Limiting greenhouse gas emissions: is the Cancun agreement enough?

Stéphanie Monjon

University Paris Dauphine (LEDa-CGEMP), CIRED and CEPII,
Place du Maréchal de Lattre de Tassigny,
75775 Paris cedex 16, France
Email: stephanie.monjon@dauphine.fr

Abstract: The objective set by the IPPC of limiting the increase in average global temperature to +2°C compared with 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 paper 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 then go on to assess whether the measures taken by the various countries are sufficient.

Keywords: Kyoto Protocol; climate change; greenhouse gas emissions.

Reference to this paper should be made as follows: Monjon, S. (2012) 'Limiting greenhouse gas emissions: is the Cancun agreement enough?', *Atoms for Peace: An International Journal*, Vol. 3, No. 3, pp.197–205.

Biographical notes: Stéphanie Monjon is an Assistant Professor of Economics at the University Paris Dauphine and research fellow at CIRED (Centre International de Recherche sur l'Environnement et le Développement), a CNRS research centre specialised on environment economics and at CEPII (Centre d'Etudes Prospectives et d'Informations Internationales), a public research centre specialised on international economics. She was previously senior economist at the French Environmental Agency (ADEME), in charge of the economic issues related to climate change. She holds a PhD from the University Paris 1 Panthéon-Sorbonne. Her primary areas of interest are industrial competitiveness and climate policy, carbon markets and socially responsible investment.

1 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, which has 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?

2 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; 11 years of the period 1995–2006 figure among the 12 warmest years since 1850 (date 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.

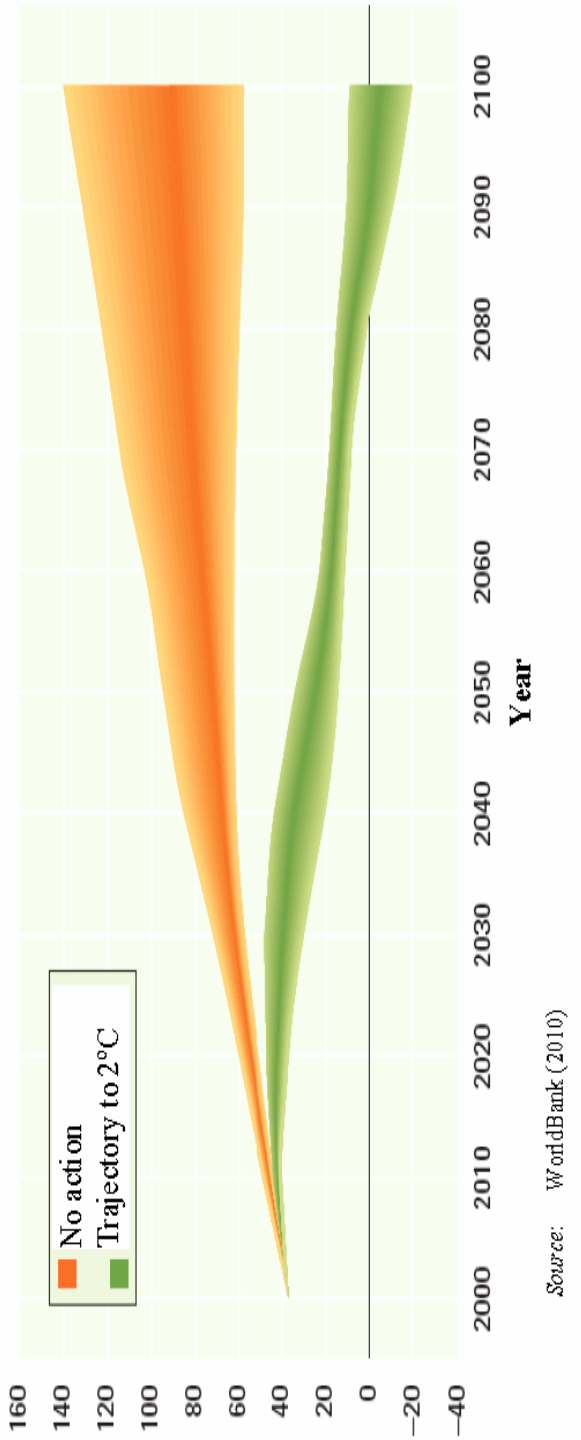
If trends continue, global greenhouse gas emissions could increase by 25% to 90% between 2000 and 2030 (IPCC, 2000). This increase could lead to an average increase in temperature between 1.8°C and 4°C between now and 2100, depending on the scenarios (by way of comparison, the difference between current 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.

3 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_2-equivalent – 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.

Figure 1 Projections for total annual global emissions volume (Gigatonnes of CO_2-eq.) (see online version for colours)



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 (Figure 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 emissions, 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 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.

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 to –50
490–535	2.4–2.8 (1.6–4.2)	2000–2020	–60 to –30
535–590	2.8–3.2 (1.9–4.9)	2010–2030	–30 to +5
590–710	3.2–4.0 (2.2–6.1)	2020–2060	+10 to +60
710–855	4.0–4.9 (2.7–7.3)	2050–2080	+25 to +85
855–1130	4.9–6.1 (3.2–8.5)	2060–2090	+90 to +140

Source: IPCC (2007)

4 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, but the USA

consider this target is neither necessary nor feasible. However, it would seem that the majority of countries have an interest in taking steps as soon as possible in order to reduce the cost in economic terms. A report by the RECIPE 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 (Edenhofer et al., 2009).[4] 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, consistently with the principle of shared but differentiated responsibilities adopted in the United Nations Framework Convention on Climate Change (UNFCCC; in 1992). However, the USA are still making greater demands on the major emerging countries than the European Union. It would appear that it all rests on a point of principle. 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 USA 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 future commitment to reduce their emissions very costly.

5 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 the largest emitter of greenhouse gases emissions in the world. The USA 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 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 the commitments will make it possible to limit the increase in temperature to +2°C (see Houser, 2010; Rogelj et al., 2010; Stern and Taylor, 2010; UNFCCC, 2010). 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.

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%
	USA	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

Note: *Carbon intensity is defined by the quantity of greenhouse gas emitted per unit of GDP.

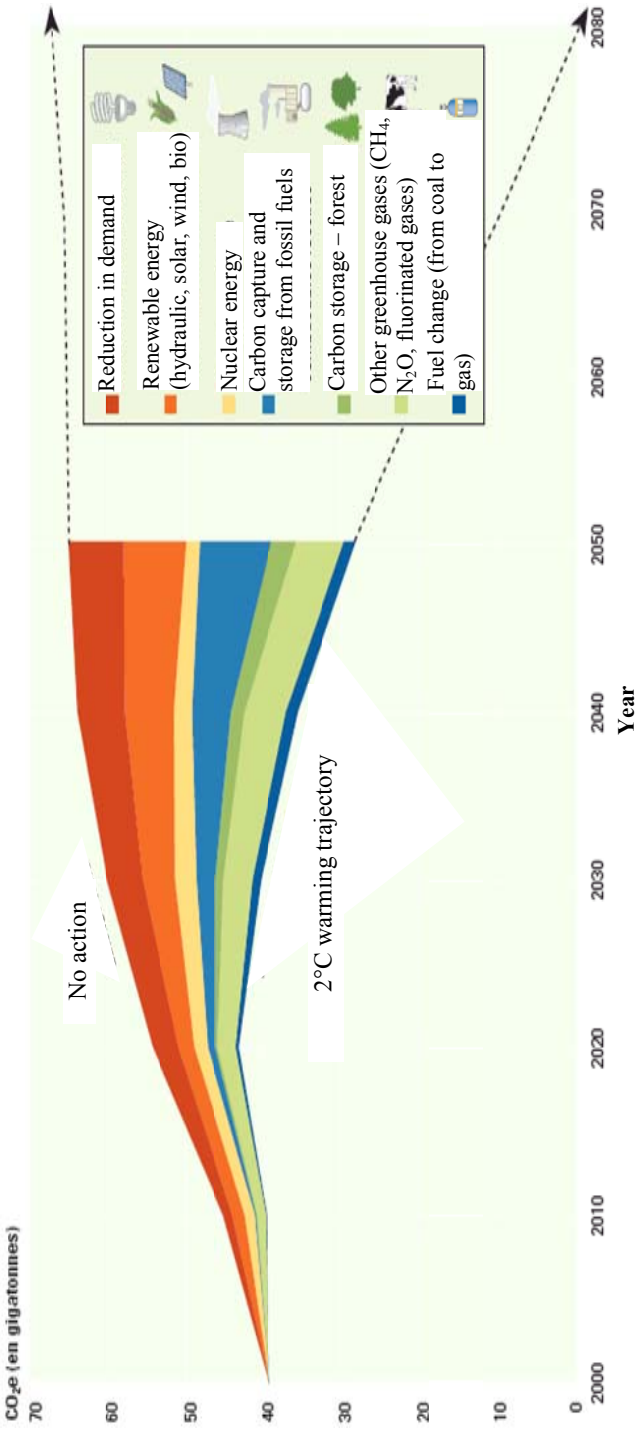
Source: Casella et al. (2010)

6 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.

Figure 2 Reaching the objective of +2°C: a wide range of measures and technologies (see online version for colours)



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 1300 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 USA 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.

Acknowledgements

References

Casella, H., Delbosc, A. and de Perthuis, C. (2010) 'Cancun : l'an un de l'après Copenhague', *Les Cahiers de la Chaire Economie du Climat*, 8 October.

Edenhofer, O., Carraro, C., Hourcade, J-C., Neuhoff, K., Luderer, G., Flachsland, C., Jakob, M., Popp, A., Steckel, J., Strohschein, J., Bauer, N., Brunner, S., Leimbach, M., Lotze-Campen, H., Bosetti, V., de Cian, E., Tavoni, M., Sassi, O., Waisman, H., Crassous-Doerfler, R., Monjon, S., Dröge, S., van Essen, H., del Río, P. and Türk, A. (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.

Houser, T. (2010) *Copenhagen, the Accord, and the Way Forward*, Policy Brief, Peterson Institute for International Economics, PB10-5, March 2010.

IPCC (2000) *Emissions Scenarios*, Cambridge University Press.

IPCC (2007) *Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Chapter 3, Cambridge University Press, Cambridge, UK and New York, NY, USA.

Rogelj, J., Nabel, J., Chen, C., Hare, W., Markmann, K., Meinshausen, M., Schaeffer, M., Macey, K. and Höhne, N. (2010) 'Copenhagen Accord pledges are paltry', *Nature*, Vol. 464, pp.1126–1128.

Stern, N. and Taylor, C. (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.

World Bank (2010) *Development and Climate Change – World Development Report 2010*, Washington DC.

Notes

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 USA has not ratified it. The Kyoto Protocol covers the period 2008–2012.

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%.

4 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).