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LIMITING GREENHOUSE GAS EMISSIONS: THE SOONER THE BETTER

The objective set by the IPPC of limiting the increase in average global temperature to +2°C compared to the pre-industrial era is now accepted by all concerned. This ambitious objective was recognised at the Copenhagen Conference in 2009 and confirmed at Cancun in 2010. There are still no restrictive measures, but to achieve this objective, the main countries contributing to the emissions have already announced their commitment to reducing their emissions by 2020. The aim of this Newsletter is firstly to gain a better understanding of what this objective involves in terms of reducing global emissions over the next ten years. It will be then go on to assess whether the measures taken by the various countries are sufficient.

From Kyoto to Cancun

Following the relative failure of the Copenhagen Climate Conference, there was strong concern on the eve of the 16th Conference of the Parties (CoP 16) held in Cancun in December 2010. But by the end of the conference it appeared that hope had returned. We still do not know what form the international agreement will take following the Kyoto Protocol[1]. The text still lacks any restrictive commitment to reduce greenhouse gas emissions by 2020 or even 2050. Nor were there any major innovations at Cancun, except for the creation of a green fund (the procedures for which still need to be defined) and the implementation of measures to combat tropical deforestation. However, the various countries did commit to continuing the dialogue.

The Copenhagen Conference in 2009 brought so much disappointment because hopes had been set very high. Looking back, we can see that the conference was not totally in vain: the agreement sealed a year later in Cancun shows serious progress in terms of global climate negotiations. In particular, it would appear that the signatories now acknowledge the need to contain the increase in the earth's temperature to below +2°C compared to the pre-industrial era (1850-1899), meaning a maximum increase of around 1.2°C compared to current temperatures. Moreover, at Copenhagen, the countries that made a commitment to reducing emissions are responsible for 80% of global emissions, compared to only 25% under the Kyoto Protocol. Certainly, contrary to the Kyoto Protocol, these commitments are not restrictive. But Cancun sets the basis for a system of measuring and checking efforts made to reduce emissions, and the regulations have been accepted by all signatories - India, Brazil and China in particular.

Today, there is a consensus on these ambitious objectives. But there is one question: are the commitments made by each country compatible with these objectives?

Climate risks confirmed

The 4th assessment report from the Intergovernmental Panel on Climate Change (IPCC) published in 2007 confirms global warming: we are seeing a rise in average temperatures, serious melting of the glaciers and a rise in sea levels; eleven years of the period 1995-2006 figure among the twelve warmest years

1. The Kyoto Protocol was ratified at COP 3, which was held in Kyoto (Japan) in 1997, but did not come into force until 2005. Only the United States has not ratified it. The Kyoto Protocol covers the period 2008-2012.

of the period 1850-2006 (in 1850 when temperature records began)! According to the IPCC, the rise in greenhouse gas emissions due to human activity (anthropogenic gases[2]) very probably explains (i.e. with a probability superior to 90%) some of these phenomena.

If trends continue, global greenhouse gas emissions could increase by 25 to 90% between 2000 and 2030 (IPCC, 2000). This increase could lead to an average increase in temperature between 1.8°C and 4°C between now and 2100, depending on the scenarios (by way of comparison, the difference between current average temperature and that of the last Ice Age is 5 to 6°C). What is more, current climate change is occurring at a much faster rate than in the past (over several centuries rather than millennia), which leaves little time for societies and ecosystems to adapt.

Limiting global warming to +2°C should, we hope, limit the risk of irreversible and potentially catastrophic environmental upheavals to a reasonable degree.

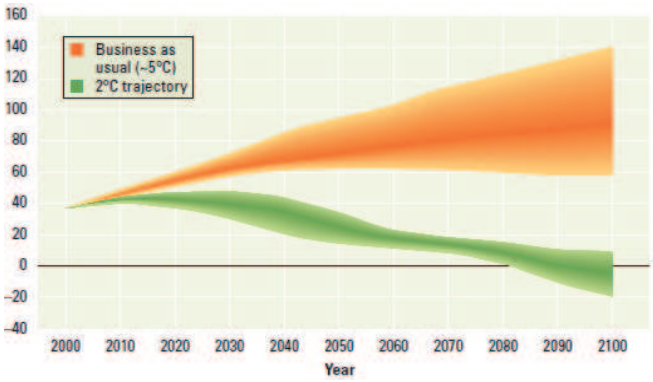
What does limiting the increase in temperature to +2°C mean in terms of emissions?

Can the objective of a maximum temperature increase be translated into a maximum greenhouse gas concentration in the atmosphere? On this point, IPCC experts consider that the figure of 450 ppm of CO_2-eq (parts per million of CO_2equivalent – all greenhouse gases are expressed in a common unit in terms of warming potential) constitutes the limit that should not be exceeded in order to have around a 50% chance of limiting the temperature increase to 2°C.

Can the level of concentration then be translated into a maximum volume of greenhouse gases emitted each year? Not really. Greenhouse gases remain in the atmosphere for decades and even centuries. The target concentration of 450 ppm gives us the maximum volume of cumulated greenhouse gas emissions, but not the sustainable emissions trajectory (Graph 1) There are a number of trajectories ending in the same level of concentration, but there is limited room for manoeuvre.

The IPCC analysed a series of scenarios for reducing greenhouse gas emissions and classified them in terms of peak emissions (the period during which global emissions need to start to fall) (Table 1). Given that the climate system has a high level of inertia, the longer we wait to reduce missions, the higher the level at which stabilisation occurs. So, in order to have a fifty-fifty chance to limit the increase in temperature to +2°C, global

Graph 1 – Projections for total annual global emissions volume (Gigatonnes of CO_2-eq.)



Source: World Bank (2010).

greenhouse gas emissions need to start dropping by 2015, and must drop by at least 50% by 2050 compared to 2000[3]. The window of opportunity for managing to stabilise concentration at 450 ppm is therefore extremely narrow. If we had to accept an increase in temperature between +2.4°C and +2.8°C (with a fifty-fifty chance not to overtake), it would only enable us to move peak emissions by five years.

How do we share out the restrictions?

At Copenhagen and then Cancun, the international community agreed on an acceptable level of risk, but there is still no shared view on the global trajectory of emissions, and even less on how efforts should be distributed across different countries. The Europeans and Americans agreed on a necessary reduction figure of 50% to 80% for emissions in developed countries by 2050 compared to 1990, but cannot agree on targets for 2020. The former are sticking to the IPCC scenarios, with a reduction in emissions for developed countries of around 25 to 40% by 2020 compared to 1990,

Table 1 – Classification of recent stabilisation scenarios for concentration of CO_2-eq.

Concentration of greenhouse gases (in ppmv CO_2-eq.)	Increase in temperature in C° (range of likelihood)	Peak period for global emissions	Variation in greenhouse gas emissions in 2050 (in % compared to 2000)
445-490	2,0-2,4 (1,4-3,6)	2000-2015	-85 à -50
490-535	2,4-2,8 (1,6-4,2)	2000-2020	-60 à -30
535-590	2,8-3,2 (1,9-4,9)	2010-2030	-30 à +5
590-710	3,2-4,0 (2,2-6,1)	2020-2060	+10 à +60
710-855	4,0-4,9 (2,7-7,3)	2050-2080	+25 à +85
855-1130	4,9-6,1 (3,2-8,5)	2060-2090	+90 à +140

Source: IPCC (2007).

2. Carbon dioxide (CO_2) emissions account for about three quarters of total greenhouse gases produced by humans. The remainder is made up of emissions of water vapour, methane, nitrogen dioxide and fluorinated gases.

3. In the Kyoto Protocol, the comparison is most often made with emission levels for 1990. Between 1990 and 2000, emissions increased by around 10%.

but the United States consider this target is neither necessary nor feasible. However, it would seem that all countries have an interest in taking steps as soon as possible, even if only to reduce the cost in economic terms. A report by the RECEIPE[4] project (a European consortium of research teams on economy and climate) in fact shows that the cost of meeting the target of 450 ppm would be between 0.1% and 1.4% of world GDP[5]. If we delay efforts until 2020 however, the cost would be 0.8% to 2% of world GDP.

Another point of disagreement: the distribution of effort across developed countries and major emerging countries. Yes, all agree that rich countries need to make a bigger contribution than poor ones, as the latter cannot reduce emissions without compromising their development (the principle of shared but differentiated responsibilities adopted in the United Nations Framework Convention on Climate Change (UNFCCC) in 1992). However, the United States is still making greater demands on the major emerging countries than the European Union. It would appear that it all rests on a point of principal. In fact, the RECIPE project shows that developed countries would benefit from acting as soon as possible, independently of any action taken by others. The effects are hard to assess with great accuracy but, by acting first, Europe and the United States could enjoy an advantage over their competitors (first mover advantage). But, major emerging countries might also benefit from early implementation of their climate policy, avoiding the development of infrastructures and an energy system that would be highly carbon-intensive, which would make any commitment to reduce their emissions later very costly.

Table 2 – Commitments from countries that are signatories to the Copenhagen Agreement and that emit the highest levels of greenhouse gases

	Country	Ref year	Objective to reduce emissions by 2020
Annex 1 countries	Canada	2005	-17%
	United States	2005	-17% (subject to approval by Congress)
	Japan	1990	-25%
	Russia	1990	-15 to -25%, depending on forest area
	European Union	1990	-20%; -30% if comparable effort from other developed countries and participation from developing countries
Emerging countries	Brazil	2020	Between -36 and -39% compared to reference scenario
	China	2005	Reduction in CO_2 intensity of GDP of -40% to -45%*
	India	2005	Reduction in greenhouse gas intensity of GDP of -20 to -25% (excluding agricultural emissions))
	South Korea	2020	-30% compared to reference scenario

* Carbon intensity is defined by the quantity of greenhouse gas emitted per unit of GDP.
Source: H. Casella, A, Delbosc et C. de Perthuis (8 Octobre 2010), "Cancun : l'an un de l'après Copenhague", Les Cahiers de la Chaire Economie du Climat.

Are the commitments made consistent with the long-term objective?

For the first time in Copenhagen, a number of major emerging countries agreed to make commitments to reduce their emissions, particularly China, which is largest emitter of greenhouse gases emissions in the world. The United States has also become active again in combating climate change, declaring its objective of reducing greenhouse gas emissions by 17% by 2020 and 42% by 2030 compared to 2005 (*i.e.* -4% by 2020 and -33% by 2030 compared to 1990). So it would seem that the great majority of countries have measured the danger to the climate and are now ready to combat global warming. But is this enough? Table 2 shows the commitments notified to the Secretariat of the UNFCCC by the largest emitters on the planet.

Unlike the Kyoto Protocol, the Copenhagen and Cancun agreements do not standardise the way in which countries report on reductions in emissions that they plan to make. We have therefore ended up with a mosaic of different commitments, where procedures (tools, reference year *etc.*) vary widely between countries. A number of analyses have attempted to assess whether following the commitments will make it possible to limit the increase in temperature to +2°C[6]. The joint conclusion is that even the most optimistic interpretations will not make it possible to achieve the long-term objective. For example, the analysis carried out by the OECD concluded that the declared reductions might lead to a drop in emissions for Annex 1 countries (*i.e.* countries that have made commitments backed up by numbers under the Kyoto Protocol) of 17%, at best by 2020 compared to 1990. This is below the figures highlighted by the IPCC for limiting temperature increase to +2°C, *i.e.* between -25% and -40% by 2020. In also taking account of commitments from emerging countries, the trajectory of global emissions would actually lead to an average increase in global temperature of +3°C.

4. O. Edenhofer, C. Carraro, J.-C. Hourcade, K. Neuhoff, G. Luderer, C. Flachsland, M. Jakob, A. Popp, J. Steckel, J. Strohschein, N. Bauer, S. Brunner, M. Leimbach, H. Lotze-Campen, V. Bosetti, E. de Cian, M. Tavoni, O. Sassi, H. Waisman, R. Crassous-Doerfler, S. Monjon, S. Dröge, H. van Essen, P. del Río, A. Türk, 2009. The Economics of Decarbonization. Report of the RECIPE project. Potsdam Institute for Climate Impact Research, Centro Euro-Mediterraneo per i Cambiamenti Climatici, Centre International de Recherche sur l'Environnement et le Développement and Electricity Policy Research Group: Potsdam.
5. This is the "rough" cost, which does not include the benefits relating to the stabilisation of greenhouse gas emissions. These estimates are obtained using the Imaclim-R, Remind-R and Witch eco-energy models (the first being a general dynamic calculable balance model, whilst the other two are optimal growth models).
6. For example, see T. Houser (2010), "Copenhagen, the Accord, and the Way Forward", Policy Brief, Peterson Institute for International Economics, PB10-5, March 2010. J. Rogelj *et al.* (2010), "Copenhagen Accord Pledges Are Paltry", *Nature*, 464, 1126-1128. N. Stern & C. Taylor (2010), "What do the Appendices to the Copenhagen Accord tell us about global greenhouse gas emissions and the prospects for avoiding a rise in global average temperature of more than 2°C?", Grantham Research Institute, LSE. UNFCCC (2010), "Compilation of pledges for emission reductions and related assumptions provided by Parties to date and the associated emission reductions", Note by the Secretariat, FCCC/KP/AWG/2010/INF.1.

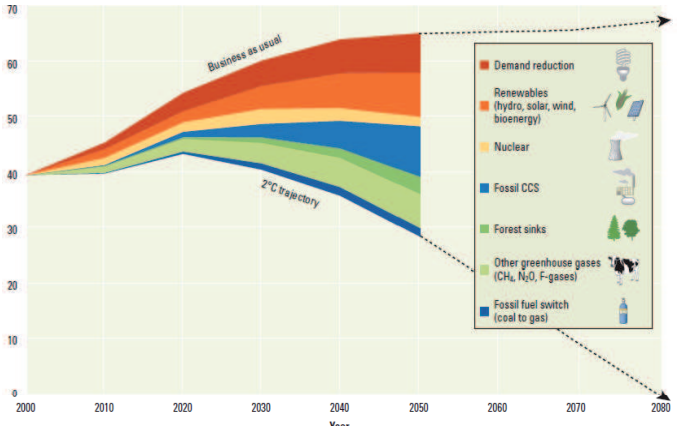
What policies do we need to reduce emissions and achieve the objective of +2°C?

The declared objective involves a massive reduction in emissions, requiring the deployment of a whole raft of technologies. A number are already on the market, but we will have to wait decades for others. The RECIPE project names carbon capture and renewable energy as technology-based options with the highest potential. Improving energy efficiency and controlling the demand for energy offer potential for significant short-term, low-cost reductions. Realising the full potential of such technology will require major socio-economic and institutional change. To achieve the required deployment, we will need suitable and effective measures that will encourage the perfecting, acquisition, application and distribution of these technologies.

In a more general sense, the transition towards an economy with low carbon intensity requires major reforms to energy, industrial, urban and land use policy. Such policies will need to cover all economic sectors and apply to businesses, households and governments alike. Any initiatives to be taken will need to guide choices in terms of public and private research, influence investment decisions and even restrict planning and mobility options. This kind of change cannot happen without changing lifestyle and consumption habits.

Finally, as has already been said, the date on which policies will be implemented, especially in emerging countries, is crucial. In fact, opportunities to move from a carbon-intensive infrastructure to one with low carbon intensity are not distributed uniformly over time. The major emerging countries are currently building infrastructures to last for decades: between 15 and 40 years for electricity power stations, between 40 and 75 years for road, rail and electricity networks. Thus, the International Energy Agency predicts that China will increase its electricity production capacity by 1,300 gigawatts between 2006 and 2030 – double the current capacity. But, for the moment, 75% of the electricity produced in China comes from fossil fuels – mainly coal. The new power stations will certainly be cleaner, but this will not be enough to limit emissions. Moreover, certain infrastructures involve investment in associated equipments (cars in low-density towns, for example), which could lock economies into energy-hungry lifestyles and consumption habits. The case of the United States illustrates the last point very eloquently: an American emits more than twice the level of greenhouse gases than a European. It is therefore vital to act quickly. If we allow high carbon intensity infrastructures to be set up, policies for reducing emissions will be harder to implement, particularly because they will be more costly. This brings us back to the fact that it is important to act as soon as possible in order to limit the cost of making adjustments.

Graph 2 – Reaching the objective of +2°C: a wide range of measures and technologies



Note: Each surface represents global reductions in emissions (in gigatonnes of CO_2) for a given technology. For example, a reduction in demand (energy savings) would reduce total global emissions from 65 gigatonnes of CO_2 to around 55 gigatonnes of CO_2 by 2050. By cumulating the technologies presented, we could stabilise global emissions by 2030 in relation to the year 2000.

Source: World Bank (2010).

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