

The Kyoto Protocol and the Statistical Information

Il protocollo di Kyoto e l'informazione statistica

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Riassunto

L'entrata in vigore del Protocollo di Kyoto è un segnale concreto della volontà e dell'impegno della Comunità Internazionale ad attuare delle politiche di controllo dei cambiamenti climatici. Il clima sta cambiando e, nonostante l'incertezza sui numeri, c'è sempre maggior consenso sul contributo delle attività umane ai cambiamenti in atto. L'aumento nella temperatura e nella frequenza di eventi climatici estremi su scala globale infatti avviene a fronte di una crescita economica senza precedenti, che oggi coinvolge il mondo industrializzato, le economie emergenti dell'est europeo ed alcuni grossi paesi del sud del mondo, principalmente Cina e India, caratterizzati da una altrettanto preoccupante crescita demografica. Gli scenari tendenziali di crescita delle emissioni prospettati dai modelli macro-economici sono allarmanti, e invocano il disegno e l'implementazione di politiche globali per la mitigazione e l'adattamento dei cambiamenti climatici, fondate sui principi della cooperazione, dell'equità e delle responsabilità comuni ma differenziate.

Keywords: climate change, costs, mitigation & adaptation policies, modelling.

1. Climate change as a global problem.

The control of climate change represents one of the major challenges to be faced at the global level and the recent entry into force of the Kyoto Protocol is the first real sign of the International Community's will and commitment to carry on climate change control policies, including both mitigation and adaptation policies.

Over the past few years, a progressive temperature increase has been registered and this is associated to an increasing frequency of extreme events like violent rains, floods, droughts, summer heat waves or mild winters, as well as cases of sea-level rise. All these climate and environmental effects have serious impacts on agriculture, forests, coastal areas, health, food security, energy consumption, the use of water resources, fires, tourism and the insurance sector. These impacts are different from region to region and the more vulnerable the geographical areas, the involved sectors and populations are, the more serious the impact can be. One can only think of the small Pacific Islands that risk to disappear because of sea-level rise in the next future. Climate is changing and, in spite of the uncertainty given by numbers, there is an increasing general consent towards the contribution of human activities to climate change. The raising temperature and the increased frequency of extreme climate events

on a global scale take place parallel to an extremely fast pace of economic growth. This growth, ever registered before, starting from the Industrial Revolution, has led to a relevant increase of greenhouse gases concentration, responsible for the global warming effect¹ and today involves not only the industrialized world, but also Eastern European transition economies and some big emitters in the developing world, in particular India and China, also characterized by a preoccupying demographic explosion.

2. The numbers

We have extensively read about climate change trend and future scenarios. In 2001, the third IPCC² report, which provides the most updated summary of the studies and evidences regarding climatic changes in every region of the world, mentioned an average increase of the surface global temperature over the last hundred years equal to 0.6°. Some very recent data presented by the Hadley Center³, UK, show a more preoccupying trend, recording a global average temperature increase, between 1861 and 2003, equal to 0.7°, and considering 2003 as the third absolute warmest year of this period, recognizing the warmest ten years of the century after 1990.

These climate changes occur parallel to a process of increasing growth of the global economy, with some interesting distributive aspects among macro-regions of the world. Starting from the industrial era, the emissions of carbon dioxide have increased by 30%, methane emissions by more than 100% and azote emissions by about 15%, reaching, in the latest decade, the highest concentration levels and growth rates ever, compared with any other period for which the scientists have reconstructed the atmosphere composition. The use of fossil fuels for the production and consumption of energy, land-use change and agriculture are essentially responsible for this.

In the next future, the regions of the world that are major contributors to the growth of emissions are subject to change. Some recent estimations produced by the International Energy Agency (IEA)⁴ suggest that, between 2002 and 2030, the 70% of the growth of CO₂ global emissions linked to energy will be generated by developing countries. Figure 1, based on IEA estimations, shows how, in the next years, CO₂ emissions will increase faster in developing countries, surpassing those produced by OECD countries after 2020.

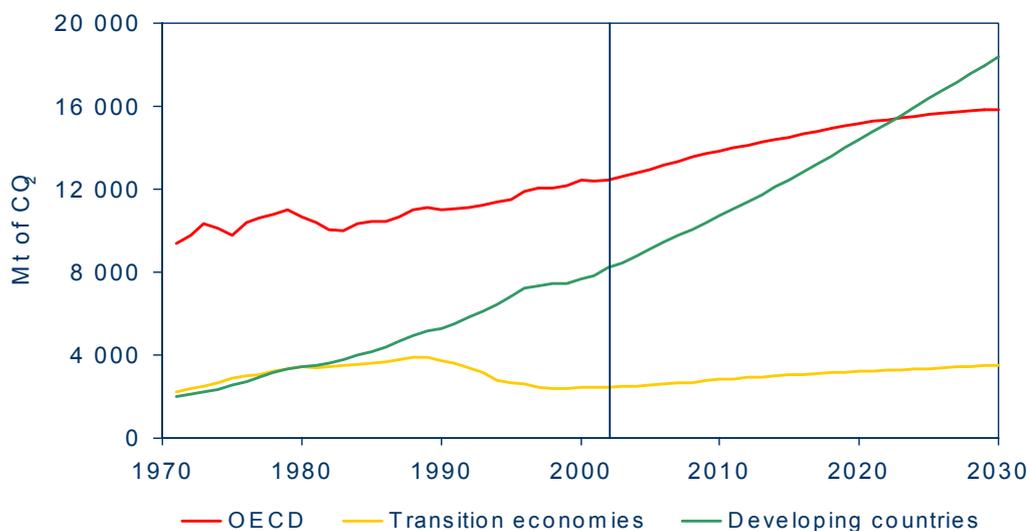
¹ The main “greenhouse gases” included in the Kyoto Protocol are: Carbon dioxide (CO₂), Methane (CH₄), Nitrous oxide (N₂O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Sulphur hexafluoride (SF₆)

² Intergovernmental Panel on Climate Change (IPCC), was established in 1988 by UNEP (United Nations Environment Programme) and WMO (World Meteorological Organization) for collecting relevant scientific, technical and socio-economic information concerning the study of climatic change, of the potential impacts and options for adaptation and mitigation.

³ Latest Climate Results from the Hadley Center. UK, presented at the scientific events on the occasion of the Tenth Parties Conference of UNFCCC (United Nations Framework Convention on Climate Change), Buenos Aires, December 2004.

⁴ World Energy Outlook 2004, International Energy Agency.

Figure 1: Global emissions of CO₂, 1971-1930 (IEA, WEO, 2004)



If in 2002, OECD countries were responsible for 54% of total emissions, the developing countries for 36% and the transition economies for 10%, the estimations for 2030 reverse the positions of the main “polluters”, with 49% of the emissions produced by developing countries, 42% by OECD countries and 9% by transition economies. The sole China will contribute to the new scenario with a fourth of the energy related to global emissions growth, because of its rapid economic growth and the strong dependence on carbon in the sectors of industry and energy production.

However, in per capita terms, emissions referring to OECD countries and to transition economies will be, in 2030, still higher than those produced by developing countries, with an increase equal to 90% regarding oil’s demand, especially in the transport sector. The models that link productive activities and the related emissions offer preoccupying views by showing the rise in temperature. Anyway, models’ results change according to the hypotheses formulated: hypotheses regarding the different climate modules used, technical change, economic and demographic growth in the various regions of the world, mitigation actions in the medium and long run.

The scientific community argues about numbers. In 2001, most of the models showed that, on the basis of the available technologies and with the adoption of appropriate mitigation measures, by 2010, it would have been possible to reach levels of stabilization⁵ of carbon dioxide concentrations that could prevent from damaging interferences on climate, containing the temperature increase within about + 2°C, compared with post-industrial era; however, today, the scientific community is less optimistic.

Figure 2 shows recent estimations referring to the business as usual scenario of carbon emissions and the gap which, in fact, divides it from a scenario of stabilization at 550

⁵ A common stabilization for several models is represented by a concentration of CO₂ in the atmosphere of 550ppm (part for a million), a unity which measures the relation between the number of CO₂ molecules and the total number of dry air molecules. The target of 550ppm is equal to a double concentration, compared with pre-industrial era.

ppm and from the Kyoto scenario itself, in the hypothesis that the reduction commitments established in the Protocol would be fulfilled.

Figure 2: Global emissions: scenarios in comparison (FEEM, 2004)

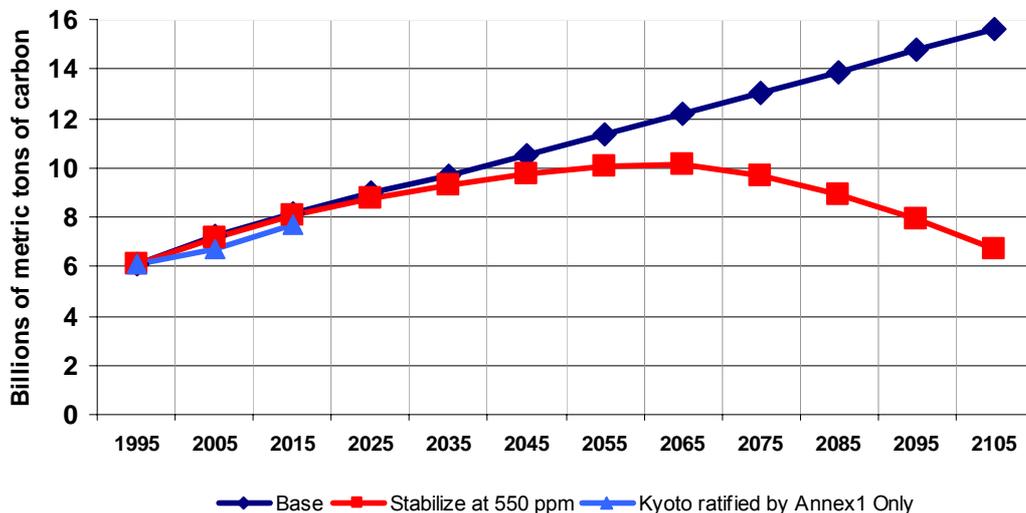


Figure 3 shows, instead, how estimated scenarios of stabilization at 550ppm and those concerning the tendential trend of carbon emissions in the atmosphere are shared among the regions of the world. A more relevant role is evident for great polluters like China and low-income countries (LI), low-medium income countries (LMI) in the trend emission scenarios, or for Business As Usual (BAU) that would take place in case of a lack of interventions and mitigation policies.

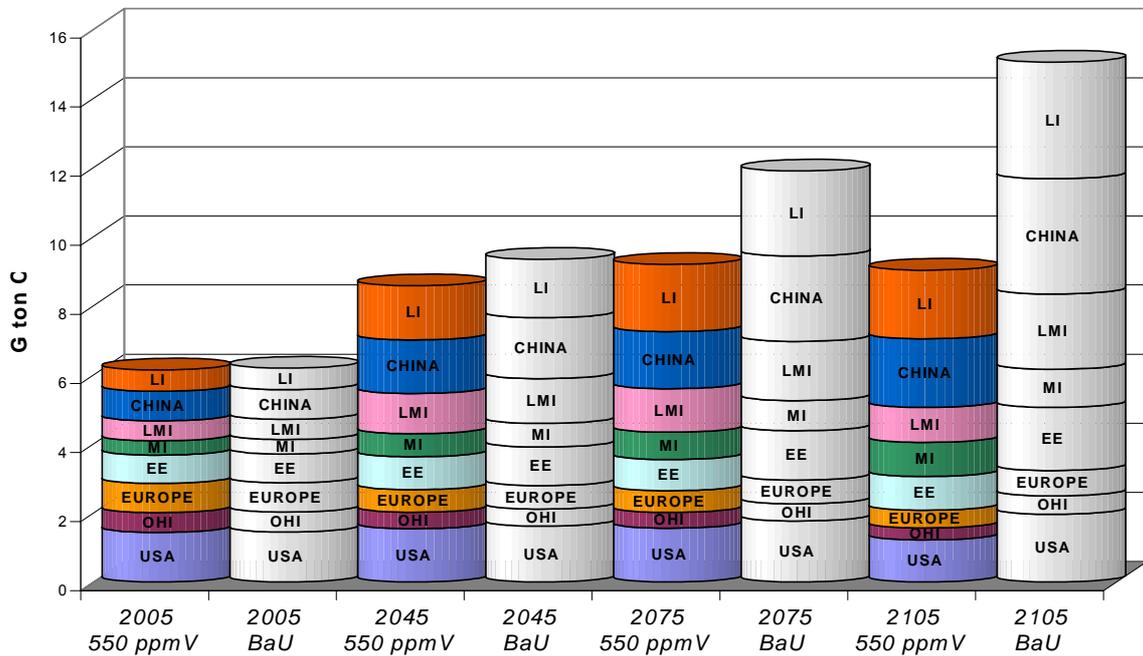
The projected increase of “greenhouse” effect gases in industrialized and fast-growing developing countries, together with the difficulty of implementing effective mitigation policies on a global scale, have clearly changed the expectations and generated doubts and fears at the global level.

The recent provocation contained in the report “*Meeting the climate challenge*”⁶, written by an international task force of research institutes that work on climate changes, states that within ten years time we will reach the non-return point, that is the moment in which we will reach the atmospheric concentration of “greenhouse” gases that can contain a climate change below +2°C compared with pre-industrial era⁷. According to the report, a temperature increase up to 2°C means that we can still face the negative consequences of climatic change with appropriate adaptation policies; beyond this limit, those policies would be no longer sufficient and a climate catastrophe would likely to happen.

⁶ International Climate Change Taskforce, January 2005.

⁷ Concentration equal to 400ppm. For an evaluation, one could think of the concentration obtained in March 2004, which was of 379ppm.

Figure 3: The role of emerging economies: scenarios for the stabilization at 550ppm and Business as Usual scenarios (FEEM 2004)



Anyway, adaptation policies imply even greater costs: the economic literature¹⁰ estimates adaptation costs in a range that varies between 7-25% of the total costs related to climatic change, equal to 2% of gross domestic product (GDP) in industrialized countries. Furthermore, even if the results of the models in the literature should be read with caution, presenting a remarkable variability and a high level of uncertainty, the distribution of the costs of climate change across macro-regions seems to imply a greater damage for poor countries. A recent study¹¹, which collects the results from different models, shows that the effects of a hypothetical global average temperature-rise of +1° could be positive, on average, in OECD countries, in Middle East and in China, whereas for all the other regions of the world the impacts would be negative, implying high costs for the economy and the society. Global costs have been estimated on average around 522 US \$ billions, equal to 2,7% of the world total income, with a standard deviation equals to 0.8%.

Without going into the specificity of the models, we can only affirm that the absolute value of the estimated average damages and their major effects on the most vulnerable regions of the world make the picture even more alarming.

⁸ International Climate Change Taskforce, January 2005.

⁹ Concentration equal to 400ppm. For an evaluation, one could think of the concentration obtained in March 2004, which was of 379ppm.

¹⁰ IPPCC SAR, 1996, IPCC TAR, 2001.

¹¹ R. Tol, 2002.

3. Policies and instruments: the Kyoto Protocol.

The international political response to climate change started in 1992 with the adoption of UNFCCC (*United Nations Framework Convention on Climate Change*) at the “Earth Summit”¹² held in Rio de Janeiro. The Convention has planned a series of actions that aim at stabilizing the “greenhouse gas” concentrations in the atmosphere, in order to prevent from “damaging anthropogenic interferences” with the climate system. The Convention, which became effective in 1994, boasts the participation of 189 parties from every region of the world.

The most well-known provision that has been adopted within the Convention is the Kyoto Protocol; it commits industrialised countries and transition economies, the so-called Annex 1 Parties, to reach quantitative emission reduction targets.

In Kyoto, in 1997, at the Third Conference of the Parties, the Annex 1 countries decided to reduce “greenhouse gases” emissions by 5.2%, compared to their total amount of emissions in 1990 (baseline year), on average each year within a first-commitment period comprised between years 2008 and 2012.

After years of uncertainty for the unfulfilled ratification from the United States, which in 1990 were responsible for 32,8% of CO₂ global emissions¹³, the Protocol, following the recent ratification by Russia¹⁴, has finally become effective¹⁵ and makes the reduction commitments binding for the countries that have ratified.

The interest of the civil society and the institutions in the Protocol is fostered periodically by the media and can be explained by the originality of this instrument. In fact, the Protocol provides for the development of market mechanisms, so-called flexible, that can reduce the emissions at minor costs exploiting the differences in levels of energy efficiency between countries, and can stimulate a “cleaner” growth (with a minor content of carbon) of the global economy.

The three mechanisms provided by the Protocol are: *Emission Trading* (ET), that is the exchange of permissions for the emissions within Annex 1 countries, *Joint Implementation* (JI) and the *Clean Development Mechanism* (CDM), based on emission reduction investment projects carried out by Annex 1 countries respectively in countries in transition (JI projects) and in developing countries (CDM projects). CDM projects provide also for interventions concerning the absorption of carbon in the atmosphere (*carbon sinks*), through afforestation or re-forestation activities. The economic rationality of the flexible mechanisms is based on the exploitation of the differences in marginal abatement costs between countries: countries with higher marginal abatement costs, typically the industrialized countries that have already reached a high level of energy efficiency, can reduce their emissions elsewhere, in places where the marginal abatement costs are lower, acquiring emission reduction credits at lower costs.

The principle of economic efficiency at the base of the flexible mechanisms has stimulated the interest of the industry, showing opportunities for *business* in rapid industrializing and industrialized countries. A real *carbon market* has flourished, with

¹² UNCED, *United Nations Conference on Environment and Development*.

¹³ GlobalStat, by Enerdata, 2004.

¹⁴ The ratification of Russia allows the reaching of the *quorum* required for the total amount of the emissions of the ratifying countries, equal to 55% of the total emissions of Annex 1 countries in 1990.

¹⁵ Starting from 16th February 2005.

the key-role of a *carbon strategy* for granting the continuous growth and competitiveness of the national industries.

The Protocol results attractive also for non-Annex 1 countries, all represented by developing countries at different stages of economic growth; 95 of them have ratified the Protocol and some of them are ready to accept emission reduction targets on a voluntary basis.

Anyway, the group of developing countries is very heterogeneous: the fast growing countries are afraid of emissions commitments that can arrest their economic growth; on the other hand, the poor countries, in which poverty exacerbates the vulnerability to climatic change, are more interested in adaptation policies to be developed at the local level (for example, the protection of coastal zones at risk of sea-level rise) and in the synergies between adaptation and mitigation policies, being particularly interested in technology transfer through the CDM. The priority of “southern countries” is that CDM projects bring concrete benefits to the economy and the environment, stimulating technology transfer and generating sustainable benefits at the local level.

The European Union has gained a leadership role within this North-South debate. Since the beginning of the negotiations, which were in favour of flexible mechanisms, in opposition to USA policies, the European Union has thought of experimenting an internal trading system (*EU ETS, European Union Trading System*¹⁶), that is the exchange of emission allowances, irrespectively of the Protocol ratification, in order to fulfil its own reduction target. The European market, which started the 1st of January this year, offers a good opportunity for testing the systems, though in face of a generalized over-allocation of emissions allowances in the interest of big industry lobbies.

Following the entry into force of the Protocol, the European market will link to other trading schemes in other countries, as well as to other flexible mechanisms, clearly offering an operating advantage to the member countries, as well as further incentives to invest in emission reduction projects in other countries for European industry.

In spring 2005, the European Council of Environment Ministers ratified the objective of containing the global temperature increase within +2°, compared to pre-industrial levels, explaining the intention of developing a strategy for reducing the emissions in industrialized countries by 15-30%, compared to 1990 levels, by 2020.

This strategy, based on investments in new technologies, technology transfer, the development of national programmes on energy efficiency and on transports, the synergies between climate change control policies and international trade policies, aims at a shared and global collective participation, on the basis of common but differentiated responsibilities.

4. Conclusions

Reflecting both on the strength and the weakness of the Kyoto Protocol points, it must be underlined that, in spite of the unfulfilled USA ratification, which has surely made

¹⁶ In the first period of trading, 2005-2007, the market will limit to about 12.000 installations in the 25 state members, covering almost 45% of the total CO₂ EU emissions and 30% of greenhouse gases emissions.

the process of ratification slow and difficult, with the risk of invalidating its effectiveness, the Kyoto Protocol has been able to focus the international negotiations' agenda on climate change control policies.

Even if, today, the scientific community does not consider the Kyoto commitments as sufficient and acknowledges the need for a global project for climatic change control, involving also the developing regions, the Kyoto Protocol represents a significant first step towards a global commitment for mitigating the impact of human activities on climate. It is one of the first examples of a quantitative and legally binding international agreement that attempts to internalise environmental costs through the use of market instruments. If we think of the weak points, we have to acknowledge that the Kyoto mechanisms are far too complex to be implemented, and that they require a heavy and bureaucratic management, as well as the implementation of a strict monitoring process, and of institutional reforms and fulfilments with very high transaction costs.

Let us only think that today the *Executive Board*, the institution for the approval of CDM projects operative since 2001, has approved only 3 out of the 84 submitted projects.

Today we talk about post-Kyoto strategies and alternative plans are being presented.

It is already clear that Kyoto's objectives are not sufficient to face climate change and it is necessary to adopt a global attitude that brings together costs minimization and sustainable development goals, granting the continuity of investment projects and the transfer of technology to developing countries.

During the last Conference of the Parties (COP10) that was held in Buenos Aires in December 2004, various hypotheses regarding post-Kyoto scenarios have been discussed. The need for a global design is now generally accepted and has also been agreed upon at the European Council in March 2005; the new policy strategy will have to involve developing countries on the basis of a common but differentiated responsibility. An example in the direction is the adoption of sectoral, rather than country-based emission reduction targets. A study presented in Buenos Aires¹⁷ shows how, sharing emissions reduction commitments on a by-sector basis, with a stabilization objective at 450ppm, in most developing countries emissions could increase above 1990 levels. On the other hand, the study shows that in industrialized countries emissions could diminish by 20-40%, reducing emissions at the global level by 60% in the electricity sector, by 70% in agriculture and by 90% in the production of energy from fuel source. Sectoral targets could be absolute, relative (carbon intensity based) or associated with standards¹⁸.

The Pew Center has recently published a report¹⁹ which summarizes the post-Kyoto proposals that have been discussed in literature so far: they are 44 and are based on different targets (absolute, relative, price caps, technology standards), with a different geographical focus (global, regional, national, bilateral) and with a focus on mitigation or adaptation.

¹⁷ *Options for second commitment period of the Kyoto Protocol*, ECOFYS, Germany, presented at the scientific events on the occasion of the Tenth Parties Conference of UNFCCC (United Nations framework Convention on Climate Change), Buenos Aires, December 2004.

¹⁸ *Designing future international actions on climate change*, CCAP, USA, presented at the scientific events on the occasion of the Tenth Parties Conference of UNFCCC (United Nations framework Convention on Climate Change), Buenos Aires, December 2004.

¹⁹ *International climate effort beyond 2012: a survey of approaches*, Pew Center on Global Climate Change, December 2004.

Apart from technical aspects, post-Kyoto strategies are based on the idea of a global response to a problem that involves every region of the world.

It is a paradox that the countries that have been mostly damaged so far by climate change, the poor countries, most vulnerable for what concerns the environment, the society and the economy, are the less responsible for the damage itself. Anyway, the global economy is rapidly changing and the poor countries are going to grow with rates higher than industrialized countries; at the same time, they do not have the technological and human capital that is crucial to change the actual growth model mitigating its impact on the environment.

The rich countries do not have to retreat from their responsibilities and have to act in different ways: starting from investments on research and the diffusion of cleaner technologies, more energy efficient, going also through the creation of a more favourable institutional and commercial environment, to the technical and financial assistance to the more vulnerable countries for interventions of adaptation to climate change.

A simple recipe has to provide, for the next future, policies based on cooperation principles, on equity and common, but differentiated, responsibilities. Climate control policies will have to find the consent of Governments and markets, with a political will stronger than the pressures of the industry, in the interest of the future generations.

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