Policy Briefings

BASQUE CENTRE FOR CLIMATE CHANGE
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WARNING TO NAVIGATORS: IPCC REPORT ON CLIMATE CHANGE MITIGATION

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Introduction

This document analyses the principles of the report "Climate Change 2014. Mitigation of Climate Change" published in April 2014 (IPCC 2014). This report is the latest of three which, together with a Synthesis Report, will constitute the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, IPCC.

The first report, published in September 2013, demonstrated proof of the global warning observed in the planet ("detection") and its human origin ("attribution"), in addition to the future implications for the system in terms of higher temperatures and rising sea levels. The myriad changes noted to date have no precedents in a scale ranging from hundreds to thousands of years. For example, CO2 concentrations in the atmosphere, which rose to 400 parts per million (ppm) in 2013, are the highest in 800,000 years. Although new data have been incorporated and a number of projections have been extended and improved, we can say that the principle elements of climate science have been sufficiently steady for decades (see summary in Faria et al. 2013).

The second report, published in March 2014, analyses the expected impacts on human systems and ecosystems, and the possibilities that exist as regards reducing the damage through adaptation. For example, the report points towards the migration already taking place among many ocean species, lower crop yields and the possibility of irreversible impacts once beyond certain tipping points. The impacts of climate change will be harsher in the more exposed regions, but also in the most vulnerable, i.e. the ones that do not have sufficient resources to protect themselves or to adapt to the changes. This report therefore particularly highlights the importance of integrating policies of adaptation to other areas of public action, such as sustainable development and poverty relief. The report forecasts that a temperature rise of 2ºC will cause a dent of between 0.2 and 2% in world income (see summary in Saiz de Murieta et al. 2014), not including the costs associated to extreme occurrences, for example.

The third report, analysed here, studies the existing mitigation options and their implications, understanding by mitigation all actions aimed at reducing greenhouse gas sources and increasing carbon sinks. The Working Group was headed by Ottmar Edenhofer (Germany), Ramón Pichs-Madruga (Cuba) and Youba Sokona (Mali).

Key Points

- *Despite the proliferation of climate change plans and strategies, global emissions have accelerated over the last decade.*
- *If the present trends continue, temperatures will have risen between 3.7 and 4.3ºC by the end of the century.*
- *To stabilise temperatures at 2ºC, emissions must be reduced between 40 and 70% by 2050 and have dropped to almost zero in 2100. This will imply a radical change at technological and institutional level; it will also mean an important transformation in lifestyles.*
- *Fortunately, there are several stabilising options which are technically viable and economically assumable.*
- *Nevertheless, it is important that investments are materialised in the coming decades (2010-2030) to avoid having to use technologies to capture emissions in the atmosphere (negative emissions) that would entail higher costs and greater risks.*
- *International cooperation and the search for fair agreements are essential for making progress with and maintaining mitigation efforts.*

Cartographers and navigators

The IPCC is an intergovernmental panel of experts on climate change, the principle mission of which is to make a non-prescriptive analysis of different mitigation alternatives and provide politicians with scientific evidence on which to base their decisions. Thus, following the analogy used by Youba Sokona when presenting the report, we could say that the IPCC scientists are the cartographers and the political heads the navigators who decide what direction to take. The scientists must not only give a good indication of the potential routes, but must also point out landforms, unexplored territories and potential dangers lying along the way. They must be transparent as regards the challenges, risks and potential consequences of the different routes; however, it is not their mission, at least within the IPCC, to propose specific mitigation technologies or to establish precise distributions by countries of the effort required to reduce emissions.

One of the most widely read documents of the IPCC Working Groups is the Summary for Policy Makers, SPM. And it is precisely on the approval of this document that government heads and scientists interact, given that said document requires approval line by line. The current SPM ran up against friction, for example, when breaking down emissions by countries according to income categories and the manner of measuring emissions from the point of view of production or consumption. What was finally included in the SPM is the result of that negotiation, although, as we are reminded by Ottmar Edenhofer, “it is the scientists who control the report from start to finish”. On the other hand, although certain contents were unable to appear in the SPM for different reasons, they can be found in full in the longer technical summary or in the 15 chapters of the report.

Having established the context of the report, below we present the contents that we believe are most important.

Main results

Despite the proliferation of climate change plans and strategies, global emissions have accelerated over the last decade. Efficiency gains have been insufficient to compensate for the rise in population and per capita consumption.

One of the principle messages of the report is that, despite the proliferation of climate change plans and strategies, and of the 2007-08 economic crisis, global greenhouse gas emissions (GHG) have accelerated rather than slowing down.

Total GHG emissions rose continually between 1970 and 2010, but have gained in intensity in the last decade, coming to an equivalent total of 49 gigatonnes of carbon dioxide a year (GtCO2eq) in 2010, 78% of which are emissions arising from the burning of fossil fuels. Half of all CO2 emissions accumulated between 1750 and 2010 (historic emissions) have taken place in the last 40 years.

Figure 1 shows the variation in CO2 emissions due to combustion and the driver responsible for them. We can see that, although in the decades falling between 1970 and 2000 emissions rose at an increasingly-slower rhythm (4.0, 2.9 and 2.4 GtCO2 a year), from 2000-2010 they did so at a faster rate (6.8 GtCO2/year). Energy efficiency gains have not been sufficient to compensate for increases associated to the rising population and, particularly, the strong rise in per capita consumption/GDP. Added to this, the greater use of coal means that the intensity of CO2 from energy use has also started to rise.

Analysing the evolution of emissions by region, we can see how the developed or high-income countries (OECD) concentrate the great majority of historic emissions. However, a large part of recent emissions growth comes from the emerging countries, particularly in Asia. As far as sectors are concerned, the main emissions increases have taken place in the energy supply, industry and transport sectors.

Figure 2 (published in chapter 5) gives us a broader conceptual idea of the origin of emissions and the potential policies and measures for their reduction. Immediate or direct drivers include decomposition factors of the emissions analysed in figure 1. However, the underlying drivers refer to the processes which have a more direct effect on the said tendencies. Outstanding among these is probably the part played by international trade in localisation of the most contaminating production, the availability of different fossil resources, the productive structure of each country or the technologies used. Also hugely important are policies

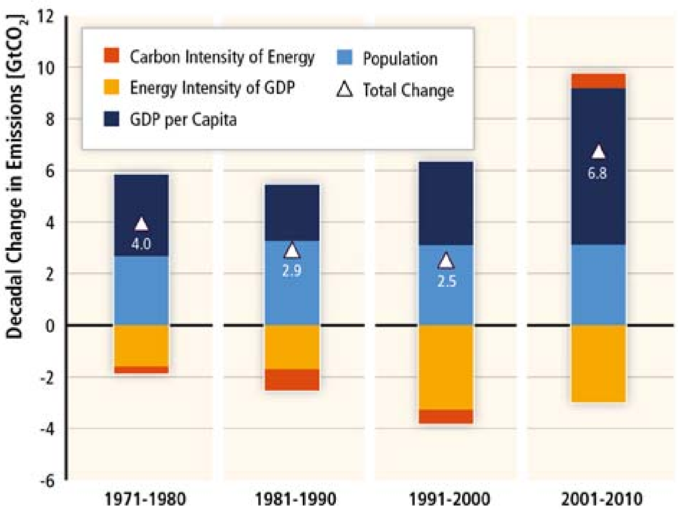

Figure 1: Contribution of different factors to the rise in global CO2 emissions from combustion
Source: IPCC (2014)

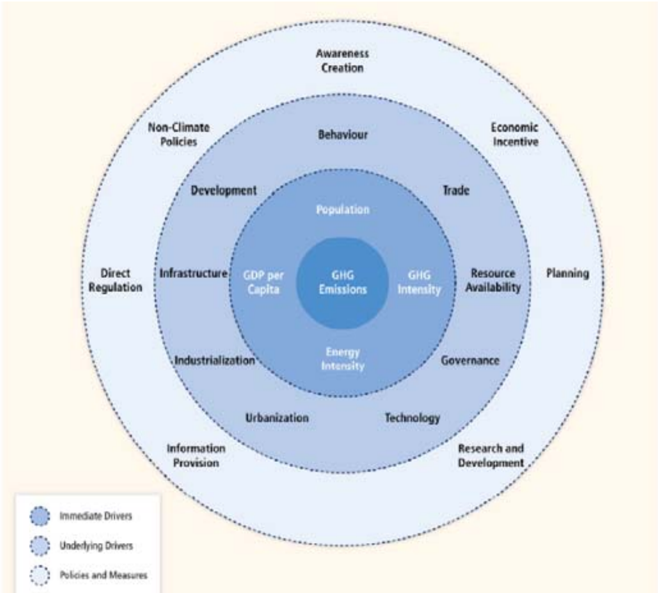

Figure 2: Interrelation between greenhouse gases, direct drivers, underlying drivers, policies and instruments.

Source: IPCC (2014)

related to the design of transport infrastructures and town planning. Some of these circumstances, although they may seem to have little connection with CO2 emissions, are in fact fundamental. For example, in the case of transport and town planning, their effect lies in limiting the possibilities of reducing emissions in the future.

Another of the main messages of the report is that, without additional efforts to reduce GHG emissions, they will continue to rise. According to the majority of reference scenarios, GHG concentrations in the atmosphere would be greater than 450 ppm in 2030 and would rise to concentration levels of between 750 and more than 1.300 ppm in 2100. As a result, the mean temperature of the Earth would stand in 2100 at between 3.7 and 4.8°C higher than pre-industrial levels, which could cause dangerous interferences in the climate system and generate important damage across the planet. Added to this, given the uncertainty of the climate system, the range could hit even greater highs, from 2.5 to 7.8ºC. These scenarios place the rise in temperatures far above 2ºC, the target threshold adopted by the international community at the Copenhagen Summit as the temperature above which damage may be excessive and dangerous. In this respect, and in the words of Edenhofer: “science is sending us a clear message: to prevent dangerous interferences in the climate system, we cannot continue with trend as it stands today”.

To prevent dangerous interferences in the climate system, we cannot continue with the trend as it stands today as it would lead to temperature rises of between 3.7 and 4.8ºC

If we want to maintain the rise in average temperature of the planet to below 2ºC, emissions must be reduced by 40-70% (in comparison to 2010) by 2050, and to almost zero by 2100 (see Figure 3). The range of reduction in 2015 is wide because, technically speaking, the level of mitigation required to stabilise the temperature at 2ºC can be reached from different starting points. Nevertheless, and this is somewhat less widely known, as said, in 2100 these emissions should be almost zero across the globe; however, in the event of the reductions falling into the lower range in 2050, given the inertia of the climate system itself, emissions in 2100 will in fact have to be negative.

Keeping temperature increase to below 2ºC won’t be an easy task: emissions must be reduced in comparison to 2010 by 40-70% by 2050 and to almost zero by 2100. This entails radical technological and institutional change, and an important transformation in lifestyles.

The IPCC itself recognises that achieving stabilisation at 2ºC will not be an easy task. For example, the pledges made by countries at the Cancun Summit in 2010 which, to make matters worse are not binding, address a series mitigation objectives which the IPCC considers to be more in line with a stabilisation target in the region of 3ºC. To succeed in stabilising the temperature at 2ºC a radical change is required in technological and institutional systems, and in behaviours and lifestyles. In addition, decarbonisation of the world economy must take place in a context where 1,300 million people do not have access to electricity or to modern sources of energy. We therefore require a wide range of large-scale technologies, added to political and public support and the necessary financing to make the said transition possible.

The last circle of Figure 2 indicates the kind of politics that can help to modify said drivers, such as access to information and awareness raising techniques, regulation and economic incentive policies, long-term planning policies and research and development. Also important are policies not a priori related to climate policy, such as energy security policies or others to reduce local contamination, which may have an indirect impact on emissions. This report places great stress on the importance of mitigation policies being lodged within the wider frame of sustainable development policies and on account being taken of the potential additional advantages and disadvantages that could be generated. In addition, the document underlines the importance of international cooperation and the search for fair agreements in order to be able to progress with and maintain mitigation efforts.

The positive message of the report is that, fortunately, there are different ways, in other words, different combinations of technologies and policies that make said stabilisation feasible. From a technological point of view, transition is, for the time being possible. On the other hand, and from an economic point of view, the costs, although they do exist, are modest and assumable. In Edenhofer's words "saving the planet does not cost the world".

Saving the planet does not cost the world: there are several options for stabilising the temperature that are technically viable and economically assumable. Nevertheless, it is extremely important that the required investments are made in the coming years

According to the report, the mitigation costs associated to achieving 2ºC would correspond to an average global loss in consumption of 3.4% in 2050 and 4.8% in 2100. It is extremely important to understand that these losses are compared with a scenario whereby the tendency towards economic growth is approximately 2% a year until 2100. In other words, the IPCC is telling is that, if global consumption were to rise, for example, by 300% from 2010 to 2100, mitigation would mean that consumption would 'only' increase by 295.2%. Specifically, the IPCC estimates an annual loss in economic growth of 0.06%.

It is also important to understand that these costs have a series of associated assumptions. The costs refer to minimum costs in an ideal scenario where all countries cooperate in the mitigation, where there is therefore a global instrument (e.g. a CO2 tax/market or an emissions ceiling) and no market failures. In addition, it also assumes that all technologies are available in time and that the investments are made at the right moment. Nevertheless, the IPCC analyses and quantifies different scenarios where international climate policy is fragmented, or where, for example, the decision is taken not to use certain technologies. Greater flexibility with regard to the where (countries and sectors) and how (technologies) of going about the mitigations would mean greater costs and transfer of the effort to other sectors, countries or generations.

In addition, the mitigation costs analysed do not take account of the damage prevented, which is the main reason for these policies but is difficult to quantify. Similarly, these costs do not consider some of the most important associated positive effects, such as the reduction in local contamination, which causes serious health problems, and increased energy security.

Nevertheless, one essential message of the report is that, despite the fact that the 2ºC objective is technically and economically feasible, it is enormously important that the investments are materialised in the coming decades (2010-2030). The first reason is, given that the useful lives of many decisive infrastructures for the evolution of emissions (e.g. a thermal power station or a road)

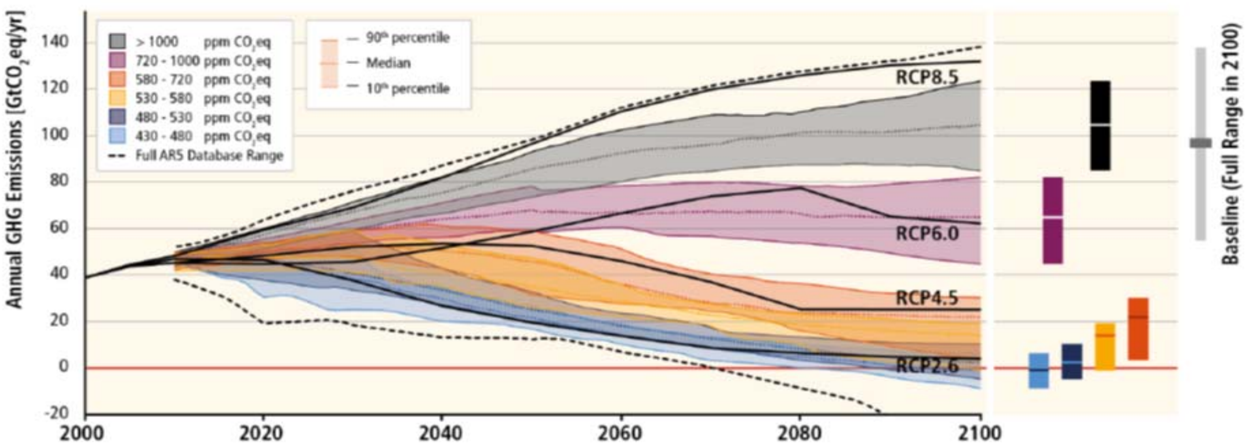

Figure 3: Emission trends (RCP 8.5) and pathway to stabilisation at 2ºC (RCP 2.6)

Fuente: IPCC (2014)

Note: Representative Concentration Pathways (RCP) measure radiative forcing, or in other words, the imbalance existing in the global energy system for 2100, in W/m2. In 2010, radiative forcing was such that the amount of accumulated energy was positive ("global warming"), standing at a value of 2.2 W/m2. The existing excess energy could light a 2.2W bulb for every square metre on stretch over decades that all new investments not made in low-carbon technologies represent an economic and environmental dead weight for the future. The second reason is that, if emissions are not reduced and certain levels of concentration in the atmosphere are overshot, the only way to achieve reduction and a negative emissions balance will be to 'remove' the CO2 from the atmosphere. Figure 3 shows how the gradual short-term delay in emission reduction comes with an associated higher quantity of mitigation and negative emissions in the future. If the emissions do not reach their highest point until 2030, it will be necessary to "remove" from the atmosphere 20GtCO2 a year, almost a half of current emissions. To achieve said negative emissions it would be necessary to generate electricity through the large-scale use of biomass in combination with Carbon Capture and Storage (CCS). Biomass would absorb the carbon content in the atmosphere and CCS technology would inject it into hermetically sealed compartments, thereby succeeding in "extracting" CO2 from the atmosphere. Although this technology may be viable in the future, it is thought that it will be more expensive. There are also numerous risks associated to the large-scale use of biomass given that it competes for the use of land for producing food and can have a powerful effect on biodiversity; in addition to this are the risks and uncertainties inherent to the Carbon Capture and Storage technology.

Figure 4 shows what could be a cost-efficient pathway for investments between 2010 and 2030 to achieve the 2ºC objective and prevent overshooting. The additional total investment into low-carbon electricity generation (the sum of investment in renewables, nuclear and carbon capture and storage) must reach US$147,000m, while associated investment into traditional fossil technologies should drop by US$30,000m. It will also be necessary to give a strong boost to efficient energy in transport, building and industry amounting to US$336,000m. This investment pathway, particularly the renewables, nuclear and CCS composition, can be modified, provided that the reduction in one technology is compensated with others. The report lists the advantages, disadvantages, risks and estimated costs of each one. In any event, the IPCC underlines (SPM p. 23) the important reduction in the cost of renewable energies in recent years and their strong increase in the energy mix, while nuclear energy has been dropping since 1993 due to the different barriers and risks existing.

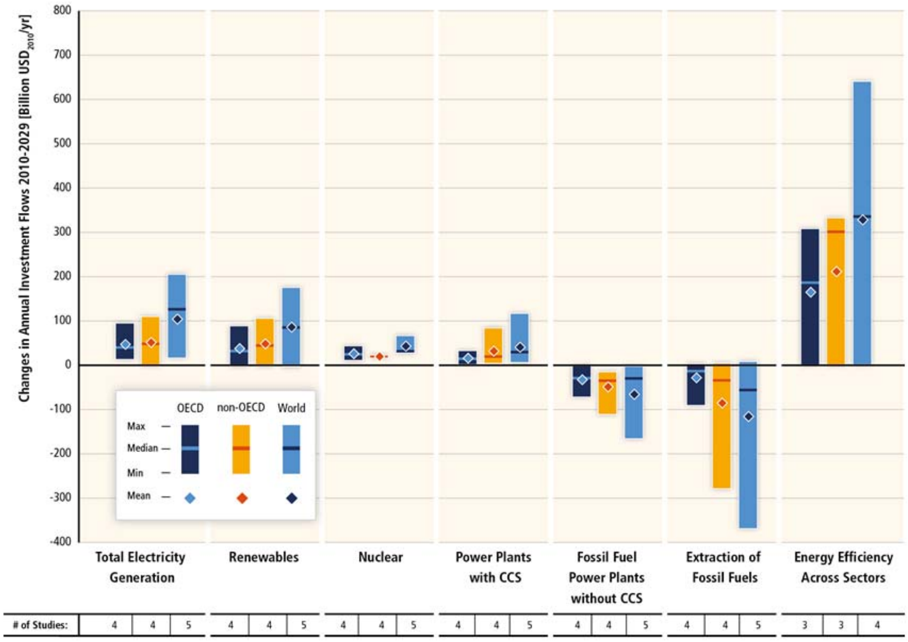

Figure 4: Annual investment over the coming two decades (2010-2029) to stabilise temperature at 2ºC.
Source: IPCC (2014)

No matter what pathway we choose, the use of fossil fuels tends to disappear from all mitigation scenarios, which will probably cause these assets to lose value. The doubt is what part can be played by gas as a transition fuel in the first half of the century and whether the capture and storage technology can or not sufficiently reduce its costs to make it profitable in plants that produce electricity with coal. Today, the costs associated to this technology are very high; it has only been tested in pilot plants and its commercialisation is not expected to take place before 2030. If CCS is not technologically or economically viable, a decarbonisation consistent with the 2ºC pathway would require an important part of fossil resources to remain underground.

Finally, summing up, the message of the IPCC report is clear: "if we truly want to succeed in limiting temperature to no more than 2ºC the mitigation train must leave the station soon and at full throttle, with every society in the world on board", in the words of Rajendra Pachauri, Chairperson of the IPCC. The Climate Summit scheduled for next year in Paris will show us just how willing the passengers are.

AR5 Publication: Youba Sokona, Ramón Pichs-Madruga, Ottmar Edenhofer (WGIII Co-Chairs); Rajendra Pachauri, IPCC Chair (from left to right). Credit: Benjamin Kriemann/IPCC

Sources :

IPCC (2014) Climate Change 2014. Climate Change Mitigation, Summary for Policy-makers.

Sainz de Murieta, E., Neumann, MB, and Markandya, A. (2014), IPCC WGII Fifth Assessment Report (AR5): Expanding the solution space for adaptation, Policy Briefing, Special Issue-02, BC3 http://www.bc3research.org/policybriefings

Faria, S.H., Spadaro, J.V, and Markandya, A. (2013) Breaking the 400 ppm barrier: Physical and Social implications of the recent CO2 rise, Policy Briefing, Special Issue-1 http://www.bc3research.org/policybriefings

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