

## Bali: an agreement in principle for post-Kyoto negotiations but no emissions reduction targets

Ten years have passed since December 1997, when the United Nations Framework Convention on Climate Change (UNFCCC) was signed in Kyoto. It's been a decade of tough international negotiations, leading to the beginnings of an international CO<sub>2</sub> emissions trading market, whose future past 2012 remains uncertain. The December negotiations in Bali may not have produced a successor to the Kyoto Protocol, but they did get all parties to the Convention to sign an agreement in principle to post-Kyoto negotiations.

The ultimate objective of the Kyoto Protocol, negotiated in 1997, was to limit atmospheric concentrations of greenhouse gases (GHGs)<sup>1</sup> to avoid possible climate change. At the time, the developed countries agreed to commitments to cut GHG emissions by 5.2% on average from 1990 levels by 2008-2012. The Parties to the UNFCCC met in Bali last December to set a timeline for negotiations to curb long-term global warming by limiting the increase in temperature to between 2 and 2.4°C, compared to the beginning of the industrial revolution. After ten years of international negotiations, the community of experts has implicitly accepted the evidence of climate change. Given the difficulty of getting all major GHG-emitting countries involved, this same community is seeing the range of possible outcomes offered by an international GHG reduction agreement shrink to almost nothing.

The first Commitment Period under the Kyoto Protocol started on January 1, 2008 and will last five years. On December 3, 2007, Australia finally joined the signatories of the Kyoto Protocol, leaving only one country, the United States, standing on the sidelines in terms of international commitment. The Bush administration continues to reject the principle of binding GHG emissions abatement targets, in order to defend the competitiveness of US companies. In 2005, the United States emitted more CO<sub>2</sub> than any other

country in the world: it generated close to 22% of world CO<sub>2</sub> emissions. In 2007, China became number one. The absence of constraints imposed on these top emitting countries (we might also mention India and Brazil) considerably limits the effectiveness of the Kyoto Protocol which, in the final analysis, only covers one-third of worldwide CO<sub>2</sub> emissions.

The IPCC Fourth Assessment Report, published in 2007, indicated that the warming of the climate system is unequivocal and that, to limit warming, world CO<sub>2</sub> emissions must be cut by 50 to 85% from the 2000 level. A great deal remains to be done before 2012. Today, the real challenge will be to obtain an agreement to succeed the Kyoto Protocol after 2012.

### Steady increase in world concentrations of GHGs, including CO<sub>2</sub>

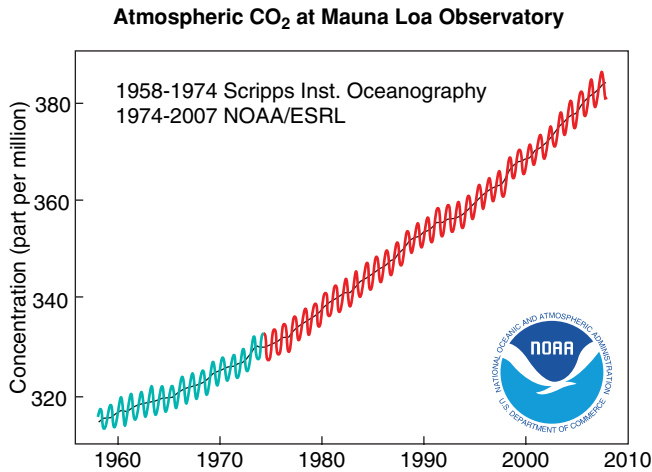
Without a doubt, the atmospheric concentrations of GHGs, especially CO<sub>2</sub>, have shown a steady increase. Since 1960, the atmospheric concentrations of CO<sub>2</sub> measured at Mauna Loa, Hawaii, climbed from 315 ppm in 1960 to 384 ppm in 2007 (Figure 1). In a five-year period (2003 to 2008), average CO<sub>2</sub> concentrations in the atmosphere went up by 1.6 ppm a year.

Similarly, for all six greenhouse gases, radiative forcing has increased by 20% since 1990. CO<sub>2</sub> is dominant among the GHGs and continues to show very significant growth (Figure 2).

(1) There are 6 GHGs: CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFC, PFC and SF<sub>6</sub>.

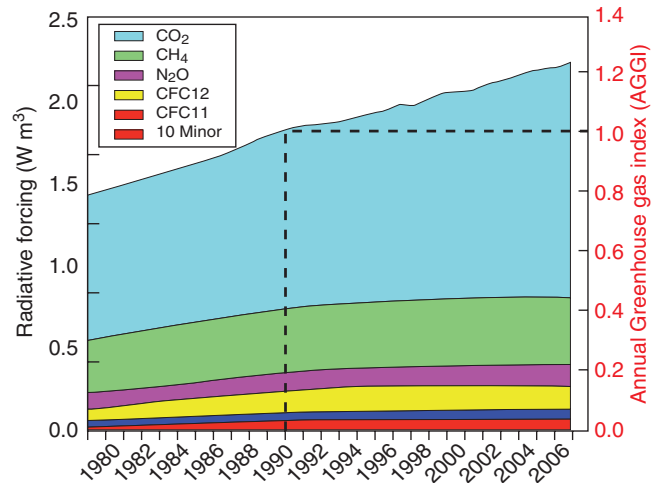
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Fig. 1 - Monthly average (1960-2008), atmospheric concentrations of CO<sub>2</sub> (ppm) at Mauna Loa, Hawaii



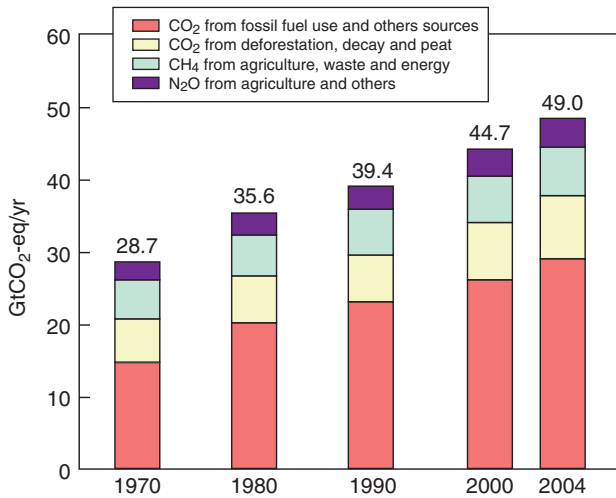
Source: NOAA

Fig. 2 - Evolution of the GHG contribution to radiative forcing



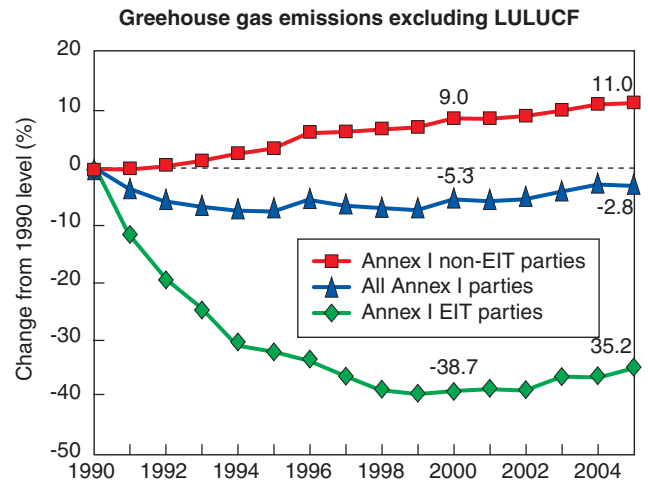
Source: NOAA

Fig. 3 - World anthropic GHG emissions (1970 to 2004)



Source: IPCC Fourth Assessment Report ("Climate Change 2007")

Fig.4 - World GHG emissions



Source: EEA. Greenhouse gas emission trends and projections in Europe 2007

## World GHG emissions, including CO<sub>2</sub>, also steadily rising

Worldwide anthropic emissions of greenhouse gases have never reached such high levels. Between 1990 and 2004, they rose 24.4%, from 39.4 GtCO<sub>2</sub>eq in 1990 to 49.0 GtCO<sub>2</sub>eq in 2004 (Figure 3).

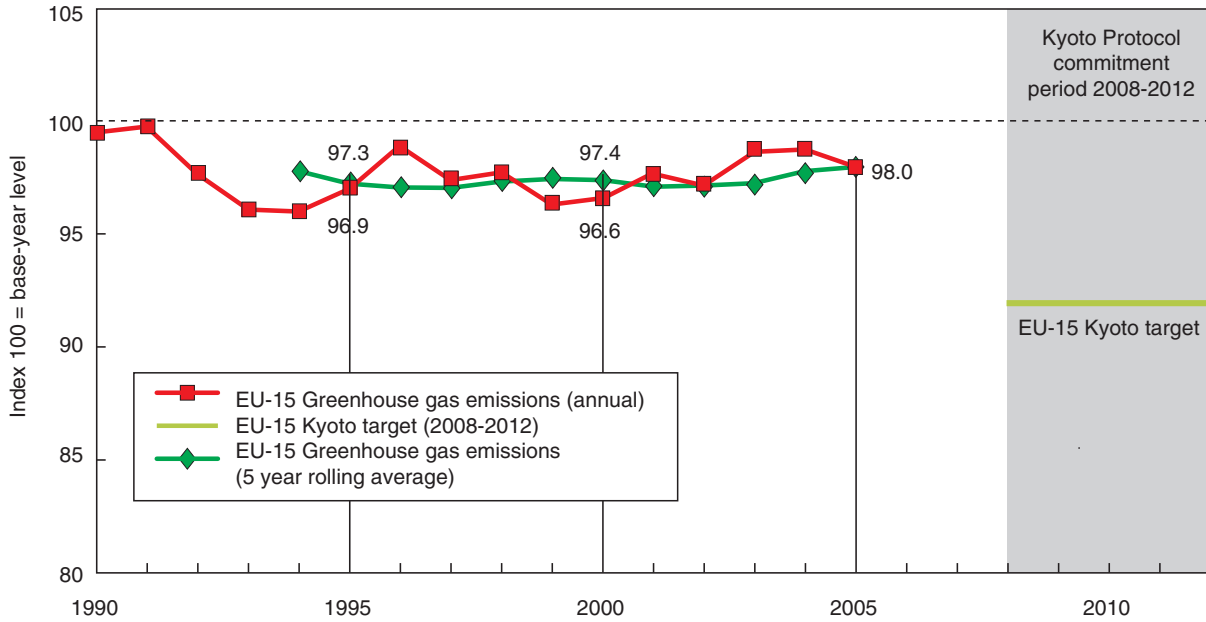
From the geographical perspective, however, GHG emissions did not all grow at the same rate. For instance, emissions generated by Kyoto signatory countries dropped by 2.8% between 1990 and 2004.

Does that mean the average reduction target of -5.2% for 2008-2012 will be attained for all Kyoto countries in the aggregate? This seems uncertain, especially since the earlier reduction target was met, thanks to the sharp cut in emissions achieved by transition countries (-35.2%). On the other hand, the GHG emissions for Kyoto signatory states, not including Eastern European countries, have seen an 11% increase since 1990 (Figure 4).

As future emissions in Eastern European countries rise due to economic recovery, especially in Russia and

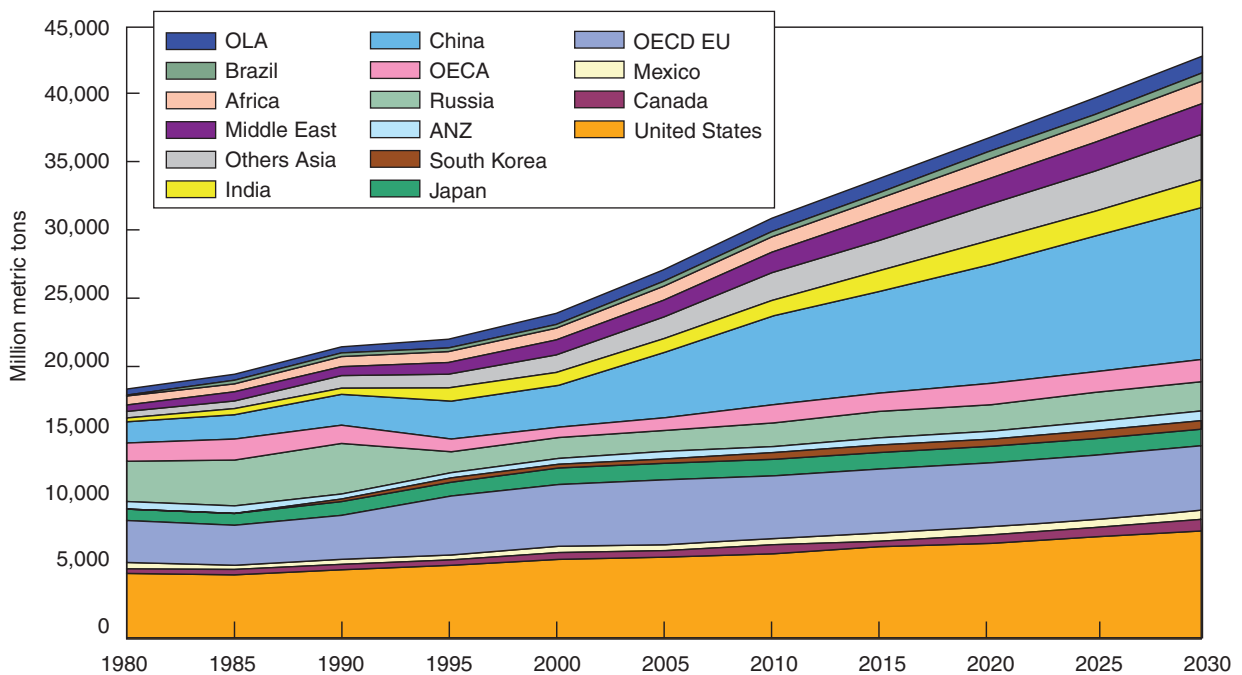
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Fig. 5 - Annual GHG emissions reported for the EU of Fifteen



Source: EEA. Greenhouse gas emission trends and projections in Europe 2007, based on national GHG inventory data

Fig. 6 - CO<sub>2</sub> emissions by country/region (1980 to 2004) and forecasts (millions of tons of CO<sub>2</sub>)



Source: Energy Information Administration, US Department of Energy (2007a and b)

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Ukraine, Annex I countries, taken collectively, could see an overall increase. This would make it harder for them to reach their reduction target if nothing is done.

### Europe: current situation

A signatory of the Kyoto Protocol, the European Union of Fifteen undertook in 1997 to reduce its GHG emissions by 8%. In 2005, it reported a slight decrease in emissions (-2%) compared to the 1990 level, falling from 4,227 MtCO<sub>2</sub>eq in 1990 to 4,142.5 in 2005. That does not leave the EU much time to get itself on—and stay on—a trajectory that would allow it to reach the Kyoto reduction target (Figure 5).

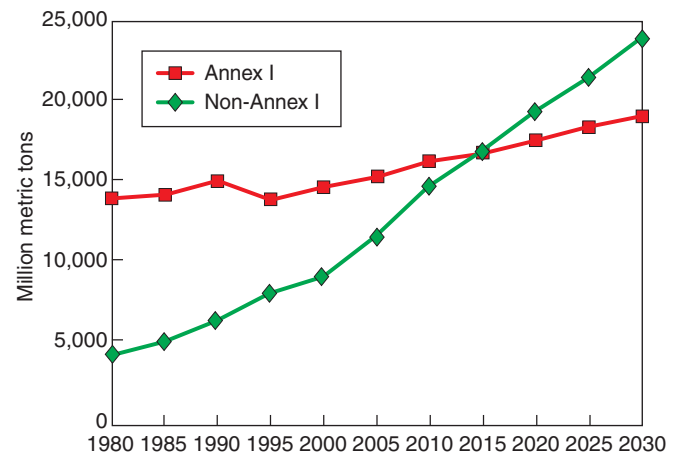
At the conference in Bali, Europe was an important player in the international negotiations. Stavros Dimas<sup>2</sup> called for international negotiations, saying that it's time for the rest of the international community to follow the European Union and commit to ambitious GHG emissions reduction targets. In March 2007, the European Union set itself the goal of reducing its GHG emissions by 20% from the 1990 level by 2020. It said it was ready to go farther and undertake a commitment to a post-2012 reduction of 30%, provided that a fair and effective agreement is concluded at world level.

### Emerging countries see increasingly steep uptrend in GHG emissions

In 2004, CO<sub>2</sub> emissions from energy production represented about 57% (in CO<sub>2</sub> equivalents) of world GHG emissions. World CO<sub>2</sub> emissions from fossil fuels have risen by 25% since 1990, from 24 Gt of CO<sub>2</sub> in 1990 to 30 Gt in 2004 (IPCC-2007). This does not include CO<sub>2</sub> emissions from deforestation or the decay of biomass, which represent about 17% of the total. So the reduction of CO<sub>2</sub> emissions is a priority. However, reduction targets are aimed at all GHGs. Methane of agricultural or industrial origin accounts for about 14% of the total, nitrogen protoxide (N<sub>2</sub>O, primarily of agricultural origin) accounts for 8% and other industrial gases slightly more than 1%.

Forecasts by the EIA<sup>3</sup> and IEA<sup>4</sup> agree that CO<sub>2</sub> emissions will double between 1990 and 2030 if nothing is done to slow down the current trend, with a steadily increasing proportion of emissions generated by China, Southeast Asia and India.

Fig. 7 - CO<sub>2</sub> emissions and projections for Annex I and non-Annex I countries (MtCO<sub>2</sub>)



Source: IEA (2007a and b)

The proportion of total world emissions generated by developing countries is soaring. Getting the US and major emerging emitters to participate in future efforts to reduce CO<sub>2</sub> emissions is a prerequisite to any post-Kyoto negotiations with a hope of stabilizing GHG emissions over the long term.

The emerging countries, reluctant to make commitments to reduce GHG emissions, stress that their emissions per capita are still low, pointing to the historic responsibility of developed countries in this respect.

Emissions of CO<sub>2</sub> equivalent per capita vary greatly throughout the world. This figure is higher in wealthier regions (about 26 tCO<sub>2</sub>eq for a North American, 11 for a European) and lower in less wealthy regions (8 tCO<sub>2</sub>eq for a South American, 3 for an Asian). In terms of energy content, the difference between a person living in the US and a person living in Africa is great. If this is so, what is the right criterion for establishing a GHG emissions threshold?

### The climate constraint and GHG emissions forecast scenarios

According to the IPCC Fourth Assessment Report on climate change, the next 20 to 30 years will be key to the efforts to curb global warming. In the most favorable scenario, world GHG emissions would peak by 2015 then decline and the average increase in temperature would not exceed 2 to 2.4°C. Objective: stabilize the concentrations of GHG gases present in the atmosphere.

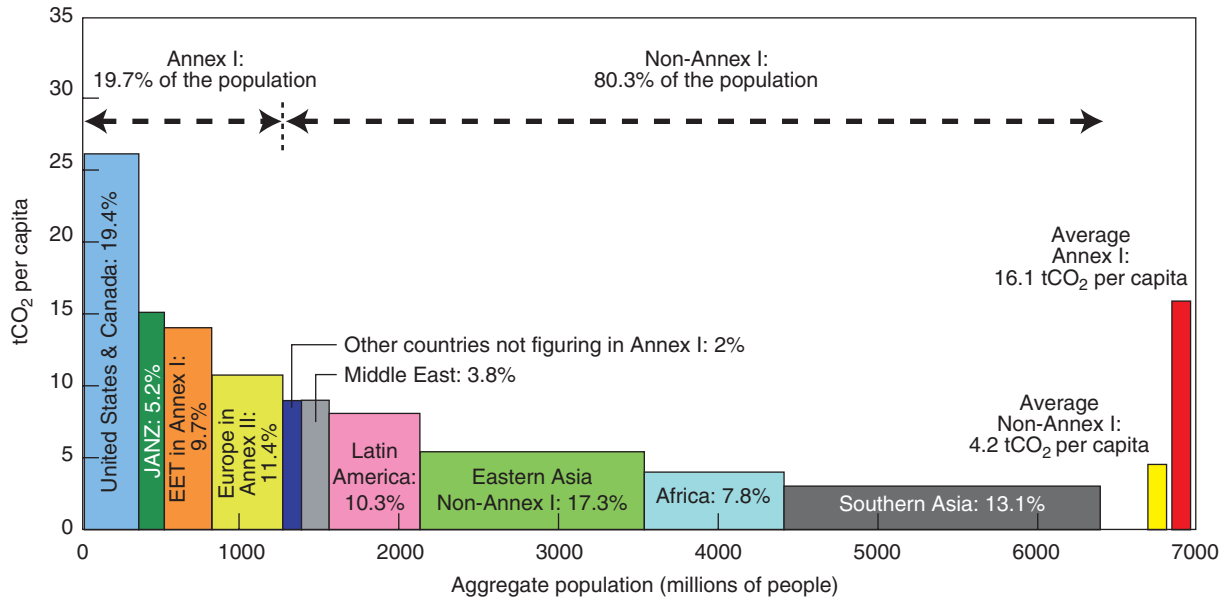
(2) EU Environment Commissioner.

(3) EIA: Energy Information Administration, US Department of Energy.

(4) IEA: International Energy Agency.

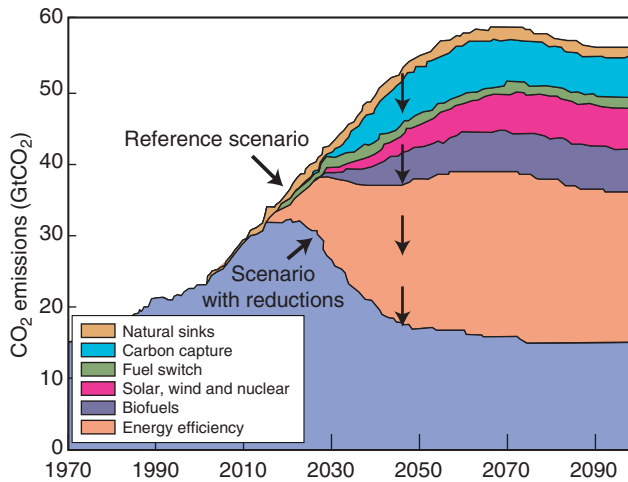
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Fig. 8 - Regional distribution of GHG emissions per capita as a function of the population for different groups of countries (2004). The number in each bar indicates the percentage of total world GHG emissions generated by that region



Source: IPCC Fourth Assessment Report. Working Group III

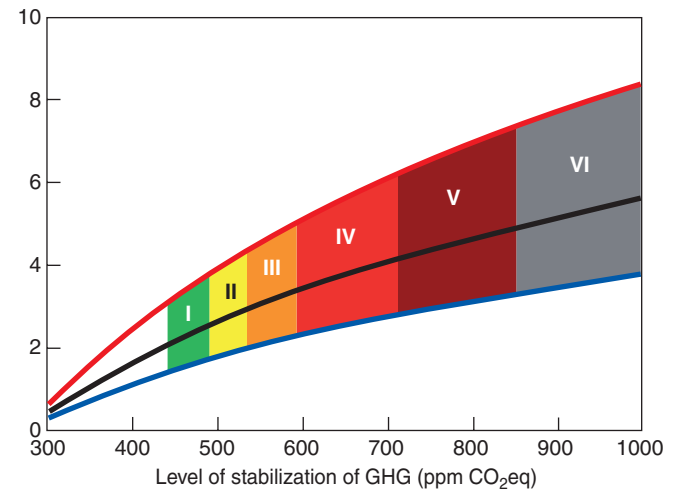
Fig. 9 - Reference scenario and world CO<sub>2</sub> emissions reduction scenario



Source: EC

To succeed in reaching this target of 2 degrees, experts believe it necessary to cut CO<sub>2</sub> emissions by between 50 and 85% by 2050. Emissions levels could be stabilized by deploying an array of technologies: some are already on the market and, in the decades to come, others will be if appropriate incentives are provided.

Fig. 10 - Increase in world temperature from the level existing before the Industrial Revolution (°C)



Source: IPCC Fourth Assessment Report. Working Group III

The IPCC and the European Commission both regard energy efficiency as key to GHG emissions reduction, including energy savings in buildings and more efficient lighting systems. Other measures involve increased reliance on nuclear, solar and wind power, as well as CO<sub>2</sub> capture and storage.

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The long-term goal is not to exceed atmospheric GHG concentrations of 450–480 ppm and thus limit the average temperature increase to 2.4°C.

### Economic constraint and the incentive to reduce GHG emissions rapidly

The economic assessment by IPCC experts concludes that it is not too late to slow down this phenomenon. According to several stabilization scenarios, it would cost between 0.2 and 3% of world GDP between now and 2030 to stabilize GHG emissions. The estimated macroeconomic costs of multigas abatement, consistent with stabilization trajectories of between 445 and 710 ppm CO<sub>2</sub>eq, range from a decrease of 3% to a slight

increase in total GDP by 2030, compared to the reference scenario. However, the magnitude of regional costs may differ from that of the total cost.

Similarly, the review supervised by Nicholas Stern<sup>5</sup>, economic advisor to the British Chancellor of the Exchequer, estimated the impact cost for a trend scenario with a temperature increase of 5 or 6°C. When only known climatic phenomena are integrated, the economic impacts and the non-economic impacts (on the environment and health) amount to 11% of world GDP. When less known factors of climate change are integrated (release of methane from melting permafrost, extra regional costs), one arrives at a total of 20% of world GDP.

The Stern report also evaluates the political costs of curbing GHG emissions. For a scenario limiting concentrations to 550 ppm of GHGs, the peak would have to occur in the next 10 to 20 years, then emissions would have to fall by 1 to 3% a year. Total emissions would have to be 25% lower than the current level by 2050, knowing that the present trend would result in an increase of more than 140% by then. A target of 550 ppm would yield a cost of 1% of GDP between now and 2050. It would be

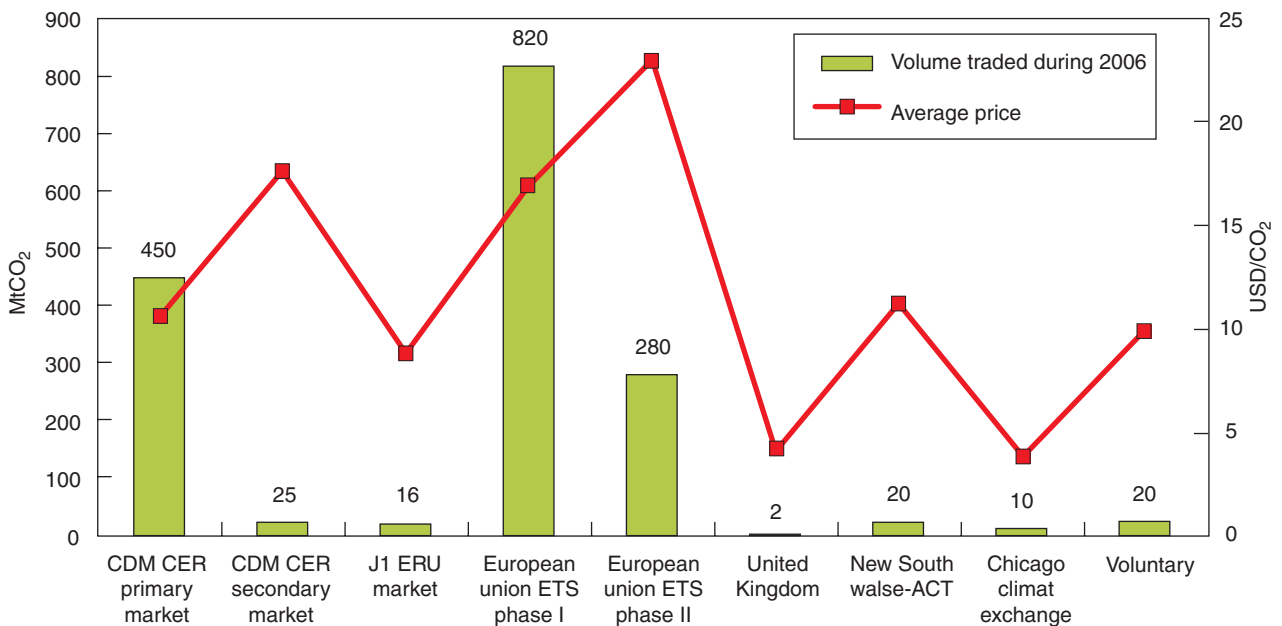
Table 1

Estimated total costs (2030) for lowest-cost trajectories aiming to reach different stabilization targets

Level of stabilization (ppm CO <sub>2</sub> eq)	Mean reduction in GDP (%)	Size of GDP reduction (%)	Reduction in the average rate of growth in GDP (percentage points)
590-710	0.2	-0.6-1.2	< 0.06
535-590	0.6	0.2-2.5	< 0.1
445-535	-	< 3	< 0.12

[5] Stern Review on the Economics of Climate Change, October 30, 2006.

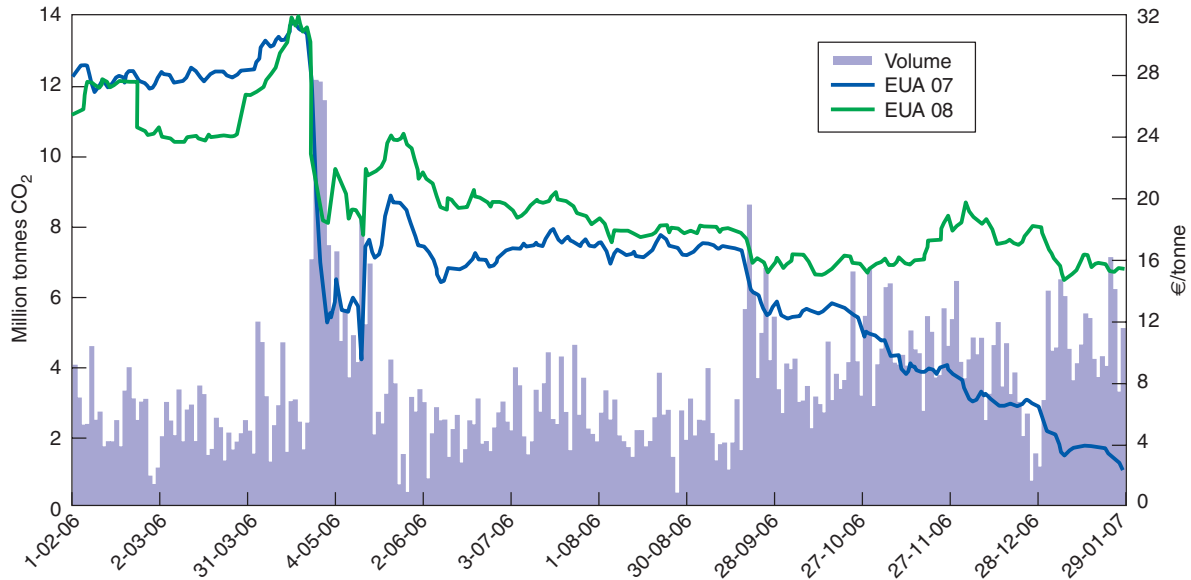
Fig. 11 - Volumes traded and prices on international carbon markets (2006)



Source: UNFCCC

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Fig. 12 - Volumes traded and prices on international carbon markets (2006)  
Daily prices for 07- and 08- contracts, as reported by Point Carbon together with daily volumes in the OTC and exchanged markets



Source: Point Carbon 2007c

nearly impossible to attain this target, if the measures taken in the next 10 to 20 years are not strong enough. Stabilization at 450 ppm already seems out of reach.

Based on the assumptions made in the report, Nicholas Stern concludes that the cost of inaction in the face of climate change would be far greater than the cost of measures taken to reduce the concentrations of CO<sub>2</sub> in the atmosphere.

### The international carbon market

The emissions trading market, the Clean Development Mechanism and the Joint Implementation Scheme stimulate emissions reduction investments and provide incentives to take those measures that will reduce emissions most cheaply. In 2008, the countries bound by the Kyoto Protocol will be able to purchase units or emissions credits to meet part of their abatement commitments.

Since 2005, the carbon market has developed. Without the Kyoto Protocol and its binding GHG emissions reduction targets, the carbon market would never have come into existence.

Without a firm post-2012 agreement, the carbon market could disappear as quickly as it appeared. To keep the market working smoothly, it would be advisable to avoid discontinuity between the end of the Commitment

Period provided under the Kyoto Protocol and the awaited post-Kyoto agreement.

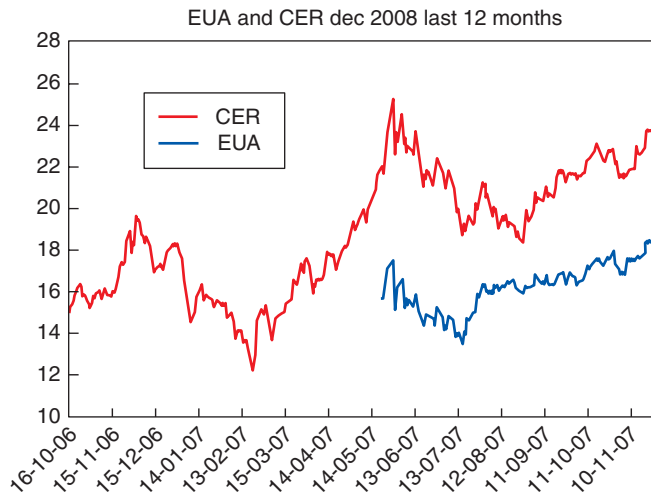
The trading volume on the carbon market tripled from 2005 to 2006, reaching USD 30 billion and, according to the International Emissions Trading Association (IETA), it could amount to USD 60 billion in 2007. The European Union Emission Trading Scheme is the largest market in terms of traded volumes. With more than 825 projects to be carried out in 49 countries already registered and 1,800 others in the process of being evaluated, the Clean Development Mechanism should generate more than 2.5 billion certified emissions reduction units (which can be traded) by the end of the first Commitment Period in 2012. But what future can be expected for projects based on Kyoto mechanisms, if there is no post-Kyoto framework to maintain their economic value?

On October 26, 2007, an agreement was concluded between the member States of the European Economic Area (EEA) and the European Commission to connect the EU ETS with the trading system used by Norway, Iceland and Liechtenstein. Together, these two systems will cover thirty countries across the European continent.

Today, the European allowance (EU ETS Phase II) is traded at about EUR 24/tCO<sub>2</sub>, a comeback to the price level of Phase I prior to the publication of the real 2005 emissions figures for the industrial companies concerned.

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Fig. 13 - European allowances (EUA) and CER certificates for CDM projects quoted on the EU ETS market



### The negotiations in Bali: a post-Kyoto "road map"

From December 3 to 14, 2007, the thirteenth Conference of the 192 Parties to the United Nations Framework Convention on Climate Change took place in Bali in Indonesia. The objective was to set a timeline for negotiations (if possible with emissions reduction targets) in order to produce a successor agreement to the Kyoto Protocol by year-end 2009.

In Bali, conference participants once again sought to obtain a consensus between the 35 developed countries that undertook to comply with the Kyoto Protocol and those, like China and the United States, which have not committed to reduction targets. However, despite the proliferation of reports denouncing the risk of climate change, the negotiations were stormy because the United States rejected the CO<sub>2</sub> emission permit trading system called for by the Kyoto Protocol, preferring non-binding GHG emissions reduction targets instead.

The idea of including an emission reduction target for developed countries of 25 to 40% from 1990 levels by 2020 was the object of debate. It was advocated by the European Union, which referred to the recent report issued by the Intergovernmental Panel for Climate Change (IPCC). The proposal also called for a subsequent target of 50% from 1990 levels for all countries by 2050. These two objectives were very ambitious. They implied heavy constraints for the United States but also, given the 2050 deadline, for developing countries. In other words, a Chinese person would have to reduce emissions by a factor of 2, a European by a factor of 6 and a U.S. citizen by a factor of 10. The world's foremost economic power firmly rejected the notion of including the 25-40% range in the document. The compromise document buried the reference target by referring to the IPCC report in a footnote.

At the final session, the Europeans agreed to India's proposal concerning technology financing and transfers, and their verification. The United States had initially refused to follow suit, but finally decided to rally to the consensus view.

On December 15, the countries attending the Bali summit finally adopted a "road map" setting the agenda that they would be following until the Copenhagen summit in 2009.

The conference in Bali accomplished what it set out to do. The United States, initially taking a defensive stance, finally entered into the multilateral discussion process, which is rather positive. Some developing countries have accepted the eventuality of emissions reduction targets, which is necessary. Reduction targets have yet to be defined and implemented and, as we know from experience, this is not easily done. Once again, the cards have been dealt to players, who will play the hand until 2009, but the outcome remains uncertain.

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Final draft submitted in December 2007*