESSIVE SHAPING OF A EUROPEAN UNION ENERGY POLICY: FROM THE SILENCE OF THE TREATIES TO THE POLITICAL IMPETUS GIVEN BY THE INSTITUTIONS

The silence of the founding treaties: energy as a national policy issue

The treaties establishing the European Communities did not regulate energy policy beyond the treatment given to coal and nuclear energy in the Treaty on the European Coal and Steel Community (hereafter TECSC) and the Treaty on the European Atomic Energy Community (hereafter EURATOM (7) respectively. This silence of the treaties was not due to neglect. Rather, it was a choice: energy was part of a markedly national policy, the chief aim of which was to ensure supply. (8)

The successive oil crises (1973-71 and 1978-79) and the problem of external energy dependence which they brought to light merely strengthened the national conception of energy policy while encouraging the use of indigenous energy sources such as national coal. (9) However, this national vision of energy which initially prevailed had to coexist with a certain supra-national perspective that was progressively promoted in parallel by heads of state and government by asking the Commission to draw up proposals for ensuring an orderly functioning of the common energy market. (10)

(7) On the current usefulness of this organisation see SELLARÉS SERRA, J.: «El EURATOM subsiste, invisible e incompatible con el tinglado comunitario», in MARTÍN Y PÉREZ DE NANCLARES, J. (coord.), *El Tratado de Lisboa. La salida de la crisis constitucional*, Iustel, Madrid, 2008, on pp. 319-330.

(8) Some of the reasons that explain this traditional «national» conception of energy policy are the influence of the energy sector on industrial competitiveness, its tendency to be a natural monopoly, its conception as a public service and even the requirement of huge economic resources to restore energy infrastructure. This is pointed out by SÁENZ DE MIERA, G./ARTETA, S.: «La política energética de la Unión Europea. El peso creciente del medio ambiente», BENEYTO PÉREZ, J.M^a. (coord.), *Cincuenta años de construcción europea*, Instituto Universitario de Estudios Europeos, Universidad San Pablo-CEU, Madrid, 2008, pp. 137-160, en p. 139.

(9) At the time of completing the present article, the European Commission has decided to prolong the aid to the national coal industries. To date this aid has been based, among others, on Commission Decision no. 3632/93, in force since 1 January 1994, establishing community rules for state aid to the coal industry (1993-2002) (OJ L 329, of 30.12.1993, p. 12) and, previously, Decision 2064/1986, Decision 528/1976; Decision 3/1971 and Decision 3/1965. On this subject, see, SORIANO PAOLA, M.A.: «Situación actual y perspectivas de la política comunitaria del carbón», *Revista de Relaciones Laborales*, no. 6, 1998, pp. 259-277.

(10) Dating from this period are, for example, Council Directive 73/238/EEC of 24 July 1973, on measures to mitigate the effects of difficulties in the supply of crude oil and

Even so, the rise in oil production in the 1980s and the slump in prices and economic growth during that period were factors that contributed to dampening substantially the incentive for designing a supranational energy policy and were conducive to energy policies underpinned by firmly protectionist stances. (11) Indeed, the two major reforms of the founding treaties that took place during the 1980s (Single European Act) and 1990s (Treaty on European Union) were truly wasted opportunities to do something about energy. (12) Neither the SEU nor indeed the TEU was concerned with incorporating an energy title into the founding treaties. (13) However, unlike the silence of the initial treaties, these reforms did incorporate energy into the text of the treaties. They did so as part of the Union's objectives (14) and, furthermore, as one of various elements involved in achieving the internal market, (15) the environmental policy,

petroleum products (OJ L 228, of 16.08.1973, p. 1; EE 12/01, p. 180); Council Directive 75/339/EEC of 20 May 1975, obliging Member States to maintain minimum stocks of fossil fuel at thermal power stations (OJ L 153, of 13.06.1975, p. 35; EE 12/02, p. 42); Council Decision 77/186/EEC on the exporting of crude oil and petroleum products from one Member States to another in the event of supply difficulties (OJ L 61, of 5.03.1977, p. 23; EE 12/03, p. 3) and Council Decision 77/706/EEC, of 7 November 1977, on the setting of a Community target for a reduction in the consumption of primary sources of energy in the event of difficulties in the supply of crude oil and petroleum products (OJ L 292, of 16.11.1977, p. 9; EE 12/03, p. 31).

- (11) Aside from other considerations, MORATA judges national sovereignty considerations to be very relevant to explaining the lack of Community-level agreements on energy matters. See MORATA, F. (coord.), *La energía del siglo XXI: perspectivas europeas y tendencias globales*, Institut Universitari d'Estudis Europeus, Barcelona, 2009, on p. 11.
- (12) RASINES, L. A.: «La política energética de la Unión Europea», *Noticias de la Unión Europea*, 2000, nos. 187-188, pp. 69-81.
- (13) Indeed, although the text of the TEU that was finally adopted did not deal with a new energy title, the possibility was discussed during the work of the Intergovernmental Conference that negotiated the reform. See, in this connection, the proposals published in *Agence Europe* nos. 1709-1710, of 3 May 1991; nos. 1722-1723, of 5 July 1991; nos. 1733-1734, of 3 October 1991 and, finally, nos. 1746-1747, of 20 November 1991.
- (14) Paragraph u) of former article 3 of the TEU according to the wording of the Maastricht Treaty stated that «For the purposes set out in article 2, the activities of the Community shall include, as provided in the Treaty: [...] measures in the spheres of energy, civil protection and tourism». The italics are the author's.
- (15) Indeed, based on the old article 95 of the TEC on the adoption of harmonising measures, the «first package» of measures was adopted on the liberalisation of the electricity market, consisting of Directive 96/92/EC of the European Parliament and the Council, of 19 December 1996, concerning common rules for the internal market in electricity (OJ L 27, of 30.1.1997, p. 20) and Directive 98/30/EC of the European Par-

(16) the research and technical development policy (17) and, naturally, the policy of trans-European networks. (18)

The talks on the need for an energy title and the fierce opposition of some Member States during the negotiation of the Maastricht reform were not, however, vain efforts. Indeed, the Declaration annexed to the TEU *on civil protection, energy and tourism* was aimed at guaranteeing that energy would be one of the topics of debate in the treaty reform announced by the Treaty of Maastricht itself for 1996.

And so, during the Intergovernmental Conference of 1996, the energy question was analysed and debated on, albeit not as successfully as had been hoped. The opposition of several Member States, among them Spain, (19) prevented any substantive progress from being made in the Amsterdam Treaty beyond a brief mention in the preamble in relation

liament and the Council, of 22 June 1998, concerning common rules for the internal market in natural gas (DO L 204, of 21.7.1998, p. 1).

(16) In old article 175(2)(c) of the TEC, the Maastricht reform granted the Council powers to adopt «measures significantly affecting a Member State's choice between different energy sources and the general structure of its energy supply».

(17) With this legal underpinning, the European institutions have adopted, among others, Council Decision 1999/170/EC of 25 January 1999 adopting a specific programme for research, technological development and demonstration on energy, environment and sustainable development (1998 to 2002), OJ L 64, of 12.03.1999. More recently, the 7th Framework Programme of the European Union for Research, Technological Development and Demonstration Activities (2007-2013) defines the research objectives for guaranteeing a reduction in energy consumption.

(18) The wording given by the Maastricht reform to the old article 154 of the TEC stated that «... the Community shall contribute to the establishment and development of trans-European networks in the areas of transport, telecommunications and energy infrastructures.». The italics are the author's. And as an expression of all this, see Council Decision 96/391/EC of 28 March 1996, laying down a series of measures aimed at creating a more favourable context for the development of trans-European networks in the energy sector (OJ L 161, of 29.06.1996, p. 154) and Decision 1254/96/EC of the Parliament and the Council, of 5 June 1996, laying down a series of guidelines for trans European energy networks (OJ L 161, of 29.6.1996, p. 147).

(19) In addition to the Netherlands and the United Kingdom, Spain opposed including an energy title. The reasons for such a position were expressed in the document drafted by the Secretary of State for the European Union entitled *La Conferencia Intergubernamental de 1996. Bases para una reflexión* (2 March 1995). The nuclear issue and defence of national coal were, among others, some of the reasons cited in defence of our position.

to sustainable development and environmental protection. (20) Not even the Nice Treaty managed to make any new progress. It was necessary to wait until the Lisbon Treaty to find an energy title proper, which will be analysed in detail further on in this article. For the time being, suffice it to point out that the Union's success in establishing a shared competence in energy is partially clouded by the capacity for action reserved to states under the new treaty when it comes to determining the conditions for exploiting their energy resources, choosing between different energy sources and choosing the general structure of their energy supply. (21)

The impetus given by the Commission and the European Council decision: the Action Plan 2007-09

From the announcement by the Treaty of Nice in *Declaration no. 23 on the future of the European Union* of a new treaty reform process (22) to the entry into force of the Treaty of Lisbon at last on 1 December 2009, the European Union experienced a by no means inconsiderable number of ups and downs until it was finally able to guarantee the validity of its new legal framework. We might recall in this connection the failure to ratify the Constitutional Treaty with the negative *referenda* of the Netherlands and France, (23) the salvaging of its contents through the 2007 Intergovernmental Conference and, finally, the difficulties the Lisbon Treaty had in entering into force following the negative result of the first *referendum* held in Ireland. (24)

(20) «Determined to promote economic and social progress for their peoples, taking into account the principle of sustainable development and within the context of the accomplishment of the internal market and of reinforced cohesion and environmental protection, and to implement policies ensuring that advances in economic integration are accompanied by parallel progress in other fields». The italics are the author's.

(21) See in detail paragraph III.3.

(22) For a detailed study of the contents of Declaration no. 23 see DE WITTE, B.: «The Nice Declaration: Time for a Constitutional Treaty of the European Unión?», *The International Spectator*, no. 1, 2001, pp. 21-30.

(23) RICHARD-NIHOUL, G.: «El 'no' francés del 29 de mayo de 2005: comprender, actuar», Real Instituto Elcano, ARI no. 150/2005 (www.realinstitutoelcano.org). A more general reflection on the difficulties experienced by the European Constitution on account of the ratification procedure it was obliged to go through can be found in ALDECOA LUZARRAGA, F.: «El proceso constituyente: ¿'víctima' del proceso de ratificación?», *Revista General de Derecho Europeo*, no. 7, 2005 (www.iustel.com).

(24) On 12 June 2008 Ireland held a referendum on Irish participation in the Treaty of Lisbon. Of the 51.26% turnout, 53.75% voted against and 46.25% in favour. An initial

While the treaty reform process was finding a way forward that made the Union's new legal framework feasible, the European Commission did not remain inactive in the energy field. Indeed, it was in 2006 when the Commission adopted the Green Paper entitled *A European Strategy for Sustainable, Competitive and Secure Energy*. (25) The aforementioned document contained a proposal for debate structured around six priority areas (26) as described in the following sections:

1. Energy for growth and jobs in Europe: completing the internal European electricity and gas markets.
2. An Internal Energy Market that guarantees security of supply: solidarity between Member States.
3. Tackling security and competitiveness of energy supply: towards a more sustainable, efficient and diverse energy mix.
4. An integrated approach to tackling climate change.
5. Encouraging innovation: a strategic European energy technology plan.
6. Towards a coherent external energy policy. (27)

Likewise, during the month of January 2007, the Commission submitted no less than nine Communications to the Council and the European Parliament on energy matters. (28) These documents included *An energy*

analysis of the results of this referendum can be found in the July 2008 Eurobarometer no. 245. The full report entitled «Post referendum survey in Ireland» is available at http://ec.europa.eu/public_opinion/flash/fl_245_full_en.pdf. See BROWN, T.: «El segundo referendum irlandés», Real Instituto Elcano de Estudios Internacionales y Estratégicos (www.realinstitutoelcano.org).

(25) COM (2006)105 final, of 8 March 2006. This was not the only Green Paper drawn up by the European Commission. Although it had less impact than the one discussed here, we might recall the Green Paper entitled *Towards a European strategy for the security of energy supply* (COM (2000) 769 final).

(26) See, with greater detail, PETIT, Y.: loc. cit. («A la recherche de la politique européenne ...»), on pp. 615-616.

(27) On this subject it is appropriate to recall the joint paper of the Commission and the Secretary General/High Representative submitted in the framework of the European Council of June 2006 entitled *An external policy to serve Europe's energy interests* (S160/06). See also the paper from the Commission to the European Council entitled *External energy relations: from principles to action*; COM (2006) 590 final, 12 October 2006.

(28) For a brief analysis of each of these documents see the article by DOLADER I CLARA, J.: «La seguridad del aprovisionamiento», in GARCÍA DELGADO, J. L./JIMÉNEZ, J. C. (eds.), *Energía y regulación*, Thomson-Civitas, Madrid, 2007, on pp. 181-191.

policy for Europe; (29) the Renewable Energy Road Map; (30) a Report on progress in renewable electricity; (31) a Biofuels progress report; (32) Prospects for the internal gas and electricity market; (33) the Priority inter-connection plan; (34) a Nuclear Illustrative Programme; (35) Sustainable power generation from fossil fuels; (36) and, lastly, a document entitled Towards a European Strategic Energy Technology Plan. (37)

The impetus given by the Commission was a determining factor in the European Council's adoption. of the *Action Plan 2007-09* aimed at progressing towards shaping an Energy Policy for Europe during its meeting of 8 and 9 March 2007. (38) As the European Council itself stated, this was the political impetus in energy matters which the Union had hitherto lacked and which could mark «the start of the process of articulating a policy in this field.» (39)

Lastly, as an example of the intense activity of the European Commission, it is also worth mentioning the *EU Security and Solidarity Energy Action Plan* resulting from the second strategic review of the energy sector. The aforementioned Commission document warns of the challenges the Union must address in the long term and points out some of the Union's responses. (40) The plan basically focuses on five points: necessary infrastructure and diversification of energy supply sources; international relations in the energy sector; oil and gas stocks and crisis response

(29) Document COM (2007) 1 final, 10 January 2007.

(30) Document COM (2006) 848, 10 January 2007.

(31) Document COM (2006) 849, 10 January 2007.

(32) Document COM (2006) 845, 10 January 2007.

(33) Document COM (2006) 841, 10 January 2007.

(34) Document COM (2006) 846, 10 January 2007.

(35) Document COM (2006) 844, 10 January 2007.

(36) Document COM (2006) 843, 10 January 2007.

(37) Document COM (2006) 847, 10 January 2007.

(38) Presidency conclusions of the European Council of 7 and 8 March 2007. 7224/1/07 REV 1, Brussels, 2 May 2007. Annex I. More recently, the Informal Energy Council held on 15 January 2010 in Seville adopted the document *The energy policy of the European Union. Basic elements for the European Energy Action Plan 2010-2014*.

(39) In this connection see ZAPATER DUQUE, E.: «¿Una nueva política energética común para la Unión Europea? Entre el compromiso y la controversia», en REMIRO BROTONS, A./EGEA FERNÁNDEZ, R. (coords.), *El cambio climático en el Derecho internacional y comunitario*, Fundación BBVA, Madrid, 2009, pp. 197-236.

(40) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. COM(2008) 781 final, 13 November 2008.

mechanisms; energy efficiency; and, lastly, making better use of the European Union's indigenous energy resources.

The Energy and Climate Package for meeting the 20-20-20 targets: a new energy policy perspective

The 2007 Communication of the Commission to the Council and the European Parliament on *An Energy Policy for Europe* (41) included the proposal known as «the three 20s» for 2020: to improve energy efficiency by 20%, to increase the share of renewable energy in the mix also by 20% and to reduce greenhouse gases, again by 20%. This document was accompanied by an Action Plan laying down ten measures to be adopted in areas such as the internal energy market; solidarity between Member States and security of oil, gas and electricity supply; long-term commitment to reducing greenhouse gas emissions and the EU Emissions Trading System; an ambitious programme of energy efficiency measures at community, national, local and international level; a longer term target for renewable energy; a European Strategic Energy Technology Plan; towards a low CO₂ fossil fuel future; the future of nuclear energy; an International Energy Policy that actively pursues European interests; and, lastly, the aim of guaranteeing effective monitoring and reporting, in which the Office of the Energy Observatory will play a key role.

Continuing with the work already under way, in 2008 the Commission proposed a package of measures on climate change and energy to be implemented in 2011. (42) They included proposals for reducing emissions outside the EU Emissions Trading System, (43) carbon capture and storage (44) and, lastly, proposals concerning renewable energy. (45)

It might well be concluded from the proposals submitted that the lack of a legal basis in the energy treaties has by no means hindered the action of the Union's institutions. On the contrary, the Commission has not

(41) COM (2007) 1 final, 10 January 2007.

(42) COM (2008) 30 final, 23 January 2001.

(43) COM (2008) 16 final, 23 January 2001.

(44) COM (2008) 18 final, 23 January 2001.

(45) COM (2008) 19 final, 23 January 2001.

ceased to use its capacity for legislative initiative to give impetus to all matters which, like climate change, (46) are directly related to energy.

The third energy package: a decisive step forward in the liberalisation of the energy sector

One of the earliest energy issues that required the European Union's attention was the liberalisation of the gas and electricity sectors. Following the first liberalisation of 1996 and 1998, (47) it adopted Directives 2003/54/EC and 2003/55/EC, (48) which likewise entailed adopting common rules for the electricity and gas markets. As may be appreciated, the liberalisation of a sector like energy characterised by substantial government intervention has given rise to many consequences that directly influence the degree of autonomy enjoyed by the governing bodies of the energy companies (now privatised) in making certain decisions. (49)

(46) The European Parliament has also been sensitive to climate change. See in this connection the Resolution on climate change adopted on 14 February 2007 (P6_TA(2007)0038).

(47) Directive 96/92/EC, of 19 December, concerning common rules for the internal market in electricity and Directive 98/30/EC of 22 June concerning common rules for the internal market in natural gas. A study of both directives can be found in SOTELO NAVLPOTRO, J.A.: «Desarrollo y medioambiente en Europa: la política energética comunitaria», Observatorio Medioambiental, vol. 5, 2002, pp. 279-328, on pp. 315-325.

(48) Directives 2003/54/EC and 2003/55/EC, of 26 June 2003, (DO L 176, 15 July 2003, p. 37 and p. 57 respectively). A study of both directives can be found in DIAZ LEMA, J. M.: «La liberalización de las redes europeas de gas y electricidad (un estudio de las directivas comunitarias 2003/54 y 2003/55)», in *Derecho de la Energía*, La Ley, Madrid, 2006, pp. 77-126.

(49) We refer to the question of the so-called golden shares, which the Court of Justice stated to be incompatible with EU law in a ruling of 13 May 2003 (case C-463/00, Commission of the European Communities/Kingdom of Spain). For a detailed study of the companies involved (among them ENDESA) and of the arguments used by the Advocate General and the Court of Justice we suggest readers consult our essay «El régimen de autorizaciones administrativas previas en las empresas privatizadas. Comentario a la Sentencia del Tribunal de Justicia de las Comunidades Europeas de 13 de mayo de 2003 (asunto C-463/00 Comisión de las Comunidades Europeas/Reino de España)», *Revista de Derecho Comunitario Europeo*, no. 15 2003, pp. 683-697. Taking an approach that is more economic than legal, MARÍN QUEMADA analyses the disadvantages the business structure poses for the design of an energy policy and the commitment to creating «national champions». See MARÍN QUEMADA, J. M^a.: «Política energética en la UE: el debate entre la timidez y el atrevimiento», *Economía de la energía*, 2008, vol. 842, pp. 65-76, on pp. 74-75.

In order to complete this complex liberalisation process, on 13 July 2009 the Union's institutions adopted a set of rules—known as the «Third Package» (50)—consisting, on the one hand, of a set of Directives aimed at updating the rules governing the internal gas market (Directive 2009/73/EC, of 13 July 2009) (51) and the electricity market (Directive 2009/72/CE, of 13 July 2009); (52) and, on the other, of a varied set of regulations such as, for example, Regulation (EC) no. 714/2009 on conditions for access to the network for cross-border exchanges in electricity, (53) Regulation (EC) no. 715/2009, repealing Regulation 1775/2005, on conditions for access to the natural gas transmission networks, (54) and the adoption of Regulation (EC) no. 713/2009 establishing an Agency for the Cooperation of Energy Regulators (ACER). (55)

The directives that make up the aforementioned Third Package establish 3 March 2011 as the deadline for transposition. While the Member States strive to adapt their national legislation to the EU requirements, countries like Sweden and Belgium have already been found guilty by the court of Justice of non-compliance with the 2003 directives that the new regulations have replaced.(56) However, it is likely that these rulings of the Court of Justice will not be the only ones in this field. Indeed, it should be borne in mind that the Commission has initiated twenty-four infringement proceedings for electricity, twenty-one for gas and two in relation to transit and storage. (57)

(50) Document COM(2010)84 final of 11 March 2010 analyses how the financial and economic crisis, the dispute between Russia's Gazprom and Ukraine's Naftogaz, and the adoption of the third package of the internal energy market have influenced the EU's electricity and gas markets and how they may affect future market developments.

(51) OJ L 211, 14 August 2009, p. 94.

(52) OJ L 211, 14 August 2009, p. 55.

(53) OJ L 211, 14 August 2009, p. 15.

(54) OJ L 211, 14 August 2009, p. 36.

(55) OJ L 211, 14 August 2009, p. 1.

(56) Judgement of the EUCJ of 3 December 2009, *Commission v. Sweden*, (case 474/98) and Judgement of the EUCJ of 3 December 2009, *Commission v. Belgium* (case 475/98). Not yet published in the official compilation. Available at the Curia website [http://curia.europa.eu/jcms/jcms/j_6/].

(57) Communication from the Commission to the Council and the European Parliament, Report on progress in creating the internal gas and electricity market, COM (2010) 84 final, 11 March 2010.

THE CONTRIBUTIONS OF THE LISBON TREATY TO CONSOLIDATING AN ENERGY POLICY: COMPETENCE OF THE UNION AND PRESERVATION OF THE POWER OF THE STATE

A new energy title for the Union: the importance of having an autonomous legal basis

As pointed out in this article, it was not until the Lisbon Treaty that a new title was incorporated into the founding treaties—title XXI on energy. The main new features introduced by this title, which is based on the new article 194 of the TFEU, are not only the establishment of a series of targets to be met by the Union's energy policy but also the fact that it provides for a general decision making procedure. Actually the new article 194 of the TFEU was salvaged from article III-256 of the failed Constitutional Treaty, although in this particular case it was necessary to make a few alterations to the original version with respect to the objectives of the aforementioned policy (the new aim is included of promoting «the interconnection of energy networks»), and in relation to the spirit with which they are to be addressed (“in a spirit of solidarity between Member States»). (58)

As well as the shared competence in energy (articles 4 and 194 of the TFEU), (59) the Lisbon Treaty also incorporates two new features

(58) This was pointed out by ZAPATER DUQUE when comparing the wording of article III-256 of the constitutional treaty (“In the context of the establishment and functioning of the internal market and with regard for the need to preserve and improve the environment, Union policy on energy shall aim to (...)»), with that of the new article 194 of the TFEU (“In the context of the establishment and functioning of the internal market and with regard for the need to preserve and improve the environment, Union policy on energy shall aim, in a spirit of solidarity between Member States (...); in ZAPATER DUQUE, E.: «La seguridad energética de la Unión Europea en el contexto de la nueva política energética y el Tratado de Lisboa, in MORATA, F. (coord.), *La energía del siglo XXI: perspectivas europeas y tendencias globales*, Institut Universitari d'Estudis Europeus, Barcelona, 2009, on pp. 49-80, p. 60.

(59) As it is a competence shared between the European Union and the states, the exercise of these powers will be determined by applying the principle of subsidiarity. The European Union will thus be responsible for legislating provided that the action of the Union is necessary (necessity test) as that of the state is insufficient (sufficiency test) and the measure to be adopted has a supranational dimension (supranationality test). The Treaty of Lisbon, through the annexed Protocol on the application of the principles of subsidiarity and proportionality, includes a mechanism allowing political and, if necessary, jurisdictional control of subsidiarity. This question is explored in detail in MARTÍN y PÉREZ DE NANCLARES, J.: «La nueva regulación del régimen de

which are connected with the energy issue yet are not included under the aforementioned energy title. We are referring, first, to the contents of the new article 122 of the TFEU (under economic policy) which provides that the Council may decide, *in a spirit of solidarity between Member States*, upon the measures appropriate to the economic situation, in particular if severe difficulties arise in the supply of certain products, notably in the area of energy. Second, we also wish to mention the provision made in article 191 of the TFEU (under environmental policy) in relation to «promoting measures at international level to deal with regional or worldwide environmental problems, and in particular combating *climate change*».

At the same time, despite the new elements introduced by the Lisbon Treaty, we cannot ignore the fact that the TFEU maintains—in the terms hitherto found in earlier versions of the treaties—the references to the energy question within the titles relating to the trans-European networks (article 170 of the TFEU) and environmental policy (article 192.2.c) of the TFEU).

Aside from the maintenance of legal bases that mention energy, the importance of the Union having its own, autonomous legal basis in energy matters had already been raised in the negotiations of earlier treaty reforms, especially Maastricht. We therefore should not be surprised that the Union's institutions have called for the use of the new article 194 of the TFEU as a new legal basis for some of the legislative proposals promoted while the Treaty of Nice was in force. Some of the aforementioned proposals still being processed as of 1 December 2009 therefore had to have their legal basis reassessed in order to adapt them to the possibilities offered by the new Lisbon Treaty. (60) Of these legislative proposals we have managed to rescue those relating to energy questions, the legal basis of which will now be none other than the new article 194 of the TFEU.(61)

competencias en el Tratado de Lisboa: especial referencia al control del principio de subsidiariedad», in *ibid.* (coord.), *El Tratado de Lisboa. La salida de la crisis constitucional*, Lustel, Madrid, 2008, pp. 269-294.

(60) The Commission submitted a Communication to the European Parliament and the Council on the Consequences of the entry into force of the Treaty of Lisbon for ongoing interinstitutional decision-making procedures. See COM(2009)665 final, 2 December. Amended by COM(2010)147 final, 12 April 2010.

(61) We refer to the Proposal for a Directive of the European Parliament and of the Council on labelling of tyres with respect to fuel efficiency and other essential parameters (COM(2008)779; the Proposal for a Directive of the European Parliament and of the Council on the energy performance of buildings (recast) (COM(2008)780); the Pro-

Old and new objectives of the European energy policy: the spirit of solidarity as a political guarantor of these objectives

An important element in the shaping of any Union policy—and therefore energy policy too—is, without a doubt, establishing the objectives it pursues. In the case of energy policy, the objectives are necessarily conditioned by the context and therefore can be progressively adapted, even altering their hierarchy, in keeping with various factors. Indeed, whereas security of energy supply was undoubtedly one of the priority objectives when the European Communities were initially established and continues to a strategic objective, other aims directly related to economic and, more specifically, environmental concerns are becoming increasingly important today.

In this regard, the Treaty of Lisbon addresses the treatment of objectives after linking the Union's energy policy to the establishment or functioning of the internal market, on the one hand, and, on the other, to the need to preserve and improve the environment. It then goes on to make energy policy conditional on the achievement of the four following goals:

- a) ensure the functioning of the energy market,
- b) ensure security of energy supply in the Union, (62)

posal for a Regulation of the European Parliament and of the Council concerning measures to safeguard security of gas supply and repealing Directive 2004/67/EC (COM(2009)363); the Proposal for a Directive of the European Parliament and of the Council of on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products (recast) and the Proposal for a Council decision on the conclusion of the Statute of the International Renewable Energy Agency (IRENA) by the European Community and on the exercise of its rights and obligations.

- (62) The first Community rule regulating security of supply was Directive 68/414/EEC of 20 December 1968 imposing an obligation on Member States of the EEC to maintain minimum stocks of crude oil and/or petroleum products (OJ L 308, 23.12.1968). It was subsequently modified by Directive 98/93/EC and, more recently, by Council Directive 2006/67/EC of 24 July 2006, imposing an obligation on Member States to maintain minimum stocks of crude oil and/or petroleum products (OJ L 217, 8.8.2006). This directive establishes the obligation to maintain strategic stocks, determine how stocks are held and the protocol for making stocks available in the event of unexpected supply crises. On this subject, see PAUWELS, J.-P.: «La sécurisation de l'approvisionnement en pétrole et en gaz de l'Union Européenne», *Géopolitique de l'approvisionnement énergétique de l'Union Européenne au XXI siècle*, Bruylant, Vol. II, Brussels, 1997, pp. 295-322. An extremely interesting article in the light of the novelties provided by the Lisbon Treaty is ZAPATER DUQUE, E.: «La seguridad ener-

- c) promote energy efficiency and energy saving and the development of new and renewable forms of energy, (63) and
- d) promote the interconnection of energy networks.

Of the four objectives which the Lisbon Treaty *constitutionalises*, some were already set out in various documents drawn up by the Union's institutions. A newer feature, however, is the reference to promoting the interconnection of energy networks. This is undoubtedly a necessary goal in the progressive design of an energy policy and also essential in ensuring that other objectives, such as the security of energy supply in the Union, can feasibly be met. Even so, it is also among the objectives that lend themselves less easily to «pooling» and are more closely tied to the classical vision of energy as a national matter.(64)

One of the most striking novelties of the treaty is the statement that the proposed aims of the energy policy shall be addressed in a spirit of solidarity between Member States. (65) We are thus dealing with a regulation that resembles a wish or political intention more than a legal provision from which may stem obligations whose non-fulfilment may result in prosecution by the Court of Justice. It seems easy to imagine, without needing to take the argument too far, that any Member State could have problems adapting to the aforementioned spirit of solidarity in situations of crisis or serious difficulty. Without neglecting all these elements, we must bear in mind that some expressions of this spirit of solidarity have

gética de la Unión Europea en el contexto de la nueva política energética y el Tratado de Lisboa, in MORATA, F. (coord.), op. cit. (La energía del siglo XXI: ...), on pp. 49-80.

(63) ZAPATER DUQUE, E.: loc. cit. («¿Una nueva política energética común para la ...») on p. 202.

(64) Priority concerns in the field of interconnection are the project for electricity interconnection between Germany, Poland and Lithuania, the project to connect the offshore wind farms in northern Europe and, lastly, the interconnection of the electricity grids of France and Spain.

(65) This reference to the spirit of solidarity made by the treaty in relation to energy is not an isolated case in the Treaty on the Functioning of the European Union. Indeed, article 222 of the TFEU establishes a solidarity clause for external action whereby the Union and the Member States shall act in a spirit of solidarity if a Member State is the object of a terrorist attack or the victim of a natural or man-made disaster. For a more detailed analysis of this clause see our essay «Los nuevos instrumentos jurídicos de la Política Común de Seguridad y Defensa», in La Política Europea de Seguridad y Defensa (PESD) tras la entrada en vigor del Tratado de Lisboa, Cuadernos de Estrategia, no. 145, pp. 71-100, on pp. 93-96.

already been adopted in the field of gas (66) and oil. (67) Obviously they are not perfect solutions, but they are very interesting proposals that provide an example of what is implied by the spirit of solidarity that is now expressly enshrined in the Treaty.

The decision making procedure in the Union: limits that preserve the power of the State

As stated earlier, the reform of the Lisbon Treaty acknowledges the European Union's (shared) competence to make decisions in the field of energy (article 194 of the TFEU). Indeed, it empowers the European Parliament and the Council to establish the measures necessary—after consultation of the Economic and Social Committee and the Committee of the Regions—to achieve the aims mentioned by the treaty as pertaining to energy policy.

But over and above the legal basis or constitutionalisation of these aims, the Lisbon treaty establishes the ordinary legislative procedure as the general decision making mechanism in energy matters. (68) The choice of the aforementioned procedure (an adaptation of the now classic codecision procedure) marks a substantial improvement with respect to the participation of the Parliament and the Council in energy regulation prior to the entry into force of the Treaty of Lisbon. (69) Indeed, until the adoption of the new legal basis, any legislative action

(66) Directive 2004/67/EC of the European Parliament and the Council of 26 April 2004, concerning measures to safeguard security of natural gas supply (OJ L 127, 29 April 2004)—a security that will no doubt require further investments to guarantee new interchanges between Central Europe and the Baltic states, build new liquid gas storage terminals or, if necessary, increase the capacity of gas pipelines.

(67) The solidarity mechanism consists of establishing a system of strategic oil stores in coordination with other OECD countries, to be activated by the International Energy Agency (IEA) in serious cases, i.e. when at least one reduction of between 7 and 12% occurs in the reserves of one or more participants. Criticisms of the working of this mechanism can be found in EVANS, A.C.: «European Community Law and the problem of oil shortages», *International and Comparative Law Quarterly*, 2001, no. 31, pp. 1-16.

(68) The ordinary legislative procedure is regulated in article 294 of the TFEU. It originates from the codecision procedure introduced by the Maastricht Treaty. It is a procedure that involves two readings and in which the power of the European Parliament has been placed on a par with the legislative power of the Council.

(69) Indeed, the absence of an autonomous legal basis for adopting energy measures prior to the entry into force of the Lisbon Treaty often made it necessary to have recourse to the catch-all clause in the now repealed article 308 of the TEC. In such

by the Union in this field required recourse to the so-called catch-all clause established in the old article 308 of the TEC (the current article 352 of the TFEU)—a mechanism which limited the role of the European Parliament to that of a mere consultative body and made the Council's pronouncement conditional upon the requirement of unanimity. In the light of the foregoing, the progress made by the new treaty is more than substantial.

Only when the measures to be adopted in this area are essentially fiscal in nature does the Treaty on the Functioning of the European Union require that the Council act unanimously. On such occasions the European Parliament will play a merely consultative role.

Aside from the capacity to influence, which States can make use of through the European institutions in which they are represented during the procedure for making decisions on energy matters, the Lisbon treaty does not strip states of their power. Indeed, one of the features that deserve greater attention in the new regulation envisaged in article 194 of the TFEU concerns the limits set by the new treaty on the Union's action by steering the capacity for decision making to a strictly national sphere. The second paragraph of article 194(2) of the TFEU thus lays down the right of any Member State to determine the conditions for exploiting its energy resources, its choice between different energy sources and the general structure of its energy supply, (70) without neglecting the content of *Declaration no.35 on article 194 of the Treaty on the Functioning of the European Union*, according to which the Conference believes that the aforesaid article 194 of the TFEU «does not affect the right of the Member States to take the necessary measures to ensure their energy supply under the conditions provided for in Article 347». (71)

an event, whereas the involvement of the European Parliament was limited to a mere consultative opinion, the Council was competent to act unanimously.

(70) This capacity for action of the Member States must be compatible with the aim of the energy policy set out in article 194(1)(c) of the TFEU concerning the promotion of energy efficiency and energy saving and the development of new and renewable forms of energy.

(71) According to article 347 of the TFEU, «Member States shall consult each other with a view to taking together the steps needed to prevent the functioning of the internal market being affected by measures which a Member State may be called upon to take in the event of serious internal disturbances affecting the maintenance of law and order, in the event of war, serious international tension constituting a threat of war, or in order to carry out obligations it has accepted for the purpose of maintaining peace and international security».

As can be seen from the foregoing, States' obsession with preserving a small (but important) measure of power that rules out any capacity for action of the Union is not a novel feature introduced by the Lisbon Treaty. What is a novelty of this new legal framework is the considerable reinforcement of the power of the State and, consequently, the appreciable limitation of a competence the Union had hitherto enjoyed. And so, unlike the old article 175(2)(c) of the TEC, which made the adoption of such decisions conditional upon the unanimity of the Council, the new wording of the Lisbon Treaty prevents any kind of intervention of the Union's institutions in a matter which Member States regard as being part of the measure of power they enjoy in the energy field, and which, therefore, deserves to be appropriately protected. This is undoubtedly a small step backwards which can probably be explained by as the price the Union is obliged to pay States for having an autonomous legal basis in the field of energy.(72)

Above and beyond these observations, it seems important to judge positively the novelties the Lisbon Treaty introduces in energy matters as they signify major progress «from the point of view of the system of shared competences, transparency and the design of a European strategy», though it should not be ignored—as ZAPATER DUQUE aptly points out—that «only political will and consensus among Member States [will] allow the most to be made of this new energy Title». (73)

BY WAY OF A FINAL REFLECTION

As we have attempted to show in the present essay, there are legal, political and economic reasons that support the appropriateness of having a *common* European Union energy policy. However, suffice it to briefly examine the history of the founding treaties to note the technical difficulties of such an aim, not to mention the many national interests or the various energy strategies the Member States have not wished to re-

(72) According to ANDOURA, HANCHER and VAN DER WOUDE, «The final text of the energy Title is thus a result of a carefully crafted compromise between national sovereignty, other natural resources and energy taxation issues, and, on the other, a shared Union competence for the rest», in ANDOURA, S./HANCHER, L./VAN DER WOUDE, M.: op. cit. (Towards a European Energy Community. ...), p. 11.

(73) ZAPATER DUQUE, E.: «La seguridad energética de la Unión Europea en el contexto de la nueva política energética y el Tratado de Lisboa, en MORATA, F. (coord.), op. cit. (La energía del siglo XXI: ...), p. 62.

nounce in their exercise of a somewhat outmoded conception of national sovereignty.

Despite such a legally and politically adverse context, the Union's institutions have not only not resigned themselves to acknowledging their lack of competence in energy matters but have encouraged the adoption of a set of documents and a host of related regulations, having recourse to the legal bases laid down in the treaty for the internal market, the trans-European networks and the environment, among others. Indeed, although we cannot speak of the existence of a *common* EU energy policy, nor does it seem reasonable to ignore the existence of an amalgam of European regulations that make up a legal corpus on energy of more than considerable importance.

Given the legal situation described above, we have reason to be pleased that the latest treaty reform, that of Lisbon, has at last incorporated an energy title, in addition to maintaining a reference to this field in the framework of economic policy (article 122 of the TFEU) or environmental policy (articles 191 and 192(2)(c) of the TFEU), for example. The new title XXI of the Treaty on the Functioning of the European Union undoubtedly constitutes the legal basis that grants the Union the capacity to promote energy legislation which, under the umbrella of a new concept (more political than legal)—the spirit of solidarity—will meet the objectives constitutionalised by the very precept: to ensure the functioning of the energy market, to ensure security of energy supply in the Union, to promote energy efficiency and energy saving and the development of new and renewable forms of energy, and to promote the interconnection of energy networks. In short, it backs the decision making capacity of the Union's institutions through recourse to the ordinary legislative procedure established in the treaties.

Despite the undeniable progress the establishment of the aforementioned energy title in the treaties signifies for the Union, we cannot ignore the limitation this regulation imposes on the Union, as it preserves certain areas exclusively within the decision making power of the Member States. Indeed, the new treaty grants Member States the right to determine the conditions for exploiting their energy resources, their choice between different energy sources and the general structure of their energy supply. Legally speaking it marks a step backwards to before the Maastricht Treaty and hinders the achievement of some of the aims established as the Union's own.

Even so, above and beyond any technical and legal analysis of how energy is regulated in the Lisbon Treaty, it seems evident that time and the manner in which the Union and the Member States exercise this new shared competence will be the test of the true scope of the regulation and its repercussions on the design of the desired but so far never achieved energy policy of the Union.

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CHAPTER FOUR

GLOBAL ENERGY SECURITY AND CLIMATE CHANGE CHALLENGES

THE EUROPEAN UNION'S ENERGY POLICY IN THE LIGHT OF THE LISBON TREATY

FATIH BIROL

SUMMARY

The strict implementation of the Copenhagen Accord could be a first step towards achieving the 450 parts per million goal. The 2010 *World Energy Outlook* analyses, in our 450 Scenario, how this could be the case, and the main focus of this chapter is this scenario, and the implications for the energy sector of following that path, with a particular focus on oil markets. It also discusses the costs of achieving this scenario, and some of the resulting benefits.

Keywords: 450 Scenario, Copenhagen Accord, World Energy Outlook 2010, New Policies Scenario.

INTRODUCTION

The Copenhagen Accord, which was the outcome of the December 2009 UNFCCC conference of the parties, sets a goal of limiting to 2°C the long-term global average temperature increase. The Accord was not adopted by the conference, but 'noted', and signed up to by a majority, but not all of the attending countries. It contains an Annex, into which countries agreeing to the Accord were to enter emissions reduction or other policy commitments, aimed at achieving the 2° goal.

The pledges made, however, by no means ensure that the stated goal will be achieved. In fact, the pledges do not even necessarily ensure that the goal (which is often seen as synonymous with 2°C, but in fact only gives at best a 50% chance of limiting temperature increase to this level) of stabilising the greenhouse gases in the atmosphere at 450 parts per million will be achieved. Worse, a year on, it is still unclear what the Ac-

cord actually means in terms of emissions in 2020 – not just how abatement will be achieved, or where, but more fundamentally, the absolute level of emissions that can be expected in 2020.

The uncertainty as to the actual outcome of Copenhagen stems from two sources. First, in 2020, the lack of transparency of the pledges means that we don't know what emissions will be in that year. Many pledges were expressed in terms of ranges, or against unknown baselines, or made conditional without clarity as to how it could be determined whether those conditions had been met. Second, the lack of ambition for 2020, even in the strictest interpretation of the Accord, combined with the total absence of any mention of longer-term goals, much less concrete, credible targets for the post-2020 period, mean that even if the outcome in 2020 could be seen as in line with the Accord, it is entirely possible that emissions will be so far above the level that is compatible with reaching a 450 parts per million stabilisation that the 2°C goal is entirely out of reach. The 2010 *World Energy Outlook* analyses a scenario in which the Copenhagen Accord pledges are implemented, but at the less ambitious end, and action after 2020 results only in a continuation of the rate of improvement in the CO₂ intensity of the global energy sector (rather than the near-doubling in the rate of improvement needed in the 450 Scenario). We have called this scenario the New Policies Scenario, and it would result in emissions in line with a temperature increase of more than 3.5°C, a level which could have catastrophic impacts for the world. The major implications of this are discussed in this chapter, but we do not focus on this scenario here.

All this is not to say that strict implementation of the Accord could not be a first step towards achieving the 450 parts per million goal: it could. The 2010 *World Energy Outlook* analyses, in our 450 Scenario, how this could be the case, and the main focus of this chapter is this scenario, and the implications for the energy sector of following that path, with a particular focus on oil markets. It also discusses the costs of achieving this scenario, and some of the resulting benefits.

THE FUTURE EMISSIONS TRAJECTORY IN THE CURRENT GLOBAL POLICY CONTEXT

The trajectory that might now be followed by world energy-related carbon-dioxide (CO₂) emissions has to be determined in two stages. First, there is the path to 2020, which we have taken as being set by the outcome of the Copenhagen negotiations, interpreted in two different ways. Second, the

path beyond 2020 must be chosen, limited, in the case of the 450 Scenario, by the need to bring global annual emissions to an early peak so that, allowing for the slow dispersal of accumulated greenhouse gases from the atmosphere, the concentration of emissions can be brought down to the required level in a reasonable timescale. The trajectory of the 450 Scenario has been constrained to be compatible with this goal. The trajectory of the New Policies Scenario is based on the assumption that, after 2020, policies produce an annual global average improvement in CO₂ intensity that, broadly speaking, continues the trend of the previous ten years.

The Copenhagen Accord sets the goal of limiting global average temperature increase to 2°C, but does not set out a path to reach this goal beyond 2020, and leaves many questions still unresolved. The first difficulty is to interpret the commitments associated with the Copenhagen Accord.

Although pledges for 2020 have been made by many countries, many of these lack transparency, and there remain very substantial uncertainties about the interpretation of some of these targets in terms of their impact on global green-house gas emissions. A number of countries, both Annex I and non-Annex I, have entered ranges rather than specific pledges. There are also a number of open questions relating to the provisions of the Accord and the future evolution of the Kyoto Protocol mechanisms, including questions about the future of the Clean Development Mechanism (CDM) and banking for future use of Assigned Amounts Units (AAUs), some of which are expected to be discussed and possibly settled in the next Conference of the Parties in Cancun in December 2010 – although, of course, progress is uncertain. Even at the high end of the Annex I pledges – that is assuming that all Annex I countries implement the most ambitious version of the pledges they have made in the context of the Copenhagen Accord – the uncertainty around non-Annex I countries' emissions in 2020 exceeds the maximum abatement attributable to the pledges of the Annex I countries in total. Of the total uncertainty around the non-Annex I countries' figures of 3.2 gigatonnes (Gt) CO₂, we estimate uncertainty for Brazil may be over 350 million tonnes (Mt) CO₂, related to uncertainty about the baseline. Uncertainty about the Chinese pledge is estimated to be at least 2 Gt CO₂, while uncertainty about the Indian pledge amounts to over 600 Mt CO₂, on the basis of different gross domestic product (GDP) estimates. All of these figures could be higher, depending on the assumptions made in calculating them. It is also unclear what level of emissions will result from the targets announced by Annex I countries, as many have entered ranges rather than specific targets. Although this uncertainty – at 675 Mt CO₂ for all Annex I countries together –

is less than that for Non-Annex I countries, and is quantifiable and independent of assumptions, in that the targets are expressed against fixed baselines, it nonetheless adds to the difficulty of saying with any certainty what is the absolute emissions level associated with the Copenhagen Accord, and results in estimated total uncertainty of 3.9 Gt.

- **Uncertain baselines:** Where pledges are defined as deviations from Business As Usual (BAU) but that baseline has not been published or stated, or more than one official projection exists, it is not clear what the pledge means in terms of the absolute levels of emissions implied by fulfilment of the pledge.
- **Uncertain components of finance:** The Annex I countries pledged that they would «mobilise» finance of \$100 billion per year by 2020 in order to fund mitigation and adaptation in developing countries. However, it is not clear from the Accord how much of this finance will be in the form of direct financial transfers to governments, and how much will come through carbon finance, nor what the split might be between mitigation and adaptation. This is particularly relevant where pledges of action by non-Annex I countries are conditional on finance, as it is possible that the two conceptions of finance do not match.
- **Uncertainty around carbon market regulation:** The form that carbon markets and, therefore, carbon finance will take in the future remains very uncertain. No extension of the CDM has been agreed, nor has any linking between markets in Annex I countries. The accounting rules for off-set credits generated in countries with targets that are not expressed in terms of absolute limits on emissions remain unelaborated, leading to the possibility of double-counting of reductions towards Annex I targets (in Mt CO₂ reductions) and non-Annex I targets (in, for example, carbon-intensity reductions).
- **Land use, land-use change and forestry:** There remains, as has historically been the case, uncertainty regarding not only the interpretation of pledges of abatement of emissions from land use, land-use change and forestry (LULUCF) and what accounting method should be used for these emissions, but also around measurement of these emissions in the first place.

THE NEW POLICIES SCENARIO

Setting issues of uncertainty aside, in order to carry out meaningful analysis, assumptions about the interpretation of countries' commitments have to be made. The New Policies Scenario takes account of

the broad policy commitments and plans that have been announced by countries around the world, to tackle either environmental or energy-security concerns, even where the measures to implement these commitments have yet to be identified or announced. These policies and plans include the national pledges to reduce greenhouse-gas emissions (communicated formally under the Copenhagen Accord) as well as plans to phase out fossil-energy subsidies. This scenario allows us to quantify the potential impact on energy markets of implementation of those policy commitments. But this scenario does not assume that they are all fully implemented. How governments strive to meet their policy commitments and the strength of their policy action to achieve them remains uncertain, for the reasons described above. For the purposes of this scenario, therefore, whereas we take into account action extending beyond existing policies alone (the basis of our former Reference Scenario) where there is a high degree of uncertainty, we have adopted a relatively narrow set of policy assumptions corresponding to a cautious interpretation and implementation of the climate pledges and planned subsidy reforms. Countries that have set a range for a particular target are assumed to adopt policies consistent with reaching the less ambitious end of the range. In countries where uncertainty over climate policy is very high, it is assumed that the policies adopted are insufficient to reach their target. Financing for mitigation actions is also assumed to be limited and carbon markets are assumed to grow only moderately. These assumptions may be regarded as contentious. Their adoption is not a judgment on the countries concerned, but rather a means of illustrating the implications for world energy and emissions should these assumptions prove accurate.

Most of the formal national climate commitments that have been made relate to the period to 2020. For the period 2020-2035, we have assumed that additional measures are introduced that maintain the pace of the global decline in carbon intensity — measured as emissions per dollar of gross domestic product, in purchasing power parity terms — established in the period 2008-2020. The assumption of additional, but not necessarily ambitious further measures, reflects the absence of a binding international agreement to reduce global emissions. It is nonetheless assumed that each OECD country introduces an emission-reduction target across all sectors of the economy and establishes a harmonised emissions cap-and-trade scheme covering the power and industry sectors, which results in an acceleration of the decline in carbon intensity. Non-OECD countries are assumed to continue to implement national policies

and measures, maintaining the pace of decline in domestic carbon intensity of 2008-2020. International sectoral agreements are assumed to be implemented across several industries, including cement and light-duty vehicles. In addition, we assume that fossil-fuel consumption subsidies are fully removed in all importing regions and are removed in exporting regions where specific policies have already been announced.

In the New Policies Scenario, global demand for each fuel source increases, with fossil fuels accounting for over one-half of the increase in total primary energy demand. Rising fossil-fuel prices to end users, resulting from upward price pressures on international markets and increasingly onerous carbon penalties, together with policies to encourage energy savings and switching to low-carbon energy sources, help to restrain demand growth for all three fossil fuels. Oil remains the dominant fuel in the primary energy mix over the next 25 years, though its share of the primary fuel mix, which stood at 33% in 2008, drops to 28% by 2035, as high prices and government measures to promote fuel efficiency lead to further switching away from oil in the industrial and power-generation sectors, and new opportunities emerge to substitute other fuels for oil products in transport. Demand for coal rises through to around 2020 and starts to decline towards 2035. Growth in demand for natural gas far surpasses that for the other fossil fuels due to its more favourable environmental and practical attributes, and constraints on how quickly low-carbon energy technologies can be deployed. The share of nuclear power increases from 6% in 2008 to 8% in 2035. The use of modern renewable energy — including hydro, wind, solar, geothermal, modern biomass and marine energy — triples over the course of the *Outlook* period, its share in total primary energy demand increasing from 7% to 14%. Consumption of traditional biomass rises slightly to 2020 and then falls back to just below current levels by 2035, with increased use of modern fuels by households in the developing world.

Non-OECD countries account for 93% of the projected increase in world primary energy demand in the New Policies Scenario, reflecting faster rates of growth of economic activity, industrial production, population and urbanisation. China, where demand has surged over the past decade, contributes 36% to the projected growth in global energy use, its demand rising by 75% between 2008 and 2035. By 2035, China accounts for 22% of world demand, up from 17% today. India is the second-largest contributor to the increase in global demand to 2035, accounting for 18% of the rise, its energy consumption more than doubling

over the *Outlook* period. Outside Asia, the Middle East experiences the fastest rate of increase, at 2% per year. Aggregate energy demand in OECD countries rises very slowly over the projection period. Nonetheless, by 2035, the United States is still the world's second-largest energy consumer behind China, well ahead of India (in a distant third place).

The implications of scenario for climate change are alarming. In this scenario, rising demand for fossil fuels would continue to drive up energy-related CO₂ emissions through the projection period. Such a trend would make it all but impossible to achieve the 2°C goal, as the required reductions in emissions after 2020 would be too steep. In this scenario, global emissions continue to rise through the projection period, though the rate of growth falls progressively. Emissions jump to 33.7 gigatonnes (Gt) in 2020 and over 35.4 Gt in 2035 — a 21% increase over the 2008 level of 29.2 Gt. Non-OECD countries account for all of the projected growth in world emissions; OECD emissions peak before 2015 and then begin to fall. These trends are in line with stabilising the concentration of greenhouse gases at over 650 ppm CO₂-eq, resulting in a likely temperature rise of more than 3.5°C in the long term (IPCC, 2007).

THE 450 SCENARIO: ASSUMPTIONS AND METHODOLOGY

The New Policies Scenario misses the 2°C goal by a substantial margin. The 450 Scenario is designed to outline a path which would give a good chance of meeting this goal, by limiting the atmospheric concentration of greenhouse gases to 450 parts per million. It therefore assumes that policies are put in place to realise the more ambitious end of the ranges of pledges made in association with the Copenhagen Accord. The 450 Scenario also assumes the rapid implementation of the removal of fossil fuel subsidies agreed by the G20. Beyond 2020, our analysis assumes that all countries contribute to the necessary action to bring emissions down to a level that is compatible with long-term stabilisation of atmospheric concentrations of greenhouse gases at 450 parts per million. Very stringent emissions targets are set in the OECD+ countries and Other Major Economies, with Other Countries selling emissions reduction credits in international carbon markets and receiving direct financing for mitigation.⁽¹⁾

(1) The Copenhagen Accord envisages a «Green Climate Fund» to support actions taken in developing countries for adaptation and mitigation purposes.

The 450 analysis assumes that the pledges made in Copenhagen by Annex I countries, alongside the other abatement commitments of OECD+(2) countries, are met using emission caps for the power and industry sector and carbon pricing. Different cap-and-trade systems in the OECD+ countries converge into a single system by 2020.(3) We assume a rule limiting the purchase of carbon offset credits by OECD+ countries to an amount no greater than one-third of their abatement commitment. This would permit some 940 Mt of abatement to be financed in Other Major Economies and Other Countries using an international offset mechanism, such as the CDM or its successor, at an estimated cost of \$28 billion to the purchasing countries. It will be particularly important to ensure that mechanisms exist to prevent offset credits being counted towards the targets of more than one country; this analysis makes the simplifying assumption that there is no double counting. We have also assumed that there is no banking of unused emissions allowances from earlier periods for later use. To achieve the overall emissions target in Annex I countries in 2020, measures are also taken in the transport sector (stringent fuel economy standards and incentives for biofuels) and in the buildings sector (implementation of energy standards and subsidies for renewables), reflecting the current political debate in each country. Non-Annex I countries take their mitigation action partly on the basis of co-financing, and are assumed to reach their stated goals. Domestic action in Other Major Economies and Other Countries, taking account of the

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- (2) For the purposes of World Energy Outlook analysis, OECD+ countries include member countries of the OECD, along with those members of the European Union which are not OECD members. Annex I countries and OECD+ countries broadly refer to the same group, with some exceptions. Annex I countries not in OECD+ are Belarus, Croatia, Monaco, Russia and Ukraine. OECD+ countries not in Annex I are Cyprus, Korea, Malta and Mexico. Other Major Economies includes the largest emitting countries outside OECD+ (based on their total emissions of energy-related CO₂ in 2007), with GDP per capita (in PPP terms) that is expected to exceed \$13 000 in 2020. The countries belonging to this group are China, Russia, Brazil, South Africa and the countries of the Middle East. Other Countries comprises all other countries, including India, Indonesia, the African countries (excluding South Africa), the countries of Latin America (excluding Brazil), and the countries of Asia and Eastern Europe/Eurasia (excluding those in OECD+ countries and Russia).
- (3) While this may be seen as a bold assumption given the political context at the end of 2010, it allows us to model the energy sector without having to make specific assumptions about the most politically likely way in which carbon will be limited in countries which are now looking less likely to introduce carbon markets. While the same abatement could be achieved by other means, without a single linked carbon market, it is likely that costs would be higher.

various announced targets,(4) amounts to 840 Mt of abatement in 2020, compared with the baseline of no policy change. Direct financial transfers, either bilaterally between countries or through a multilateral funding mechanism, are assumed to secure a further 420 Mt of abatement in non-Annex I countries in 2020. Achieving this abatement requires some \$250 billion in investment between 2010 and 2020. Annual expenditure increases across the period, reaching around \$46 billion in 2020. If the cost to Annex I countries of financing this 420 Mt of abatement by developed countries is taken to be equivalent to the purchase of offset credits (that is, calculated based on the prevailing carbon price and the amount of abatement achieved), it would add around \$13 billion in direct transfers to the expenditure of \$28 billion on offsets in 2020.

It is not clear whether the purchase of offset credits as well as direct transfers will be regarded as falling within the scope of the \$100 billion of finance pledged by developed countries, nor what the split of expenditure might be between mitigation and adaptation. It is also unclear whether direct financial transfers will cover only marginal abatement costs – that is, be equivalent to purchase of offset credits in their calculation – or whether transfers will cover all investment over time to achieve that abatement. Since this is a matter for international negotiations, we have not taken a position on these questions.

The analytical framework applied to the period after 2020 assumes that the global community adopts a plausible combination of policy instruments to achieve the trajectory leading to a long-term concentration of greenhouse gases in the atmosphere no higher than 450 ppm CO₂-eq. These include: cap-and-trade systems; international agreements with sectoral targets for the iron, steel and cement industries; international agreements setting fuel-economy standards for passenger light-duty vehicles (PDLVs), aviation and shipping; and national policies and measures, such as buildings efficiency standards, labelling of appliances etc.

In the 450 Scenario, prices per tonne of CO₂ in OECD+ reach \$45 in 2020, and climb to \$120 in 2035. The carbon markets of the OECD+ and Other Major Economies are not directly linked, but both markets are assumed to allow access to offsets in other countries. This assumption

(4) Many non-Annex I countries announced actions that they would undertake that were not in terms of emissions-reductions or intensity improvement targets, but that will have an impact to reduce emissions. These are available at <http://unfccc.int/home/items/5265.php>.

is made to avoid a price slump in the OECD+, which would be a risk if linkage were to take place at very different price levels. By 2035 emissions in OECD+ countries are just over half their 1990 level, the CO₂ price resulting in 90% of electricity generation coming from low-carbon technologies and ensuring widespread deployment of carbon capture and storage (CCS) in industry. CO₂ prices in Other Major Economies rise more steeply than in OECD+ countries, increasing from near zero in 2020 to \$90 per tonne of CO₂ in only 15 years.

TOTAL GREENHOUSE-GAS EMISSIONS AND THEIR ENERGY-RELATED COMPONENT

All gases

In the 450 Scenario, greenhouse-gas emissions from all sources reach just over 46.2 Gt CO₂-eq by 2010, remain broadly flat for the next ten years, and then begin to fall rapidly, reaching a total of 21.4 Gt CO₂-eq in 2050, 40% lower than 1990 levels.⁽⁵⁾ This trend is in sharp contrast with the situation were no changes to be made to current policies, which would result in global emissions reaching 71 Gt CO₂-eq in 2050. Likewise, emissions if the Copenhagen Accord is only weakly implemented as is assumed in the New Policies Scenario, would be much higher than desirable, stabilising at around 50 Gt, more than twice as high as in the 450 Scenario in 2035.

The atmospheric concentration of greenhouse gases in the 450 Scenario follows an overshoot trajectory – that is to say, it reaches a peak at some 520 ppm CO₂-eq around 2040 before falling back to 450 ppm CO₂-eq by around 2150. Although targeting a 450 ppm concentration is often treated as equivalent to a 2°C target, it is important to be clear that long-term stabilisation at 450 ppm by no means guarantees that the temperature increase will be limited to 2°C. There remains very substantial uncertainty around the sensitivity of the climate to greenhouse-gas emissions, as well as around the interplay of different factors and possible feedback effects. The IPCC 4th Assessment report (2007) pointed to 2°C

(5) The OECD ENV-Linkages model has been used to estimate the greenhouse-gas emissions trajectory compatible with the long-term target of stabilising the atmospheric concentration of greenhouse gases at 450 ppm CO₂-eq. The University Corporation for Atmospheric Research Model for the Assessment of Greenhouse-gas Induced Climate Change (MAGICC version 5.3v2) was used to confirm this result.

as the mid-point of warming likely to be associated with stabilisation at 450 ppm, but more recent research suggests that the chances of limiting the temperature increase to 2°C at 450 ppm may be much lower than this. In addition, overshoot trajectories lead to much greater risk. If the temperature increases by more than 2°C in the period before concentrations fall back, there is a risk that the higher temperature reached could set in motion feedback loops. One example is melting permafrost, which leads to emissions of methane, and in turn, to a higher atmospheric concentration and greater warming. These risks and uncertainties strengthen the argument for taking even stronger action to curb emissions early in the period.

Energy-related CO₂ Emissions

Energy-related CO₂ emissions continue to form the greatest part of global anthropogenic greenhouse gases emitted in the 450 Scenario, reaching 31.9 Gt CO₂ in 2020, or about 70% of total emissions. In order to move from this point to a trajectory that is compatible with long-term stabilisation of the atmospheric concentration of CO₂-eq at 450 ppm, energy-related emissions need to fall to 21.7 Gt CO₂ by 2035. Global emissions decline by an average of 640 Mt per year from 2020 to 2035. Emissions from OECD countries decline steadily from before 2015 and are 55% lower than 2005 levels in 2035 (or 48% lower than 1990). Emissions in non-OECD countries peak in 2018 at 19.8 Gt and decline thereafter, driven by large reductions in China. Nonetheless China is still the largest emitter in 2035, at 5.2 Gt, followed by India and the United States, each at 2.3 Gt, and the European Union at 1.8 Gt.

Global average energy-related CO₂ per-capita emissions decline gradually over the projection period, masking divergent underlying trends. Per-capita emissions in the United States, 18 tonnes CO₂ per person in 2008, decline to 15 tonnes per person in 2020 and then begin to fall more steeply, to 6 tonnes CO₂ per person in 2035, an extremely dramatic and rapid change. China, meanwhile, sees its per-capita emissions exceed those of the European Union around 2020, as EU per-capita emissions fall. By this time, however, Chinese per-capita emissions have already peaked and they begin to fall back at a similar rate to those in the European Union across the second half of the projection period, just edging below the level of those in the European Union by the end of the period. Per-capita emissions in India remain comparatively low across

the period, though increasing slowly. By 2035, India is still emitting only 1.6 tonnes CO₂ per person.

From 1990 to 2008, global CO₂ intensity declined at an average annual rate of 1.4%. To decarbonise the energy economy to the extent required to achieve to 450 Scenario, a doubling of these carbon intensity improvements is required from 2008 to 2020; and almost twice that, 5.3% per year, is required thereafter. The contrast with what would be the case without new policy is striking: in the absence of any compelling force for change, the improvement post 2020 would be barely higher than that seen between 1990 and 2008. To put the improvements required into perspective, the oil price shock in 1973 resulted in a 2.5% improvement in energy intensity between 1973 and 1974 – more than twice this improvement is needed in the 450 Scenario, sustained in each and every year from 2020 to 2035.

WHERE AND HOW ARE THE SAVINGS TO BE MADE?

Abatement by region

As we have seen, emissions in the 450 Scenario reach 31.9 Gt in 2020 and decline to 21.7 Gt in 2035, 20.9 Gt or 49% lower than would be the case if there were no change to current policies. To achieve those levels of abatement the engagement of all countries to impose stringent abatement measures is necessary as of 2020. In the OECD+, emissions are expected to rebound through to 2012 as these economies recover from the financial crisis, but, in the 450 Scenario, to fall steadily thereafter. By 2035 OECD+ emissions collectively reach 5.9 Gt, just over half 1990 levels – a level similar to emissions from the United States today. Though emissions in Other Major Economies continue to grow until around 2020, they fall below current levels by 2030 and decline to 8.6 Gt by 2035. In Other Countries, growth in emissions continues through 2023, with a peak at 6.4 Gt and a slight decrease thereafter. In 2035, emissions are 6.1 Gt, 18% higher than in 2008 and 75% higher than in 1990.

Abatement in just six regions accounts for the bulk of the global CO₂ reductions, the share of these countries in the abatement, relative to what would be the case with no new policy from mid-2010, growing from 66% in 2020 to 74% in 2035. China's abatement is greater than that in the whole of the OECD+, at 7.4 Gt CO₂ or 35% of total abatement, com-

pared with the OECD+'s 6.4 Gt CO₂. Over the period as a whole, China accounts for one third of cumulative global abatement. By contrast, India sees growth in emissions from 2020 to 2035 even in the 450 Scenario, although this growth is restrained by the new policies assumed.

Selecting the measures

The contribution made by different abatement measures to the 450 Scenario changes over time, as cheaper options are exhausted and more expensive options have to be taken up. End-use efficiency accounts for 67% of the 3.5 Gt abated in 2020, vis-à-vis the level implied by no policy change, but its share declines to 47% by 2035, when total abatement is 20.9 Gt. Over time, the contribution made by energy efficiency is evenly split between abatement achieved through greater efficiency in direct combustion of fossil fuels (e.g. through the increased efficiency of coal furnaces) and abatement achieved as a result of lower electricity demand attributable to greater efficiency in end use (e.g. more efficient appliances) which reduces the combustion of fossil fuels in the power generation sector. Cheap end-use efficiency measures are quickly exploited in OECD+ countries, where consumers react to a CO₂ price by putting in place efficiency measures in electricity use. The CO₂ price is also instrumental in achieving energy efficiency improvements in direct use of fossil fuels in industry, while fuel economy standards are the key instrument for transport. Efficiency measures are also of more weight early in the period because other abatement measures, such as CCS, have longer lead-times.

Renewables, including biofuels, account for a slightly increasing share of CO₂ savings over time, provided that support policies are in place that go beyond the impact of the carbon price, their share growing from 19% in 2020 to 24% in 2035. The cost of those policies increases from some \$60 billion in 2009 to more than \$300 billion by 2035. Faster deployment of renewables, which reduces their capital costs, and higher electricity prices due to rising CO₂ prices mean either that renewables become competitive earlier in the projection period, or that they require a lower level of support per unit of energy – for example, onshore wind in the United States becomes competitive in 2020 in the 450 Scenario, ten years earlier than in the would be the case without policy change. Nonetheless, the total amount of the support increases throughout the period, due to the rapid expansion in the use of renewable sources.

CCS becomes a key abatement technology by the end of the projection period, accounting for nearly 4 Gt of abatement by 2035. CCS is used in new coal (and gas-fired) power plants after 2020 in OECD+ and Other Major Economies and is also widely used as a retrofit measure. CCS becomes a key abatement option in certain industrial applications, as well as in energy transformation (e.g. coal-to-liquids). Finally, nuclear power accounts for a fairly constant share of abatement across the period, increasing in absolute terms to 1.7 Gt by 2035.

IMPLICATIONS FOR ENERGY DEMAND

In the 450 Scenario, total growth in both primary and final energy demand is restrained by the implementation of environmentally-ambitious policies and measures. World primary energy demand reaches 14 900 million tonnes of oil equivalent (Mtoe) in 2035, representing an annual average growth rate less than half that seen from 1990 to 2008. Demand for all fuels is higher than today's levels by 2020, but by 2035 demand for both coal and oil has fallen back below the level in 2008. Fossil fuels continue to be the major component of primary demand, although their share falls from more than 80% in 2008 to just over 60% in 2035. By contrast the share of nuclear and renewables in global primary demand increases to almost 40% in 2035, from less than one fifth in 2008.

The most dramatic change in energy demand growth over the period is seen in China, where, from around 2000, the growth in energy demand has been very steep, at around 9% per year on average. This growth begins to slacken off as early as 2012. From 2020 to the end of the projection period, Chinese energy demand remains almost flat. The United States also sees a change. Historically, its energy demand has grown at an average rate of around 1% per year. In the 450 Scenario, demand remains flat from 2009 to 2020, but then falls until 2030, when it once again stabilises. As a result of these trends, total primary energy demand in China, around 150 Mtoe lower than that of the United States in 2008, exceeds demand in the United States by more than 1 000 Mtoe by 2035.

Primary natural gas consumption is projected to climb to 3.8 trillion cubic metres (tcm) in 2030, at an average annual growth rate of 0.8%, after which demand begins to fall. The slow rise in global gas demand to 2030 and fall thereafter masks very divergent trends in different regions. For example, gas demand in the United States rises sharply from 2020 through

2025, as the power sector shifts from coal to gas, but by 2035 gas demand in the United States has declined well below current levels, due to fuel-switching in power generation to nuclear and renewables. China and India both see steady growth in gas demand across the period, quadrupling their demand compared with 2008 levels by 2035. In Europe, demand for gas falls more or less steadily across the period. Despite these regional deviations from the global trend, the overall share of gas in the global primary energy mix remains at around 21% across the projection period.

Coal demand is the most affected in volume terms, peaking in before 2020 at just below 5 500 million tonnes of coal equivalent (Mtce). Coal demand declines in every year from 2020, returning to 2003 levels by 2035. Coal demand is by then some 3 600 Mtce, around 25% lower than today. The OECD+ coal market is significantly affected, with demand for coal in 2035 falling to less than half of the 2008 level.

As a result of policies and measures implemented in the 450 Scenario, in particular carbon-price signals, demand for nuclear power and renewables combined reaches just over 5 600 Mtoe in 2035, almost two-and-a-half times the 2008 level. Demand for modern renewable energy (that is, renewables excluding traditional biomass (6)) nearly quadruples over the projection period, growing from 843 Mtoe in 2008 to around 1 500 Mtoe in 2020 and, much more substantially, to 3 250 Mtoe in 2035 – representing an increase in share of total primary energy demand from 7% in 2008 to 11% in 2020 and 22% in 2035.

All regions see increases in demand for renewable energy, with some seeing dramatic growth. Renewable energy demand in India increases more than four and a half times and in China by nine times, to more than 530 Mtoe by 2035. The United States also sees very substantial increase in demand for modern renewable energy by 2035, with demand reaching 550 Mtoe and accounting for 26% of total primary energy demand by 2035. Brazil remains (as is the case currently) the country with the largest share of renewables in total primary energy demand, 55% of energy coming from modern renewables in 2035.

(6) Modern renewables encompass all renewable energy sources other than traditional biomass, which is in turn defined as biomass consumption in the residential sector in developing countries and refers to the unsustainable use of wood, charcoal, agricultural residues and animal dung for cooking and heating. All other biomass use is defined as modern.

World electricity demand increases over time in all end-use sectors in the 450 Scenario. In the transport sector, demand for electricity reaches almost 1 500 terawatt-hours (TWh) by 2035, five and a half times the 2008 level. This is driven by a major shift to electric vehicles. The share of nuclear in power generation increases by about 50% relative to current levels by 2035. Renewable-based generation increases to more than 45% of the global generation mix, two and a half times higher than today, with wind power increasing to almost 13% and solar photovoltaics (PV) and concentrating solar power (CSP) to more than 6%. Overall, low-carbon fuels (nuclear, renewables and coal- and gas-fired power plants fitted with CCS) make up over three quarters of electricity generation by 2035, up from less than one third today.

OIL DEMAND

Primary oil demand trends

Oil demand in the 450 Scenario peaks before 2020 at slightly over 88 million barrels per day (mb/d) and declines steadily thereafter to 81 mb/d in 2035, 3 mb/d below 2009 levels. This is in sharp contrast with what we would expect in the absence of strong action to address climate change. This represents a demand-driven peak – that is, not ‘peak oil’ in the traditional sense of a production peak due to declining stocks, but a peak in demand due to policy intervention. Oil’s role in the world primary energy mix is reduced significantly in the 450 Scenario; the global economy relies on oil for around a quarter of its energy needs in 2035, 7 percentage points less than today.

Policies in the transport sector account for more than three quarters of the reduction in oil demand in 2035, relative to the New Policies Scenario; around 80% of these transport-related oil savings come from road transport. The main measures that drive these reductions in transport oil demand are international sectoral agreements that set very ambitious CO₂ emissions limits per vehicle, and gasoline and diesel pricing and tax policies.

Regional trends

The global oil demand trends in the 450 Scenario mask stark differences between regions. Oil demand in OECD countries declines steadily, from around 42 mb/d in 2009 to 28 mb/d in 2035, while demand in non-

OECD countries increases, from 36 mb/d to 46 mb/d, over the same period. China, where demand grows by 5 mb/d; India, 3.6 mb/d; the Middle East, 0.7 mb/d; and ASEAN countries, 0.7 mb/d, account for most of the global increase. Despite the measures introduced in the transport sector, the spectacular growth in the vehicle stock in those countries continues to push up their oil use. China becomes the largest oil consumer soon after 2030, surpassing the United States, where demand is in decline. Non-OECD Asia gains 13 percentage points in market share over the by 2035, accounting for almost a third of global oil demand by that year.

Sectoral trends

With the exception of transport and industry, global oil demand declines in all sectors between 2009 and 2020. After 2020, global oil demand falls even in transport and industry, as increasingly stringent policies take effect. During that period, demand in the transport sector declines most in absolute terms, due to its magnitude and the fact that the limited remaining oil use in other sectors (for example, diesel generators in rural areas and oil used as feedstock for petrochemicals and chemicals) is the most costly and difficult to displace. Although the share of oil use declines steeply in all sectors after 2020, oil remains the dominant fuel in the transport sector and in non-energy use.

Impact of lower oil demand on oil prices

In the 450 Scenario, crude oil import prices increase more slowly than in the other scenarios presented in *WEO-2010*, reflecting the lower demand. In real terms, the price needed to balance supply (see below) and demand reaches \$90/barrel (in 2009 dollars) in 2020 and remains stable at that level thereafter. The IEA crude oil import price in 2025 is, on average, \$15/barrel lower than in the New Policies Scenario; in 2035, it is \$23/barrel lower. Prices are \$30/barrel lower in 2025 and \$45/barrel lower in 2035 than would be the case with no policy change. Nonetheless, in the 450 Scenario, there is a price increase between 2009 and 2035 of almost \$30/barrel, or 49% in real terms.

Oil production

Lower oil demand growth in the 450 Scenario obviously means that oil production grows less too. The strong policies to reduce oil demand that are assumed to be adopted to respond to the challenge of climate

change result in a peak in global oil production of just under 86 mb/d before 2020, production following an undulating plateau for much of the 2010s. (7) From around 2020, global oil production gradually declines, reaching 78 mb/d in 2035.

In the 450 Scenario, the breakdown of oil production, both between the different types of oil supply, and between OPEC and non-OPEC, changes notably over the projection period. Global production of conventional crude oil declines continuously over the next quarter century, from 68 mb/d in 2009 to 58 mb/d in 2035. In contrast, production of natural gas liquids (NGLs) rises, from around 11 mb/d today to over 13 mb/d in 2035, and their share of total production increases from 13% to 17%. The rising share of NGLs results from the quicker growth in production of natural gas relative to oil in the 450 Scenario and because an increasing share of gas production occurs in regions with «wet gas», *i.e.* gas that contains a significant amount of NGLs.

The role of unconventional oil in world oil production also expands, albeit to a lesser extent than would be the case with less (or no) policy intervention. Production increases from 2.3 mb/d in 2009 to 7.4 mb/d in 2035. By 2035, unconventional oil represents 9% of global production, compared with 3% in 2009. Growth is fastest in the current decade and then tapers off, with declining world oil demand, causing oil prices to level off, which reduces the attractiveness of investing in projects to develop these higher-cost resources. Although the production of unconventional sources of oil generally emits significantly more greenhouse gases than most conventional sources, growth in output is assumed to be made possible by the introduction of new technologies which reduce emissions. Canadian oil sands remain the main source of unconventional supply, with just over 3 mb/d of production in 2035. Venezuelan extra-heavy oil also continues to play a significant role, together with coal-to-liquids (CTL), gas-to-liquids (GTL) and, to a lesser extent, oil shales.

Non-OPEC oil production in the 450 Scenario declines steadily to less than 37 mb/d in 2035, a net loss of production of almost 11 mb/d compared with today. Lower oil prices reduce the profitability of new investment in the relatively high-cost resources in non-OPEC regions, which become increasingly expensive to produce over time. The resultant fall in investment accentuates the decline in mature basins in non-OPEC regions. The fall in non-OPEC output accelerates through the *Out-*

(7) Production is total supply (which equals demand), less volumetric processing gains.

look period, reaching an average of 700 kb/d per year in the first half of the 2030s. OPEC production, in contrast, rises to over 40 mb/d in 2020 and almost 42 mb/d in 2035, an increase of 8 mb/d, thanks to its lower production costs, which leave it less affected by the drop in oil prices, and increased output of NGLs. Although the increase in OPEC production over the twenty-five year period is less than would be the case with weaker climate policy intervention, it is still bigger than the increase in OPEC production in 1980-2009. OPEC's share of world production rises considerably in the 450 Scenario, from 41% in 2009 to 53% in 2035.

Even though global oil production drops by 2.5 mb/d between 2009 and 2035 in the 450 Scenario, there is still a need to develop almost 50 mb/d of new capacity in order to compensate for the decline in production at existing fields as they pass their peak level of production and flow-rates begin to drop. This is just over four times the current production capacity of Saudi Arabia. However, the need for exploration to find and then develop reservoirs that are as yet unknown is only two-thirds of that in the New Policies Scenario, with weaker climate policy intervention – a difference of almost 60 billion barrels. This reduction is equivalent to two-thirds of the estimated volume of oil that is thought to remain to be found in the Arctic and is more than the total volume of oil discovered worldwide during the past five years. As the oil industry typically develops easy-to-find oil first, this reduced need to bring on new capacity allows the industry to dispense with some of the more costly and more environmentally sensitive projects.

OPEC's cumulative production of conventional oil (crude and NGLs) in the 450 Scenario is some 18 billion barrels lower in the period 2009-2035 than in the New Policies Scenario. This amounts to 1.5 years of output at current rates of production that would remain in the ground to be produced when conditions make this economically advantageous. Particularly in OECD countries, where oil demand falls away most rapidly, the fall in demand for oil products projected in the 450 Scenario is likely to speed up the closure of smaller, less profitable refineries.

THE COST OF ACHIEVING THE 450 SCENARIO

The global transformation of the energy sector to achieve the necessary reduction in CO₂ emissions will require very substantial investment in low-carbon technologies and energy efficiency. The term investment, as

it is used here, covers capital spending by businesses, but also spending by individuals on cars, equipment and appliances (but not on their operation – meaning that the investment figures are gross, taking no account of savings in running costs attributable to more efficient appliances and cars). (8) The investment discussed here is additional to that which would be incurred if we assume no policy change from mid-2010, and is expressed in 2009 dollars. In the 450 Scenario, it amounts to \$18 trillion in the period 2010 to 2035. Of this investment, only 12% (or \$2.2 trillion) is incurred before 2020, more than half (or \$9.4 trillion) in the decade from 2020 to 2030, and the remaining third (or \$6.4 trillion) during the last 5 years of the projection period. This pattern is partly due to the fact that the abatement achieved in the period up to 2020, even with relatively vigorous action arising from the Copenhagen Accord, leaves much to be accomplished in the later period and at a higher capital cost per unit of CO₂ saved.

The greatest increase in investment is needed in the transport sector, where additional investment over the period reaches \$7.2 trillion. Almost 40% of this is incurred in the OECD+ countries, around one-quarter in Other Major Economies, around 20% in Other Countries and the remainder in international bunker fuels. The building sector is the second-largest area of cumulative additional investment, amounting to \$5.6 trillion. About one-half of this is required in OECD+ countries. Of the cumulative investment needed in the power generation sector (\$2.4 trillion) and the industry sector (\$2 trillion), around 40% is incurred in the OECD+, 42% in Other Major Economies and the remaining 17% in Other Countries. Additional investment needs for biofuels are largest in the OECD+ countries, where around 70% of the total \$0.7 trillion is invested.

In 2020, the largest share of additional investment is needed in the European Union, with almost a quarter of the total, just above China. By 2035, additional investment needs are greatest in China, at around one-quarter of the total, and second in the United States, at around 20%, while the European Union's share declines to just above 10%. While the country in which investment takes place is not necessarily the country in which the cost of the investment is incurred – since some of the abatement achieved may be sold to other countries in the form of offset credits, or, if the abatement takes place in developing countries, may be financed by developed countries – it is nonetheless striking to note the dominance of a small number of countries in terms of the location of

(8) See WEO-2009, pp 260-1 for further details.

investment, notably China, the United States and the European Union, which together require more than half the additional investment across the period. In the case of China, the share of investment is lower than the corresponding share of abatement because China has lower investment costs per unit of abatement; for the US, with higher abatement costs, the share of investment is higher than the share of abatement.

Oil investment

The oil production trends in the 450 Scenario imply a need for cumulative investment along the oil-supply chain of over \$6.4 trillion in 2010-2035. Capital spending amounts on average to \$245 billion per year, but it falls over time as global oil demand drops, production shifts increasingly towards less costly regions and technology drives down unit costs. Almost three-quarters of projected oil-sector investment is needed in non-OECD regions. Investment in OECD countries is high relative to OECD production capacity, because of higher unit costs.

Capital spending on upstream exploration and development dominates oil-sector investment, accounting for 85% of the total. Approximately \$5 trillion is invested in conventional oil developments and some \$440 billion in unconventional oil projects. Almost 12% of total spending is directed to investments in oil refining, where it increasingly goes towards improving conversion and quality-treatment capability to meet ever more stringent fuel-quality standards. Investment in oil tankers and oil pipelines for international trade amounts to \$210 billion in 2010-2035.

Investment in oil supply in the 450 Scenario is lower than would be the case with weaker or no policy intervention, particularly after 2020. This results from the reduced need to bring on new production capacity, including the most costly deepwater offshore oil projects.

The cost of Copenhagen

Last year's *World Energy Outlook* assumed that Copenhagen would deliver a binding global agreement that would set in motion deep cuts in emissions by 2020. The actual results of Copenhagen, even on an ambitious interpretation, result in emissions around 1.2 Gt CO₂ higher in 2020 than in last year's 450 Scenario. Achieving a 450 trajectory becomes that much more difficult. To compensate for the cumulative excess of 17.5 Gt CO₂ before 2020, rapid innovation is required after 2020 in all sectors,

and the speed of the necessary transformation of the economy means that some investment decisions could be classed as economically irrational, for example, retiring power plants before their initial investment has been recouped.

The investment needed to achieve the long-term stabilisation of atmospheric CO₂ has is therefore higher than would otherwise be the case. A binding agreement to earlier and more stringent commitments is still possible before 2020 but, on the present basis and our assumptions about the arrangements beyond 2020, by 2030 the energy sector will have invested nearly \$1 trillion more than we had estimated last year for an unchanged final result. Investment from 2010 to 2030 has risen from \$10.6 trillion (9) to \$11.6 trillion.

Higher emissions than seen in last year's 450 Scenario prior to 2020 are reflected in lower investment in the same period. As action to reduce emissions becomes more intense after 2020, so does investment. The transformation needed in the energy sector is no different in scale to that outlined in *WEO-2009*, but has to occur much more rapidly – and more expensively – because it occurs later, leading to the \$1 trillion excess overall by 2030.

Benefits

The increased cost of reaching a 450 Scenario, based on the Copenhagen Accord, inevitably worsens any cost/benefit analysis of action on climate change. But this should not be allowed to obscure the scale of benefits, both in terms of the avoidance of climate change and the associated impacts and adaptation costs and in terms of other co-benefits. These include reduced local pollution and improved health outcomes as a result, which is quantified as a reduction in years of life lost, since these emissions are detrimental to human health.

Reduced local pollution

One of the benefits associated with moving to a low-carbon future is the associated reduction in the emissions of gases other than CO₂. Sulphur dioxide (SO₂), nitrogen oxides (NO_x) and particulate matter (PM_{2.5}) all have negative effects, both on human health and on the environment.

(9) The figure specified in *WEO-2009* was \$10.5 trillion in year-2008 dollars; this equates to \$10.6 trillion in year-2009 dollars.

Like climate change, the effects of these gases are not limited to the country or region in which they are emitted, but are felt beyond national borders. The policies aimed at reducing CO₂ emissions in the 450 Scenario also have the effect of reducing emissions of these air pollutants. By 2035, SO₂ emissions are 61 Mt, or one third lower than would be the case with no policy change. The majority of the decrease (27 Mt) takes place outside the OECD+, as in most OECD+ countries sulphur control measures are already in place, while non-OECD+ countries benefit from the reductions in SO₂ emissions due to lower fossil fuel consumption. NO_x emissions are 27% lower. PM_{2.5} emissions are 8%, or 3.3 Mt, lower globally, though it should be noted that OECD+ emissions of particulates in the 450 Scenario are 17% higher in 2035 than in the would be the case with no policy change, due to greater use of biomass in the residential sector there. Emissions of particulates in non-OECD+ countries decrease by nearly 4 Mt. China and India benefit most. Due to their high reliance on coal, the paucity of pollution control mechanisms, and the expected exponential growth in car use, energy diversification measures have a particularly high value in these countries. Otherwise, environmental costs could be high enough to pose a threat to future growth. A further benefit is a 23% global reduction in the costs of pollution control, compared with no policy change (IIASA, 2010).

While reducing these pollutants has a positive impact on human health, insufficient data are available to allow for a quantitative global assessment of this impact. Estimates for European countries, China, India and the European part of Russia suggest that exposure to the concentrations of fine particles in ambient air which prevailed in 2005 will cause a loss of about 1.9 billion life-years, of which 1.6 billion life-years are in India and China, translating into a shortening of life-expectancy of more than one year. (10) The 450 Scenario saves at least 750 million life years compared with a baseline of no policy change, the vast majority of them in China and India (IIASA, 2010). If the data were available, these figures would certainly be higher on a global basis.

Avoided mitigation and adaptation costs

A valuation of the benefits of avoiding climate change is beyond the scope of our analysis. Estimates vary widely. One major variable is the dis-

(10) By the statistical convention governing the measurement of the health impacts of (outdoor) air pollution, only population above the age of 30 are taken into account in calculating the average effect on life-expectancy.

count factor used, an important consideration because the costs of unabated climate change would be incurred in the future, while the costs of mitigation are incurred now, meaning the former must be «discounted» to reflect the higher value society places on spending (or cost-saving) now. Of course the facts that emissions trajectories are uncertain and that the temperature increases associated with specific emissions trajectories can be calculated only probabilistically make it even more difficult to assess the costs of unabated climate change. Estimates, however, have been made.

The UNFCCC (2007) has estimated that adaptation, in the absence of mitigation measures, would cost around \$49-\$101 billion dollars per year globally by 2030 – which is well before the full impacts of climate change could be expected to be felt. A subsequent review of estimates of the cost of adaptation (Parry *et al.*, 2009) concluded that the UNFCCC results were «likely to be substantial under-estimates», and placed the global estimated annual cost of adaptation in 2030 at two or three times the UNFCCC estimates for the sectors covered, and far higher again if other sectors are included (e.g. mining, manufacturing, retail, tourism). Including ecosystems protection alone could add up to around \$300 billion per year to the estimates. These estimates of adaptation costs do not include any allowance for those economic impacts of climate change which cannot be avoided through adaptation measures due to technical or economic constraints (such as sea defences beyond a certain limit of sea level rise) and as such are only a partial estimate of costs which might be avoided through mitigation. The Garnaut Report, while focusing mainly on Australia, is emphatic that the costs of action are lower than the costs of inaction, reporting a net positive impact on Gross National Product (GNP) after 2050 with mitigation action. Ackerman and Stanton (2008) estimate that in the United States, the costs of unmitigated impacts in terms of hurricane damages, real estate losses, energy-sector costs and water costs will amount to \$1.8 trillion in 2100.

FURTHER IMPLICATIONS OF THE 450 SCENARIO FOR OIL MARKETS

Turning the 450 Scenario into reality would require an unprecedented mobilisation of finance and technology in all types of oil-consuming capital stock from cars to boilers, and aircraft to petrochemical plants. The policy measures that would drive these actions would have important repercussions on the oil market. For consuming countries, the econom-

ic benefits that would accrue from policy-driven reductions in demand and prices would help offset part of the significant costs associated with achieving the 450 Scenario. Oil exporters, despite understandable concerns about lower global oil demand, would see continued growth in the demand for their oil, a rising oil price and a tripling of their revenues, compared to the last 25 years. They, too, would enjoy environmental benefits.

Oil trade

At the global level, the volume of inter-regional oil trade in the 450 Scenario expands until around 2020 before starting to decline. By 2035 it reaches 39.5 mb/d, compared with 36.7 mb/d in 2009. Oil imports into the OECD drop sharply over the *Outlook* period, but this is more than offset by an increase in demand for imports from other regions (Table 15.5). In the United States, oil imports drop by 45%, from 10.4 mb/d in 2009 to 5.7 mb/d in 2035 – a level last seen in the mid-1980s. All other OECD countries also see a decline in their oil-import requirements, compared with current levels, ranging from a 15% cut in the European Union to a 42% cut in Japan.

In contrast with the OECD, non-OECD Asian countries see an increase in imports in the 450 Scenario, albeit not to the extent projected under the assumption of weaker or no climate policy intervention. Growth in demand from increasing vehicle ownership and industrial activity more than offsets the impact of strong demand-side efficiency and fuel diversification policies. China and India experience the biggest jump in absolute terms. China's net imports grow from 4 mb/d in 2009 to 11 mb/d in 2035 – but this is still a reduction of over 2 mb/d, compared with the New Policies Scenario, in which we assume weaker climate action.

The fall in oil trade seen in the 450 Scenario, compared with the New Policies Scenario, would have several other important implications. The volume of oil transiting key choke-points (such as the Strait of Hormuz, Strait of Bab el-Mandab and the Suez Canal) would be lower than in the New Policies Scenario. Furthermore, the absolute volumes of oil stocks IEA countries are obliged to hold to meet their membership obligations (equivalent to 90 days of net oil imports) would be lower in 2035 than today, with a commensurate reduction in the cost of maintaining oil storage. For China and India – both of which are now developing strategic oil storage facilities – cumulative spending on oil storage in the 450 Scenario to maintain the same level of emergency preparedness would be much less onerous than in the New Policies Scenario.

Oil-import bills and intensity

Lower oil-import requirements and lower international oil prices significantly reduce oil import bills in the 450 Scenario, compared with the New Policies Scenario. In 2035, the five largest importers – China, the European Union, the United States, India and Japan – collectively spend around \$560 billion, or onethird, less than in the New Policies Scenario. These savings increase over time as the impact of efficiency and diversification measures grows and as the difference between oil prices in the different scenarios increases.

In some OECD importing countries, oil-import bills are actually lower in 2035 than in 2009. The oil-import bill in the United States peaks in 2015, at around \$350 billion, and declines to some \$190 billion in 2035, 19% below 2009 levels and less than half the peak value reached in 2008. The savings for the United States are also very large compared to the import bill in the New Policies Scenario – almost \$135 billion in 2035. Among OECD countries, the proportionate impact on the import bill is highest in the United States, but the reduction in other countries is also marked. In the European Union, import bills peak around 2015, at \$320 billion, and decline steadily to \$250 billion in 2035. This level is slightly higher than the 2009 level, but 33% lower than the peak value reached in 2008.

Spending on oil imports by China and India increases in the 450 Scenario, compared with current levels, but is significantly lower than in the New Policies Scenario. In 2035, China's spending on oil imports is almost \$180 billion (or 34%) and India's \$80 billion (or 29%) lower than in the New Policies Scenario. Nonetheless, at around \$350 billion and \$190 billion respectively in 2035, China's oil-import bill overtakes that of the United States around 2025; and India's overtakes that of the United States, to take second position, by 2035.

The 450 Scenario projections imply a declining level of spending on oil imports as a share of GDP in all major importing countries. This share spiked in 2008, following the run-up in oil prices and the global economic slow-down. In 2035, oil spending represents less than 1% of GDP in the United States and the European Union, down from 2.8% and 2.2% respectively in 2008. As a share of GDP, oil-import bills in China and India are lower in 2035 than in 2009. The reverse would be the case with the weaker climate policy intervention assumed in the New Policies Scenario.

The policies that are assumed to be adopted in the 450 Scenario improve the efficiency of oil use and diversify the energy mix, in favour of lower carbon sources. This leads to a significant reduction in oil intensity – measured as oil use per dollar of GDP – over the *Outlook* period, reducing the vulnerability of oil-consuming countries to price volatility. The biggest changes are seen in the Middle East and the United States, where oil intensity falls by 63% and 65% respectively over the period 2009-2035, but reductions of a similar magnitude are also seen in the European Union, Japan and India.

Oil exports and revenues

Despite lower global demand for oil in the 450 Scenario, oil exports by OPEC producers increase from 26 mb/d in 2009 to 34 mb/d in 2035. An increasing share of this oil production is directed towards exports. This results from the decline in the rate of growth in domestic demand, thanks to the assumed reduction in subsidies and the introduction of more efficient cars and trucks, as OPEC countries benefit from technology spill-over from the faster deployment of advanced vehicles in global markets.

OPEC's cumulative oil revenues in the 450 Scenario in 2010-2035 are projected to amount to \$27 trillion in 2009 dollars. While this is 16% lower than earnings in the New Policies Scenario, it is still three times more in real terms than their earnings over the last quarter century.

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CHAPTER FIVE

CLIMATE CHANGE: SECURITY AND DEFENCE IMPLICATIONS

CLIMATE CHANGE SECURITY AND DEFENCE IMPLICATIONS

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... indeed, this is what I think is the truly fascinating and challenging, that Climate Change is the mother of all threats. It's the first threat that concerns every country in the world at the same time, in which no continent escapes. This never happened before. ... Climate Change is different [from other risks]. It's the first universal threat which can only be solved universally. (1)

SUMMARY

The consequences of Climate Change phenomenon effects are currently affecting the geostrategic and geopolitical scenario, globally and universally. This universality and the possibility that its effects increase in the future, if no action is taken in a coordinated and supportive manner, impact specifically on the world's peace and security. In this sense, the global and potential dangers of Climate Change strategic implications reinforce the position of the United Nations as the cornerstone of the new security architecture, capable of leading efforts to tackle the new challenges. Supporting this effort, most of the national security strategies are incorporating Climate Change phenomenon in its entirety, considering the leadership role of a reformed United Nations to direct the global action in a consistent and supportive way.

The world of Defense, through its planning cycles, is continuously adapting to the changing environment, an evolution whose most charac-

(1) http://www.nato.int/cps/en/natolive/news_59989.htm?selectedLocale=en 4 December 2009. NATO lecture series on new security challenges. Dr Jamie Shea, Director of Policy Planning in the Private Office of the Secretary General, and former NATO Spokesman. Visited on 13.08.10

teristic features are further enhanced by the visible effects of Climate Change. In addition, Climate Change presents specific consequences of a global nature, generating uncertainty and instability that directly affect Defense. In this latter sense, it is becoming progressively an independent phenomenon with its strategic trends already affecting the transformation of Military, but certainly it will have a major influence in Military's future design and use. Currently the Military evolves to address both sides of a phenomenon that affects it directly. On the one hand, as part of the problem being an intervening factor in its development like a major consumer of fossil fuels. On the other, as a societal instrument to counteract the Climate Change most unpredictable and undesirable effects. In this line means the Spanish Military efforts together with all developed countries.

Moreover, the energy efficiency is critical to the nature of the Military and a key strategic factor. In this endeavor, an element that has always been considered essential is and will be the technological innovation. Another key aspect in relation to energy efficiency refers to the degree of vulnerability that leads to dependence on the logistics chain for operations. But the progressive adaptation of Military to the strategic and operational environment on the new missions, in which the phenomenon of Climate Change can be considered as a persistent factor, has been steady, both in relation to the evolution of its preparation, organization and capabilities. The need to respond to natural disasters and the rapid proliferation of peacekeeping missions and humanitarian operations conducted by international organizations have encouraged Military development in a phased manner, in a world in which the causes of Climate Change are increasing dramatically the conflict world map, where the foundations of the state are crumbling and the spiral of violence continues to grow, affecting currently one third of the world's population.

Keywords: Climate Change, natural disasters, environment, peace, justice, freedom, Security, Defence, Strategy, Energy, energy efficiency, energy security, Military, technological innovation.

INTRODUCTION

Unlike the challenges that we are used to dealing with, these [Climate Change effects] will come upon us extremely slowly, but come they will,

and they will be grinding and inexorable. But maybe more challenging is that they will affect every nation, and all simultaneously. (2)

In 2010, the 35th anniversary of Wallace Broecker's coining of the term «Global Warming»,⁽³⁾ the data seem incontestable. The industrial revolution, the consequences of uninterrupted economic development and unstoppable demographic growth are exerting dramatic pressure on the environment. The effects of the so-called «Climate Change» can take diverse and unpredictable forms. The aftereffects on natural resources, the impact on ecosystems that always played an equilibrating and stabilising role, and changes in the pattern of behaviour of the climate, which is dramatically surprising for its randomness and the harshness with which its consequences strike anywhere in the world, are clearly influencing the normal development of society.

While the phenomenon of Climate Change seems to be becoming legitimised and society is increasingly aware of its possible—and in some cases dramatic—effects, the concept of «Human Security» ⁽⁴⁾ is gaining ground in the international lingo and the Millennium Development Goals ⁽⁵⁾ are becoming consolidated as a key factor of social and human development. With the end of ideology-based confrontation, the international debate is shifting its focus to «human dignity, man's inviolable and inherent rights, the free development of his personality, respect for the law and for the rights of others» as the basis of political order and social peace. ⁽⁶⁾ The Universal Declaration of Human Rights ⁽⁷⁾ is the focus of attention as a basic factor to be protected and on which national policies should hinge. The security architecture is thus fanning out into multilateral relations in which the security concept is indissolubly linked to that of overall development.

In addition, more recently the *financial crisis* that erupted in Wall Street has aroused great mistrust in the market economy and in ultra-liberal policies. In the past few years, while all the countries attempted to overcome the global crisis in the most coordinated and effective manner possible and to steer themselves back onto the path of growth, signs of a new

(2) Retired Vice Admiral Richard H. Truly, space shuttle commander and NASA administrator. Member of the National Academy of Engineering.

(3) <http://www.realclimate.org/index.php/archives/2010/07/happy-35th-birthday-global-warming/> visited on 13.08.10.

(4) <http://www.unclef.com/es/peace/> visited on 14.08.10

(5) <http://www.un.org/spanish/millenniumgoals/> visited on 14.08.10

(6) Spanish Constitution. 1975. Title I, article 10.

(7) <http://www.unclef.com/es/documents/udhr/> visited on 14.08.10

security system taking shape have become more visible. New regional powers are emerging from the crisis with greater vigour and authority than ever, giving shape to a many-sided structure which may develop sharp edges; economic growth, as a measuring stick for judging political systems, is heightening the debate on security and bringing into conflict the attempts to coordinate policies in the field of Climate Change.

But in this *strategic scenario* characterised by «its complexity, uncertainty and potential danger», (8) international cooperation and technological progress provide the basic elements that allow us to envisage a future full of hope. The possibilities are considerable, some with uncertain development prospects and many with their sights set on the long term. This promising future is compromised by the need for short-term results that is inherent in political debate and decision making. As always, a distant future of uncertainty and hope contrasts a reality based on the consumption of perishable information and de facto situations that strew the path with conflicting interests. We seem to be approaching the end of the fossil-fuel-based industrial age, as the Saudi Arabian energy minister, Sheik Yamani, sensed more than ten years ago in his statements to the British daily *The Telegraph*.(9) A new era is unfailingly looming on the horizon and, like any change, may unfold in a controlled manner or in a chaotic and radical way.

It is a *future* that looks set to build a new virtual society based on factors that are drastically different to those of today's society, a future in which the main communication channels and the pillars of the economic infrastructure will shift and develop in cyberspace. A future in which energy will be generated in two completely different spheres: one local and individualised based on renewable natural resources which will promote human development integrated with the natural environment: and another based on highly sophisticated renewable energies interconnected in an interstate and intercontinental network of networks, with nuclear energy as a supporting element and underpinned by major distribution networks, making for more harmonious and cooperative economic development.

In this environment of *uncertainty*, Climate Change will emerge as the main vector of change and also as a generator and multiplier of risks,

(8) National Defence Directive 01/2008. Page 2.

(9) <http://www.telegraph.co.uk/news/uknews/1344832/Sheikh-Yamani-predicts-price-crash-as-age-of-oil-ends.html> «The Stone Age came to an end, not because we had a lack of stones, and the oil age will come to an end not because we have a lack of oil.» Visited on 13.08.10

playing a dominant role. The pressure on Security will thus come from a broad spectrum of risks and threats of greatly varied intensity, giving rise to a strategic landscape characterised by the growing complexity, globality and randomness of its component factors and in which insecurity will require courageous, long-term decisions based on cooperation and solidarity as key factors. In this situation of growing perplexity which affects basic elements like water, food, territory and energy resources, natural phenomena, whether or not related to Climate Change, strike with increasing virulence, having a dramatic effect on the normal course of social life. Under such circumstances, which are increasingly frequent, despair, chaos, violence, crime and delinquency of all kinds may be the determining factors in the eruption and development of violent conflicts.

The Defence world could not be oblivious to this process of *change*. From the outset it has progressively adapted to the diverse situations that required its involvement and the environmental needs associated with conflict scenarios. At the same time it has gradually incorporated the factors associated with Climate Change into its strategic planning. What is more, it has fostered the debate at most discussion forums, in addition to encouraging the most important think tanks to study the possible geopolitical and geostrategic implications of its effects in order to facilitate political decisions allowing a transformation that is increasingly felt to be necessary.

CLIMATE CHANGE FACTORS IN THE GENESIS OF CONFLICTS

We are entering a bifurcated world. Part of the globe is inhabited by Hegel's and Fukuyama's Last Man, healthy, well fed, and pampered by technology. The other, larger, part is inhabited by Hobbes's First Man, condemned to a life that is «poor, nasty, brutish, and short.» Although both parts will be threatened by environmental stress, the Last Man will be able to master it; the First Man will not. (10)

Drawing from the *Spanish Constitution* we may establish that a potential conflict situation is one in which social peace and political order are crumbling. The Constitution names the three basic pillars of peaceful coexistence which should underpin a situation from which conflict is absent: justice, freedom and security.

(10) <http://www.theatlantic.com/magazine/archive/1994/02/the-coming-anarchy/4670/> Robert D. Kaplan. Article «The Coming Anarchy». February 1994. The Atlantic Magazine. Visited on 13.08.10

Justice generates confidence and cooperation, elements which are crucial to countering the risks associated with Climate Change. However, today many opinions are voiced at forums of debate on the possible consequences of Climate Change and global policies for stemming it, with mutual accusations of blame for its effects and the lack of political decisions for reaching agreements to address it.

In some cases the current situation and the proposed measures for stemming its effects are regarded as an act of aggression on the part of the industrialised world against the poorer world's integrated development, in harmony with nature. It was recently published that Australia had overtaken the US as the biggest polluter per capita,⁽¹¹⁾ while the European Union, with a level half that of the United States and less than Russia, doubled the world average. ⁽¹²⁾

Voices such as that of Uganda's president, Yoweri Museveni, ⁽¹³⁾ and, more recently, that of the leaders gathered at the World People's Conference ⁽¹⁴⁾ on Climate Change and the Rights of Mother Earth, underline the legal uncertainty of a situation that generates serious inequalities; the Bolivian ambassador to the UN even proposed setting up an International Court of Justice on Climate Change. ⁽¹⁵⁾

Terrorism is also using the phenomenon of Climate Change as a recruitment lure and weapon for destabilising a system considered to be

(11) <http://www.physorg.com/news171889925.html> British firm Maplecroft placed Australia's per capita output at 20.58 tons a year, some four percent higher than the United States and top of a list of 185 countries. Canada, the Netherlands and Saudi Arabia rounded out the top five. China remains the world's biggest overall greenhouse gas polluter, followed by the United States. Maplecroft added that China and India's per person carbon production came in at just 4.5 and 1.16 tons respectively, in sharp contrast to their big overall figures. Visited on 16.08.10

(12) <http://www.eea.europa.eu/data-and-maps/figures/energy-related-co2-emissions-per-capita-in-the-eu-usa-russia-china-and-the-world> http://www.eea.europa.eu/data-and-maps/figures/#c15=all&c5=climate&c9=&c0=15&b_start=0&c8=greenhouse+gases visited on 28.08.10.

(13) <http://pacificsci.blogspot.com/2007/10/is-climate-change-act-of-aggression.html> Yoweri Museveni: «One may well ask...Why should the poorest die for the continued excesses of the richest?» Visited on 16.08.10

(14) <http://www.kaosenlared.net/noticia/evo-morales-pide-suspender-cumbre-cambio-climatico-cancun> <http://cmpcc.org/> visited on 16.08.10. «Cancún va ser otro Copenhague. Los pueblos van a perder la esperanza hacia sus Estados. Los Estados y las NNUU perderán autoridad frente al mundo que debate sobre el cambio climático»

(15) <http://www.un.org/wcm/content/site/climatechange/gateway> visited on 20.08.10

tailored to the needs of western countries. Osama bin Laden in particular has used it on many occasions—in 2010 on 29 January, when he presented himself as a battler against Climate Change and blamed the US and the industrialised countries for its related effects, (16) and more recently on 1 October, when he again expressed his concern about the effects of Climate Change and the floods that hit Pakistan.(17)

The link between peace, *freedom* and development, in which the concepts of stability and security are intermingled, is deeply rooted in the founding spirit of the American state and, as could not be otherwise, in the charter of the United Nations and the Universal Declaration of Human Rights. One of the founding fathers of the American nation is attributed the famous words: «People willing to trade their freedom for temporary security deserve neither and will lose both». (18)

On 23 September 2010 the US President stated in his address to the UN General Assembly:

In times of economic unease, there can also be an anxiety about human rights. Today, as in past times of economic downturn, some put human rights aside for the promise of short term stability or the false notion that economic growth can come at the expense of freedom... Yet experience shows us that history is on the side of liberty; that the strongest foundation for human progress lies in open economies, open societies and open governments. (19)

In an address during a conference at Lloyd's of London, (20) NATO's secretary general underlined the basic differences between Climate Change and other types of threats, emphasising the difficulty of pinning down the exact effects it will cause, the exact cost of combating it and how long we have to do so. In this connection, drawing on his experience as Danish prime minister, he underlined the difficulties of making the correct political decisions unless we act with a generous state-wide vision. This insecurity as to what the political goals should be for achiev-

(16) <http://english.aljazeera.net/news/middleeast/2010/01/20101277383676587.html> visited on 20.08.10

(17) <http://english.aljazeera.net/news/asia/2010/10/201010115560631340.html> visited on 20.10.10

(18) Benjamin Franklin., although it is also quoted as being Thomas Jefferson.

(19) <http://www.whitehouse.gov/the-press-office/2010/09/23/remarks-president-united-nations-general-assembly> visited on 14.10.10.

(20) http://www.nato.int/cps/en/natolive/news_57793.htm?selectedLocale=en

ing well-being, (21) in the pursuit of happiness, (22) dramatically influence the need for liberty in any society aiming to generate a climate of social peace and political order which, according to the Constitution, shall «promote the progress of culture and of the economy in order to ensure a worthy quality of life for all». As Franklin Roosevelt stated, misery and liberty are incompatible.

With respect to the third pillar, *security*, following the strategic trends defined by the Defence Staff for the international landscape for the 2030 planning horizon (23) and also bearing in mind the study conducted by the United States Joint Forces Command, with a vision that stretches to 2050 in some cases, (24) we may deduce empirically how these strategic trends could be affected by the impact of Climate Change-related factors:

Demography

The population has been growing unstoppably since the end of the Second World War, from 2.5 billion to the current 6.8 billion, and will inevitably reach the 9.5 billion mark by 2050. But the most worrying fact is the distribution of this population, of which one billion—the oldest—will be in the developed countries; 1.4 billion in China; 1.8 billion in India; and 5.3 in the rest of the world. If, as it seems, the developing countries will be hardest hit by the effects of Climate Change, the impact on 90% of a particularly vulnerable population may prove unpredictable.

Migration and urbanisation

The effects of Climate Change on coastal areas, where the highest percentage of the population—two-thirds—is concentrated, may lead to mass migration sparking tension that is not only economic but also cultural, ethnic and religious. The migratory phenomenon, (25) which is projected to affect 6.4 billion people by 2050, together with the unstoppable

(21) Miguel Alonso Baquer. *¿En qué consiste la estrategia?*» Fundación Cánovas del Castillo. Madrid 1997.

(22) <http://www.ushistory.org/declaration/document/> The Declaration of Independence. In Congress, 4 July 1776. The Unanimous Declaration of the 13 United States of America.

(23) «La Fuerza Conjunta ante los Retos del Futuro. Preparándonos para las operaciones hasta el 2030.» October 2009. Estado Mayor de la Defensa de España.

(24) «Joint Operating Environment 2010. United States Joint Forces Command. Ready for today, preparing for tomorrow.»

(25) <http://www.migrationinformation.org/Feature/display.cfm?ID=773> visited on 17.08.10.

upward trend in the population living in urban areas, (26) will be dramatically accentuated by the foreseeable Climate Change-related stress on coastal and rural areas.

Economic factor

The economic cost associated with Climate Change is unparalleled by the other threats society currently faces. (27) No other risk or threat involves an economic scenario of such magnitude. (28) The Human Development Report 2007-2008 (29) puts the average annual cost until 2030 at 1.6% of GDP. What also seems clear is that the cost of not doing anything about it could range from 5 to 20% of GDP, depending on the calculation method used.

In the report on «National Security and the Threat of Climate Change» by the Center for Naval Analyses (CNA), retired US Marine Corps General and former Commander in Chief of US CENTCOM, Tony Zinni, urged action to be taken now, even if the cost is high, stating:

It's not hard to make the connection between climate change and instability, or climate change and terrorism. We will pay for this one way or another. We will pay to reduce greenhouse gas emissions today, and we'll have to take an economic hit of some kind. Or we will pay the price later in military terms. And that will involve human lives. There will be a human toll. There is no way out of this that does not have real costs attached to it.(30)

(26) http://www.un.org/News/briefings/docs/2010/100401_UN-Habitat.doc.htm visited on 17.08.10. «Mr Mboup said that 50% of the world's population now lived in urban areas, and all developing regions, including Africa and Asia, would have more people living in urban than in rural areas by 2030.»

(27) http://www.nato.int/cps/en/natolive/news_59989.htm?selectedLocale=en «The financial implications of fixing climate change are staggeringly higher than the financial implications of fixing the other problems ...It's been calculated for example that to decarbonise the economies of the major industrialised countries would cost 20 trillion dollars. China which is now taking climate change seriously alone estimates that it is going to need 300 billion dollars a year simply to be able to stabilise in 2030 its emissions at the level which they are at today».

(28) http://www.ieee.es/Galerias/fichero/2010/DIEEE_I04-2010_INFORMATIVO_ROAD-MAP_2050.pdf visited on 21.08.10

(29) <http://www.acnur.org/biblioteca/pdf/7709.pdf> visited on 21.08.10

(30) <http://securityandclimate.cna.org/report/National%20Security%20and%20the%20Threat%20of%20Climate%20Change.pdf> . Visited on 21.08.10

Energy

Energy sources and the related resources will undergo a transformation which is assumed to bring radical changes to the international geopolitical map. A paradigmatic example is the recent visit paid by Russia's President Medvedev to the US, including a two-day stay in California, as part of his new strategy to modernise an economy dominated by oil and gas by shifting to one in which technology plays a predominant role. (31) Also in 2007, President Hu Jintao of China appointed the engineer Wan Gang, a world authority on electric automobiles, as minister of scientific development, for the first time breaking away from the tradition that all ministers should be members of the Communist Party. (32)

What looks set to become a reality in the medium and long term is the growing energy demand of the emerging countries and the progressive replacement of fossil fuels by other cleaner energies. These two trends will probably give rise to a climate of tension in which the possibilities of cooperation and confrontation will increase enormously.

The use of nuclear energy as a backup for renewable energies will facilitate the proliferation of the technology and materials associated with this type of energy, and the inherent risk associated with its peaceful use and the possibility of its use as a weapon of mass destruction could become one of the greatest threats stemming from the changes linked to Climate Change. (33) To quote the figures supplied by NATO (34) at the proliferation conference at the Institute for European Studies in Brussels, according to the International Energy Agency the number of nuclear plants would increase from the current 439 (35) to 1400 by

(31) <http://www.businessweek.com/news/2010-06-18/russia-to-help-spur-new-economic-order-medvedev-says-update2-.html> «We really live at a unique time, and we should use it to build a modern, prosperous and strong Russia, a Russia that will be a co-founder of the new world economic order.» Visited on 21.08.10

(32) http://www.foreignpolicy.com/articles/2010/10/11/the_great_battery_race visited on 13.10.10

(33) <http://www.eia.doe.gov/oiaf/ieo/highlights.html> visited on 21.08.10

(34) Dr Jamie Shea, Director of Policy Planning in the Private Office of the Secretary General, and former Alliance spokesman.

(35) El mundo. Tuesday 7 September 2010. «439 nuclear plants in the world of which 167 are in Europe—8 in Spain, 19 in the UK, 31 in Russia, 59 in France, and 50 in the rest of Europe—104 in the US, 55 in Japan and 113 in the rest of the world. Of the 30

2030. (36) Nearly all the countries are reconsidering using them; for example the United States' new security strategy (37) clearly mentions the need to reinvigorate the use of nuclear energy.

This context explains the US Administration's growing effort to re-launch a policy aimed ultimately at achieving a nuclear weapon-free world, in fulfilment of article VI of the Non-Proliferation Treaty,(38) which is so far completely distorted and used as an excuse for some countries' attempts at proliferation.

Scientific and technological factor

Science and technology will be of crucial importance in the impact of Climate Change-related factors on the concept of human security. All its foreseeable effects are already influenced by current technological capabilities, but they will be modified much further by scientific progress and innovative capacity in the future. The US security strategy of the Obama Administration views innovation as the cornerstone of its power, placing special emphasis on the need to continue to be the world leader in science and innovation. (39)

Another aspect—this one more unsettling—of technological capabilities is the so-called «geo-engineering» (climate engineering), which can modify weather locally and temporarily. The possibility of an escalation in its indiscriminate use by the most underprivileged nations may create feedback of the effects—in this case negative—it is intended to mitigate attempted to mitigate, the so-called «positive feedback loop». (40)

countries with nuclear plants, France is the most dependent country—78%—while China consumes 2%». Translated from the Spanish

(36) http://www.nato.int/cps/en/natolive/news_59989.htm?selectedLocale=en visited on 21.08.10

(37) <http://www.ieee.es/Galerias/fichero/2010/DIEEEA04ApuntesSeguridadEnergetica.pdf> visited on 21.08.10

(38) <http://www.un.org/spanish/Depts/dda/treatyindex.html> visited on 21.08.10 <http://www.iaea.org/Publications/Documents/Treaties/npt.html> visited on 21.08.10

(39) http://www.ieee.es/Galerias/fichero/2010/DA-IEEE_06-2010_NSS_2010_ASPECTOS_DESTACADOS_DE_SU_EVOLUCION.pdf visited on 24.08.10

(40) http://www.nato.int/cps/en/natolive/news_60771.htm?selectedLocale=en visited on 24.08.10

Globalisation

The effect of globalisation heightens the perception of insecurity owing to the speed, clarity and crudeness with which all the effects associated with the Climate Change phenomenon spread throughout the world. All the weaknesses of a social system that is developing in an ordered manner are suddenly brought face to face with situations that are very difficult to prevent and impossible to handle properly, giving rise to chaotic and irrational conduct, while inequalities are exacerbated and the differential factors that trigger conflict situations are emphasised.

Territorial disputes are already evident—in some cases with mechanisms aimed at achieving peaceful and cooperative arrangements, such as the Arctic Council (41) in which all the member nations have declared their firm intention to appeal to international institutions to settle their differences. Other cases which may be used to define different scenarios are: the energy sources in Iraq which are preventing the normal development of its potential; another, which is more dramatic on account of its consequences, is the bloody conflict centred on the Darfur region.

Food

The food chain is one of the strategic trends that will be worst hit by the possible effects of Climate Change (42) exacerbated by demographic trends. The effects are already clearly visible and concern underlies the many studies and activities promoted at all levels, such as the conference of the EU Council held in The Hague from 31 October to 5 November on agriculture, food security and Climate Change. (43)

The effects which are starting to be visible in rice and corn cultivation (44) also extend to oceans and seas, leading to critical situations in many fisheries. An example is the connection with the problem of piracy in Somalian waters owing to a large part of the Somali population's lack of traditional fishery resources.

(41) <http://www.arctic-council.org/> visited on 24.08.10

(42) <http://www.fao.org/climatechange/en/> visited on 24.08.10

(43) <http://register.consilium.europa.eu/pdf/en/10/st10/st10887.en10.pdf> visited on 24.08.10

(44) http://www.bbc.co.uk/mundo/economia/2010/08/100814_rusia_trigo_exportacion_pea.shtml visited on 24.08.10 http://www.elpais.com/articulo/internacional/sequia/incendios/diezman/cultivos/cereales/Rusia/elpepiint/20100806elpepiint_5/Tes visited on 24.08.10

In this case innovative capacity and scientific advances will exert determining influence on future food insecurity. The debate is taking place at the scientific level, on the possibilities of the so-called «green revolution» continuing to evolve towards the «genetic revolution». (45) The goal pursued is to mitigate the most undesirable effects of food shortage in the future—a trend that has only just begun and is already sparking radical viewpoints.

Water

Water resources, overexploited by unstoppable demographic growth, are particularly under threat from global warming. Their historic scarcity in certain geographical areas may extend to other latitudes where the population is unaccustomed to situations of water stress. According to the US Joint Forces Command, (46) more than 40% of the population will be in such a situation by 2030. But more worrying still is the intensive use of aquifers and the progressive thaw of the glaciers that feed the main rivers of southeast Asia.

If oil was the geopolitical indicator par excellence of the twentieth century, the scarcity of water, exacerbated by Climate Change, could become the key geostrategic factor of the twenty-first century, as many analysts have long been announcing.

Natural disasters

Natural disasters are part and parcel of human history. In countless cases such situations have triggered major conflict. They look set to preserve their character in future, but what seems increasingly evident is the frequency and harshness of the form they take as a result of the climate factor.

The most dramatic case of the many witnessed in summer 2010 was the flooding in Pakistan owing to the Monsoon, which affected more than 20 million people and devastated more than one-fifth of the territory. The country's armed forces were mobilised to aid the population, and the army chief of staff, who had planned to visit Spain and with whom the Spanish Institute for Strategic Studies was organising a work meeting for 14 September, had to postpone his trip. The US armed forces provided

(45) <http://www.fao.org/docrep/008/af276e/af276e00.HTM> visited on 24.08.10

(46) <http://www.jfcom.mil/newslink/storyarchive/2010/pa031510.html> visited on 24.08.10

support for the operations to evacuate the population and distribute humanitarian assistance, especially using air assets, aircraft and helicopters belonging to their forces stationed in Pakistan and from Afghanistan.

Another element affected by natural disasters, anthropogenic and otherwise—such as deforestation, whether caused by fire or industrial overexploitation or to create new farming areas—is the degradation of environmental ecosystems. This degradation, which is exacerbated by human pollution, both influences and is strengthened by Climate Change-related factors.

Pandemics

Pandemics, like natural disasters, have recurred throughout history. What is more, in some cases their gravity has been such that they have almost wiped out some ethnic groups. Fortunately, it seems that medical progress has succeeded in mitigating the seriousness of their incidence. However, the frequency and speed at which they spread is being increased by a combination of trends that are given impetus by environmental degradation exacerbated by greenhouse gases.

Cybernetics and space

Unlike other strategic trends, the acceleration of technological development associated with cyberspace and the use of Space as a physical environment can be regarded as less subject to the influence of Climate Change-related factors. However, thanks to technological and scientific advances, the availability of systems based on both types of space will have a vital effect on mitigating its consequences in relation to security. In particular, communication capacity and early warning systems will play an essential role in creating a rapid intervention capability to attenuate their incidence and allow more effective planning and management of their consequences.

SECURITY VIS-À-VIS CLIMATE CHANGE. A NECESSARY DEVELOPMENT

«People are saying they want to be convinced, perfectly. They want to know the climate science projections with 100 percent certainty. Well, we know a great deal, and even with that, there is still uncertainty. But the trend line is very clear. We never have 100

percent certainty. We never have it. If you wait until you have 100 percent certainty, something bad is going to happen on the battlefield. That's something we know. You have to act with incomplete information. You have to act based on the trend line.(47)

The global nature and potential danger of the strategic implications of Climate Change reinforce the position of the *United Nations* (UN) as the cornerstone of the new security architecture, capable of addressing the new challenges. The involvement of the organisation's structure and key posts in combating its effects is a guarantee that the progressive development of the concept of security will adopt the necessary «multi-disciplinary approach and comprehensive action» (48) encompassing the different regional organisations and all the national and local authorities.

The first ministerial meeting of the Security Council on «The impact of Climate Change on Peace and Security» (49) was held on 17 April 2007 at the request of the UK representative, then president of the Council. More than 50 speakers were heard and the need for UN leadership was underlined. However, different opinions were also noted on the role each of its various agencies should adopt. The most critical of the Security Council's role were China, Russia, the group of 77, (50) the African group (51) and the Non-Aligned Movement, while the Pacific Islands Forum and the EU were the most in favour of the Security Council playing a priority role.

Efforts made to date from very diverse spheres, including the military world, have succeeded in considerably raising society's awareness of the consequences of failure to act. Most national security strategies are incorporating Climate Change as a whole, considering the leading role of a reformed United Nations organisation capable of spearheading global, coherent and supportive action.

In its security strategy entitled «A Secure Europe in a Better World» (2003), (52) the *EU* does not address the concept of Climate Change, although it does list most of its consequences when discussing strategic trends, presenting itself as a global actor with a single, integrated

(47) General Gordon R. Sullivan (Ret.) Former US Army Chief of Staff

(48) http://www.mde.es/Galerias/ooooe/fichero/EMD_directiva_nacional.pdf

(49) <http://www.un.org/News/Press/docs/2007/sc9000.doc.htm>

(50) <http://www.g77.org/>

(51) http://www.un.org/wcm/content/site/citizenambassadors/lang/en/home/thecampaign/contest2010/regional_groups

(52) <http://www.consilium.europa.eu/uedocs/cmsUpload/031208ESSIIIES.pdf>

civilian and military capacity for action, requiring more action, capacity and coherence of its members. In the report on its implementation (2008) which can be regarded as its practical review, «Providing Security in a Changing World»,⁽⁵³⁾ Climate Change is included among the challenges and threats that affect European security interests and considered a threat multiplier, with particular emphasis on prevention and management aspects and on analysis and early warning capabilities. Another of the aspects examined is the need for multilateral cooperation, for which it is considered essential to boost effectiveness and adopt a more efficient decision making process. Also in this connection special mention is made of the important role played by the UN at the apex of an international system inherited from the end of the Second World War, which needs to be revised. As the document specifies, «faced with common problems, there is no substitute for common solutions».

In the *US*, the phenomenon of Climate Change was already given specific treatment in the 1991 Security Strategy of President *George H. W. Bush*,⁽⁵⁴⁾ which establishes global ecological protection as one of its chief priorities in reaction to the environmental degradation caused by Saddam Hussein during the first Gulf war. It states the need to assess Climate Changes as one of the most complex non-traditional issues that affect security.

During the administration of President *Clinton* ⁽⁵⁵⁾ Climate Change became a continual reference point, promoting the *US*'s international leadership in its relationship with sustainable development. But it was in a document of 1997 ⁽⁵⁶⁾ that Climate Change was furthermore defined as a transnational threat along with terrorism, drug trafficking and international organised crime. The document of 1998, ⁽⁵⁷⁾ «A National Security Strategy for a New Century», broadened its scope even further by linking it to energy security and prosperity. The last two documents (1999 and 2000) ⁽⁵⁸⁾ mention the need to reverse its trend.

(53) http://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressdata/ES/reports/104637.pdf

(54) <http://www.globalsecurity.org/military/library/policy/national/nss-918015.htm>

(55) <http://www.globalsecurity.org/military/library/policy/national/>

(56) <http://www.globalsecurity.org/military/library/policy/national/nss9705.htm>

(57) <http://www.globalsecurity.org/military/library/policy/national/nss-9810.pdf>

(58) <http://www.globalsecurity.org/military/library/policy/national/nss-1299.pdf> <http://www.globalsecurity.org/military/library/policy/national/nss-0012.htm>

However, in the first security strategy of President *George W. Bush* (2002), (59) Climate Change is dealt with from a purely economic angle and disappears as such in that of 2006. The latter mentions the environmental destruction caused by man, energy security based on diversification, and the promotion of clean energies.

But it is in the first security strategy of President *Obama* (2010), (60) with 23 references throughout the document, that its danger is literally considered «real, urgent, and severe». President Obama intends the US to establish itself as the leader (61) of a new international system capable of effectively combating extremism and proliferation, achieving balanced and sustainable economic development and able to cooperate efficiently in stemming the threat of Climate Change, armed conflicts and pandemics. The document is very clear in recognising that in order to succeed in exercising this leadership, capacity for action, conviction and influence must be based on an inner drive that is both moral and economic. In this connection it particularly underlines the need to bring together all the nation's powers in this endeavour. A crucial factor of this integration that is specifically mentioned is military might and its ability to promote international cooperation.

In relation to the new international system it notes the development of the G8 into the G20, which should be a better reflection of the new geopolitical reality, and specifically mentions China, Indonesia, Brazil and South Africa as well as its Asian allies (Japan, South Korea, Australia, the Philippines and Thailand) in connection with Climate Change.

In its national security strategy «to 2020», President Medvedev's first (2009), (62) the *Russian Federation* mentions Climate Change only once in connection with domestic protection of the environment, which is bad-

(59) <http://www.globalsecurity.org/military/library/policy/national/nss-020920.pdf>

<http://www.globalsecurity.org/military/library/policy/national/nss-060316.htm>

(60) http://www.whitehouse.gov/sites/default/files/rss_viewer/national_security_strategy.pdf

(61) http://www.ieee.es/Galerias/fichero/2010/DA-IEEE_06-2010_NSS_2010_ASPECTOS_DESTACADOS_DE_SU_EVOLUCION.pdf With respect to the new leadership advocated by the Obama administration, the IEEE recently wrote: «As basic aspects of this exemplary leadership, it is committed to continuing to adapt and balance the nation's material and moral resources through innovation and education, in order to tackle the new challenges such as climate change and pandemics, while addressing the necessary energy transformation and the challenge of immigration and racial and cultural diversity as intrinsic values of American society. In this regard the aim is to prepare society to counter radicalisation, but with the clear message that diversity is a strength and not a source of division or insecurity.» (translated from the Spanish)

(62) <http://www.scrf.gov.ru/documents/99.html>

ly threatened by the country's antiquated industry, inefficient state control and the absence of a modern regulatory system.

However, Climate Change and its geopolitical implications was the sole topic on the agenda of the 17 March 2010 meeting of its Security Council. The first salient feature of this meeting is its mention of the failure of the Copenhagen conference, in contrast to the US strategy which surprisingly makes no such statement and perhaps in reaction to it, given that the council meeting took place almost immediately after the publication of the US strategy. What is more, the information published (63) is written in a clearly confrontational tone throughout with respect to the developed countries, while adopting a victimist viewpoint. The western countries are criticised for taking protectionist and unilateralist measures against Russian interests which are harming its exports. Other aspects of interests are addressed, such as:

- The need to act prudently owing to the unreliability of current forecasts.
- A specific mention of the dispute in the Arctic area, criticising the action of the other bordering countries, once again, as going against Russian interests. Furthermore 1 June 2010 was set as a deadline for beginning the «Arktika» multipurpose space system programme for meteorological monitoring of the area.
- Recognition that Russia lags behind the developed countries in scientific research and forecasting, as well as in the organisation and management of climate-related issues and their practical application.

In its annual report to Congress (64) on military and security developments of the *People's Republic of China*, the US Defense Department points out that China does not have a document equivalent to a national security strategy. Guidelines are taken from the so-called «white papers» (65) (66)

(63) <http://eng.kremlin.ru/news/140>

(64) http://www.defense.gov/pubs/pdfs/2010_CMPR_Final.pdf

(65) http://europa.eu/scadplus/glossary/white_paper_en.htm «Commission White Papers are documents containing proposals for Community action in a specific area. In some cases they follow a Green Paper published to launch a consultation process at European level. When a White Paper is favourably received by the Council, it can lead to an action programme for the Union in the area concerned.» http://europa.eu/scadplus/glossary/green_paper_en.htm «Green Papers are documents published by the European Commission to stimulate discussion on given topics at European level. They invite the relevant parties (bodies or individuals) to participate in a consultation process and debate on the basis of the proposals they put forward. Green Papers may give rise to legislative developments that are then outlined in White Papers.»

(66) http://english.gov.cn/official/2005-08/17/content_24165.htm#2010

and from lectures and articles. The «white papers» on National Defence have been issued biannually since 1998. When establishing the strategic security situation, for the first time the most recent document published in 2008 specifically mentions Climate Change as a risk. (67) Bearing in mind that according to many reports China will be one of the worse hit areas by the effects of Climate Change (68)—which could affect up to 35% of its food production—concern is focused mainly on its own security and, as in the case of Russia, there are signs of a growing effort to speed up changes in the economic development model by promoting technological innovation. (69)

NATO does not specifically mention Climate Change in its latest Strategic Concept of 1999, although it does include among the factors that need to be considered in defence during the twenty-first century: political, social, economic and environmental issues. Indeed, it regards the environmental factor as an essential element of Euro-Atlantic cooperation together with emergency civil planning and scientific research.

In recent years, possibly spurred by the appointment to the post of Secretary General of Anders Fogh Rasmussen, (70) who was particularly sensitive to Climate Change as Danish prime minister, it has devoted par-

(67) http://english.gov.cn/official/2009-01/20/content_1210227_3.htm «World peace and development are faced with multiple difficulties and challenges. Struggles for strategic resources, strategic locations and strategic dominance have intensified. Meanwhile, hegemonism and power politics still exist, regional turmoil keeps spilling over, hot-spot issues are increasing, and local conflicts and wars keep emerging. The impact of the financial crisis triggered by the U.S. subprime mortgage crisis is snowballing. In the aspect of world economic development, issues such as energy and food are becoming more serious, highlighting deep-seated contradictions. Economic risks are manifesting a more interconnected, systematic and global nature. Issues such as terrorism, environmental disasters, climate change, serious epidemics, transnational crime and pirates are becoming increasingly prominent.»

(68) http://www.nato.int/cps/en/natolive/news_60771.htm?selectedLocale=en

(69) http://english.gov.cn/2010-08/23/content_1685870.htm visited on 24.08.10.

(70) <http://www.nato.int/docu/comm/2009/0904-summit/index.html> Precisely at the summit of heads of state and government held in Strasbourg (France) and Kehl (Germany) on 3 and 4 April 2009, where he was appointed Secretary General, climate change is mentioned in the final declaration on Alliance security. «Today, our nations and the world are facing new, increasingly global threats, such as terrorism, the proliferation of weapons of mass destruction, their means of delivery and cyber attacks. Other challenges such as energy security, climate change, as well as instability emanating from fragile and failed states, may also have a negative impact on Allied and international security. Our security is increasingly tied to that of other regions.»

ticular attention to this area, as may be inferred from its website, (71) as well as from other addresses delivered such as the one at Lloyd's of London and COP15 security panel. (72) Similarly, it has reorganised its International Staff, creating a new division (73) related to the new security challenges.

The 17 May 2010 report on the new strategic concept «NATO 2020: Assured Security; Dynamic Enlargement», (74) drawn up by the group of experts led by Madeleine K. Albright, (75) quotes Climate Change five times, underlining the uncertainty it arouses when analysing the medium-term strategic situation and its dangerous consequences. Also, in the section on recommendations, although it recognises that NATO does not have a formal role in reducing CO₂ emissions, it states that it should consider the effects of Climate Change in its policy and planning in order to be prepared for future contingencies.

As could only be the case, the recent strategic reviews of the NATO countries reflect this growing concern about the strategic security implications of Climate Change, although *Canada*, for example, does not consider it in its security policy of 2004: (76) «Securing an Open Society: Canada's National Security Policy» or in its first defence strategy. (77) The latter does, however, pay special attention to the change in climate models in the Arctic region and the challenge it poses with respect to both sovereignty and the potential rise in illegal activities.

The *United Kingdom* has shown the most interest in developing Climate Change in its national security strategy entitled «Security in an interdependent world», (78) in which it is mentioned as many as 36 times.

(71) <http://andersfogh.info/tag/climate-change>

(72) http://www.nato.int/cps/en/natolive/news_60163.htm?selectedLocale=en
http://www.nato.int/cps/en/SID-B08C9C5E-C49E78AB/natolive/photos_60164.htm?selectedLocale=en

(73) <http://www.nato.int/cps/en/natolive/index.htm> visited on 24.08.10.

(74) <http://www.nato.int/strategic-concept/expertsreport.pdf> http://www.ieee.es/Galerias/fichero/2010/DA-IEEE_03-2010_OTAN_2020_COMENTARIOS_AL_INFORME_ALBRIGHT.pdf

(75) Secretary of State during the Clinton administration and the first woman to hold the post.

(76) <http://www.pco-bcp.gc.ca/docs/information/publications/natsec-secnat/natsec-secnat-eng.pdf>

(77) <http://www.cdfai.org/PDF/The%20Canada%20First%20Defence%20Strategy%20-%20One%20Year%20Later.pdf>

(78) http://www.ieee.es/Galerias/fichero/Estrategia_Nacional_de_Seguridad_UK_2008.pdf

The document refers to it as the greatest global potential risk to stability and security and therefore to national security, as well as stating that its effects are now becoming evident and notably affect stability and security both globally and locally. It proposes making tough decisions immediately as the only means of tackling the potential risks. Like the United States, the United Kingdom believes that the international security system needs to be adapted to the new situation, underlining failures such as Rwanda and frustration over Darfur. It also reckons that pressure to reform the international security architecture will gradually increase. In the 2009 update (79) Climate Change is mentioned as many as 99 times, demonstrating palpably the growing importance that the cabinet of the former prime minister, Gordon Brown, attached to this issue.

The security strategy of the government of the Conservative prime minister, David Cameron, (80) in coalition with the Liberal party, attaches the same importance to Climate Change, which is associated chiefly with water and food resources, underscoring the need for global solutions. Similarly, it continues to refer to it as a risk multiplier and points out its disproportionate impact on the developing world, particularly the poorest areas, especially in Africa. It stresses the backward step the failure to reach a binding agreement at the Copenhagen conference signifies, although it shows a certain amount of optimism about the fact that some 70 countries, which are responsible for 80% of CO₂ emissions, have committed themselves to reducing their emissions.

In *France* the Defence and National Security White Paper (81) uses the terms climate change and climate warming indistinctly, regarding them as phenomena that spark tension over essential resources—water, food and energy—and, as such, as potential triggers of regional and global crises. The concern they arouse is particularly related to the African scenario.

Similarly, *Germany's* 2006 White Paper on security policy and the future of defence (82) considers the concept of Climate Change to be

(79) http://www.ieee.es/Galerias/fichero/Estrategia_Nacional_de_Seguridad_UK_update_2009.pdf

(80) http://www.cabinetoffice.gov.uk/newsroom/news_releases/2010/101018-national-security-strategy.aspx visited on 22.10.10

(81) http://www.livreblancdefenseetsecurite.gouv.fr/information/les_dossiers_actuelles_19/livre_blanc_sur_defense_875/livre_blanc_1337/livre_blanc_1340/index.html

(82) http://merln.ndu.edu/whitepapers/Germany_White_Paper_2006.pdf

linked to the African scenario, although it extends it to Asia and associates it directly with Germany's own security owing to the moral duty to provide assistance.

In the case of *the Netherlands*, as in the British document, references to Climate Change are the keynote. Even in the introduction, which asks the question «why do we need this strategy», (83) society's vulnerability to threats such as bird flu, Climate Change and terrorism is mentioned; the answer it gives is the need to establish a multidisciplinary and integrated approach, one of the essential elements of which is international cooperation. This reasoning is reaffirmed by the inclusion of Climate Change in one of the five vital interests—ecological security—that are listed in the document. At the same time it paints a strategic landscape full of uncertainty owing to countless threats that are becoming increasingly diffuse and devastating.

As for *Spain*, it is too soon to analyse how Climate Change will be dealt with, as the first security strategy is currently being drawn up by a committee that is organisationally responsible to the Presidency of the Government and is led by Javier Solana at the time of writing this article. However, in the first seminar organised by the the Spanish Institute for Strategic Studies (IEEE) and Fundación Alternativas to discuss the «context of the drawing up of Spain's Security Strategy» and in the supporting analysis document written by the IEEE, (84) Climate Change was considered in its full extent and underlined, to quote Javier Solana, as being a threat and risk multiplier and global challenge that generates uncertainty and instability.

The National Defence Directive (DDN) of 01/08, which established the need to draw up a National Security Strategy as a framework for future DDNs, states in connection with the strategic landscape, in addition to underlining the scramble for basic resources and the technological revolution, that «the effects of humanity on the environment also appear to be

(83) http://www.ieee.es/Galerias/fichero/Estrategia_Nacional_de_Seguridad_NL_2007.pdf «Why do we (need this strategy)? Our society is vulnerable. We see this when we are confronted with threats like bird flu, climate change and terrorism. The answer to existing and new threats cannot be formulated by one ministry or organisation alone. Reinforcement of national security requires a joined-up, integral approach within which international cooperation is an essential element. The strategy describes how the Cabinet is going to realise this approach.»

(84) http://www.ieee.es/Galerias/fichero/2010/DA-IEEE_02-2010_EL_CONTEXTO_DE_ELABORACION_DE_LA ESTRATEGIA ESPANOLA DE SEGURIDAD.pdf

generating the birth of a new phenomenon, **climate change**, the instability of which may lead to the appearance or increase of recurring natural phenomena that give rise to **disasters**. Even today, their occurrence and consequences are difficult to predict, especially when they generate, among other things, health or sanitary risks and the interruption of critical networks and infrastructures.»

Finland, an EU country which is not a NATO member, deals very extensively with the phenomenon of Climate Change in its security and defence policy document of 2009, underlining the need for a global EU policy as the only means of countering its effects. It also emphasises the importance of coordinating EU and US policies in this area. It likewise notes the vulnerability of nations if they address the challenges of Climate Change and the financial crisis individually. (85)

The *Organisation for Security and Cooperation in Europe* (OSCE), which encompasses a region stretching from Vancouver to Vladivostok, also states the need to include environmental challenges in early warning and conflict prevent tasks in its Maastricht 2003 strategy. The Madrid declaration of 2007 recognises Climate Change as a long-term challenge. Lastly, the Bucharest conference of 2009 establishes as an objective studying its impact on security and identifying the role the organisation could play in mitigating the potential threats. (86)

Other non-OSCE countries vary greatly in their approach to the Climate Change phenomenon in their national security documents.

Australia's 2009 Defence White Paper cites Climate Change as a new security concern, although it considers that the strategic consequences of its effects will not be felt before 2030. Another prominent aspect the document considers is the need to be prepared to assist the countries in the East Pacific region and East Timor, which are highly vulnerable to its effects.

Japan includes Climate Change as a possible cause of regional conflicts in its 2009 defence document. (87)

(85) http://merln.ndu.edu/whitepapers/Finland_English-2009.pdf «Climate change and the financial crisis that shakes the very foundations of the global economy show how vulnerable nation-states are on their own.»

(86) http://ecc.adelphi.de/PDF/Shifting_Bases-Shifting_Perils.pdf

(87) http://www.mod.go.jp/e/publ/w_paper/2009.html

Argentina (2007) (88) and *Brazil* (2008), (89) however, do not include the phenomenon in their respective defence documents. The most salient features are Argentina's failure to mention the Antarctic region and Brazil's statement of interest in beginning its civilian use nuclear programme and its treatment of the Amazon rainforest, which it regards solely as a specific area that needs specialised armed forces.

DEFENCE AS A SECURITY TOOL. AN ADAPTATION FORETOLD

...so, as you move down this road it is getting progressively worse [Climate Change. Global Warming] and it is already the case. Which I think has some major political implications. That is going to get worse for 30 or 40 years. I mean, that's done.... . But the political implications of that in terms of impatience, radicalisation, let alone the failed states, need to be considered. People do not have infinite patience; people work to short timescales, people will behave irrationally. Somebody I was talking to in Washington, an academic, he was deputy national security advisor in the Clinton administration, said that «at a certain point you must expect the political system to change in their behavior». I mean, political systems are adapted to physical environment like other things are ... you assume a level of order in the society and then you can have this political system, but in a chaotic environment ... you don't necessarily have that system anymore, so there are risks at the political level. That compounds the risks at physical level, that's irrationality. People don't behave well under stress, I mean, it is what all soldiers know, that's why we have the military. We know people don't behave well under pressure, and the pressure is going to be extreme. So that's the situation now. (90)

Through its *planning cycles* (91) the Defence world constantly adapts to the changing environment, progressively updating its organisation, the means needed to achieve its force goal, operational procedures, the training of its personnel and the direction of research and technological innovation efforts. The most characteristic features of these changes

(88) <http://merln.ndu.edu/whitepapers/Argentina2007.pdf>

(89) http://merln.ndu.edu/whitepapers/Brazil_English2008.pdf

(90) http://www.nato.int/cps/en/natolive/news_60771.htm?selectedLocale=en Doctor Gwynne Dyer. Historian, journalist, author of the book *Climate Wars*. Visited on 22.08.10

(91) http://www.mde.es/Galerias/ooooe/fichero/EMD_planeamiento.pdf

are magnified by the visible effects of Climate Change. What is more, Climate Change specifically has global consequences that give rise to uncertainty and instability, directly affecting Defence. In this regard it is gradually becoming an independent phenomenon in one of the strategic trends that is already affecting the transformation of the armed forces, but will most likely have greater influence in their design and utilisation in the future.

In this progressive adaptation to the environment the armed forces are evolving (92) in order to address the two sides of a phenomenon that affects them directly: on the one hand, as part of the problem, as it is another contributory factor in their development as they are one of the main consumers of fossil fuels; (93) and on the other, as another tool which society can use to counter its most unforeseeable and undesired effects. The efforts of the Spanish armed forces, in consonance with practically all the developed countries, are along these lines.

As for the first of the characteristics, as an important part of alleviating the problem, the Spanish Ministry of Defence (MD), through its *environmental policy* based on the constitutional precepts, (94) has been developing an active programme designed to mitigate the impact of Defence activities on the development of the phenomenon. This policy has a broader vision (95) than the one enunciated by the first specific Climate

(92) http://www.mde.es/Galerias/oooo/fichero/EMD_FAS_Mejorando.pdf

(93) <http://www.mod.uk/NR/rdonlyres/58799038-34D2-4A93-94C8-6BBF770B9EA0/0/MODClimateChangeStrategyFINAL.pdf>

The emissions of the British MOD are:

- a. Our marine, aviation and ground fuel which will be part of the Transport sector, for which the MOD share is 3% of the overall emissions.
- b. Our own Public Sector Estate and Operations which will be part of the Public Sector Estates and Operations emissions sector, which includes emissions from our estate, and from our business administrative travel.
- The MOD has an 18% share of emissions in this sector. Based on 2008/2009 figures, the MOD is responsible for emissions of approximately 5.6 Mega tonnes of Carbon Dioxide equivalent (Mt CO₂e) each year, roughly 1% of UK emissions.»

(94) 45.1 Everyone has the right to enjoy an environment suitable for personal development, as well as the duty to preserve it.

45.2 The public authorities shall safeguard a rational use of all the natural resources with a view to protecting and improving the quality of life and preserving and restoring the environment, by relying on essential public co-operation.

(95) <http://www.gestion-calidad.com/derecho-ambiental.html> visited on 25 August 2010.
«Our environmental policy bears in mind the concept of the Constitutional Court, which defines environment in one of its judgements as: «the living space of mankind

Change strategy of a ministry of defence, the UK «MOD Climate Change Strategy 2010». In this document the British armed forces establish mitigation as one of their goals in these areas—that is, the continual reduction of greenhouse gas emissions resulting from their activities until they cease to be a significant part of the problem. (96)

In this regard the Spanish MD, through its «General Action Plan for the Management of Infrastructure, Energy and the Environment» in accordance with the Spanish Strategy for Climate Change and Clean Energy», (97) establishes as operational functions: the Natural Environment, which encompasses biodiversity, forest mass, fire fighting and natural spaces; Environmental Quality, which includes pollution of the atmosphere, water and soil, in addition to waste and «Environmental Management Systems»; (98) and Climate Change which covers energy saving and efficiency, sustainable transport, institutional cooperation and, as is only logical, awareness raising.

As for the *Natural Environment*, the plans relating to forest mass and fire fighting have direct implications for the mitigation of the factors associated with Climate Change. It is now thought that the deforestation

in a system of harmony, which combines the useful and the pleasurable. In an analytical breakdown it is comprised of a series of geological, climate, chemical, biological and social elements or agents which surround living things and affect them positively or negatively, conditioning their existence, their identity, their development and in more than one case their extinction, disappearance or consumption». This definition was later expanded on in the Law on the Assessment of Environmental Impact when referring to the content of the compulsory assessment required in order to implement certain projects: «assessment of the foreseeable direct or indirect effects of the project on the population, the flora, the fauna, the soil, the air, the water, climate factors, the landscape and material assets, including art historical and archaeological heritage. Consideration shall also be given to the interaction of all these factors.»

(96) <http://www.mod.uk/NR/rdonlyres/58799038-34D2-4A93-94C8-6BBF770B9EA0/0/MODClimateChangeStrategyFINAL.pdf> «Objective 1 – Mitigation: Continually reduce the GHGs that result from Defence activities, such that Defence will eventually not be a significant contributor to the causes of climate change.»

(97) http://www.mma.es/secciones/cambio_climatico/documentacion_cc/estrategia_cc/pdf/est_cc_energ_limp.pdf Ministry of the Environment.

(98) «The commitment of the MD to safeguarding the environment is one of the highlights of its policy for the 21st century. Spain is the European Union country which has the most military installations with an implemented Environmental Management System, nearly 200, which is a reflection of the care and protection that is afforded to Spain's rich natural heritage in them.» Carme Chacón. Minister of Defence. «La Red Natura 2000 en el Ministerio de Defensa» (The number is currently put at 251)

suffered by the planet accounts for 20% of the concentration of carbon dioxide particles in the atmosphere, which is directly linked to global warming and the associated phenomena. (99)

Spain's MD has over 140,000 hectares of natural heritage which have a great capacity to become significant CO₂ sinks. The agroforestry plan for the past 10 years envisaged 72 bases totalling 116,000 hectares, which amounted to 72% of Defence property. The reforestation convention refers to a total of 1,250 hectares with 1,062,500 new trees planted. As for fire fighting, more than 15 technical plans for the prevention and extinction of fires have been drawn up, as well as forestry works such as firelines and firebreak areas, protective infrastructure, etc.

As for *Environmental Quality*, the phasing out of halons and CFCs (Chlorofluorocarbons) in accordance with the Montreal Protocol (100) on substances that deplete the ozone layer has been successfully completed. With respect to the Kyoto Protocol (101) on the reduction of greenhouse gases, the Plan links up with actions in the field of Climate Change, and specifically the efforts are underpinned by law 34/2007 (102) on air quality and protection of the atmosphere.

In this respect, energy saving and *energy efficiency* go hand in hand with the nature of the armed forces and are a key strategic factor. In 1912 Winston Churchill, who was responsible for the British navy as First Lord of the Admiralty, decided to convert the fleet's coal powered ships to oil.(103) His decision ushered in the so-called era of oil, which dominated the geopolitics and mapped out the geostrategic course of the twentieth century. Nearly a hundred years on from this important decision, which marked a strategic advantage that was both operational and logistic, we are on the threshold of a new, post-oil era. A new era that needs to establish new strategic principles allowing us to leave behind the old geopolitical factors linked to the fossil fuels which were encouraged by neo-colonialist policies. A new era with new policies that should promote active multilateralism and the opening of markets, allowing the

(99) <http://climate.nasa.gov/> visited on 25.08.10. According to the NASA (National Aeronautics and Space Administration) the current level is 389 parts per million, the highest in the past 650,000 years.

(100) http://new.unep.org/ozone/Treaties_and_Ratification/2B_montreal_protocol.asp

(101) <http://unfccc.int/resource/docs/convkp/kpspan.pdf>

(102) <http://www.boe.es/boe/dias/2007/11/16/pdfs/A46962-46987.pdf>

(103) http://www.nato.int/cps/en/natolive/news_59989.htm?selectedLocale=en

present century to lay the groundwork for more cooperative, harmonious and sustainable development.

Another of the key aspects of energy efficiency that was stressed during the Climate Change conference organised by NATO (104) is the degree of vulnerability resulting from the dependence of operations on its cumbersome *logistic chain*. Such is the case of Afghanistan and the high number of casualties (105) due to the logistic effort associated with fuel supply, which is put at 180 deaths in 2008 during transit from Pakistan to Afghanistan. (106) In order to reduce the number of convoys in transit along the border with Pakistan in areas easily used by the insurgency, a major diplomatic effort is being made with the former Soviet Asian republics and Russia in order to diversify supply lines and make them more secure. (107) What makes the present time particularly important is the impetus being given to the pursuit of energy excellence as a strategic advantage factor that is intrinsically linked to the armed forces and whose importance is magnified by the reality of Climate Change, which calls for deep innovations in this field.

An example, albeit limited in scope, of the positive synergies that may be achieved in this field is the action of the Spanish MD on the island of Isabel II belonging to the archipelago of the Chafarinas. The installation of a photovoltaic solar plant (108) and three cutting-edge atmospheric water generators (cooling condensation) (109) supply electricity and water to

(104) http://www.nato.int/cps/en/natolive/news_59989.htm?selectedLocale=en

(105) Truscott, Peter (2009) «Military preparedness for a post-hydrocarbon world» «The American Army has begun to try to save energy and therefore lives. Half of their war-time casualties are sustained in convoys, which carry fuel and are often targeted by insurgents. They estimate that every 1 per cent of fuel saved means 6.444 soldiers do not have to travel in a vulnerable convoy.»

(106) <http://www.cnas.org/blogs/naturalsecurity/2010/10/militants-increase-attacks-against-nato-fuel-convoys-pakistan.html> visited on 10.10.10

(107) <http://www.iiss.org/publications/strategic-comments/past-issues/volume-16-2010/august/northern-route-eases-supplies-to-us-forces-in-afghanistan/>

(108) The plant, which has an installed capacity of 68,400 kWp and an estimated electricity production of 165,068 kW, with an output of more than 85%, consists of a total of 600 modules each 1.28 sq m in area. In the environmental balance it is estimated that 173.77 mT of CO₂ emissions and 486.95 kg of acid rain caused by sulphur dioxide (SO₂) emissions are saved annually.

(109) Production stands at 1,000 litres of water daily. The water obtained by the system the machine uses is from condensing atmosphere humidity. This is the same system used by nature to convert water from vapour (clouds) to a liquid state (rain), and it therefore respects the environment in that it does not go against the so-called

the island with negligible environmental impact. This achieves substantial logistical autonomy, diminishing the vulnerability of the supply flow. It also saves a significant amount of energy and money if we consider not only consumption on the island but also consumption associated with the logistic effort otherwise needed to supply it.

In order to achieve the energy saving set forth in the «Spanish Strategy for Climate Change and Clean Energy 2007-2012-2020 Horizon», (110) the conversion from diesel oil-based systems to natural gas is being encouraged by installing cogeneration systems, in addition to seeking alternative systems such as those which generate electricity using renewable energies, for example wind turbines and geothermal and photovoltaic systems. The «Energy Saving and Efficiency Plan 2009-2012» is focused on 70 bases which account for around 70% of the total consumption of the armed forces and where audits will be conducted leading to specific actions.

The *cogeneration* plant and ancillary facilities of the Gómez Ulla Defence Central Hospital is a good example of this effort, as it achieves considerable energy and financial saving thanks to the use of natural gas as a primary energy source through motor-generators which supply their own electricity and furthermore produce a surplus that is injected into the grid, and thermal energy using the various mechanical elements of the motor. It is comprised of two motor-generators, a heat recovery boiler, a hot water boiler, an absorption refrigeration machine and ancillary facilities to allow surplus energy to be sent to the Iberdrola grid. During 2009 it generated 28 MKW, of which 3M were imported, 16M exported and 15M consumed by the hospital, with a total turnover of €59,874. As for thermal generation, consumption totalled 45,756 MW equivalent to more than 4 million litres of diesel oil, amounting to a 43.8% saving and preventing an estimated 127 tons of greenhouse emissions. Electricity yields of over 60% exceed the minimum requirement of 55% (111) and reached

«water cycle». The principle on which this conversion is based is to make the machine work in such a way that it imitates the «dew point» at which, depending on atmosphere temperature and humidity, this conversion takes place.

(110) http://www.mma.es/secciones/cambio_climatico/documentacion_cc/estrategia_cc/pdf/est_cc_energ_limp.pdf visited on 18.08.10

(111) http://www.nato.int/cps/en/natolive/news_59989.htm?selectedLocale=en The energy efficiency of fossil fuel is currently considered to fall between 30% and 32%. New generation plants are in the range of 60%, amounting to a 100% saving in

an all-time high of 68.2% over the past months. Availability has exceeded 98% and reliability 99%.

Along these lines, in order to boost the efficiency of actions in a more coordinated manner, it is expected that the new «Energy Efficiency Plan in Military Installations 2010-2016» will be signed before year end. The plan, in collaboration with ISDEFE (112) and the Ministry of Industry, Tourism and Trade, is intended to be applied to 130 installations and seeks to promote more efficient and systemised action that will also serve as a model for the whole country.

In keeping with this progressively increasing awareness of the military world in the gradual shift away from the use of fossil fuels, two proposals were received from the US during 2010 for the installation of systems based on renewable energy at the dual-use bases of Morón and Rota in Spain.

At the Morón Air Base the US forces, which have certain backup facilities authorised for use, have applied for the construction of a 100KW nominal power *photovoltaic plant* consisting of 630 panels. The Spanish government has authorised the installation, which will benefit the base by allowing it to reduce its dependence on the external grid for electricity supply, save costs and enjoy the benefits of new clean energies.

In line with this policy, at Nellis air base (113) (Nevada) on 18 December 2007 the US army celebrated the completion of work on what is the biggest (72,000 panels) photovoltaic solar energy system to date. The system generates 14.2MW, meeting as much as 25% of the needs of the base, which has 12,000 personnel. This facility saves one million dollars annually and reduces CO₂ emissions by 24,000 tons. The project cost 100 million dollars and occupies 140 acres. Another of the possibilities the US Department of Defense is using (114) is *geothermal energy*, which has been operating since 1987 at the China Lake naval base (California), producing 270MW. (115)

power generated per litre of fuel used, which is immediately translated to the two energy bills, emission of pollutant gases and money. Visited on 24.08.10.

(112) ISDEFE (Ingeniería de Sistemas para la Defensa de España, SA)

(113) <http://www.nellis.af.mil/news/story.asp?id=123079933>

(114) The US Department of Defense possesses 300,000 facilities which account for 30% of consumption and a four billion-dollar electricity bill in 2009. Its goal is to have reduced greenhouse gas emissions by 34% by 2020.

(115) <http://www.defense.gov/News/NewsArticle.aspx?ID=59294>

At Rota Naval Station, Ameresco's proposal was based on *wind generators* comprised of 4-6 1.5MW turbines with an annual production of 20MW, covering between approximately 20 and 25% of its requirements. In this case the proposal has been dismissed by the Spanish authorities in consonance with the misgivings recently expressed by the US Administration concerning the proposal for Iberdrola to build three wind farms in the Columbia river canyon and the project for the biggest wind farm in the world, equivalent to a nuclear plant, which Caithness Energy planned to build in Oregon. Problems of aerial navigation, interferences with the navigation systems and radars owing to false echoes and electromagnetic and noise pollution are the concerns that should be studied at length before granting or refusing authorisation. A recent study by the Lincoln Laboratory of the Technological Institute of Massachusetts confirms the generation of false echoes and proposes measures for mitigating them. (116)

An element which has always been considered essential in the adaptation of the armed forces to the environment but will play a determining role in the future is *technological innovation*. (117) Part of the «National Science and Technology Strategy» is the «Technology and Innovation Strategy for Defence» (ETID-2010). This strategy is aimed at progressing in the coordination and management of the activities needed to acquire and apply knowledge and advanced but not sufficiently mature technologies, in order that they may be transferred to the operational sphere as soon as possible. The main challenge the ETID-2010 faces is to achieve the integration of all the national technological actors—public or private, industry, enterprise and education—together with de-

(116) http://www.acq.osd.mil/ie/download/green_energy/exec_sum_windturbinestudy.pdf

(117) http://www.ieee.es/Galerias/fichero/docs_analisis/2010/DIEEEA11-2010InnovacionTecnologicaSeguridad.pdf «Therefore technological innovation should be considered in the Spanish Security Strategy as a determining factor in the security of Spain in the world, in which its business and technological fabric must play an essential role and in which the effort as the State as a whole in education and innovation will be the key elements.» (translated from the Spanish) http://www.ieee.es/Galerias/fichero/2010/DA-IEEE_06-2010_NSS_2010_ASPECTOS_DESTACADOS_DE_SU_EVOLUCION.pdf «The new strategy [National Security Strategy 2010] recognises that the external strength and influence of the US begins with the internal measures that are adopted: economic growth and deficit reduction, education for competing in the age of knowledge and of global markets, development of clean energies for industry that free the US from foreign oil and preserve the planet, promotion of science and research; in short, they regard innovation as the cornerstone of US power.» (translated from the Spanish)

fence institutions (118) and international organisations, (119) making it possible to open up one of the most important channels for innovation and technology, namely civil-military and international collaboration. Clear examples of the foregoing are the programmes developed by the European Defence Agency (120) and the NATO «Science for Peace and Security» programme. (121)

The ETID-2010 that stems directly from Defence Planning and supports its development is structured into six functional areas, one of which covers platforms, materials and energy. In this connection on 3 November the SDGTECIN (122) held a technological conference at the ITM centred on energy needs at the deployed bases and the possible existing solutions currently being developed by the Technological Observatories (Observatorios Tecnológicos). (123) The latest work conducted has given rise to a few projects which also underline the interconnection between all the functional areas of research:

- *Self-generation systems for deployed bases, such as photovoltaic and micro-wind*, and hybrid hydrogen/fuel cell systems.
- Radar Systems with Gallium Nitride or Silicon Carbide Components, which allow the equipment to function at high temperatures without need for refrigeration and with greater power than currently. This case underlines another of the challenges of Climate Change, this time in relation to the need to develop systems that maintain maximum operational capacity in extreme temperature situations.
- Solar energy driven high-altitude surveillance UAVs (Unmanned aerial vehicles).
- Rechargeable batteries on missions; this links up with the projects being run in practically all nations on the highly technified combatant of the future, one of the key aspects of which will be batteries that support the cutting-edge technology incorporated, to grant them unlimited autonomy and readiness.

(118) INTA (Instituto Nacional de Técnica Aeroespacial «Esteban Terradas»; ITM (Instituto Tecnológico la Marañosa; and CEHIPAR (Canal de Experiencias Hidrodinámicas de el Pardo)

(119) EDA (European Defence Agency) and RTO (NATO Research and Technology Organisation)

(120) <http://www.eda.europa.eu/newsitem.aspx?id=660>

(121) <http://www.nato.int/science/index.html>

(122) Subdirección General de Tecnología e Innovación

(123) <http://www.mde.es/areasTematicas/investigacionDesarrollo/sistemas/#sub5>

- Thermal insulation materials in tents and camps, involving both the replacement of tent fabrics by new materials and the use of insulating foam. (124)
- Replacement of materials such as steel and other metal structures by other lighter ones such as aluminium and carbon structures which, in addition to boosting energy efficiency, improve the manoeuvrability and, basically, the operability of the units.

As to the environmental impact of all the technological areas and the tangible benefits of innovation in these fields, the US Navy, with its NMCI (Navy-Marine Corps Intranet) project, which is considered the largest intranet in the world, reckons that virtual programmes have made it possible to reduce 6,800 tons of CO₂ emissions, the equivalent to removing 2,550 cars from circulation, and these reductions are expected to increase to 7,446 tons when the project has been completed. (125)

Another of the areas on which the US is placing greater emphasis in research is in fuels and energy generation and storage systems. The US Navy, which flew a F/A-18 Super Hornet fighter plane powered by a 50:50 biofuel blend for 45 minutes on «Earth day», 22 April 2010, proposes deploying a combat group with two less contaminating sources of energy, nuclear and biofuel, in 2010, and in 2016 a green fleet with all units, including aircraft, powered by cleaner fuels, including hybrid electric systems. (126)

In the case of Spain, for his inaugural address to the Royal Academy of Engineering, Vice-Admiral Sanjurjo (127) ruled out nuclear propulsion for the Navy and advocated integrated electric propulsion with engines and generators based on superconductor technology, using hydrogen as a primary fuel. For the development of the propulsion plant of the new generation of submarines, Spain is working on a system of fuel cells fed by hydrogen produced on board from bioethanol. In one part of his ad-

(124) <http://www.independent.co.uk/environment/climate-change/armies-around-the-world-go-green-to-save-fuel-and-lives-1662954.html> «One simple innovation – insulating tents in Iraq and Afghanistan with a layer of hard foam, reducing the need to heat and cool them – has saved 100,000 gallons of fuel a day.»

(125) http://www.vmware.com/files/pdf/customers/09Q3_cs_vmw_NMCI_Green_english.pdf visited on 10.10.2010

(126) Proceedings. June 2010. Pp. 80-81. «Alternative fuels for the Navy». Colonel Bill Siuru, US Air Force (Retired).

(127) http://www.real-academia-de-ingenieria.org/docs/2009/10/29/09500001_4_8_0.pdf visited on 10.10.2010

dress Vice-Admiral stated «I do not rule out the possibility of the frigate Jorge Juan being driven by hydrogen! It is very possible that this century will witness the hydrogen revolution in parallel with the digital revolution».

But the progressive *adaptation* of Defence to the strategic and operational environment of the new missions, in which the phenomenon of Climate Change may be considered a lingering factor, has been constant as to development of its preparedness, organisation, and operational means. The need to provide a response to natural disasters and the rapid proliferation of peace and humanitarian missions conducted by international organisations (128) have given gradual impetus to these developments.

Organic Law 5/2005 on National Defence refers specifically to the activity of the armed forces overseas as «observers, intervention, peace-keeping and humanitarian assistance forces». (129) In order to carry out these activities, the law establishes two basic elements: on the one hand, an organisation that makes joint action of the forces possible; and, on the other, a structure that allows a clear distinction to be drawn between the organisational chain for force preparation and the operational chain for use in the missions assigned to them. This law furthermore establishes four types of basic tasks: constitutional; peacekeeping, stability and humanitarian assistance; collaboration with the other state institutions and public authorities in cases of serious risk, disaster, calamity or other public needs; and the evacuation of Spaniards residing abroad.

This legislative vision is corroborated by a *reality* that seems inexorable. On the one hand, the armed forces need to be involved in humanitarian assistance such as that provided by Spanish navy ships in Central America following the devastation caused by Hurricane Mitch in 1998; (130) in response to the tsunami that ravaged the Indonesian coasts in December 2004; and, more recently, after the devastating consequences of the earthquake in Haiti. These operations underline the unique capa-

(128) <http://www.un.org/en/peacekeeping/>
<http://www.consilium.europa.eu/showpage.aspx?id=268&lang=EN>
<http://www.nato.int/cps/en/natolive/index.htm>
<http://www.osce.org/>

(129) http://www.mde.es/Galerias/docs/politica/seguridad-defensa/DGL_Ley5_2005DefensaNacional.pdf

(130) http://www.armada.mde.es/ArmadaPortal/page/Portal/armadaEspannola/conocenos_actividades/deLaFuerza--918_Apoyo-Humanitario-Haiti-Castilla-2010 visited on 30.08.2010

bilities of military units in the initial post-disaster period in the absence of support infrastructure in the disaster area.

The *readiness* of military units for immediate autonomous projection and their joint action on land, at sea and in the air without the need for support infrastructures in the area of operations allows them to provide immediate assistance of any kind and prevent outrages from being committed in the absence of local authorities, in addition to supporting the reconstruction of essential systems that make possible the arrival of civilian assistance and the reestablishment of basic services. During the summer of 2010, when Pakistan suffered the worst flooding in history, these missions became an absolute priority for the Pakistani army, which was supported by US army units that provided assistance that was of outstanding importance, transferring elements from the conflict areas of the Afghan theatre of operations.

As is only logical, the importance of these natural phenomena and their recurrence modifies defence planning, affecting the *capabilities* required by many units. A good example of the foregoing is the Spanish navy's new strategic projection ship which meets the challenges of the century from an approach that is both global and integrates its capabilities. (131) Another of the most salient features of military adaptation to these phenomena is the creation of units that are specially organised, equipped and trained for these tasks. Also important is preventive planning and selective use of some of the capabilities of specific rapid reaction units for the performance of assignments of this kind.

An example of the former is the setting up of the Emergency Military Unit (132) which, in addition to operating on national territory, performed its first overseas assignment searching for survivors after the Haiti earthquake. (133) It is important to underline that the international interest units of this type arouse was stressed during its 5th anniversary celebra-

(131) http://www.armada.mde.es/ArmadaPortal/page/Portal/ArmadaEspañola/conocenos_noticias/00_noticias/2010/09/NT-286-Entrega-BPE-JCI_es?_selectedNodeID=432499&_pageAction=selectItem&_selectedNodeID=432499&_pageAction=selectItem visited on 10.10.2010. <http://www.servimedia.es/Noticias/DetalleNoticia.aspx?seccion=1&id=70394> visited on 30.08.2010. <http://www.ingenierosnavales.com/ponencias/BPE-NAVANTIA.pdf> visited on 30.08.2010.

(132) <http://www.mde.es/ume/>

(133) http://www.mde.es/ume/noticias/2010/01/Noticias/2010_01_15.html

tions. (134) However, the unit which might have been considered most emblematic owing to its characteristics (SHIRBRIG (135) Multinational Standby High Readiness Brigade for United Nations Operations) was short lived and ceased to exist on 30 June 2009. (136)

To cite an example of the second case, part of the troops of the NATO Response Force (NRF)(137) were used in response to the disaster caused by the earthquake that ravaged the area to the northeast of Pakistan's capital, Islamabad, in the extensive Kashmir region along the Indian border. The operation was directed by Spain, then leader nation of the NRF.

Another aspect that is influenced by Climate Change and is likely to become more widespread and dramatic is the current world map of potential *conflict*, consisting of states with cracked foundations, conflict factors deeply rooted in the strategic trends analysed above, and an incessantly growing spiral of violence. This map current extends to one-third of the world's population.

According to the figures supplied by the studies conducted by NATO for its cycle of conferences on the new security challenges, (138) there are currently at least 40 international operations (139) led by the UN, the EU, NATO and other regional organisations. Nearly every week the UN requests greater support for all kinds of security and humanitarian operations in the so-called «incessant demand for international security forces». The UN Security Council, which authorised only 16 operations between 1945 and 1990, has started 49 since the end of the cold war. What is more, the cost of operations of this kind has progressively risen from 1.5 billion dollars in 1990 to the current figure of around 8 billion dollars a year. But these figures have a special significance when we consider that the cost of security operations is four times greater when they are led by the West. The cost of military intervention in Iraq and Afghanistan has risen above one trillion dollars, so far half of what the

(134) http://www.mde.es/gabinete/notasPrensa/2010/10/DGC_101007_Dia_Institucional_UME_2010.html visited on 18.10.10

(135) <http://www.shirbrig.dk/html/main.htm>

(136) http://www.shirbrig.dk/html/the_end_of_shirbrig.htm

(137) http://www.nato.int/cps/en/natolive/topics_49755.htm

(138) http://www.nato.int/cps/en/natolive/news_59989.htm?selectedLocale=en visited on 23.10.10

(139) <http://www.un.org/en/peacekeeping/currentops.shtml>

<http://www.consilium.europa.eu/showpage.aspx?id=268&lang=EN>

http://www.nato.int/cps/en/natolive/topics_52060.htm#current visited on 23.10.10

Second World War cost. The possibility of it soaring to two trillion dollars is real, as the Afghanistan conflict is costing about 300 billion dollars per year, between half and one million dollars per American soldier deployed in Afghanistan per year. These figures put into perspective the economic cost of combating Climate Change and General Gordon R. Sullivan's reminder that we will pay today or tomorrow, but the longer we leave it the cost will not only be a question of money but involve a large number of human lives.

In July 2010 there were some 100,000 blue helmets, amounting to an increase of 600% over the past 20 years, with 116 countries contributing to this effort. (140) In the first 10 years (1999-2009) of the European Security and Defence Policy (ESDP), renamed Common Security and Defence Policy (CSDP) by the Lisbon Treaty, the EU has launched 23 missions, and NATO has led 15 operations since beginning its out-of-area intervention in 1992.

The drama of this situation is heightened by the daily figure of the 2,000 deaths caused by conflicts of this kind over the past 20 years. But perhaps the most tragic aspect of this reality is that the many of those killed are civilians, mainly women and children. This led to the declaration of the «Responsibility to Protect» doctrine, (141) which was adopted at the UN World Summit in 2005 and is rooted in the concept of «Human Security» and the right of humanitarian intervention. The European Security Strategy (2003) (142) puts the death toll at 4 million since 1990, 90% of them civilians. It also estimates that 18 million people have been displaced on account of these conflicts. The UN's latest statistics as of the end of 2009 (143) show the highest number of displaced people since the mid-1990s.

This context explains the active and constant *participation* in peace and humanitarian assistance operations. This participation ensures that military capabilities are constantly evolving and brings them face to face with the need for integration in a multi-sectorial effort to rebuild peaceful

(140) <http://www.un.org/en/peacekeeping/contributors/> visited on 02.11.10

(141) <http://www.responsibilitytoprotect.org/>

(142) <http://www.consilium.europa.eu/showPage.aspx?id=266&lang=ES>

(143) <http://www.unhcr.org/4c11f0be9.html> «There were 43.3 million forcibly displaced people worldwide at the end of 2009, the highest number since the mid-1990s. Of these, 15.2 million were refugees; 10.4 million who fell under UNHCR's responsibility and 4.8 million Palestinian refugees under UNRWA's mandate. The figure also includes 983,000 asylum seekers and 27.1 million internally displaced persons (IDPs).»

coexistence and re-establish the conditions needed for the development of societies structured around the three basic principles enshrined in the Spanish Constitution: justice, freedom and security.

In 2008 the UN completed its sixtieth year of uninterrupted action in the so-called peacekeeping operations.⁽¹⁴⁴⁾ For its part, in 2009 Spain celebrated the twentieth anniversary of its first participation in a peace mission, recognising the major contribution this involvement has made to the modernisation and transformation of our armed forces. ⁽¹⁴⁵⁾

But this *modernisation and transformation* is in constant motion and neither can it be stopped nor does it have a final destination. As President Obama stressed at West Point during the presentation of the new national security strategy, ⁽¹⁴⁶⁾ preparation and training play a fundamental role. The importance of understanding the culture, traditions and language of the societies to which the units are deployed is of crucial importance. In this respect the final part of the six-month training Spain provides prior to each mission focuses on the basic characteristics of the mission and the specific theatre of operations.

As to the *evolution* of the means and capabilities possessed by the units, the force objective includes three areas that deserve special attention. There appears to be little controversy about the first two, although much remains to be done and efforts never seem to be enough:

- Protection of units during deployment using the most advanced material, both offensive and defensive. It is essential to avoid any kind of accidents and equip them with the most technologically advanced capabilities in order to perform the assignment, as well as with the best self-protection means. Spain recently set up a Coun-

⁽¹⁴⁴⁾ <http://www.un.org/events/peacekeeping60/factsheet.shtml>

⁽¹⁴⁵⁾ Quoted by SEGENPOL on 27 October 2009, in the inaugural lecture of the seminar of the Instituto de Cuestiones Internacionales y Política Exterior (INCIPE): «de Angola a Somalia: evolución de la participación española en misiones internacionales de paz». «Without wishing to go into a philosophical disquisition on which process has been most significant to our Defence, I would venture to say that the experience of the Armed Forces' involvement in peace missions has been the catalyst of the major process of transformation and change our army, air force and navy have undergone. In this case, it may be categorically affirmed that this function is spurring a continual adaptation of the organisation of our Defence and of military capabilities to a strategic landscape that is constantly evolving.» (translated from the Spanish)

⁽¹⁴⁶⁾ http://www.ieee.es/Galerias/fichero/2010/DIEEE_I03-2010_INFORMATIVO.CLAVES_DE_LA_NSS_NORTEAMERICANA._DISCURSO_WEST_POINT.pdf

ter-Improvised Explosive Devices (C-IED) Centre of Excellence in Hoyo de Manzanares, making it the centre of reference in the development of the means necessary to counter this threat, which is among those that cause the highest number of victims in security operations.

- Transport capability at all three levels: strategic, operational and tactical. Unit readiness is not efficient unless the projection capability allows rapid deployment, in addition to sufficient mobility in the area of operations. Without this mobility, efficiency sinks to a level at which the entire mission is at risk, and the vulnerability of the force soars to an intolerable level. In addition to this transport capability, the so-called support services, particularly health and engineers, are now considered essential. Chronic shortcomings in this area are number of vessels, strategic transport aircraft, helicopters and health personnel.
- The third of the areas is more polemical and in some cases triggers heated debates: (147) quantity versus quality. There seems to be no doubt that more of everything is required—more troops, helicopters, communication equipment, ships, etc. In the latter case, the falling number of units in western fleets is cause for serious concern, given that sea policing and maritime security are regarded as essential tasks which will become even more necessary if the effects of Climate Change continue according to the most pessimistic projections. Despite their undeniable progress, reporting and monitoring systems are considered insufficient.

But while everyone seems to agree on the need for quantity, the loss of the conventional deterrent capability provided by the technological advantage of highly sophisticated units and the resulting need for major investments in extraordinarily costly systems does not elicit the same consensus. The situation is particularly delicate bearing in mind the economic landscape of major cuts and the substantial economic interests behind the most important armaments programmes. Basically, loss of the conventional deterrent capability is regarded as a risk that nobody wants to run, especially in view of the uncertainty and threats associated with a strategic situation whose development is unpredictable.

Another very important aspect to consider is *anticipation*. There can be no doubt that the development of any conflict amounts to failure of

(147) http://news.bbc.co.uk/2/hi/uk_news/8466961.stm

the peace and security architecture, its warning systems and confidence and prevention measures. These systems must be a priority. It is reckoned that 85% of the conflicts which have arisen in the past twenty years have been detected in time for preventive action. (148) This leads us to consider the need to create security systems with sufficient diplomatic and economic means, as well as civilian and military capabilities and the command and control assets required to manage crises appropriately at the first sign of trouble.

But monitoring and correctly interpreting the warning signs of a conflict require intelligence services capable of coordinating their activities and fostering international cooperation in order to provide a comprehensive response to global security threats. (149) The US has set up a special division of the Central Intelligence Agency (CIA) (150) with specialists and resources capable of carrying out assessments and analyses and developing proposals for anticipating the effects of Climate Change. Also noteworthy in this field is interest in spatial and meteorological systems, as well as in special equipment for investigating the different strata of glaciers, which can give an idea of the characteristics of the periods in which the earth's temperature was as much as 6 degrees higher than it is currently. (151)

But we should not end this section without specifically mentioning the approach described by DDN 1/08 as «multidisciplinary and comprehensive action», NATO's «Comprehensive Approach», and the EU's «Common Security and Defence Policy» in which preparedness, planning and single action with combined civilian and military capabilities, in addition to the effective coordination of public and private resources, make it possible to break away from the tendency for sectorial actions, which is one of the most dramatically marked tendencies of our political systems.

(148) Paddy Ashdown. UN High Representative for Bosnia-Herzegovina from 2002 to January 2007. Author of the book «Swords and Ploughshares» (Wiedenfeld and Nicolson)

(149) http://www.mde.es/Galerias/docs/politica/seguridad-defensa/DGL_DirectivaDefensaNacionalESP.pdf (DDN 1/08)

(150) <https://www.cia.gov/news-information/press-releases-statements/center-on-climate-change-and-national-security.html> (visited on 10 October 2010)

(151) <http://www.rfi.fr/science/20100705-le-glacier-punjak-jaya-perd-environ-7-metres-an> (visited on 5 September 2010)

CONCLUSIONS

The time [for bringing the security aspects of Climate Change to the NATO table for discussions to get a view of what the challenge is and what the way forward might be] has come for a change in our approach. First we now know enough to start moving from analysis to action... [the effects] are clear enough that we... begin taking active steps to... this global challenge....But as I said throughout, this cannot be done by the Defense people alone; it has to be a true team effort, civilian and military, public sector and private companies as well, all talking together and working... mutually reinforcing efforts. That might seem unrealistic to those of us who have been in politics for some years. No glacier is as imposing, no desert... as impossible as stovepipes within government. Then again sailors never thought the mythical Northwest passage would ever open, but it is opening. Anything is possible. (152)

In conclusion, in order to sum up the previous sections, I will begin by forecasting possible future scenarios, ending with a SWOT analysis (153) of the impact of Climate Change in relation to the international peace and security architecture, and the development of the state of the defence world.

The summary includes three scenarios. The first two are labelled «preferred future» and «most possible future», and the third is a pessimistic possibility in which the constant progress of mankind is interrupted and in which insecurity, chaos and ruin endanger the degree of human development achieved. (154)

(152) http://www.nato.int/cps/en/natolive/news_57793.htm?selectedLocale=en. NATO Secretary General Anders Fogh Rasmussen delivered a keynote address on NATO's role in response to piracy, cyber threats and the security implications of climate change at a conference organized jointly by NATO and Lloyd's of London on 1 October 2009.

(153) SWOT: Strengths, Weaknesses, Opportunities and Threats.

(154) Jean Claude Barreau, Guillaume Bigot. «Toute l'histoire du monde: de la préhistoire à nos jours». «Barbarous times or decline. Since the beginning of history mankind's progress had been constant. When an incredible happening occurred in the year 410 of our era... It might be believed that the whole of civilisation disappeared until the 10th century... Anarchy triumphed. Anarchy kills more than war... Anarchy is much more destructive than battles governed by rules... The population had fallen by 70%. Insecurity entails hunger, the death of cities and of trade... Everywhere, with the course of the tide, anarchy causes hunger and the disappearance of schools... The barbarous times, those centuries of anarchy and massacres, without

Three forecast horizons:

1. «*Preferred future*». A treaty to succeed the Kyoto Protocol is negotiated and the international peace and security architecture begins to be relaunched with a much more comprehensive and cooperative vision. Development is balanced and becomes fairer and more human. Habits change and the first signs are glimpsed of humankind's cohabitation with the natural environment, and the rate of Climate Change attributable to human intervention gradually returns to the natural patterns of the pre-industrial era.
2. «*Possible future*». A treaty to succeed the Kyoto Protocol is negotiated, but the world continues with the same security structures which scarcely delay the worst forecasts. The world progressively cracks up with increasingly isolated and antagonistic regional structures without a global agency to provide a common vision of problems. The gap between the West and the rest of the world widens owing to its greater resistance capacity and renewed innovative effort, which accords it greater independence. The technological advantage enjoyed by the West, which protects it effectively from the most harmful effects of Climate Change, increasingly isolates it in a world that is becoming impoverished, with ever greater differences between rich and poor. This dehumanisation threatens the basic foundation of solidarity which underpins the three basic elements of the western peace and security structure—the UN, the EU and NATO, which are perceived by society as an intolerable imposition.
3. *Pessimistic*. There is no agreement on signing a treaty to succeed the Kyoto Protocol. Efforts are not coordinated and, despite the developed world's efforts, Climate Change progresses according to the worst forecasts. In this situation chaos, instability and insecurity take over the world, triggering isolationist and self-help tendencies that lead to populist and extremist authoritarian systems.

SWOT analysis

1. *Strengths*

- 1.1. Security architecture has increasingly major mechanisms for action vis-à-vis the risks and threats that endanger the normal

schools or trade, almost without cities, were a dreadful period.» pp. 98-107. (Translated from the French)

progress of international relations. What is more, the effects of Climate Change can be so devastating that the great majority of nations regard international cooperation as the only possibility of combating its consequences. Also, the possibility of a new post-industrial era in which development will be more human and fair arouses great hopes that give rise to important collaboration projects.

- 1.2. The progress of the Common Security and Defence Policy and the level of political development achieved by the EU give it the potential to become the major global actor in the fight against Climate Change. NATO in turn, with the new Strategic Concept, is consolidating its position in the security structure, strengthening the transatlantic link and solidarity between Allies. Also, the various regional security organisations such as UNASUR,¹⁵⁵ the AU, the ASEAN and the Arctic Council, to name a few, are playing a crucial geostrategic role in a responsible manner as moderators and instruments of close and direct support in a transition that will cause many wounds and poses a not inconsiderable number of challenges.

2. Weaknesses

- 2.1. An international peace and security architecture which was established after the Second World War and has not evolved in pace with the new global geopolitical situation heightens the perception of a world controlled by an unfair security system. The West is blamed for the developments in the situation by preventing a change that encourages the cooperation and collaboration needed to stem the effects of Climate Change.
- 2.2. The Defence world, despite the progressive adaptation of its strategic thought and operational planning to the new environment, finds itself constrained when it comes to putting it into practice by the inability to incorporate into its «multidisciplinary and comprehensive action approach» the rest of the sectors of society, which are reluctant to see the armed forces play a bigger and more general role in relation to security.

(155) UNASUR (Unión de Naciones Suramericanas); AU (African Union); ASEAN (Association of South East Asian Nations);

3. Opportunities

- 3.1. Thanks to the existing international peace and security architecture and available technological advances, the deep, global challenge that Climate Change signifies is a major opportunity for states to engage in supportive and coordinated action allowing its structures to evolve towards a new design in which all societies feel they are fully represented.
- 3.2. The new security space is defined with an integrating vision in which Defence is one of various tools, where the different capabilities needed to prevent and manage conflicts quickly and effectively at any stage of their development are combined, and in which solutions are permanent. Prevention systems are the principal tool thanks to cooperation and technological resources. Direction resources and control and command capabilities are centralised at the political-military strategic level, while action is decentralised and located in the area where the conflict originated.

4. Threats

- 4.1. The current security architecture in which states are the reference point could lose its capacity for effective action owing to the impossibility of achieving consensus. The lack of understanding of a system grouped into supranational, regional and world organisations renders it incapable of preventing conflicts and providing the necessary assistance, triggering the reaction of a society which seeks to protect its interests and ensure its physical security in closer and more efficient groups. Warlords, family clans and organised criminal groups become the paradigm of the new security system.
- 3.2. As a result of the intervention in Iraq and Afghanistan and given the proliferation «sine die» of the increasingly frequent security operations, the defence world could lose the confidence of society, which approves drastic cuts in its budgets. This spiralling loss of credit ends up undermining one of the key elements of peacekeeping, security and international stability. .

I shall end with two quotes which I believe perfectly sum up the vision presented in this article. The first is from a review of two books on Climate Change published in the 4 September 2010 edition of *The Econo-*

mist, which ends by stating that both «look at the opportunities as well as the costs; they encourage as well as warn. And both remember that there will be some things that cannot be saved, even though others may not be lost.» The second is the last sentence spoken in the NATO lecture with which the article began: «Faced with the risk of Climate Change, mankind stands everything to lose, but perhaps it also stands everything to gain.» (156)

(156) http://www.nato.int/cps/en/natolive/news_59989.htm?selectedLocale=en 4 December 2009. Series of NATO lectures on the new security challenges. Dr Jamie Shea, Director of Policy Planning in the Private Office of the Secretary General, and former NATO Spokesman.

CHAPTER SIX

NATIONAL ENERGY POLICY PLANNING HORIZON 2030

NATIONAL ENERGY POLICY - 2030 PLANNING HORIZON

ANTONIO CUEVAS DELGADO

SUMMARY

The steady rise in the world's population, coupled with the rapid growth of economic activity in certain areas of the world, is causing major imbalances in the world energy cycle. Pressure on primary energy sources pushes up prices and increases risks to security of supply in the medium and long term. Higher world energy consumption in turn generates greater CO₂ emissions, affecting climate change.

For the more developed nations—the great majority of which lack energy resources—guaranteeing security of energy supply is crucial to maintaining their industry, economy and model of social wellbeing. Technological development together with efficiency and energy saving are the best options for reducing energy dependence and CO₂ emissions simultaneously.

Energy security is not only a problem of guarantees between supplier countries, transit countries and consumer countries; it is also a firm commitment towards a sustainable energy model. Although energy and the environment are taken into account in our national security system, we need to continue to advance and translate the defence implications into the design of our future energy model.

Keywords: Sustainability; Security of supply; Competitiveness; Energy dependence; Climate change; National security.

INTRODUCTION

As mankind progressively evolves and attains a higher degree of development, demand is increasing for the energy needed to sustain the fast

growth pace of the emerging countries and those at less advanced stages of development. For the most developed nations, the great majority of which lack indigenous energy resources, securing energy supply is essential to maintaining their economic level and model of social well-being.

The current rapid growth in economic activity in certain regions of the world are experiencing is causing major imbalances in the world energy system. A group of countries known as the BRICs (Brazil, Russia, India and China), which have in common a large population, a vast territory, huge natural resources and sustained GDP growth of about 10% in recent years, account for most of the world growth in energy consumption. These circumstances are exerting a considerable pressure on primary energy sources, pushing up prices and also increasing the risks to security of supply in the medium and long term. Most of the gas and oil importers depend on supplies from areas characterised by some measure of uncertainty, be it legal, economic or political.

What is more, greenhouse gas emissions are continuing to increase, and their greater impacts on the environment are making the current energy system increasingly more difficult to sustain.

We are therefore facing a highly complex crossroads: how to produce the energy the world requires without exhausting available resources and at the same time reduce global CO₂ emissions before it is the effects are irreversible—a complicated task is indeed indeed..

Perhaps the only way out of solution to this complex situation is if for all nations to become aware of the problem, as is occurring in Europe, and to work hard to improve efficiency and savings both in household consumption and in the productive, transport and service industries.

In the electricity sector it is necessary to continue to introduce low CO₂ emission power generation technology such as renewables, while maintaining sufficient back-up power (nuclear, combined cycle, etc.) to guarantee the balance of the system. Both issues entail an increase in the end price of electricity for citizens, and it is therefore essential to take action on the regulatory framework in order to reduce the time renewable energy plants take to reach break even. If we do not tackle this question as soon as possible, we will be slowing down their installation process as it will not be possible to finance the cost increment they generate.

The transport industry, which is responsible for nearly 30% of CO₂ emissions, consumes 40% of final energy and depends almost exclu-

sively on oil imports. A priority concern should be to implement emission-reduction and electrification policies, encouraging the use of collective transport and electric vehicles .

Coordinated policies of a similar kind are needed in the rest of the sectors, and in all of them it is essential to assign more funds, both public and private, to research into new energy sources and production and storage methods, as well as the installation of advanced telematic operation and management networks in transport and electricity transmission and distribution.

THE GLOBAL ENERGY SITUATION

Developments and trends

In recent years the energy sector has undergone deep changes, and this has been reflected in the political, economic and social sphere and in defence-related geostrategic issues that are related to defence. According to the latest report of the International Energy Agency (IEA), (1) IEA since 1995 the so-called emerging countries have accounted for practically 90% of the growth in world energy consumption. These countries' substantial economic growth has caused a shift in the centre of gravity of world energy consumption. The average economic growth of the OECD countries over the past 20 years is 2,2%. The growth of the emerging countries is 7%. The current economic crisis has widened this gap very significantly in the past two years. This higher growth means greater energy consumption.

In 1985 primary energy consumption in the USA tripled that of China; by 2009 both countries' consumption levels were consuming practically the same; and during 2010 China will become the world's biggest energy consumer.

Another significant factor regarding the energy sector during those years is related to the price level. From 1985 to 2005 the price per barrel of oil remained at moderate levels and was relatively stable, fluctuating between 10 and 30 dollars. However, since 2005 both the price level and price volatility have increased. In the past three years alone the price per barrel has soared to 150 dollars and dipped to 40 and is again approaching the 100-dollar barrier.

(1) «World Energy Outlook 2009» (WEO 2009)

Furthermore, during the previous century environmental awareness played a secondary role in social debate. Concerns were focused on the effects of production methods on health and quality of life. In recent years scientific research has shown the environmental issue to be a worldwide priority, warning of alerting us to the impacts of human activity on the climate and on biodiversity. Today the most pressing concern of scientific, social and political institutions all over the world is centred on the challenge of ensuring sustainability and preserving the balance of nature during the present generation and for generations to come.

The new challenges

Analysing the challenges we face in the light of the foregoing is a complex task that involves finding unknown quantities and which we cannot be resolved in the short term. Issues such as the results of the forthcoming Climate Change Summit in Cancun (2) and, accordingly, the sustainability scenarios or production and consumption trends that will prevail in the future are determining factors and take time owing both to their own evolution and to the pace of scientific and technological development relating to energy; what we need to know is how long we have to make decisions. This article examines the most significant factors:

- *World population growth*
- *Primary energy sources.*
- *Climate change*
- *New energy technologies.*
- *Energy as a strategic consideration*

World population growth

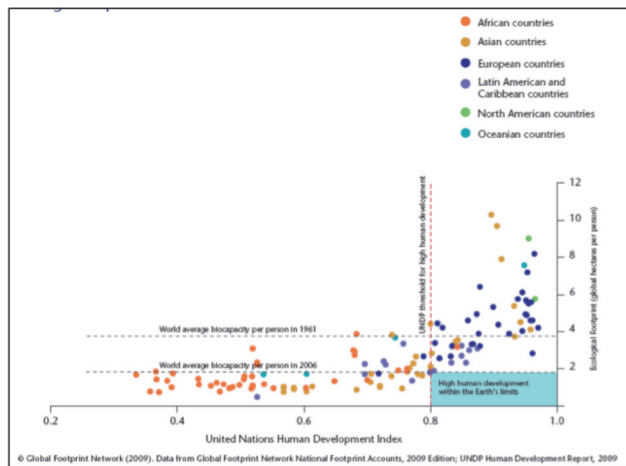
According to the United Nations' estimates, the world's population will go from the current 6.9 billion to more than 9 billion by 2050. Ninety-eight percent of this growth will take place in emerging and developing countries. The population will double in urban areas.

The purchasing power of large sectors of the population of emerging areas will increase, improving access to food, water and health services, although inequality will also increase and extreme poverty will continue. More people will attain a middle-class standard of living, consuming more resources and leading to triggering an upward trend in the demand for energy.

(2) The Cancun Climate Summit will take place at the end of 2010

The report *Vision 2050* (3) states that in order to progress towards a sustainable future, the world must address global policy issues—, how to help countries improve their development levels, at the same time reducing their environmental ecological impacts—, but it will also be necessary to tackle questions such as the concepts of success and progress, not only in economic terms but also in terms of environmental and social impact. The following chart sums up the challenge of sustainable development: *to meet people's needs within the ecological limits of the planet.*

Graph 1: Ecological footprint s. human development index in different countries of the world



Source: Global Footprint Network

The above analysis shows the current behaviour of the various countries and the Human Development Index HDI (4) of the United Nations.

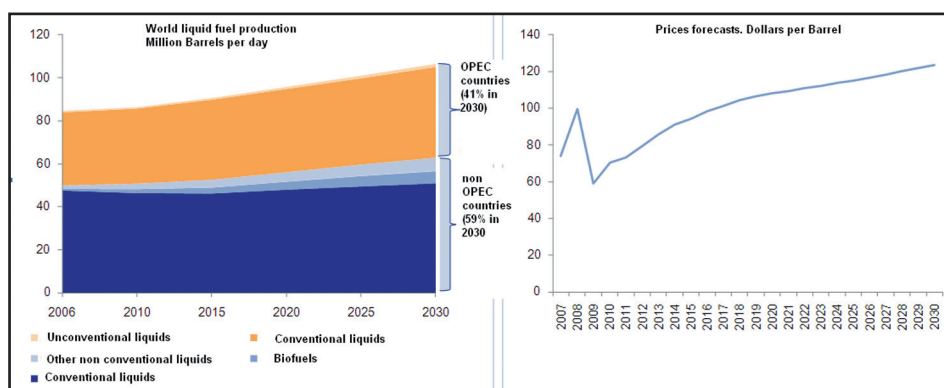
- (3) *Vision 2050 - The new agenda for business* is a report drafted by 29 companies belonging to the World Business Council for Sustainable Development (WBCSD).
- (4) The Human Development Index (HDI) is an indicator of human development per country, compiled by the United Nations Development Programme (UNDP). It is based on a statistical social indicator consisting of three parameters:
 - A long and healthy life: Life expectancy at birth
 - Access to knowledge: Mean years of schooling and Expected years of schooling
 - A decent standard of living: GNI per capita (PPP US\$)
- A long and healthy life (measured by life expectancy at birth) Education (measured by adult literacy rate and combined gross enrolment rate for primary, secondary and higher education, and years of compulsory schooling).
- A decent standard of living (GDP per capita in dollars).

srDevelopment Programmo DUNDP) aand the Ecological Footprina (5 of Global Footprint Network. In the countries situated to the left of the vertical line representing an HDI score of less than 0.8, a high level of development according to the UNDP definition has not been achieved. In the countries situated above the horizontal dotted line and to the right of the vertical line, a high level of development has been achieved, but this puts more demandsplaces more demands on nature than it could endurebear ifwere the whole of the world's population livedto live in this way.

Primary energy sources

According to the IEA, world oil and gas resources will be sufficient, at least until 2050, but there is no guarantee they will be exploited fast enough to keep pace with the demand forecast in the aReference Scenario» (6). Other estimates consider that gas and oil reserves will last between 60 and

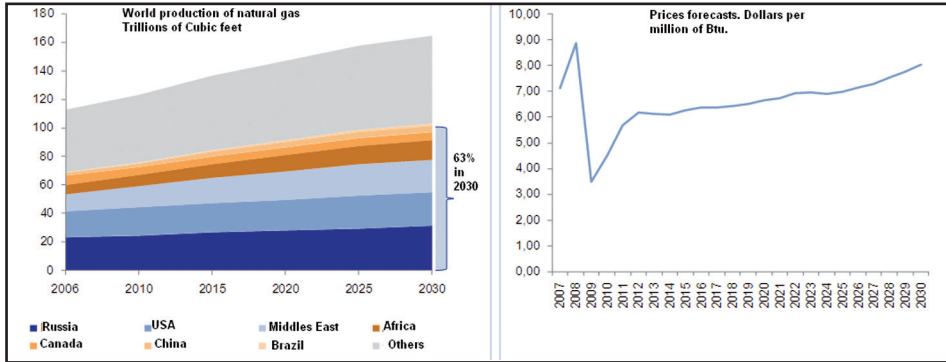
Graph 2: World liquid fuel production and prices forecasts



Source: Energy Information Administration (EIA) – International Energy Outlook 2009 and historical data

- (5) The *ecological footprint* is an aggregate indicator defined as «the amount of biological-ly productive land (crops, pasture, forests or aquatic ecosystems) required to produce the resources used, and to assimilate the waste produced, by a defined population at a specified standard of living, indefinitely». Its main purpose is to assess the impact on the planet of a particular mode or way of life, compared to the biocapacity of the planet. It is a key indicator of sustainability .
- (6) The «Reference Scenario» in the IEA's *report WEO 2009* describes the situation that would arise in the absence of specific policies to change the course of the increase in CO₂ emissions. It assumes that world energy demand will increase by 1.5% annually between 2007 and 2030, leading to a CO₂ concentration in the atmosphere of more than 1.000 ppm (parts per million).

Graph 3: World production of natural gas and prices forecasts



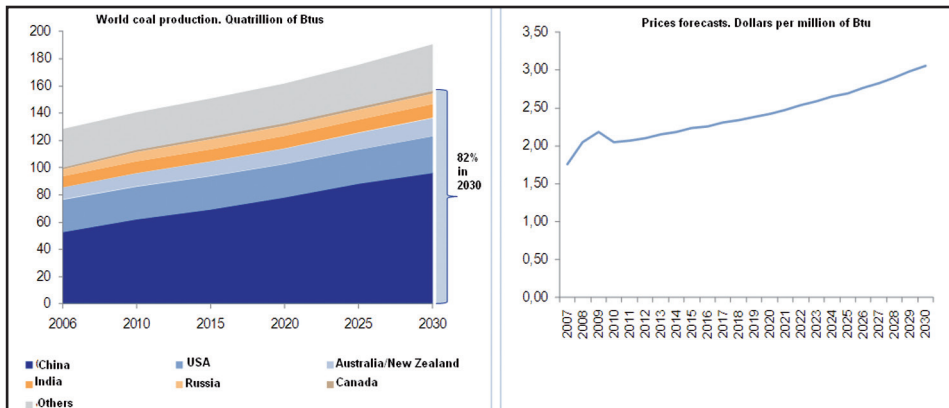
Source: Energy Information Administration (EIA) – International Energy Outlook 2009 and historical data

70 years. Eighty percent of oil reserves are concentrated in just eight countries (approximately 60% of these reserves belong to OPEC countries).

Gas production is increasing significantly and so is demand. Russia is the world's leading producer together with the Middle Eastern countries (Iran, Saudi Arabia, Qatar and the United Arab Emirates) and those of Africa (Algeria, Egypt and Nigeria). The new technologies currently being developed in the USA could provide additional reserves.

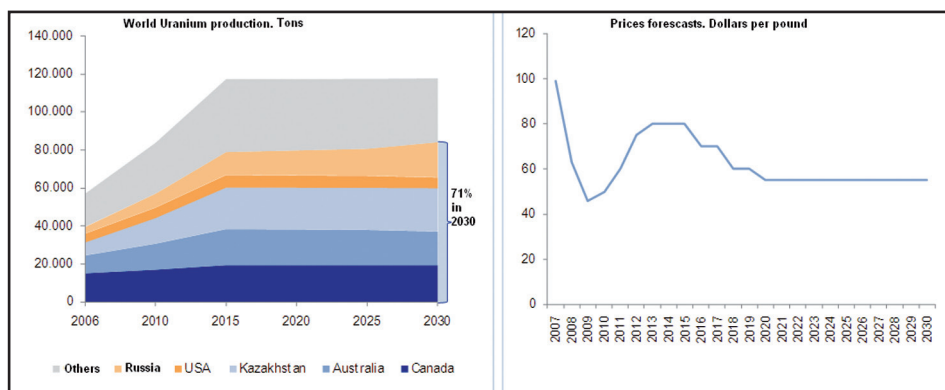
Coal reserves are more abundant and more evenly distributed and are located in countries with a high consumption such as China and the United States. India, Canada, Russia and Australia also possess large

Graph 4: World coal production and prices forecast



Source: Energy Information Administration (EIA) – International Energy Outlook 2009 and historical data

Graph 5: World uranium production and prices forecast



Source: World Nuclear Association – Uranium Outlook and prices forecast

reserves. Nevertheless, intensive coal use will call for the development of CO₂ capture technologies to make it compatible with environmental sustainability targets.

Demand for uranium is expected to increase from the current 80,000 tons to 120,000 tons by 2030 as a result of the plans to build new plants and the development of new nuclear technologies, some of which are already at the demonstration stage. Five countries (Canada, Australia, Kazakhstan, Russia and the United States) account for 70% of world production and the problem is not so much of exhaustion of the reserves themselves as of the possibility of reusing the waste stored.

Climate Change

The latest report of the Intergovernmental Panel on Climate Change (IPCC) (7) documents the effects human action is already causing on ecosystems and also points out, using a series of scenarios, the consequences it could have on life on the planet and its inhabitants. The energy model is a determining factor in all the scenarios envisaged.

In the aforementioned WEO 2009 report the IEA draws very similar conclusions and argues that unless global measures are taken, the planet is heading for an irreparable huge-scale climate disaster. The report does however state that there is still time to allayward off such a disaster it

(7) Climate Change 2007, IPCC, Fourth Assessment Report

if agreements are established along the lines of the «450 Scenario».(8) In this scenario, forecasts for the average global temperature increase have established a limit of 2° C, compared to the disastrous 6° C of the «Reference Scenario».

Ensuring energy supply is necessary to the evolution of mankind, but preserving the planet's natural resources and putting a brake on climate change are vital for its survival.

New energy technologies

In the near future it will be necessary to develop new technologies that enable efficiency, automation and sustainability to be improved not only in the electricity sector but also in industry, transport and building. The development of new energy technologies, especially renewable, will partly alleviate the heavy energy dependency of many countries without indigenous resources of their own, such as Spain, helping ensure their security of supply.

Energy saving and efficiency are the chief means of reducing CO₂ emissions. The aim is to achieve a more efficient use of resources by consuming less energy and maintaining the same standard of living level of well-being. These measures have huge potential and all countries have improved their energy efficiency as their economies have developed economically.

At this point we might say that the energy sector's predicament may be solved with technology and the development of a collective awareness based on respect for the environment, as is already occurring in the most culturally advanced countries, though this involves accepting certain cost increments. The right combination of technology and culture and the political ability to give priority to investments in these areas will be the keys to a sustainable future.

It is evident that intensive investment in the technological development of the energy sector is required in order to make a more balanced

(8) A scenario that describes the results of implementing energy policies that establish the CO₂ concentration in the atmosphere at 450 ppm. In this scenario the average annual increase in demand between 2007 and 2030 would be 0.8%, and world CO₂ emissions would be limited to 30.9 Gt in 2020, thereafter decreasing to 26.4 Gt by 2030—that is, 2.4 Gt below the 2007 level and 13 Gt below the level envisaged in the «Reference Scenario» outlined in the same report.

distribution of world consumption compatible with a higher average standard of living and ecological sustainability. Some of the energy solutions viewed as possible that seem possible in the energy landscape are the following:

- *Clean coal.*
- *Nuclear fission (3rd and 4th generation)*
- *Nuclear fusion.*
- *Tidal*
- *Photovoltaic solar*
- *Thermoelectric solar*
- *Clean gas*
- *Biomass co-combustion.*
- *Biofuels.*
- *Electric vehicles*
- *Hydrogen (generation and fuel cells)*
- *Distributed production*
- *Intelligent grid management*
- *Energy efficiency and self-sufficient sufficiency of buildings.*

The solutions to the energy problem are not monotechnological (single-technology) and several technologies will therefore be necessary. The most important will be renewable and, nuclear energy and clean coal technologies. As it clean coal is one of the electricity technologies of the future and a critical technology for China, India and the USA, technological progress towards clean coal will be as important in strategic terms as renewable energies and nuclear energy.

The only significant future substitute for current motor fuels is electricity (either direct or through hydrogen cells). Furthermore, most electrical systems have an installed capacity that is idle for a considerable amount of time. Such a change which, if it occurred would occur, would be a genuine revolution, underlines the strategic nature of electricity technologies, which will be a determining factor in the future.

Energy as a strategic consideration.

The scramble for basic resources, particularly energy resources and water, will be the biggest source of conflict in the future. The spread of economic development to large areas of the planet is occurring in a very uneven way, giving rise to territorial imbalances and social conflicts.

Therefore we cannot base protection solely on the risks discussed so far: international terrorism, organised crime, international conflicts, etc. It is necessary also to incorporate to consider also the phenomena which trigger them, such as environmental degradation, poverty, territorial imbalances, population increases, migration and ecological risks.

These phenomena, and others that are derived from them, are closely interrelated and are determining factors in defining the energy model of the future. We need to progress by increasing the effectiveness of international agreements and commitments allowing that allow the implementation of new energy policies on a world scale, and among them the unavoidable linking of the concept of National Security to energy.

INTERNATIONAL AND EUROPEAN ENERGY COMMITMENTS

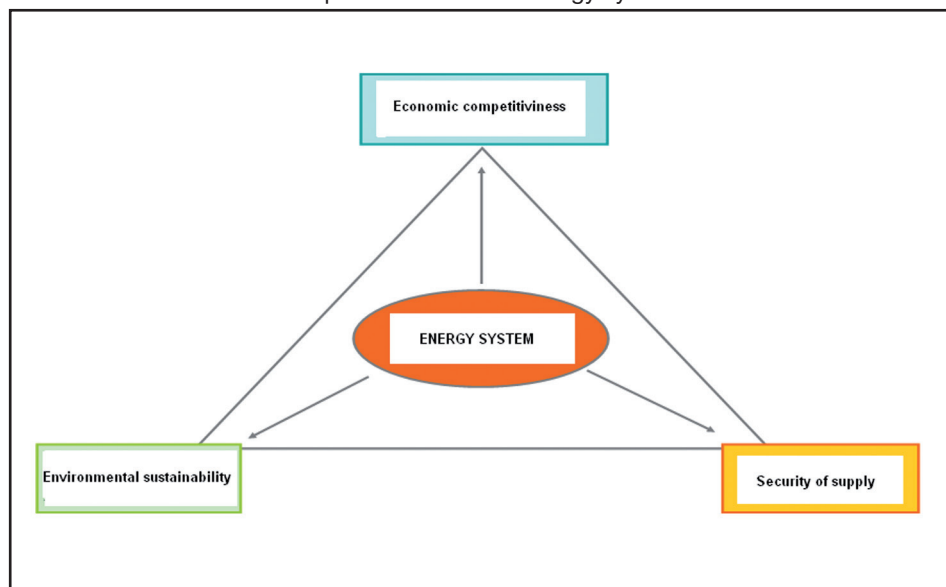
Efforts to establish a new energy model in the international and European sphere have been directed mainly at mitigating the effects of climate change. Important commitments have been adopted, such as those of the Kyoto Protocol whereby the European Union undertook to reduce its CO₂ emissions by 8% with respect to the 1990 level by the year 2012. This goal is distributed differently between the Member States, a limitation ceiling of 15% being having been set for the increase in Spain's emissions.

In order to progress towards a Common Energy Policy, in January 2007 the European Commission proposed a set of measures, which were ratified by the Presidency of the European Council in March 2008. They are based on three essential pillars: security of supply, competitiveness and environmental sustainability.

These objectives have been translated into three main commitments to be achieved by 2020. They are closely interrelated and will mark energy and environmental policy in the medium and long term:

1. To decrease greenhouse gas emissions by 20% with respect to 1990.
2. To ensure, as a binding objective, a 20% share of renewables in the final energy mix (this includes bringing the use of biofuels in transport up to 10%)
3. To improve energy efficiency by 20% with respect to consumption trends.

Graph 6: Pillars of the energy system



The European Union needs reliable, affordable and sustainable energy flows. This is a key to its economic development and to the achievement of the goals laid down in the Lisbon Treaty.

European policies focus on renewable energies, energy saving and efficiency, the trading of emission rights and CO₂ capture and storage. It is necessary to incorporate and develop energy issues in the Common Foreign Policy owing to the growing importance of energy in geopolitics. Likewise, the European Union devised the so-called SET Plan outlining the roadmap for the development of new technologies with synergies between energy policy and R&D&I policy.

Energy supply therefore requires a combination of domestic and foreign policies. It is necessary to act in a coordinated manner at Community level and this is what led to the drafting of the European Commission Green Paper, (9) pointing out the magnitude of the energy challenges and from which a European energy strategy may be inferred.

To address these global geopolitical challenges, the European Union has designed an «Energy security and solidarity action plan» proposing

(9) European Commission Green Paper, 29 November 2000 Towards a European strategy for the security of energy (COM (2000) 769 final)

an ambitious energy policy based on: security of supply, competitiveness and environmental sustainability.

The five key points of this action plan are as follows:

- *Infrastructure needs and the diversification of energy supplies.*
- *External energy relations.*
- *Oil and gas stocks and crisis response mechanisms.*
- *Energy efficiency.*
- *Making the best use of the EU's indigenous energy resources.*

The European Union considers that energy policy affects the national security of each Member State, and is also an essential pillar of Community policy; it is therefore crucial that security of Europe's energy supply be part of the Common Foreign and Security Policy (CFSP).

THE ENERGY SITUATION IN SPAIN

General characteristics of the Spanish energy system

Generally speaking, Spain has similar problems to those of the European Union countries, although some are more extensive. We have worse energy efficiency ratios. We also exceed the CO₂ emissions permitted by the Kyoto Protocol. Our external energy dependency is in the region of 80%, whereas the European average is 54%. Lastly, Spain is the continental European country with the lowest capacity for interconnection, a factor that is essential to integrating the European markets and securing supply.

Notwithstanding these weaknesses, the Spanish energy system has reacted positively and successfully to its supply problems and to the challenge of climate change. During the present decade practically the entire new power generation capacity under the ordinary regime has been combined cycle (natural gas) and 70% of new power generation under the special regime has been wind power. Nonetheless, in a system with a high share of renewables, security of supply may be affected by the current low rate of usage of combined cycles, which also affects long-term gas supply contracts in the long term.

As pointed out by the recent OECD report on Spain, «Policies for a sustainable recovery», (10) the Spanish energy sector must address major future challenges.

(10) OECD report on Spain, «Policies for a sustainable recovery», *OECD Report on Spain: policies for sust* March 2010.

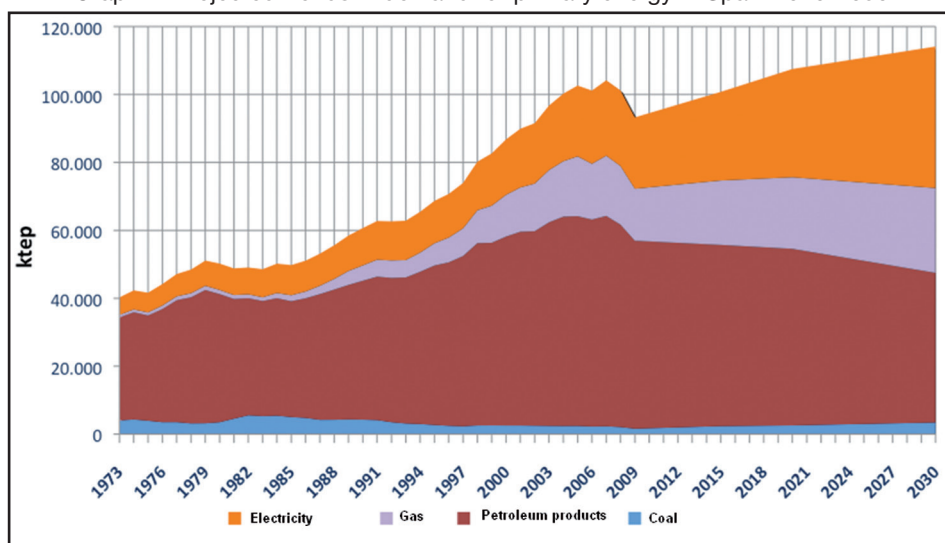
The security and sustainability of the Spanish energy model require a long-term strategy owing, among other factors, to our heavy external dependence, and the need to develop new infrastructure and meet the international commitments relating to environmental protection. Spain's insular situation with respect to energy situation as an «energy island» has forced us to make an extra effort to ensure energy supply, as a result of which; this has made our generation capacity and transport transmission networks are highly efficient, especially as renewables are now currently a substantial part of the electricity system .

The implementation establishment of supranational markets, the Iberian Electricity Market and the Single European Market, should enhance boost the security of supply and competitiveness of the Spanish system, which still has major shortfalls in its interconnections, particularly with France.

Energy demand in Spain

The demand for primary energy in Spain fell by 8.2% in 2009 with respect to 2008, continuing the downward trend initiated the previous year as a result of the economic crisis.

Graph 7: Projected trends in demand for primary energy in Spain 2020-2030



Source: MITyC and compiled by the author

Forecasts point to indicate a return to growth in 2011, although it will remain moderate (around 1.3% for the next ten years). In this case demand for primary energy would not bounce back to a level similar to that of 2007 (the year before the crisis erupted) until 2017.

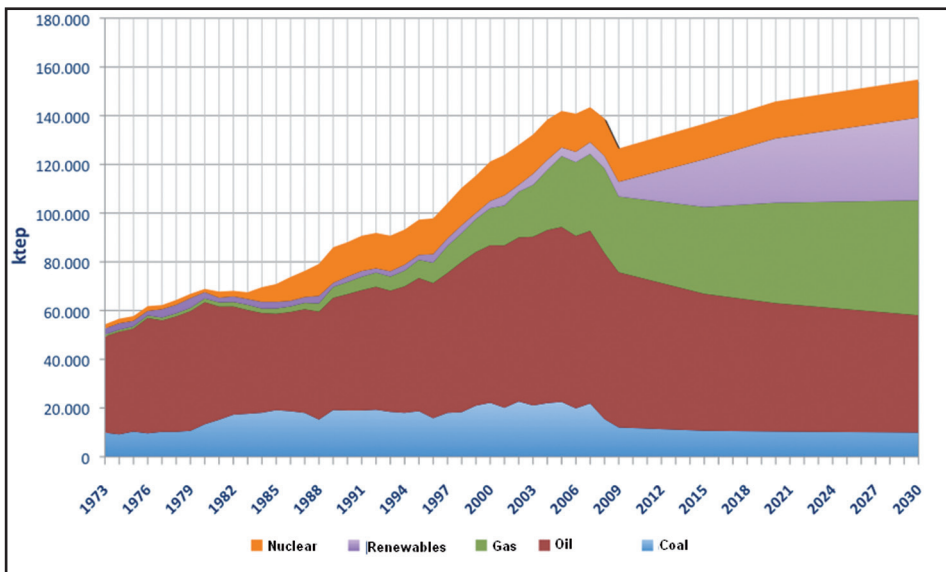
Meeting How energy demand is met

Final energy consumption in Spain in 2009 fell by 7.1% with respect to 2008. This trend is due to decreased demand from all sectors as a result of the crisis.

Everything seems to indicate that Spain's final energy demand will return to growth in 2011. However, the increase in demand could be moderate during 2010-2030 (annual growth of around 1.3% during 2010-2020).

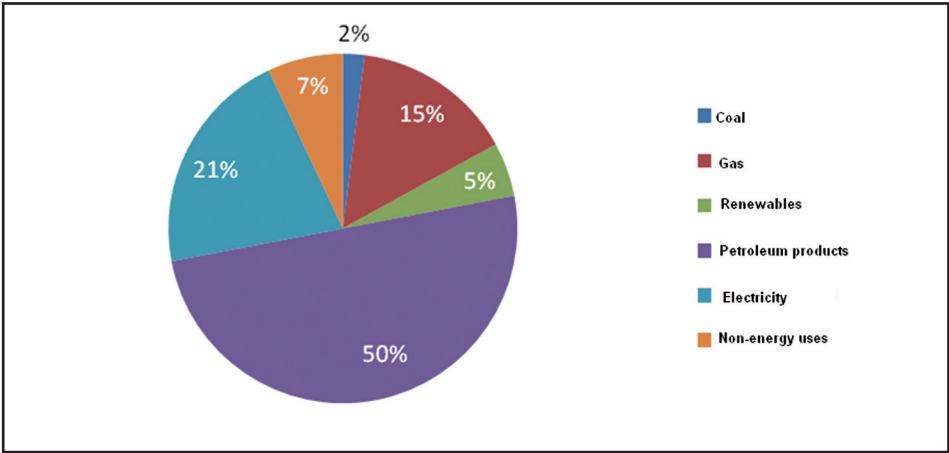
In this period increases rises in demand will be the result of increases in transport and industry, with growth rates of over 1%, whereas the rest of other uses (services, residential and agriculture) will increase very moderately. From 2020 onwards it is expected that energy efficiency measures will maintain the growth rates of final energy demand at close to 0.6% annually.

Graph 8: Projected trends in final energy demand in 2020-2030



Source: MITYC and compiled by the author

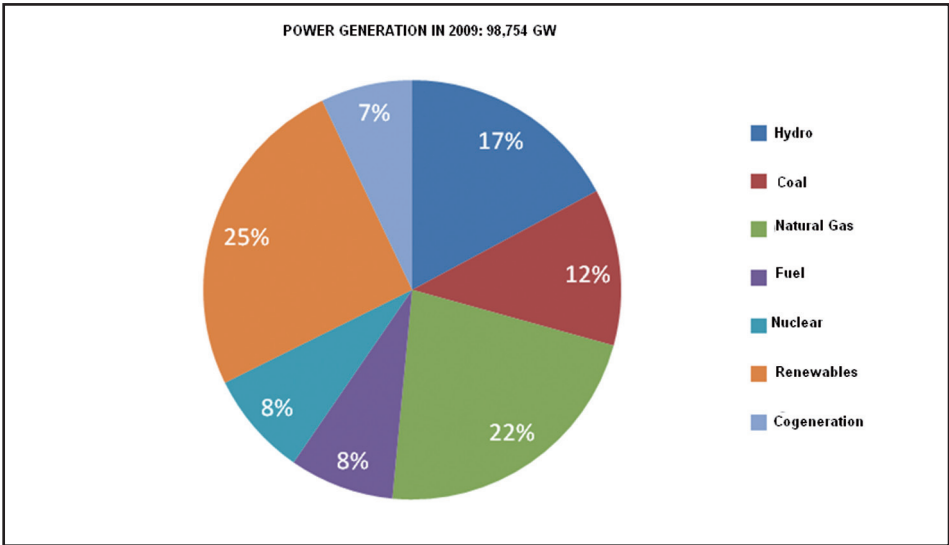
Graph 9: Final energy consumption in Spain (2009)



Source: Red Eléctrica de España

Final consumption of petroleum products fell by 7.4%. Diesel oil was the worst affected, owing to decreased economic activity and lower sales of commercial vehicles, as well as petrol, consumption of which had been slackening in previous years

Graph 10: Breakdown of electricity production in Spain in 2009 by type of fuel



Source: Red Eléctrica de España

Demand for electricity slumped 5.7% in 2009. How electricity demand was met and total power generation in 2009 are shown in the following chart.

Dependence and supply

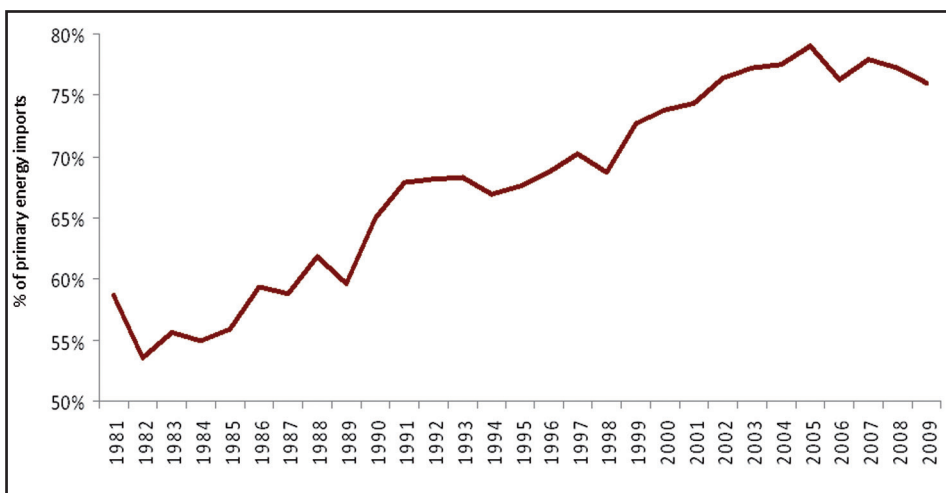
Probably the characteristic aspect of the Spanish energy system that is most significantly linked to security is its heavy external energy dependence. At about 80%, it is one of the highest and undoubtedly the greatest among all the major economies. The following chart shows trends in Spanish energy dependence up to 2009.

Spain depends on external sources for almost all its oil and natural gas—nearly 100%— and these account for slightly more than 70% of primary energy in the system. Lowering this figure will be a very slow process; it is estimated that by 2020 it will be down to 65%. The following chart shows dependence with respect to the various energy sources.

The following chart illustrates Spain's energy dependence compared to that of the other EU countries.

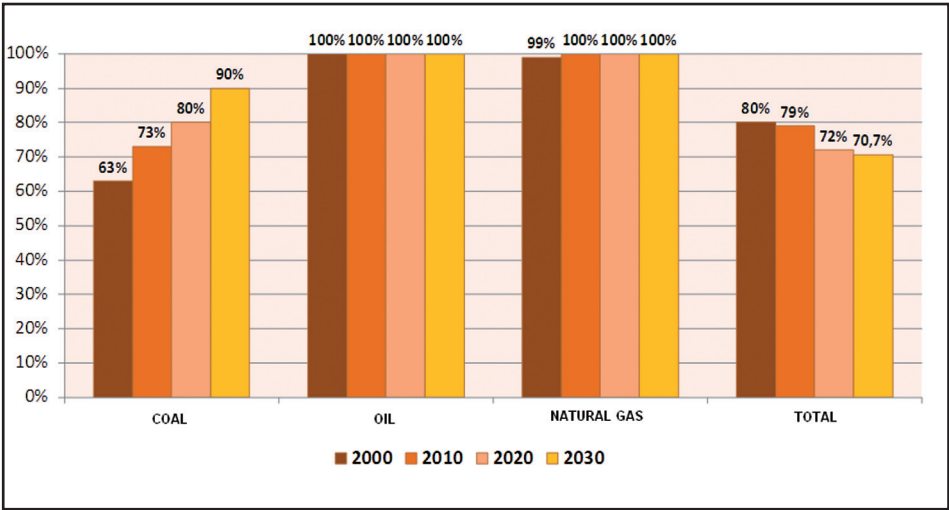
Spain has had to bear additional infrastructure costs to mitigate the risk of shortages (regasification plants, which have made it possible for 72% of imported natural gas to be liquefied) and to ensure minimum strategic stockpiles (underground natural gas storage reservoirs and oil tanks).

Graph 11: Trends in external energy dependence



Source: MITyC

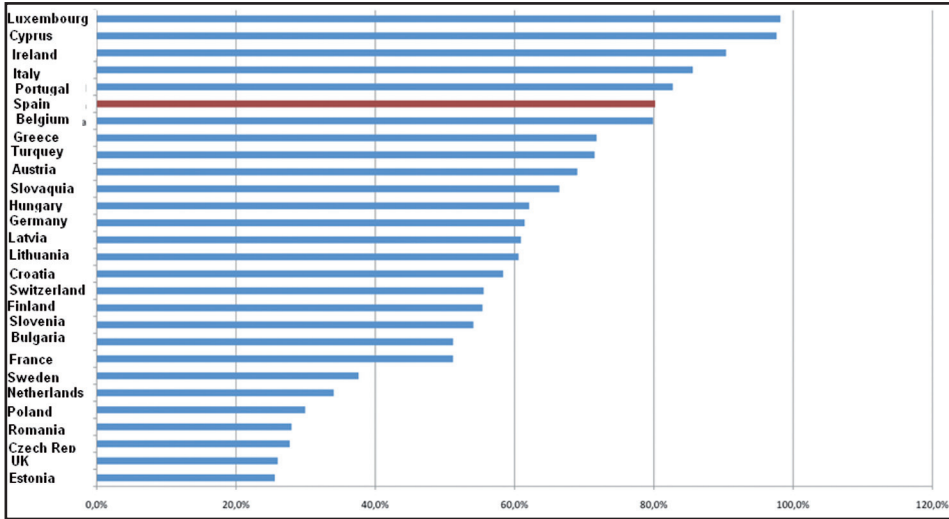
Graph 12: Expected reduction in energy dependence in Europe



Source: EUROSTAT

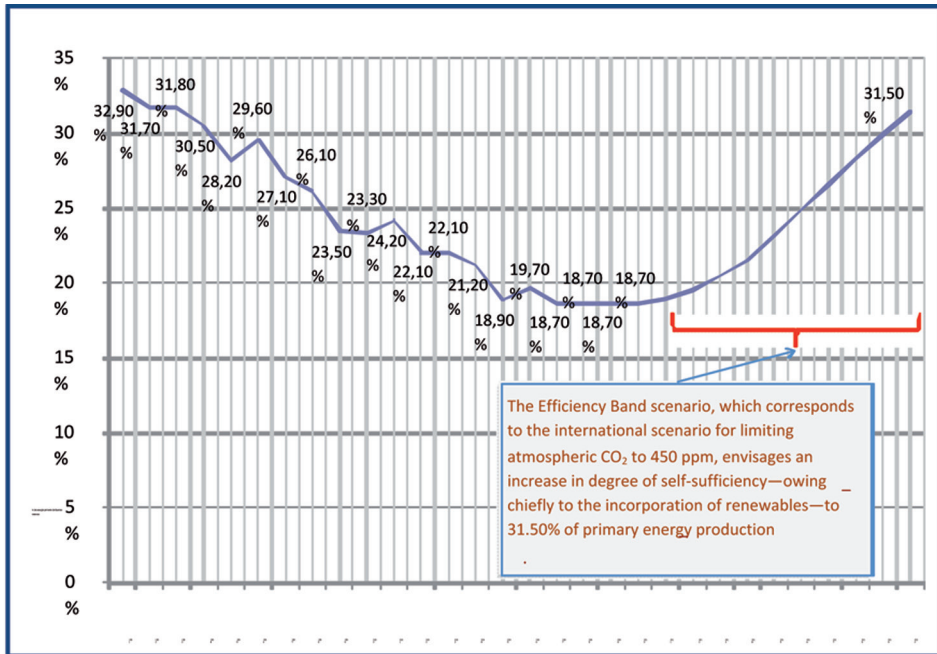
As a result of these investments and other regulatory measures, the current supply of oil and gas is relatively diversified, bearing in mind that production of these fuels is mainly concentrated in only a few countries.

Graph 13: Energy dependence by country expressed as a percentage of primary energy imports



Source: EUROSTAT

Graph 14: Trends in degree of self-supply of primary energy self-sufficiency in Spain
The Efficiency Band scenario, which corresponds to the international scenario for limiting atmospheric CO₂ to 450 ppm, envisages a greater increase in degree of self-supply—owing chiefly to the incorporation of renewables—to 31.50% of primary energy production

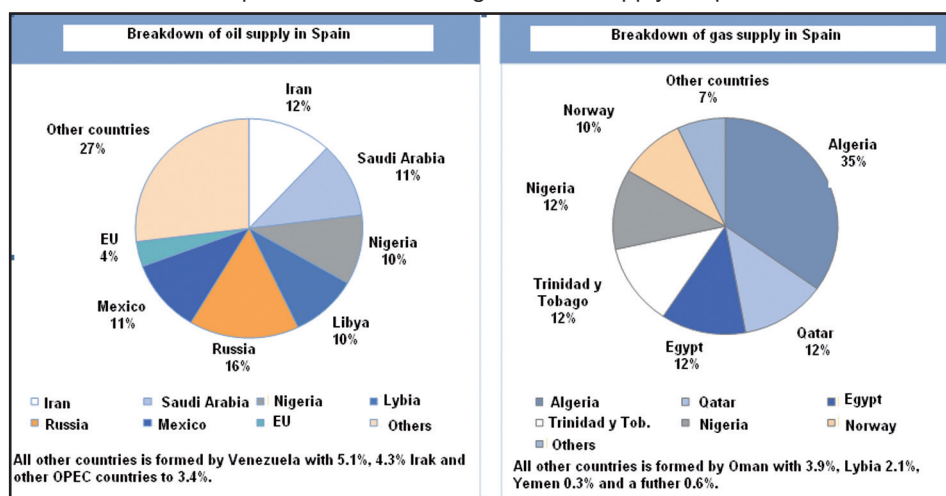


Source: Boletín Trimestral de Coyuntura Energética. Ministry of Industry, Tourism and Trade

- As for oil, some 56% of imports come from the OPEC countries followed by Russia, which is our chief supplier, providing which accounts for 16%.
- As for natural gas, about 35% of imports are from Algeria. The other importing countries account for less than 13% of imports.

From the strategic point of view supply, in Spain, as in most like most NATO Member States, has 90-day security petroleum reserves—stocks equal to 90 days consumption security and 30-day strategic reserves (maintained by the Corporation of Strategic Reserves of Oil-based products, CORES by its Spanish acronym) for ongoing military operations and 30-day Strategic Reserves for ongoing military operations.

Graph 15: Breakdown of gas and oil supply in Spain



Source: Ministry of Industry, Tourism and Trade - Balance estadístico de hidrocarburos, December 2009

Energy isolation

Another characteristic that particularly affects security is Spain's «energy isolation». As can be seen in graph 19, Spain can be considered insular with respect to energy, having very low interconnection levels: within the EU only the United Kingdom has a lower level of interconnection.

This issue affects security from several viewpoints. These range from risk of shortage owing to saturation of supply lines resulting in the event off some primary energy source fails to the impossibility of developing greater energy potential from renewable sources because the management of this type of energy requires a greater level of interconnection making it possible allowing to regulate peaks and dips to be regulated by using energy from neighbouring countries.

The Kyoto commitments

Spain exceeds the maximum 15% increase in CO₂ emissions permitted by the Kyoto Protocol. In 2009 emissions were 30.6% higher than in 1990.

Graph 16: Progress towards Kyoto targets

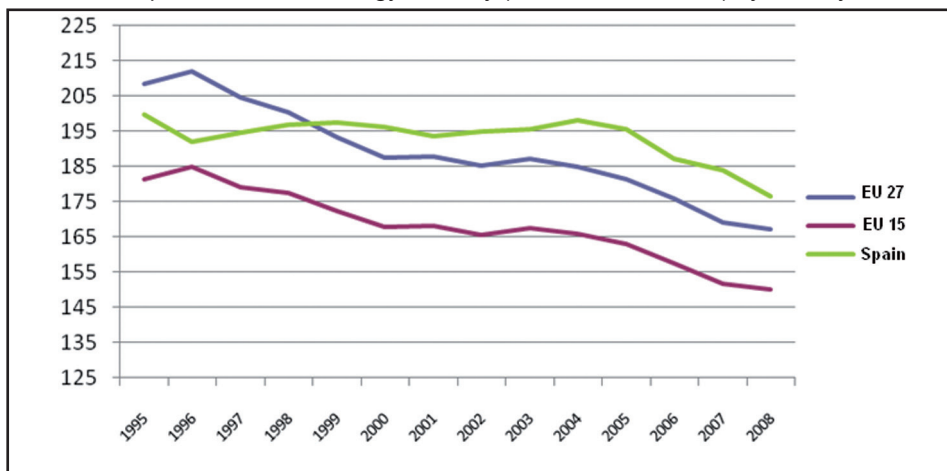
	% from base-year emissions in 2008	2012 target % from base-year emissions	Difference
Germany	78%	79%	-1%
Spain	140%	115%	25%
France	94%	100%	-7%
Italy	105%	94%	11%
Netherlands	97%	94%	3%
Austria	110%	87%	23%
Poland	70%	94%	-24%
Portugal	130%	127%	3%
United Kingdom	89%	104%	-15%

Source: EEA - Greenhouse gas emission trends and projections in Europe 2009

Energy intensity

The period from the latter half of the 1980s to the end of the 1990s saw a rise in Spain's energy intensity with respect to the average trend in the EU as a whole. Energy efficiency began to improve notably in 2004 owing to a combination of structural and technological effects.

Graph 17: Trends in energy intensity (KGOE / €1000 GDP) by country



Source: EUROSTAT

A cumulative improvement in final energy consumption intensity of 11.3% was recorded in the period between 2005 and 2008.-

Renewable energies

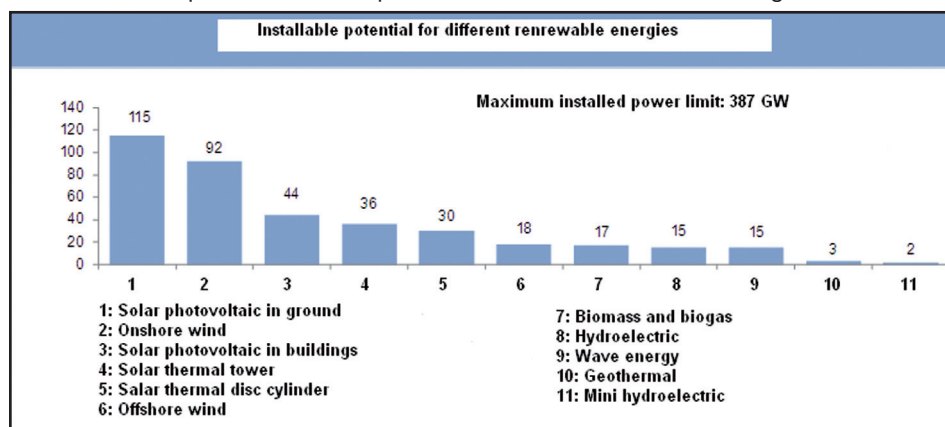
Spain is firmly committed to renewable energies that help reduce greenhouse gas emissions and alleviate our external energy dependence. We have become one of the world leaders in both generation and industrial production and innovation, and today Spanish companies are developing projects in many countries of the world.

Renewable energy production has increased 4.5-fold over the past eight years. Last year 28% of energy was generated using renewable technologies. This rapid pace of development is due largely to subsidisation and the system's obligation to purchase all the energy they produce.

From a logistic viewpoint, without bearing in mind taking into account system operation and distribution network criteria and, considering only the various physical (land availability, climate, etc.), social (public opinion, visual impact, etc.) and environmental limitations (protection of nature reserves, etc.), it is estimated that our maximum installed power limit is 387 GW.

This power ceiling provides a sufficient margin of installable power compared to the current capacity of installed renewable energy (40 GW).

Graph 18: Installable potential for different renewable energies



Source: Ministry of Industry, Tourism and Trade and compiled by the author

Technologies for electric power generation from renewable energies sources pose technical challenges to the electricity generation system and the transportationtransmission of electric energy (grid capacity and primary and secondary regulation of the system) on account of the discontinuity and random nature of the energy source used:

Development of storage systems allowing demand to be met efficiently when renewable resources are insufficient, thereby increasing the flexibility of these energies.

- *Development of new schemes for managing the electrical system with distributed generation (cogeneration, renewables) and consumers active in the management of the electrical system.*
- *Detection and quantification of the limitations imposed by the current electricity grid on the upper limit for renewable energy penetration.*
- *Need to assess the spatial distribution of the different sources of renewable energy.*

ENERGY INFRASTRUCTURE

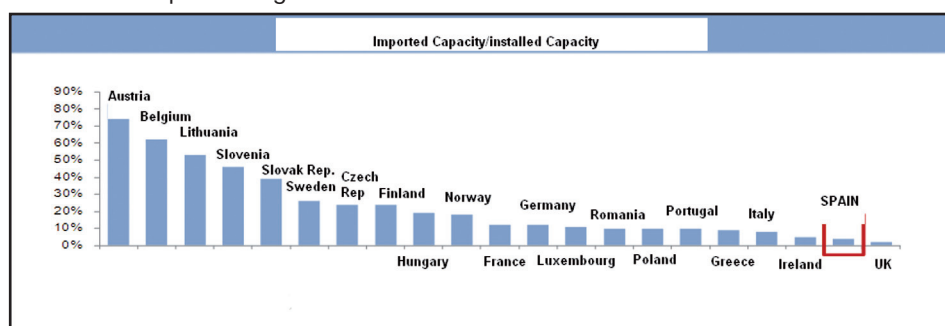
The development of gas and electricity interconnections, especially with Europe via France, is essential to our country's energy competitiveness. This interconnection is far from meeting minimum requirements. The European Union cannot argue that there is a Common Energy Policy unless it overcomes misgivings and develops a genuine energy market through cross-border interconnection in order to allow European—and Spanish—companies to compete on an equal footing.

Electricity transmission and distribution networks

Spain's electricity transmission network is currently comprised of more than 34,300 kilometres of high-voltage lines and more than 3,100 substations, and has a transformation capacity of more than 62,000 MVA.

The northeast region of the Peninsula displays a high concentration of transmission lines, as it is here that many lines from the thermal and hydroelectric plants of Galicia, Asturias and León converge. Conversely, the inland part of the southeast region displays the lowest density of lines and substations owing to the absence of power plants and major centres of consumption.

Graph 19: Degree of electrical interconnection of the EU countries



Source: Red Eléctrica Española 2009

As can be seen in the following graph, Spain's level of interconnection is one of the lowest in the European Union. Therefore the various projects aimed at improving interconnection are considered a priority for Spain's energy policy over the coming years.

In May 2008 the government gave the go-ahead to the 2008-2016 planning document for the electricity and gas sectors, the purpose of which is to provide guidelines for investment in electrical infrastructure to ensure the security and quality of energy supply. The document attaches particular importance to projects aimed at strengthening international interconnections.

International electricity interconnection between Spain and France

The interconnection between Spain and France is a priority strategic objective, as it is an important asset for ensuring the security of the Spanish electricity system by interconnecting it to the European system.

Action to increase the interchange capacity between France and Spain is meeting the target of achieving an interchange capacity of 4,000 MW, nearly 10% of the Spanish system's peak demand .

At the beginning of 2008 Red Eléctrica and Réseau de Transport d'Electricité (RTE) signed an agreement to build a new line along the east of the Pyrenees between the substations of Santa Llogaia (Spain) and Baixas (France). In addition to enhancing interconnection capacity, this line will reinforce the security of both systems and allow the integration of a larger volume of renewable energy, particularly wind power.

International electricity interconnection between Spain and Portugal:

A project has been outlined to reinforce interconnection networks with Portugal along two routes: in the north, in the area of the river Miño, a new 400kV line is due to be built between Pazos (Spain) and Vila do Conde (Portugal); and in the south, in the Huelva region, a new 400kV line is planned between Guillena (Spain) and Sotavento (Portugal).

With these reinforcements minimum interchange capacity is expected to be increased to as much as 3,000 MW.

Other international interconnection projects:

Interconnection with Morocco: several studies have been conducted to assess the feasibility of increasing interchange capacity with Morocco.

Interconnection with Algeria: there are currently proposals to implement an interconnection project with Algeria by means of some 200km of cable that would reach the coast of Almería and would make it possible to connect the area with surplus energy produced by Algeria (1200-2000 MW) and to reinforce the Mediterranean Electricity Ring.

Gas transportation and distribution networks

The particular characteristics of the Iberian Peninsula make it insular with respect to natural gas, bearing in mind that indigenous reserves are scant.

This difficulty delayed the introduction of natural gas to Spain until 1969, the year the regasification plant in Barcelona was started up.

Major impetus was given to the development of the natural gas infrastructure by the Gas Protocol of 1985. This development is still continuing and has translated into several Gasification Plans established between gas companies and autonomous regions. The development of the gas infrastructure is conditioned by the characteristics and extension of Spain's territory, as well as by the disperse distribution of population centres and industrial areas.

The current natural gas infrastructure in Spain is comprised of: six liquefied natural gas regasification plants, 6.000 km of gas transportation pipelines, more than 31,000 km of gas distribution pipelines, two under-

ground storage reservoirs, three deposits and five or five??? international connections (one with Morocco, two with France and two with Portugal), in addition to other ancillary facilities, compressor stations and LNG satellite plants.

The Ministry of Industry, Tourism and Trade's 2008-2016 planning document for the electricity and gas sectors reflects the future investments in gas infrastructure, placing special emphasis on international interconnections and on increasing storage capacity, which is currently considered insufficient.

International interconnection projects

Spain-France interconnection: an international connection with France via the Larrau-Calahorra gas pipeline came into service in 1993; it was the first connection with the European network of gas pipelines. The Euskadour interconnection later came into service. A new international connection with France is planned via Catalonia.

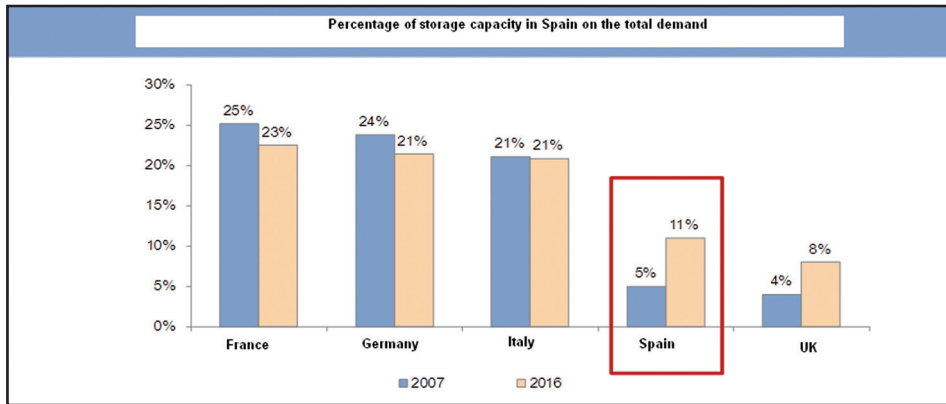
Spain-Portugal interconnection: Badajoz has been one of the connection points between the Spanish and Portuguese natural gas transportation networks since 1996. The other point is in Tuy (Pontevedra) and began operating in 1998. During the planning period current international connections with Portugal may be stepped up and even new interconnections may even be established in order to boost the development of the Iberian Gas Market (MIBGAS in Spanish).

Increased regasification capacity: Although Spain currently has a large number of regasification plants, they are all being enlarged and a new plant is due to come into service at Musel harbour (Gijón) in 2012.

Gas storage projects

To ensure the security of the gas supply in Spain gas storage facilities have been developed. There are currently three gas storage reservoirs that are up and running (El Serrablo, La Gaviota and Las Marismas) with a total capacity of 2.8 billion cubic metres. This gas storage capacity will be increased over the next few years thanks to the new Poseidón, Yela, and El Castor storage reservoirs which are expected to come into service between the present year and 2012.

Graph 20: Percentage of storage capacity of several EU countries



Source: Sedigás

Regasification terminals have played an important role in ensuring security of supply in Spain owing to its high percentage of LNG imports and the absence of sufficient underground storage. There are also plans to extend these LNG terminals and new tanks are being developed in order to comply with Spanish regulations on strategic gas reserves.

Oil transportation and distribution networks

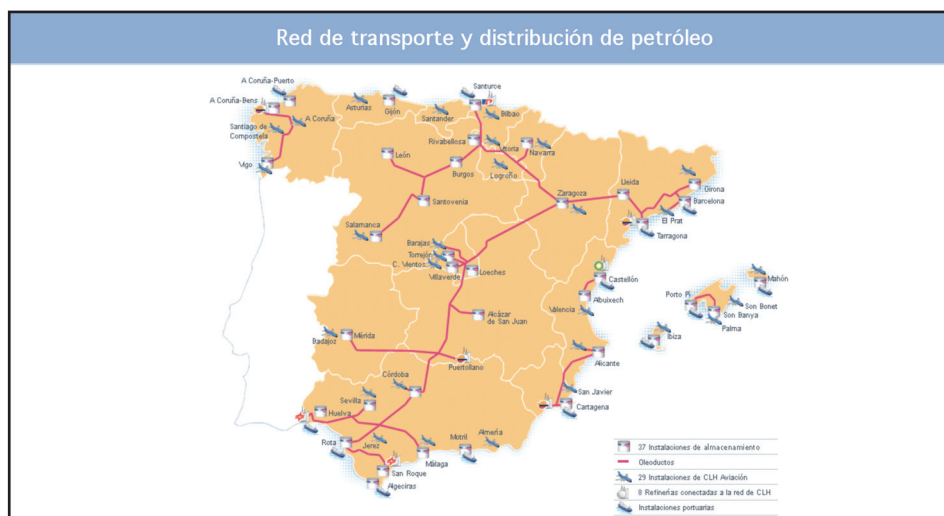
Various oil pipelines, complex networks of road and rail tankers, propane and butane packing plants, and petrol stations and reservoirs ensure the distribution of petroleum-derived fuels across the country.

Starting out at from the refineries, a network of oil pipelines distributes fuels, carrying them to depots near their points of consumption. Spain's transport pipeline network isreservoirs are some 4,000 kilometres long.

The main branch runs from Cadiz to Barcelona, passing through Madrid and Zaragoza. It is a legacy of the oil supply pipeline built in the 1950s from the naval base in Rota to supply the US Airforce bases in Morón, Torrejón and Zaragoza.

The logistic system of the Compañía Logística de Hidrocarburos (CLH) continues to be the most important in Spain. The CLH network covers 3,500 km, making it the most extensive civil oil pipeline network in Western Europe.

Graph 21: Oil distribution infrastructure in Spain



Source: CLH

As Spain is not a petroleum producer, it depends almost wholly on imported petroleum products. The geographical situation is a hindrance to international connections and has led to the consideration that it is of public interest to store petroleum products to ensure national supply. In this regard, Spain's strategic planning involves implementing several projects and contracts to aimed at increasing hydrocarbon storage capacity:

As pointed out, it is essential for Spain to increase electrical and gas interconnections, fostering market integration and ensuring optimum use of surplus electricity production, especially renewable. To this end it is necessary to promote agreements with our neighbouring countries, particularly France, in order to achieve interconnection rates that allow Spanish companies to compete with their European counterparts. Interconnection with France needs to be increased substantially in the short and medium term; likewise, gas interchanges with Europe and North Africa need to be completed and extended.

Initiatives for the future

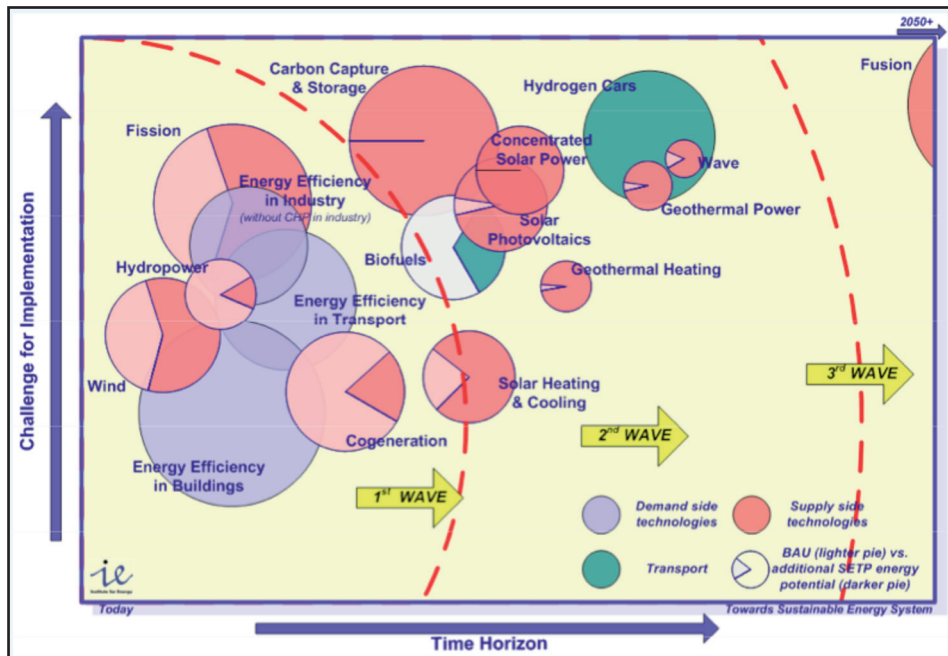
In the field of technological development the so-called SET Plan is the technological cornerstone of the European Union's energy and climate policies. It is structured designed as a route map for coordinated research and development of low carbon technologies, and lays down

specific actions for pooling the efforts of science and industry. It establishes a selection of technologies with high potential, common planning and budget estimations for investment. The first four European Industrial Initiatives (EIs) on electricity grids, solar energy, wind power and CO₂ capture, transport and storage were presented during the Spanish Presidency of the European Union .

In the long term projects such as the Mediterranean Solar Plan, the DESERTEC project and the TRANSGREEN INITIATIVE, aimed at the large-scale development of renewable enargiesenergies in the south and east Mediterranean countries and their connection with the European Continent, offer Spain important opportunities and the change to develop the technologies of the future as to the electricity production and transmission, as well as a major political opportunity in interconnections that would help solve the problem of its energy isolation.

The Mediterranean Solar Plan is a French initiative for Europe. It is aimed at building solar energy facilities providing 20 gGW of additional power generation capacity in the countries of North Africa.

Graph 22: Potential of technologies included in the SET Plan. Creation of the EIs



Source: Strategic Energy Technology Plan (SET Plan); European Commission

The DESERTEC project is a German initiative aimed at drafting a plan over the next three years focused on electricity production involving projects capable of generating more than 1GW in order to meet the target of supplying the equivalent of 15% of European needs by 2050. Spanish companies are taking part in the project.

TRANSGREEN is also a French initiative and is aimed at studying the possibility of building and exploiting a long-distance European network for the transmission of electricity generated from renewable sources using high voltage direct current interconnections.

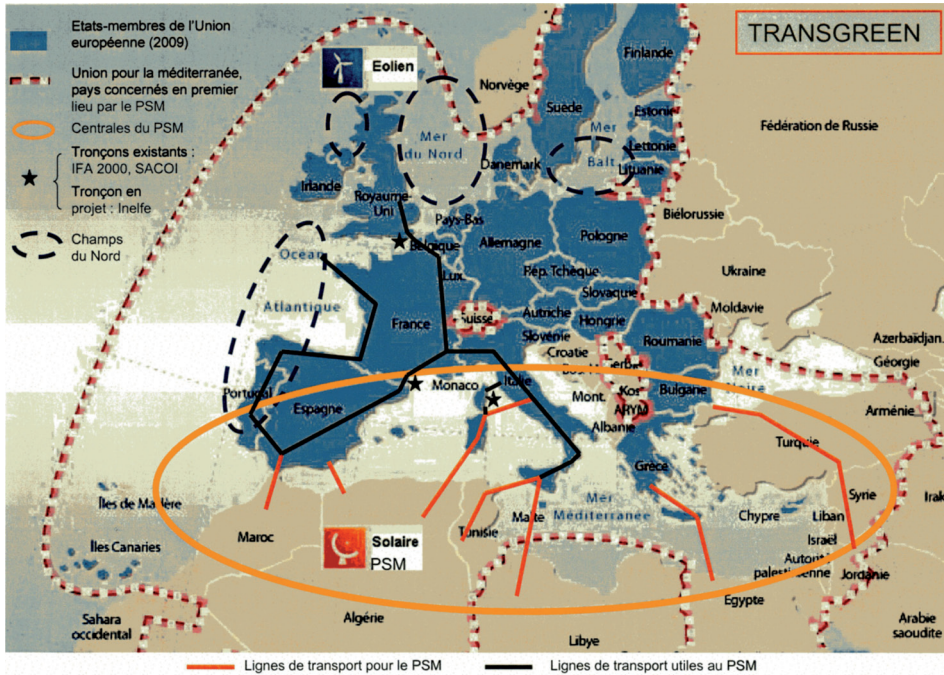
These projects for solar thermal power plants in North Africa, the Sahara and the Middle East which are part of the Mediterranean Solar Plan and the DESERTEC project and the major projects for offshore wind farms in the North Sea supported by the Netherlands, Britain and Germany and providing new prospects for the English Channel and the Atlantic coast need infrastructure to convey the power to the consumption areas.

Graph 23: Diagram of the DESERTEC project



Source: DESERTEC Foundation

Graph 24: Diagram of the Transgreen project



Source: TRANSGREEN PROJECT

Only high or very high voltage allows long-distance transmission without distribution losses to . Direct current transmission will also make the system better equipped to cope with overload, improving its security. In addition, only direct current transmission is possible for undersea cables and in sensitive places, such as connections in the Mediterranean, in the North Sea or across the Pyrenees.

THE FUTURE ENERGY MODEL FOR SPAIN

The Spanish energy sector must address major challenges which require a long-term energy policy, owing, among other factors, to our heavy external dependence and the need to develop new infrastructure and adopt new international commitments. This policy requires an analysis of long-term prospects and the following aspects must be considered with respect to its integration into European and international policy: the availability and development of technologies; implications of the liberalisation of the energy markets; restrictions imposed by environmental

commitments; capacityability of demand to respond to energy savings and improvement of energy efficiency; the consequences of the strategies aimed at ensuring security of supply; interconnection capacity with external markets; and, lastly, the cost of energy and its repercussion on the competitiveness of the national industry and on the quality of life of Spanish citizens.

Spain's energy policy should bear in mind the following premises:

1. The energy system as a whole must be *secure, competitive and sustainable* and future actions must be underpinned by these three considerations.
2. It is necessary to reinforce the European dimension of our energy policy. It will not be possible to maintain isolated energy models in the future, and we must therefore consolidate the European energy market.
3. Energy efficiency and saving are the best options for reducing energy dependence and CO₂ emissions simultaneously. It is necessary to continue implementing efficiency measures, but at a faster pace and with more specific targets and deadlines.
4. All the current energy sources are necessary, without exception. Our energy system needs to findstrike a balance between them in keeping with the aforementioned criteria of security of supply, competitiveness and sustainability. In this regard it is necessary to use all our installations as efficiently as possible, incorporating new technologies at the pace set by their competitivenessas they become competitive.
5. Conventional energies will continue to have considerable weight in the national energy mix and will still be important in terms of investment and employment.
6. The major challenge posed by renewable energies is to achieve greater efficiency and economic rationality, a better balance between cost and profit, incorporating the European and global dimension into the development of this market in which Spain is a pioneer. The cost increment of renewables, an inherent part of the learning curve of any technology and which is currently borne only by electricity consumers—through electricity tariffs—needs to be assumed by the Spanish energy system's consumers as a whole. Otherwise it will not be possible to incorporate more renewables into the system owing to their repercussions on the price of electricity.

7. The Spanish energy sector must firmly support the new CO₂ capture and storage technologies in line with the European policies owing to the major potential they offer companies that develop and acquire capabilities in this field.
8. The development of gas and electricity interconnections with Europe and North Africa is essential to Spain's energy competitiveness and to the shapingbuilding of the Common Energy Policy.
9. It is an unavoidable necessity for the future of Nuclear Energy to be defined as soon as possible and with the greatest possible consensus, assessing all the circumstances inherent in this technology, its importance in our energy system, its social significance and its weight in the industrial and technological sectors, just as the countries with high energy dependence are doing in Europe and in the world in general.
10. In order to navigate the technological crossroads, it is necessary to give firm impetus to Spain's participation in research, development and innovation (R&D&I) programmes in the field of energy.

National energy security

Security of energy supply is a global concept that includes not only political and economic aspects, but also national defence considerations.

The 2005 Law on National Defence established a geostrategic framework, stating that security is a national challenge and that in order for it to be effective it requires not only defence but also other means, including economic policy and international policy.

The passing of this Law on National Defence made it possible, for the first time, for energy security to be considered an essential element of a Single National Strategy on national security in the National Defence Directive of 2008.

The new approach states what we pointed out previously:

The sphere of security and defence has experienced important changes in recent years. The rise of new risks and threats, the implications of globalization and the growing complexity of conflicts require the design and implementation of a Spanish security and defence system that can effectively respond to these challenges, safeguarding our national interests. Therefore, it is imperative to integrate and harmonize all national instruments and resources to ensure the unity of State action.

The National Defence Directive is thus part of a National Security Strategy for which there is an evident need. This strategy includes the values and interests which underpin national security, analysing risks, threats and weaknesses and their causes, establishing at the same time frameworks for action and the bases for providing an integrated response that ensures the protection of national interests.

The Directive defines the strategic landscape, specifying the new reality of a world which has evolved, pointing out that:

The current strategic scenario is characterised by complexity, uncertainty and potential danger. Current and foreseeable conflicts are multi-dimensional in their configuration, which makes resolution by strictly political, diplomatic, economic or military means unfeasible.

It goes on to underline the significance of globalisation in current conflicts, which:

can turn the effects of even a local conflict into one with much broader repercussions, so that borders do not necessarily constitute any longer the frame of reference for guaranteeing national security.

But one of the most significant contributions of the National Defence Directive is its inclusion of energy security as an integral part of National Security. Such is the case, for example, of the so-called regional conflicts, which:

may also threaten energy security by limiting access to certain energy sources and placing global distribution networks at risk.

The scramble for basic resources is expected to become one of the chief sources of conflicts in coming years. On the one hand, the economic drive and population of certain emerging countries are triggering competition for resources, sources of energy, and in some areas water, sparking economic crises with major social repercussions. On the other hand in some areas economic development is taking place in an unbalanced and uneven manner, giving rise to deep social inequalities, mass migration and even environmental effects that are very harmful to the ecosystem.

But the Directive not only mentions energy security; it also incorporates the environmental concerns, stating that:

The effects of humanity on the environment also appear to be generating the birth of a new phenomenon, climate change, the instability of which may lead to the appearance or increase of recurring natural phenomena that give rise to disasters. Even today, their occurrence and consequences are difficult to predict, especially when they generate, among other things, health or sanitary risks and the interruption of critical networks and infrastructures.

The National Defence Directive marks a major step forward in the modernisation of Spanish strategic thought in energy matters by linking the definition of national security to the energy model and its repercussions on the environment, and by assuming that international security can likewise be affected by the global warming caused by climate change.

It thus places us among the countries which consider that energy security is not only a problem of guarantees between supply, transit and consumer countries but also entails a vision of a sustainable energy model sensitive to the major challenge of global warming and the repercussions of climate change.

This position consolidates the concept of energy security as a global issue that affects many interrelated variables whose importance requires them to be put on the agenda of the so-called *strategic problems*. The International Energy Agency, the OECD and the European Union are working along these lines.

FINAL CONCLUSIONS

We have made progress, as the strategic concepts and the energy model are now part of our national security system, although this progress as to incorporating defence considerations into the design of our future energy model bearing in mind defence considerations needs to be translated into specific measures and active policies.

In this connection it is absolutely necessary to call for such a task to be given the consideration of a *Matter of State* and to achieve a consensus among political forces leading to an energy agreement that will help consolidate and provide guarantees to the energy system and also the rest of the productive sectors .

Energy is one of the most significant strategic issues faced by Spanish politics each term, regardless of the colour of the government, each

term, because all governments need to address the same problems and inbecause the scope of energy decisions extends beyond a term in government; it is therefore striking that, in view of the magnitudemagnitude of the problem, we have not yet reached an agreement on measures to be taken to ensure the future of our energy system.

A sector as vital and as complex as energy, in which investments are huge and are programmed well in advance, needs a stable and predictable regulatory framework capable of transmitting calm and confidence to producers, operators and users. Only in this way will we be able to make progress and overcome the major challenges the future holds in store. All the issues referred to in this article and described as important, indispensable or essential truly areju.

Energy saving, efficiency, competitiveness, sustainability, security and new technologies for the production and storage of renewable energy, not to mention intelligent networks making it possible to adopt models of responsible consumption, the introduction of distributed generation and many other considerations referred to above also affect the energy model.

The economic, environmental, technological and geopolitical cross-roads at which mankind stands is so significant and affects energy sources so greatly that only with the involvement and effort of everyone will we be able to address these challenges successfully.

A parliamentary subcommittee set up within the Industry, Tourism and Trade Committee more than a year ago is working precisely on analysing the current energy model and proposing solutions for the future 2035 horizon.

The deadline for completing its work is the end of the current year and it would be excellent news for the energy sector and for the country in general if its conclusions, a result of the consensus of all the political groups, were adopted pointing out the medium- and long-term scenarios and outlining Spanish energy policy for the 2035 horizon.

All the countries are stepping up efforts to overcome the difficulties envisaged in relation to energy, the environment and sustainable development as soon as possible; it is not just a question of getting there—we need to get there on time.

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