THE CLEAN DEVELOPMENT MECHANISM:

AN OPPORTUNITY FOR DEVELOPING COUNTRIES,

A SOURCE OF PROFITS FOR SMART COMPANIES

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ABSTRACT

Under the Kyoto Protocol, industrialized countries (except the US and Australia) committed themselves to decrease their greenhouse gas (GHG) emissions. To achieve their goals, they can use three flexible mechanisms, including the **Clean Development Mechanism (CDM)**.

The CDM allows industrialized countries to invest in emission reduction projects in developing nations and earn carbon credits corresponding to the level of emissions prevented. These credits can be used by countries or companies to meet their reduction targets. They can also be banked, or sold. CDM enables industrialized countries to achieve emission reduction at a lower cost while developing nations benefit from foreign investment, **clean technology transfer** and less pollution.

The main condition to get a CDM project registered is called **additionality**. The company must prove that the project leads to **additional** emission reduction and would not have been completed without the CDM – because of stricter environmental laws, for instance, or simply because it is profitable.

The most common types of CDM projects involve biomass power generation, small hydroelectric plants and landfill gas. Companies investing in CDM projects earn carbon credits that they can use or sell on the carbon market. These credits represent extra income for these projects and increase their profitability. The rate of return for CDM projects can range from 16% for a wind farm in Morocco to 60% for a landfill gas project in Brazil.

In some cases, CDM projects can be very profitable. One great example is the French chemical group Rhodia. They invested 20 million euros to cut emissions dramatically at two large polluting plants in Brazil and South Korea. The investment was not profitable without carbon credit sale and was not required by these countries' legislation. It was then **additional**. The investment will generate 15 million carbon credits annually. At current market price (27€ per ton), this represents 400 million euros, i.e. a **2,000% return on investment!**

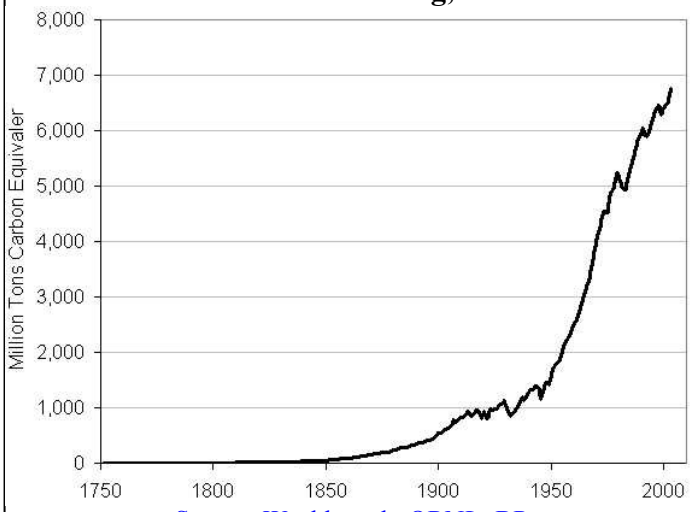
Despite these positive results, the CDM is criticized. The process to get a project registered is considered slow and expensive. The decision taken at Montreal in December 2005 to increase the funding of the CDM Board which registers the projects should accelerate the process and make it more efficient.

THE KYOTO PROTOCOL

A. THE GREENHOUSE EFFECT

The greenhouse effect is a natural process caused by greenhouse gases (GHG) present in the atmosphere. When solar radiation reaches the Earth, it reflects off the Earth's surface and radiates back to space. Some of this energy is subsequently reflected again by the GHG present in the atmosphere, further warming the planet. The greenhouse effect was essential to the birth of life on the planet. Our planet indeed used to be too cold for most creatures to survive. Carbon dioxide and other GHG gradually accumulated in the atmosphere (over millions of years), strengthening the greenhouse effect and warming our planet. Therefore the greenhouse effect is an **essential and natural occurring phenomenon**.

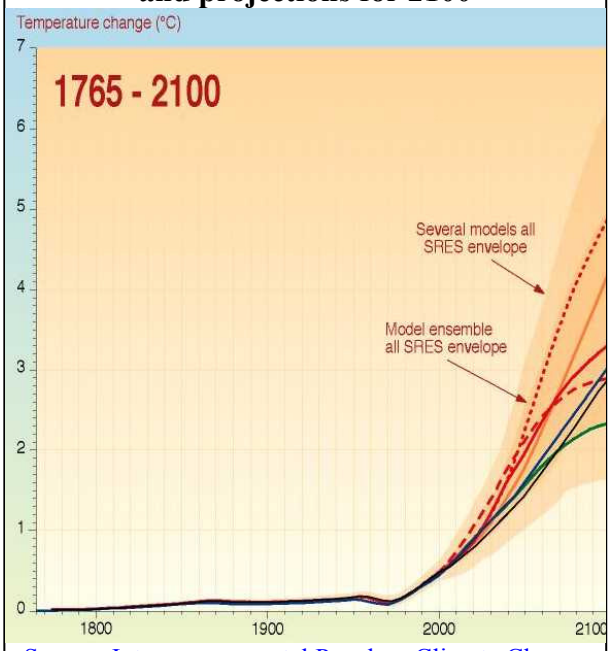
FIG.1: Global Carbon Emissions from Fossil Fuel Burning, 1751-2003



Source: Worldwatch; ORNL; BP

However, since the Industrial Revolution, human activity has released more GHG in the atmosphere, creating an **additional man-made greenhouse effect.** In a few centuries, this will achieve more than nature did over 100 thousand years. This time, the consequences to life may be critical. The Intergovernmental Panel on Climate Change (IPCC) has predicted an **average global rise in temperature of 1.4°C (2.5°F) to 5.8°C (10.4°F) between 1990 and 2100**. This will lead to major environmental disasters: sea level rise projected to cover up to 20% of present land mass, more frequent occurrence of natural disasters like hurricanes and droughts, and a decrease in food production, to mention a few.

FIG.2: Temperature change from 1765 and projections for 2100



Source: Intergovernmental Panel on Climate Change

There are six major greenhouse gases (GHG): Carbon dioxide (CO_2), Methane (CH_4), Hydrofluorocarbons (HFCs), Nitrous oxide (N_2O), Perfluorocarbons (PFCs), Sulphur hexafluoride (SF_6). All these gases have different warming potential. Since CO_2 is the most prevelant, GHG are expressed in tons of carbon dioxide equivalent (tCO_2e).

FIG.3: World's 8 largest GHG emitters (mio. tCO2e) in 2002*

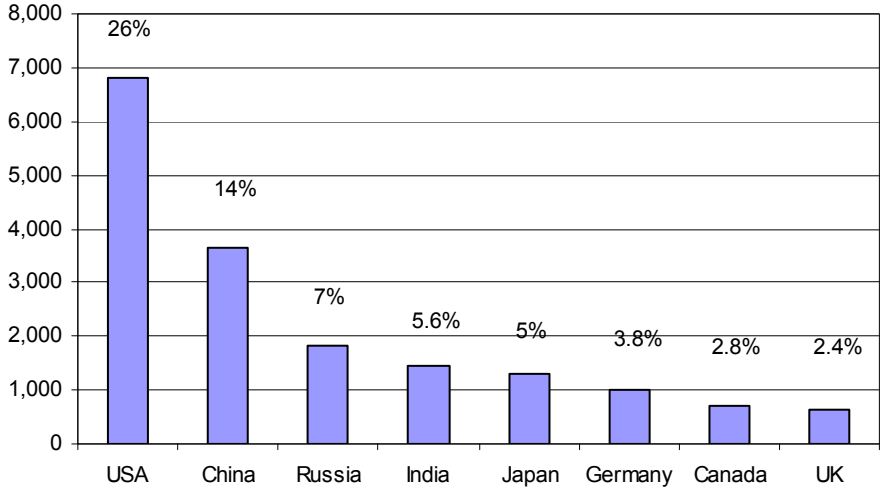
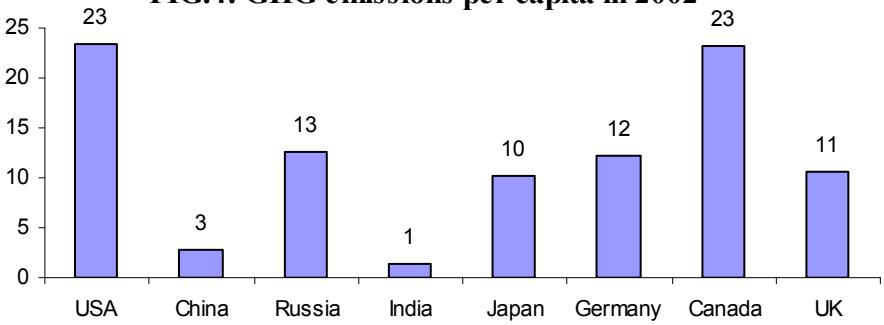


FIG.4: GHG emissions per capita in 2002*



*or estimations when not available / source: UN statistics division and EIA

World's 8 largest GHG emitters represent 2/3 of world GHG emissions.

World's 4 largest GHG emitters represent over 1/2 of world GHG emissions.

The US is by far world's largest GHG emitter with more than a quarter of world GHG for only 5% of world population. China and India score high as well, but if you consider GHG emissions per capita they pollute far less than industrialized countries. Among the latter, some economies are much more carbon-intense than others. Americans and Canadians emit on an individual basis more than twice as much as Japanese and Europeans.

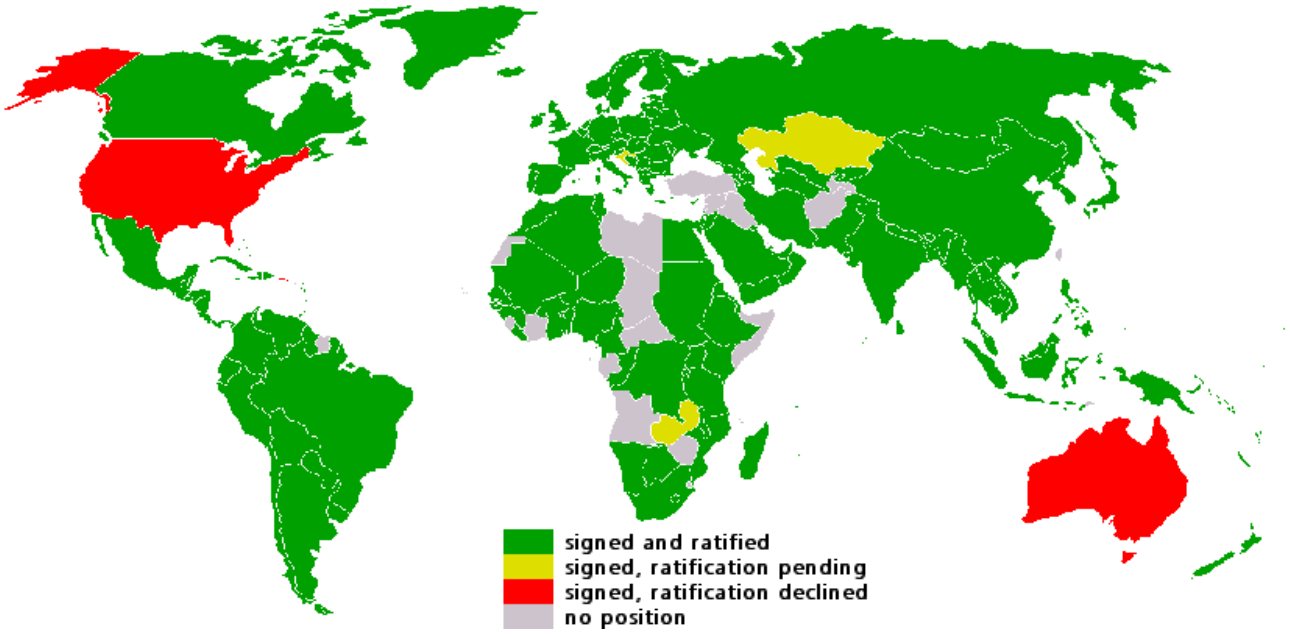
After 1991 and the collapse of the Soviet Union, Eastern Europe and former Soviet states experienced a severe economic recession resulting in the closure of many polluting plants, thus reducing carbon emissions. After 2000, the trend increased again, as these economies return to growth. Western Europe experienced a stabilization of its emissions during the same period mostly due to German reunification in 1991 that integrated East Germany into Western Europe. Like the other former Soviet satellites, East Germany experienced a recession and many polluting, fossil-fuel plants were closed, reducing emissions drastically. North America and Asia are the regions with the fastest-growing emissions.

B. BRIEF OVERVIEW OF THE PROTOCOL

The Kyoto Protocol is an amendment to the United Nations Framework Convention on Climate Change (UNFCCC). Countries that ratify this Protocol have committed either to reduce their emissions of carbon dioxide and five other greenhouse gases or to engage in emissions trading if they maintain or increase GHG emissions.

The Convention aims at the **"stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic (man-made) interference with the climate system"**[1]

FIG.5: Signatory Countries in the Kyoto Protocol



Edited from the list of signatory countries given by the United Nations Framework on Climate Change

The Protocol was negotiated in Kyoto, Japan in December 1997, and opened for signature between March 1998 and March 1999. The agreement was designed to come into force after at least 55 countries representing 55% of global GHG emissions had ratified it. Following ratification by Russia in November 2004, the Protocol took effect on February 16, 2005. As of September 2005, a total of **156 countries** had ratified the agreement (representing over **61% of global emissions**). Notable exceptions include the **United States** and **Australia,** which **signed the Protocol but did not ratify it**.

The Kyoto Protocol divides the world into two different groups: Annex I countries and the developing countries. Annex I are the industrialized countries[2] (including the transitional economies of the former Soviet Union) and have emission reduction commitments. The developing nations have no GHG emissions commitments. This distinction was justified because the largest share of historical and current global emissions of GHG originated in developed countries. Developing countries are exempt from the requirements of the Kyoto Protocol because they were not the main contributors to the GHG during the industrialization period of the last 100 years.

[1] United Nations Framework Convention on Climate Change (UNFCCC).
[2] For the whole list, consult Annex I

According to a press release from the United Nations Environment Program:

"The Kyoto Protocol is an agreement under which industrialized countries will reduce their collective emissions of greenhouse gases ***by 5.2% compared to the year 1990*** *(but note that, compared to the emissions levels that would be expected by 2010 without the Protocol, this target represents a 29% cut). The goal is to lower overall emissions from six greenhouse gases - carbon dioxide, methane, nitrous oxide, sulfur hexafluoride, HFCs, and PFCs - calculated as an average over the five-year period of 2008-12. National targets range from 8% reductions for the European Union and some others to 7% for the US, 6% for Japan, 0% for Russia, and permitted increases of 8% for Australia and 10% for Iceland."*[3]

Every industrialized country received a GHG reduction target. To achieve it, each nation gave emission reduction targets to their most polluting industries. However, these targeted industries are not the only source of GHG emissions. Individuals through transportation and home heating release a significant share of GHG. Consumers are much harder to target and therefore are not subject to reduction targets yet. The next graphs about the European Union highlight this issue. EU managed to reduce its emissions in every sector except transport, which increased its GHG emissions by 24%.

FIG.6: GHG emissions by sector in EU in 2003

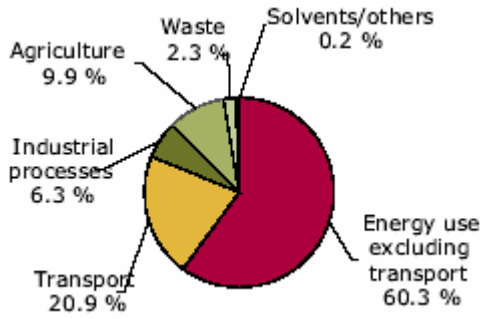
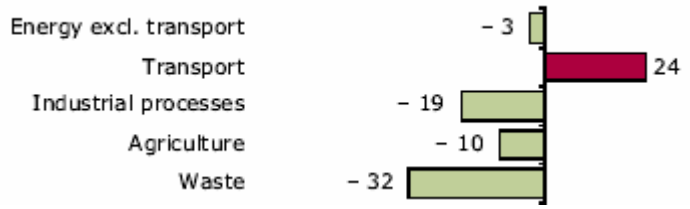


FIG.7: Evolution of emissions by sector between 1990 and 2003



Source: Greenhouse gas emission trends and projections in Europe 2005, European Environment Agency

Emission reduction is a complex issue and Kyoto designed some market-based mechanisms to help both countries and companies achieve their GHG reduction goals,.

C. THREE FLEXIBLE MECHANISMS

Three flexible mechanisms were designed to help the Annex I countries achieve their goals at a minimum cost and get developing countries involved: Emissions Trading, the Clean Development Mechanism (CDM) and Joint Implementation (JI).

[3] For the exhaustive list, see Annex I

Emissions Trading allows countries that emit more GHG than allowed to buy emission allowances from countries that emit less than their quota. All the countries with commitments are given allowances corresponding to their quotas. One allowance gives the right to emit one ton of GHG. During the commitment period (2008-2012), countries that emit more than allowed have to buy extra allowances from other countries to cover these additional emissions. Some countries will have no difficulties achieving their Kyoto targets, as for all the transitional economies of Eastern Europe and Russia. Indeed, they experienced a major economic decline after the collapse of the Soviet Union which led to significant GHG reductions. Since 1990, their GHG have been slashed by nearly one third. As their target ranges from 0% - 8% reduction, these countries will have extra credits that they can sell to countries that don't meet their targets. This mechanism rewards countries that meet and exceed their targets, and provides financial incentives for others to do so as quickly as possible.

The **Clean Development Mechanism (CDM)** allows an Annex I country to invest in the development of renewable energies or emission reduction projects in developing countries. In return, they get carbon credits that can be used to fulfill their commitments or sell to other countries.

Joint Implementation (JI) allows an Annex I country with a reduction commitment to invest in a reduction project in another Annex I country. JI host countries are mostly the transitional economies which have opportunities to reduce emissions at low cost using existing technologies. The partner will be an industrialized country that will invest in the project and earn the credits (or buy them at a lower price) created by the project. As these credits are taken from the host country's stock of credits, there is an incentive to control the project and make sure it leads to real emission reductions. JI projects are currently less developed than CDM because most of the transitional economies have not yet passed the necessary regulations. These transitional economies still have some outdated polluting plants. Technology to reduce emissions is available and foreign companies are willing to pay to reduce pollution and receive the carbon credits. Hence JI should play a significant role in GHG reduction.

The CDM and JI exclude the US and Australia, since neither have ratified the Protocol

D. KYOTO ALONE WILL ONLY REDUCE THE GROWTH OF GHG EMISSIONS

The Kyoto Protocol, even if it manages to reduce the level of GHG emissions of its signatory countries, will not alone manage to reduce the world emissions. The biggest emitter, the United States, did not ratify it and developing countries are not given goals even though they are experiencing the strongest growth in GHG emissions.

The Montreal conference in December 2005 tried to define the Kyoto Protocol beyond 2012. If more countries get involved, **especially the United States and China, which together account for 40% of world's GHG emissions**, this could lead to an effective decrease in global GHG emissions.

PRESENTATION OF THE CLEAN DEVELOPMENT MECHANISM

A. THE PRINCIPLE: GHG EMISSIONS DO NOT STOP AT BORDERS

The Clean Development Mechanism (CDM) is one of the flexible mechanisms of the Kyoto Protocol. It aims at helping industrialized countries meet their reduction targets at a lower cost. It starts from a simple statement: global warming is a planetary issue caused by the concentration of man-made GHG emissions worldwide. Thus, as long as GHG emissions are reduced or slowed on a global level, it does not matter where these reductions take place. The CDM allows companies or organizations in industrialized countries to reduce GHG emissions in developing nations rather than home if this solution proves more economically attractive.

An investor from an industrialized country can fund a project that reduces GHG emissions in a developing country. The investor gets carbon credits for the reductions, called Certified Emission Reduction (CER), and can use these to meet their Kyoto target.

The CDM involves developing countries in reducing GHG emissions. It is vital since developing nations emit ever increasing GHG: China already ranks second for GHG and India fourth. **By offering industrialized countries incentives to invest in developing countries, the CDM fosters the transfer of cleaner technologies to these countries**.

CDM projects are of two kinds. First, they can reduce the existing GHG emissions by implementing a cleaner technology in a polluting activity. Second, they can prevent the emission of new GHG by building renewable energy power plants that do not release GHG.

An example of Clean Development Mechanism

A Canadian company needs to reduce its emissions as part of its contribution to meeting Canada's emission reduction target under the Kyoto Protocol. Instead of reducing emissions from its own activities in Canada, the company provides funding for the construction of a new biomass plant in India that would not have been viable otherwise. This project will prevent the construction of new fossil-fueled plants in India, leading to a reduction in GHG emissions in India. The Canadian investor gets credit for those reductions and can use them to help meet their reduction target in Canada -- or sell them to other Canadian companies.

The actual pattern of CDM investment and crediting is often more complex than the above example. Commonly involved are intermediaries such as the World Bank or other carbon credit procurement agencies investing money on behalf of industrialized country governments and corporations. These intermediaries usually set up a fund in which companies and governments can invest. The World Bank is by far the biggest fund manager, either for itself or on behalf of governments with reduction commitments.[4] In some cases, host countries self-finance CDM projects and then seek a buyer for the emissions reductions.

[4] Detailed information about main funds can be found at http://carbonfinance.org

B. THE PROCESS: HOW TO GET A CDM PROJECT APPROVED?

The Marrakech Accords created a set of requirements for CDM projects. Project designers must complete a Project Design Document (PDD) which is a checklist explaining the design of the project and how it meets the validation requirements of the CDM. An independent certifier, called a Designated Operational Entity (DOE), reviews the document and affirms whether the project satisfies the Marrakech requirements. If it does, the project goes before the CDM Executive Board. If the Board agrees with the DOE recommendation, the project is registered and can begin monitoring and claiming credit for the emission reductions. The reductions must be verified by a different DOE before the Executive Board can issue Certified Emission Reductions (CERs). Monitoring, verification and issuance of CERs will continue for the entire duration of the project.

Remark: a simplified PDD is required for smaller projects (under 15MW or equivalent).

The World Bank estimates that the CDM could net as much as $12.5 billion for developing countries by 2012.[5]

C. BASELINE AND ADDITIONALITY

The two most critical steps of a PDD are to determine the **baseline** and demonstrate the **additionality** of the CDM project.

The *baseline* is the most likely scenario in the absence of a CDM. It is very important as it will serve as a reference to estimate the GHG emission reduction of the CDM project.

A project is called *additional* if its realization would not be possible without the CDM. In other words, the project must be different from the *baseline*, i.e. the business-as-usual outcome. If the project is the same as the baseline, it is not *additional*, because it would have happened anyway and there is no justification for giving the project carbon credits. **This issue is critical: a non-additional CDM project will result in no additional benefit to the climate** or to the developing country in which it is situated. In fact, allowing a non additional project to generate carbon credits will lead to more emissions of GHG globally, because an industrialized country can use these "fake" credits to meet its Kyoto target, and thus avoid making real emission reductions elsewhere.

To be eligible as *additional*, the designer of the project must prove that the project would have been stopped by at least one of the following barriers: investment barrier (typically the project is not profitable enough without the earnings of the CERs), technological barrier (the technology is not available in the developing country), or the barrier due to prevailing practice (mentalities in the country would not make the project possible without help from the outside).[6]

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[5] "In Asia, A Hot Market For Carbon", Business Week online, December 12, 2005, http://www.businessweek.com/magazine/content/05_50/b3963409.htm

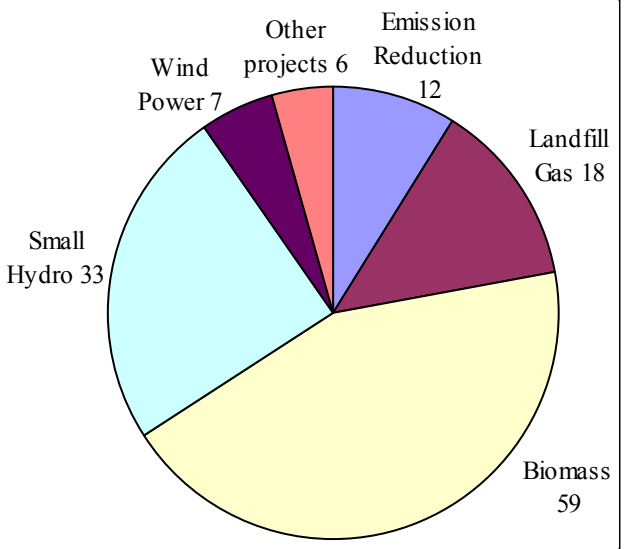
[6] Information edited from The Clean Development Mechanism (CDM) Toolkit from NGO CDMWatch that dedicates to the monitoring of the Mechanism. www.cdmwatch.org

CDM PROJECTS

A. PRESENTATION OF THE DIFFERENT KINDS OF PROJECTS

As of March 6, 2006, 135 CDM projects were registered by the CDM board (more detailed information is available in Annex II to IV). CDM projects can cover many sectors of activity: energy, most industrial activities, agriculture, reforestation, waste handle, transport and construction. However, most projects fall in 5 categories: projects that reduce plant emissions using cleaner technologies, small hydroelectric plants, wind farms, exploitation of landfill gas, and other kinds of biomass projects. (See FIG.8 and 9)

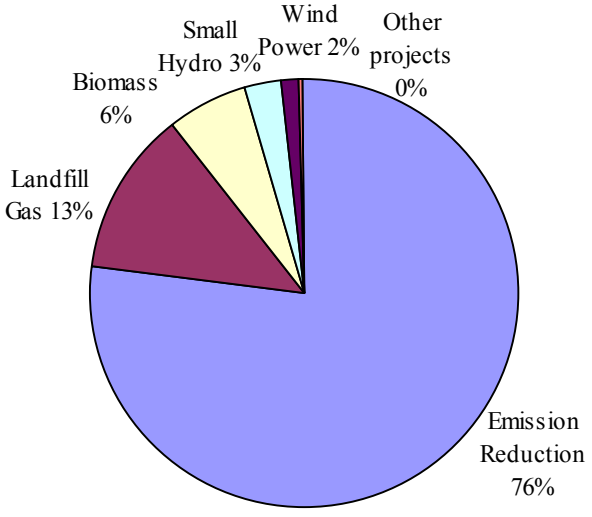
FIG.8: Number of CDM projects by category (March 2006)



Source: United Nations Framework Convention on Climate Change

Emission reduction projects often involve companies that emit significant amounts of GHG, like chemical or steel companies. These companies often pollute more abroad than would be allowed in their domestic country because of loose environmental legislation in developing countries. The technology to reduce pollution may be available but is not implemented because it is not profitable *and* not required by the host country's laws. The perspective of earning carbon credits makes the investment profitable – sometimes very profitable, as in the Rhodia example. (see next section).

FIG.9: Share of total credits for each category of CDM projects (March 2006)



Source: United Nations Framework Convention on Climate Change

Through the decaying process, landfill waste releases methane (CH_4), a very powerful GHG. Landfill gas projects collect the gas for two options: to flare it, which transforms methane into less harmful carbon dioxide, or capture and burn CH_4 for electricity generation which is used on site or sold to the local utility.

Biomass projects use biological organisms to produce energy. Most commonly used resources are agricultural wastes and animal dung. Although biomass energy emits GHG when combusted, this energy is considered clean as the biological organisms would have released GHG through the decaying process anyway. Instead of letting these resources go unused,

biomass projects produce energy, releasing the same quantities of GHG as the natural process. Hence, there are no additional GHG emissions.

Small hydroelectric plants (usually less than 40MW) and wind farms are oftentimes not profitable without incentives. Carbon credits make these projects profitable. Large hydro is not included in the CDM scope as they are usually profitable and have a larger environmental impact than small hydro.

The annual emissions reductions of these registered CDM projects amount to 39 Mt CO2e (millions of tons of carbon dioxide equivalent). They represent about half of the emissions of countries like Austria or Sweden. This is small step in the right direction if you consider that the EU still must reduce its emissions by 220 Mt CO2e to achieve its 8% reduction target. Yet, the pace of CDM registration is increasing as we approach 2008. The CDM should experience a sharp increase as Annex I countries realize that home reductions alone will not suffice. CDM will presumably play an important part in the strategy of industrialized countries to comply with their Kyoto objectives.

B. Successful Examples of CDM Projects

1. The Rhodia example: how to turn the CDM into a bonanza

Rhodia is a French chemical company with worldwide activities. The company successfully registered two CDM projects: in South Korea and Brazil. Both projects will dramatically reduce the GHG emissions in a chemical process that usually releases large quantities of GHG into the atmosphere. Rhodia's plants complied with the host country's environmental legislation. These investments would not have been profitable for the company, as they only represented a cost with no revenue. The projects would not have been undertaken without the incentive of carbon credits and are hence *additional*.

Rhodia's two CDM projects have a 2,000% return on investment

Rhodia invested 20 million euros (€) in cleaner technologies. The emission reductions will allow the company to earn annually 15 million of CERs thanks to the CDM. Considering the current market price of carbon permits at 27€ (March 2006), the company could earn 400 million euros a year and even more if the price keeps increasing. **This represents over 2,000% return on investment!**[7]

2. Biogas in Nepal

The Biogas Support Program was initiated in July 1992 with the help of Dutch and German governmental organizations to develop and promote the use of biogas in Nepal. The fourth phase of the plan was registered as a CDM project as it reduces GHG by displacing traditional fuel sources for cooking, fuel wood and kerosene.

[7] An article about Rhodia CDM projects is available at http://www.planetark.org/dailynewsstory.cfm?newsid=34282&newsdate=03-Jan-2006

The program aims at selling biogas digesters (small energy plants) to households in rural areas. Digesters are fed with cow dung and produce biogas through anaerobic digestion (without air). The Program wants to install 200,000 small biogas digesters throughout Nepal. Under previous phases, 111,395 biogas plants were installed. Despite government's efforts to develop the biogas market, the investment in the biogas sector remains a non-commercial activity in Nepal. The integration of carbon revenues will help develop this as a profitable activity.

The program has multiple social benefits. A major household benefit is the reduction in time and energy spent by women and children in collecting firewood for cooking. They can spend their extra time studying or earning additional money. Compared to burning traditional fuels, using biogas means far less smoke, hence better family health. Moreover, the residual biological slurry from the biogas plants can be used as superior organic fertilizer, enhancing agricultural yields and avoiding the use of chemical fertilizers. Except for the main valve, all digesters parts are produced locally. Over the past decade, technology transfer has facilitated the development of domestic knowledge for the construction, operation, and maintenance of efficient biogas plants[8].

Several private companies have developed similar projects, especially in India, planning to make a profit through the sale of carbon credits.

3. Wind farm project in Morocco

Lafarge Cements registered a CDM project to supply one of its cement plants in Morocco with power from an adjacent wind farm they plan to build. The investment for the wind park amounts to 10 million euros and offers a rate of return (about 10%) that is low compared to the company's standards. The investment was consequently questioned and delayed, the rate of return being considered too low to take the technical and financial risks. Selling carbon credits will increase the rate of return to a 16% (considering current market prices) that meets the company's profitability standards.[9]

4. Landfill gas recovery in Brazil -- an 80% rate of return

Onyx is a company specializing in waste treatment, charged with treating a portion of Sao Paulo's waste. In landfills, the natural process of anaerobic digestion of waste releases a gas containing 50% methane. As required by Brazilian law, landfill gas is vented to the atmosphere to prevent the risk of explosion. Onyx registered a CDM project will collect this gas and flare it, transforming methane into less harmful carbon dioxide. The total investment for this infrastructure is estimated to be 2,300,000 euros. This project will generate 70,000 CER yearly. Considering a 27-euro market price, this means yearly earnings of 1,890,000 euros, representing an estimated **80% rate of return the first year.** (After five years, the ROI of this project would be over 400%)[10]

[8] Exhaustive information at http://cdm.unfccc.int/Projects/DNV-CUK1132666829.52/view.html
[9] Exhaustive information at http://cdm.unfccc.int/Projects/DNV-CUK1123244454.33/view.html
[10] Exhaustive information at http://cdm.unfccc.int/Projects/DNV-CUK1126082019.35/view.html

HURDLES AND CRITIQUE OF THE CDM

A. AN EXPENSIVE SYSTEM

The necessity to ensure the *additionality* of emission reduction makes the registration process long and costly. The monitoring of emission reduction is also vital as it makes sure that emission reductions are real. Setting up a sophisticated system to monitor greenhouse gas emissions can cost up to $100,000 plus a further $10,000 a year to maintain. At current CER prices, that means any project that saves less than 20,000 tCO2e is not feasible.[11] Other costs of designing a CDM project can include: hiring a consultant, hiring an environmental auditor, registering the project with the appropriate national authority and with the CDM Board in Bonn.

B. TOO SLOW/TOO MUCH BUREAUCRACY

In addition to being expensive, the registration system is slow. It can take up to six months to register projects, which diminishes the attractiveness. One of the reasons of this slow validation process is the budget shortfall of the CDM's executive board. However, it was decided at the Montreal conference in December 2005 to grant extended funding which should shorten approval times.

C. A MARKET LACKING LIQUIDITY

A CER spot market is unlikely to develop before the Kyoto emission thresholds begin to be enforced in 2008. CER volumes are still low. Only 107 million tCO2e were exchanged in 2004. There is little market liquidity, since credits that do become available are usually promised to a specific buyer beforehand.[12] As we approach 2008, the Mechanism will become more attractive and more deals will be closed, resulting in an increase in market liquidity.

D. ARE ALL THE PROJECTS ENVIRONMENTALLY USEFUL?

Some registered projects are controversial as they do not strictly comply with the CDM rules, especially the *additionality* criterion. Some projects were completed and sought approval afterwards. The *additionality* rule stipulates that only projects which would not have been possible without the extra income of carbon credits should be registered. It is then questionable that projects completed before the CDM was officially launched would be *additional*. These controversial projects might have been validated because of the lack Board funding that prevented full analysis. The decision to increase the funding of the Board will hopefully help to solve this issue. Another positive point is that companies trying to get approval on completed projects will find it harder as time passes. Within a few years these opportunistic applications should just disappear.

[11] "Out of Thin Air" by Michael Thomas Derham; LatinFinance. Coral Gables, Oct 2005. pg. 1
[12] ibid

E. UNCERTAINTY ABOUT THE FUTURE OF THE MECHANISM

The Kyoto Protocol gives commitments to industrialized countries until 2012. A lot of uncertainty remains about what will happen next. Will the U.S. ratify Kyoto after 2012? Will China and India accept reduction targets? In the worst case scenario, the US and Australia would still reject the Protocol and developing countries would refuse any commitments. Under these circumstances, the other industrialized countries might decide to stop putting constraints on their industries that lead to unfair competition. In this "catastrophe" scenario, industrialized nations would no longer have any commitments. The incentive to invest in CDM projects would then disappear. Nevertheless, the latest conference about global warming held in Montreal in December 2005 gave some hope to the supporters of the Kyoto Protocol. Industrialized countries which are committed to reducing their emissions stated they would pursue their efforts to reduce emissions. While for the first time, the US showed some signs of openness.

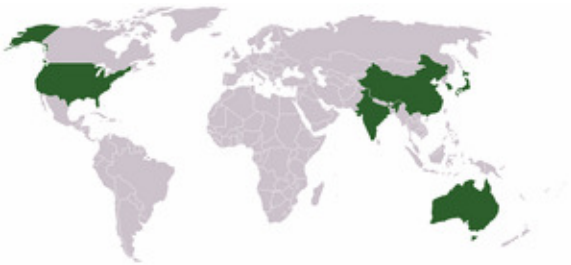
ALTERNATIVES TO THE KYOTO PROTOCOL

The countries that did not ratify the Kyoto Protocol are trying to develop alternative ways of reducing GHG emissions. Australia and the United States through the "Asia Pacific Partnership on Clean Development and Climate" committed themselves to reduce their GHG emissions – without specific targets. Within the US, some states are trying to set up an agreement close to the Kyoto Protocol known as the Regional Greenhouse Gas Initiative.

A. THE ASIA PACIFIC PARTNERSHIP ON CLEAN DEVELOPMENT AND CLIMATE

The Asia Pacific Partnership on Clean Development and Climate, also known as AP6, is an agreement between six Asia-Pacific nations: Australia, China, India, Japan, South Korea and the United States. It was introduced at the Association of Southeast Asian Nations (ASEAN) regional forum on July 28, 2005 and launched on January 12, 2006. The pact allows those countries to set their goals for reducing greenhouse gas emissions individually, but has no enforcement mechanism.

FIG.10: the AP6 members



Japan, China, India, South Korea, Australia and the US are the 6 members of the Pacific Partnership on Clean Development and Climate

The idea behind AP6 is to associate the biggest emitters of GHG into a common initiative. Member countries account for approximately 50% of the world's greenhouse gas emissions, energy consumption, GDP and population. The members agreed to cooperate on development and transfer of technologies that enable reductions of greenhouse gas emissions. The intent is to: develop, deploy and transfer existing and emerging clean technology; meet increased energy needs and explore ways to reduce the greenhouse gas intensity of economies; build human and

institutional capacity to strengthen cooperative efforts; and seek ways to engage the private sector.

Eight public-private sector Task Forces were established, covering: cleaner fossil energy, renewable energy and distributed generation, power generation and transmission, steel, aluminum, cement, coal mining, buildings and appliances. The Task Forces are to foster improvements with regard to best practices, ensuring that a range of technologies are developed and repeatedly demonstrated so that economies of scale are utilized and costs are reduced.[13]

The Partnership aims at decreasing the emission intensity of its members' economies, which means the quantity of emissions you need to generate a unit of GDP. This is a lesser goal as it does not necessarily imply a decrease in global emissions. For instance, if you reduce your emission intensity by 2% but your economy grows by 3%, it still means an increase in emissions and does not help solve the problem of climate change.

The AP6 communiqué mentions that the countries "will marshal considerable financial, human and other resources both from the public and private sectors." However, the funding of the Partnership consists of $52 million from the US[14] and $75 million from Australia[15]. These figures seem insufficient when compared to the $1 billion that India alone is expected to receive through the CDM[16].

B. THE REGIONAL GREENHOUSE GAS INITIATIVE

Regional Greenhouse Gas Initiative (RGGI) is a regional initiative by states in the Northeastern United States to reduce greenhouse gas emissions. The RGGI is designing a "cap and trade" program for emissions from power plants. In August 2005, the RGGI proposed an emissions reduction program that would start in 2009 and lead to a stabilization of emissions at current levels by 2015. This would be followed by a 10% reduction in emissions between 2015 and 2020. The proposal would also allow participants to purchase offsets (similar to the CERs) to meet 50% of their emission reductions.

As of **January 2006**, seven Northeastern US states are involved in the Regional Greenhouse Gas Initiative. It is believed that the state-level program will apply pressure on the federal government to support the Kyoto Protocol.

The participating states are Maine, New Hampshire, Vermont, Connecticut, New York, New Jersey, and Delaware. After initially supporting the project, Massachusetts and Rhode Island dropped out of the program. They are now under pressure from environmental groups to re-sign.

Maryland and Pennsylvania are both observers to the RGGI program because their residents and businesses rely heavily on coal for power generation. As observers, these states can join the program later, but are currently waiting to see if the initiative allows the states to reduce their

[13] Information edited from the communiqué of the Partnership. The full communiqué is available on http://www.dfat.gov.au/environment/climate/ap6/communique.html
[14] Asia Pacific Partnership on Clean Development, January 11, 2006, US Fed News
[15] Climate fund's $100m kickstart by Steve Lewis, Chief political reporter, January 7, 2006, The Australian
[16] The Statesman (India): Indian businessmen set to earn $1 m through CDM, November 2, 2005, The Statesman

emissions at a reasonable cost. The other observers of the RGGI are the District of Columbia and the Eastern Canadian Provinces.

C. WEST COAST GOVERNORS' GLOBAL WARMING INITIATIVE

The West Coast Governors' Global Warming Initiative, launched in 2003 by the Governors of California, Washington and Oregon, is also considering a CO_2 cap and trade program as a way of cutting GHG. Oregon has made the most progress. In late 2005, state Governor Ted Kulongoski created the Oregon Carbon Allocation Task Force, which is supposed to design a cap and trade program that can be presented to the Oregon legislature in 2007. This could form the basis for a similar program that California and Washington could support[17].

CARBON MARKETS

A. THE EUROPEAN UNION EMISSION TRADING SCHEME (EU ETS)

The EU ETS was designed to anticipate the possibility of exchanging carbon permits under the Kyoto Protocol. It targets large emitters, which represent nearly half of the EU's total emissions. These large emitters are given European Union Allowances (EUA) corresponding to the emission levels they are allowed to emit. Each EUA allows a company to emit 1 ton of CO_2 equivalent. These allowances can be bought, sold or banked. A company emitting more GHG than its quotas will have to buy extra allowances to have enough permits to cover its emissions. If a company fails to provide as many allowances as tons of emissions, it will have to provide the missing allowances next year and also pay a fine. The ETS is presently the only market where companies from Annex I countries can buy and sell carbon permits.

The ETS is comprised of 2 distinct phases: the first from 2005 to 2007 and the second from 2008 to 2012, which coincides with the Kyoto commitment period. The first phase includes fewer companies and sets looser objectives and fines. It is designed to get European companies real practice in trading carbon permits to achieve their targets. Companies now have a strong incentive to reach their targets as they face a 40 euro (€) fine per ton of CO_2 equivalent during the first period and 100€ fine per ton from 2008 - 2012.

Since the beginning of the EU ETS on January 1, 2005, EUA have experienced a sharp increase, rising from 6€/ton to 29€/ton in only 6 months. The price dropped sharply at that peak and then settled into a much smoother range between 21€ and 27€. The market is getting more mature with an increasing number of actors and daily exchanges which make EUA more liquid. (See FIG.11)

Weather is a main driver of the carbon market. Dry summers lead to greater use of air conditioning thus more electricity and more emissions. They also reduce the power generated by hydro plants and increase the part of fossil-fuel electricity. Cold winters entail more heating and

[17] Carbon Trading Comes Of Age In Europe, Coming To US, January 18, 2006, World Gas Intelligence

more electricity and emissions as well. Another key driver is the price of fuels. If the price of coal combined with the price of carbon permits is higher than the price of natural gas, utilities that are flexible enough will switch to gas. This will reduce emissions and decrease the price of carbon permits.

FIG.11: Evolution of EUA prices at the Nord Pool stock exchange between February 2005 and February 2006 (futures maturing in December 2006)

Source: Nord Pool and CO_2 Handel

The **Linking Directive** reinforces the link between the European carbon market and the Kyoto Protocol project-based mechanisms, the Joint Implementation and the Clean Development Mechanism. Companies are allowed to use these two mechanisms to fulfill their obligations. The result will be lower compliance costs for installations in Europe. This Directive thus recognizes JI and CDM credits as equivalent to EU emission allowances. You can trade CO_2 allowances on many markets throughout Europe, the main being the European Climate Exchange, Nord Pool and Powernext.

The credits earned through CDM projects (as well as JI) can be transformed into EUA through the Linking Directive. They can then sell at the same price once the emission reductions have been certified. When a company or organization (like the World Bank) invests in a CDM project, they typically commit themselves to buy the credits at 4-6€/tCO2e. These prices, much lower than those of EUA, reflect a wide range of risks not present for EU allowances, including project approval and performance risks as well as counterparty credit risks.[18] Your partner could go bankrupt before the end of the project or supply you with fewer carbon credits than expected because they did not achieve the planned level of reduction.

B. CHICAGO CLIMATE EXCHANGE (CCX)

Chicago Climate Exchange is a GHG emission reduction and trading pilot program in the United States, Canada, and Mexico. CCX is a self-regulatory, rules-based exchange designed and governed by its members. Members made a voluntary, legally binding commitment to reduce their GHG emissions by four percent below the average of their 1998-2001 baseline by 2006, the

[18] What determines price of carbon in EU? http://www.europeanclimateexchange.com/index_flash.php

last year of the pilot program. Members are scheduled to decrease their emissions by 1% a year from 2002 to reach their 4% reduction target in 2006. The baseline is the average of the member's emissions in 1998, 1999, 2000 and 2001, adjusted to reflect acquisition or disposition of facilities. The program covers the same six major GHG as the Kyoto Protocol. It was recently extended beyond 2006. Members committed themselves to reduce their emissions by 6% in 2010 compared to the baseline.

There are about 40 CCX members that include large public companies such as Rolls-Royce, Ford, Dupont, American Electric Power, Motorola, and IBM as well as universities and municipalities like Berkeley and Chicago[19]. Allowances are issued to members according to their targets. They can be bought, sold or banked. The only restriction is that an allowance cannot be used before its vintage year. (for example, you can't use a 2006 allowance in year 2004 or 2005). Members can also generate credits by qualifying mitigation projects that reduce GHG emissions outside their organization (these projects can be developed in the US, Canada, Mexico and also in Brazil).

Very similar to the Kyoto Protocol, CCX enables members emitting more than their target to buy credits from members emitting less than what they are allowed. This pilot program wants to demonstrate that a market for GHG emissions can tackle this global issue in a market-driven, efficient and cost-effective way.

AN EMISSION MARKET HAS SUCCESSFULLY EXISTED IN THE US FOR 10 YEARS

A. A TWO-PHASE PROGRAM TO DRAMATICALLY CUT SO_2 AND NOX EMISSIONS

The Acid Rain Program was designed to dramatically reduce the emission of the two main gases responsible for acid rain: sulfur dioxide (SO_2) and nitrogen oxides (NOx). Whereas the NOx reduction target is being achieved through classical regulation, the SO_2 reduction target relies on a cap and trade system.

The Acid Rain Program sets a goal of reducing annual SO_2 emissions by 10 million tons below 1980 levels (25 million tons) by 2010 which represents a 40% decrease. As power generation from burning fossil fuels (especially coal) is responsible for 70% of all SO_2 emissions in the US, the program calls on electric utilities to achieve a 50% reduction by 2010. The program is organized around two phases.

Phase I, from 1995 to 1999, affected coal-burning electric utility plants producing more than 100 megawatts. This represented 263 units in 21 Eastern and Midwestern states. An additional 182 units voluntarily joined Phase I of the program to start saving credits they would need in the second phase.

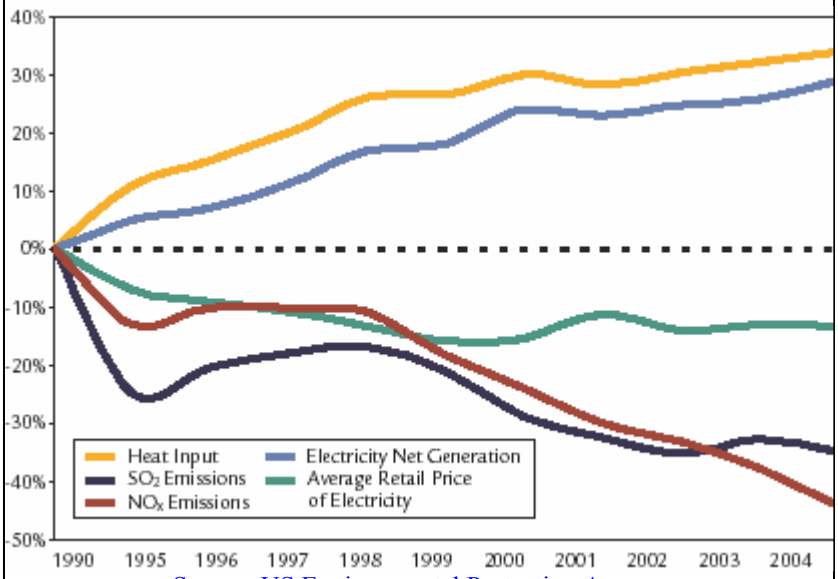
[19] The whole list is available at http://www.chicagoclimatex.com/about/members.html

Phase II, which began in the year 2000 and will end in 2009, tightened the annual emissions limits imposed on these large, higher emitting plants. It also set restrictions on smaller, cleaner plants fired by coal, oil, and gas, including over 2,000 units. Phase II affects existing utility units serving generators with an output capacity greater than 25 megawatts and all new utility plants.[20]

B. A CAP AND TRADE PROGRAM SIMILAR TO KYOTO AND VERY SUCCESSFUL

The Acid Rain Program represents a dramatic departure from traditional command and control regulatory approach which establishes specific, inflexible emissions limitations. Instead, the Acid Rain Program introduces an allowance trading system that harnesses the incentives of the free market to reduce pollution.

FIG.12: Electricity Generation and Emissions from Electric Power Sources



Source: US Environmental Protection Agency
Acid Rain Program 2004 Progress Report

Under this system, affected utility units are allocated allowances based on their historic fuel consumption and a specific emissions rate. Each allowance permits a unit to emit 1 ton of SO_2 during or after a specified year. For each ton of SO_2 emitted in a given year, companies have to present one allowance to the US Environmental Protection Agency EPA).

Allowances may be bought, sold, or banked. Anyone may acquire allowances and participate in the trading system. The Opt-in Program offers installations not required to participate in the Acid Rain Program the opportunity to enter on a voluntary basis and receive their own SO_2 allowances. These additional participants reduce the cost of achieving the 10 million ton reduction goal. They voluntarily join the market because their cost for reducing one ton of SO_2 is lower than the allowance price. They can reduce their emissions and sell the excess permits for a profit. This means more allowance supply and a lower market price, thus reducing the cost for the industry as a whole.

Contrary to what many pundits predicted, the program did not lead to an increase in electricity prices. Over 15 years, while electricity generation increased by 25%, SO2 and NOx emissions dropped by more than 30% and **prices fell by more than 10%.** (See FIG. 12)

SO_2 emissions have dropped by 40% in 2004 for targeted power utilities from 1980 levels. This is significant progress towards their 50% reduction goal by 2010.

[20] Information edited from the US Environmental Protection Agency http://www.epa.gov/acidrain/

C. SO_2 ALLOWANCE MARKET: WHAT LESSONS FOR THE CARBON MARKET?

The carbon market created by the Kyoto Protocol operates on the same principle as the SO_2 market. The latter can therefore give us precious information about what we should expect from the carbon market.

One of the most important lessons of the SO_2 market is that **the cost of reducing pollution through this system was highly overestimated** by experts. Even though the prices recently increased, the difference between estimated prices and real prices is huge. The market price of allowances is set at the marginal cost of decreasing pollution in the power industry. This cost is much lower than predicted. Before the decision was made to create a market, experts predicted an allowance price ranging from $1,000 to $1,500 per ton. The graph FIGURE 13 shows us that the price from 1995 to 2003 never exceeded $200. The price of emission reduction over this period was much lower than expected, and the market mechanism achieved a **dramatic cut in emissions very cost-efficiently.**

FIG.13: SO2 allowance prices between 1995 and 2004

Source: US Environmental Protection Agency
Acid Rain Program 2004 Progress Report and Cantor Fitzgerald

There was a sharp increase in 2004 that carried into 2005 with prices going above $1,500 per ton at the end of the year. The first reason was the need for utilities to have enough allowances to show at the end of the year. Second, they anticipated tougher rules after 2010, when the EPA's Clean Air Interstate Rule (CAIR) goes into effect, reducing the value of each allowance by half. In 2015 the ratio will rise from 2:1 to 2.86:1. Some utilities with excess allowances bank them in reserve for harder times, reducing the offer and mechanically increasing the price. Prices have significantly gone down since the beginning of 2006 -- closing below $1,000 per ton.[21]

Except for the latest peak in the end of 2005, the SO_2 market worked very well. It proved all the experts who anticipated a high cost of reducing emissions to be wrong. The cap-and-trade system has been environmentally effective by dramatically reducing SO_2 emissions, it has also been economically efficient. The SO_2 market allowed great flexibility in the way installations could decrease their emissions and allowed them to comply with their objectives at a much lower cost than any other alternatives would have permitted. The carbon market, working on a very similar basis, should then be successful at achieving emission reductions in a cost-effective way.

[21] "SO2 allowance price exceeds expectations as prices climb", November 14, 2005, Platts Coal Outlook and "SO2 Prices Plummet As Utilities Sell Into Market", February 2, 2006, Dow Jones Energy Service

CONCLUSION

The Kyoto Protocol moves the world towards a **"carbon-constrained economy"** where GHG emissions now have a cost and represent a restricted "resource". Only limited amounts of GHG should be emitted yearly in order to avoid changing our planet's balance irreversibly. Once this "carbon constraint" has been set, using market mechanisms appears the best way to allocate this scarce resource to the companies that need it most.

The Clean Development Mechanism is one innovative tool that gives Annex I countries more flexibility to achieve their reduction targets. It also gets developing countries involved in reducing emissions as it fosters the transfer of clean technologies to these countries. The CDM urges companies to find innovative ways to reduce pollution and to keep a global mind set on the global climate issue. Innovative companies are rewarded with significant extra profits and can gain decisive competitive advantage over the companies that are reluctant to take "carbon-constraints" into account.

However, this tool must be used carefully. If a company gets a non-additional project registered, it will lead to more pollution as the company can keep polluting in its domestic country without having effectively reduced pollution in another country. Therefore, the CDM Board must be very vigilant to the application of the **additionality** criterion. The Board is currently under pressure to increase the pace of approvals. Even if a greater pace is desirable, it could have a negative environmental impact if it leads to accepting non-additional projects. The funding of the Board needs to be extended to a sufficient level, allowing the Board to fully accomplish its missions. The CDM also needs a clear vision of what will happen beyond 2012. If signatory countries of the Kyoto Protocol do not secure its future, the CDM will disappear.

The CDM is only one of the Kyoto Protocol tools. CDM projects might act as catalysts to spread new technologies and make them profitable without assistance. It is not the complete answer to climate change but combined together with other solutions, it will lead to an effective decrease of world GHG emissions. As of March 2006, registered CDM projects around the world were expected to reduce 39Mt of CO_2e per year. For comparison, this equals 18% of the emission reductions Europe must achieve to meet its Kyoto target. Therefore, the CDM has only begun to impact emission reductions and it should be rapidly expanded if we truly desire to tackle climate change.

ANNEX I: REDUCTION GOALS AND EMISSION EVOLUTION BETWEEN 1990 AND 2002 OF ANNEX I COUNTRIES

Europe	Targets	Evolution 1990-2002
Western EU (EU15)*	***-8%***	***-3%***
Austria	-13%	9%
Belgium	-8%	4%
Denmark	-21%	-1%
Finland	0%	6%
France	0%	-3%
Germany	-21%	-19%
Greece	25%	24%
Ireland	13%	28%
Italy	-7%	8%
Luxembourg	-28%	-20%
The Netherlands	-6%	3%
Portugal	27%	40%
Spain	15%	41%
Sweden	4%	-4%
United Kingdom	-13%	-15%
Eastern EU**	***-7%***	***-33%***
Czech Republic	-8%	-26%
Estonia	-8%	-55%
Hungary	-6%	-31%
Latvia	-8%	-63%
Lithuania	-8%	-66%
Poland	-6%	-33%
Slovakia	-8%	-28%
Slovenia	-8%	-1%
Other European countries		
Bulgaria	-8%	-56%
Croatia	-5%	-9%
Iceland	10%	6%
Liechtenstein (1)	-8%	0%
Norway	1%	15%
Romania	-8%	-48%
Switzerland	-8%	-3%
Ukraine	0%	-47%

Oceania	Targets	Evolution 1990-2002
Australia*	8%	22%
New Zealand	0%	22%
Asia		
Japan	-6%	10%
Russia (1)	0%	-39%
North America		
USA	-7%	13%
Canada	-6%	21%

* both countries signed the treaty but did not ratify it

** when the EU signed the treaty, it had only 15 members, it now has 25 EU has a global commitment of 8% reduction but commitments vary for the different countries depending on their growth perspectives and past efforts to reduce GHG emissions

*** among the 10 new EU members, Cyprus and Malta do not have commitments

(1) Evolution in 1999, latest data available for these countries

Source: Kyoto Protocol, Annex B (http://unfccc.int/essential_background/kyoto_Protocol/items/1678.php) for the reduction commitments and United Nations statistical division for the evolution between 1990 and 2002.

ANNEX II: REGISTERED CDM PROJECTS ON MARCH 6, 2006
SORTED BY QUANTITIES OF EMISSION REDUCTION

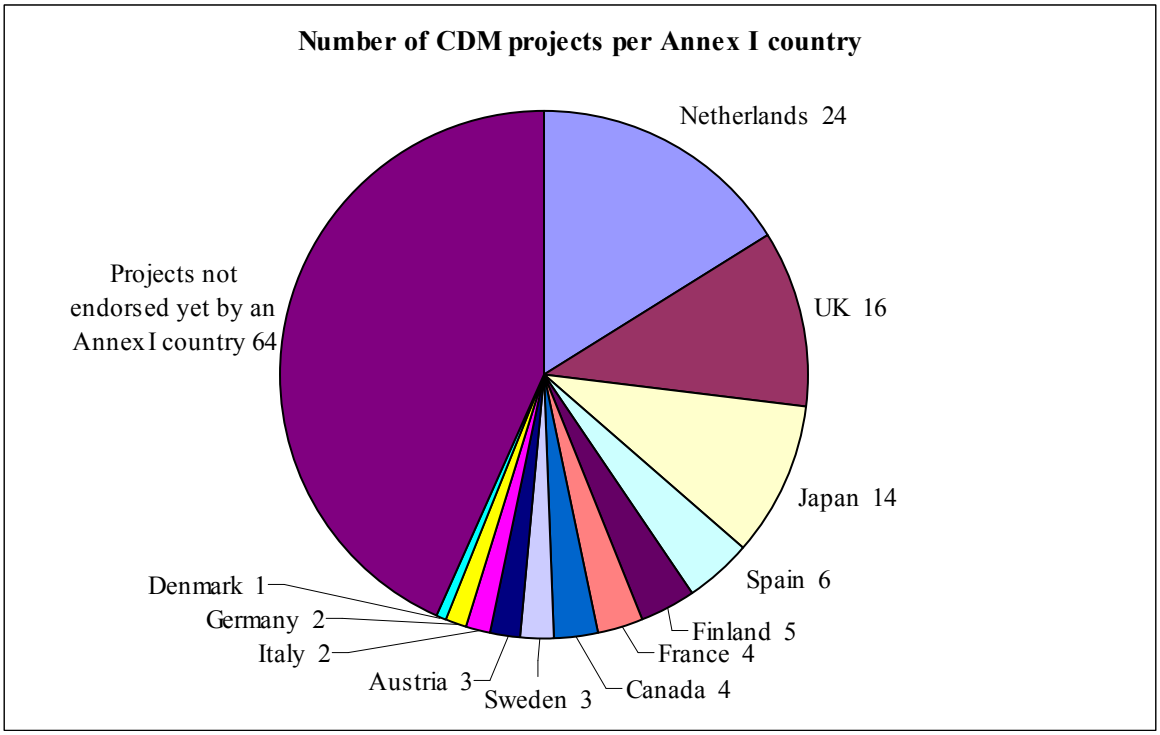
25 largest projects in terms of emission reduction

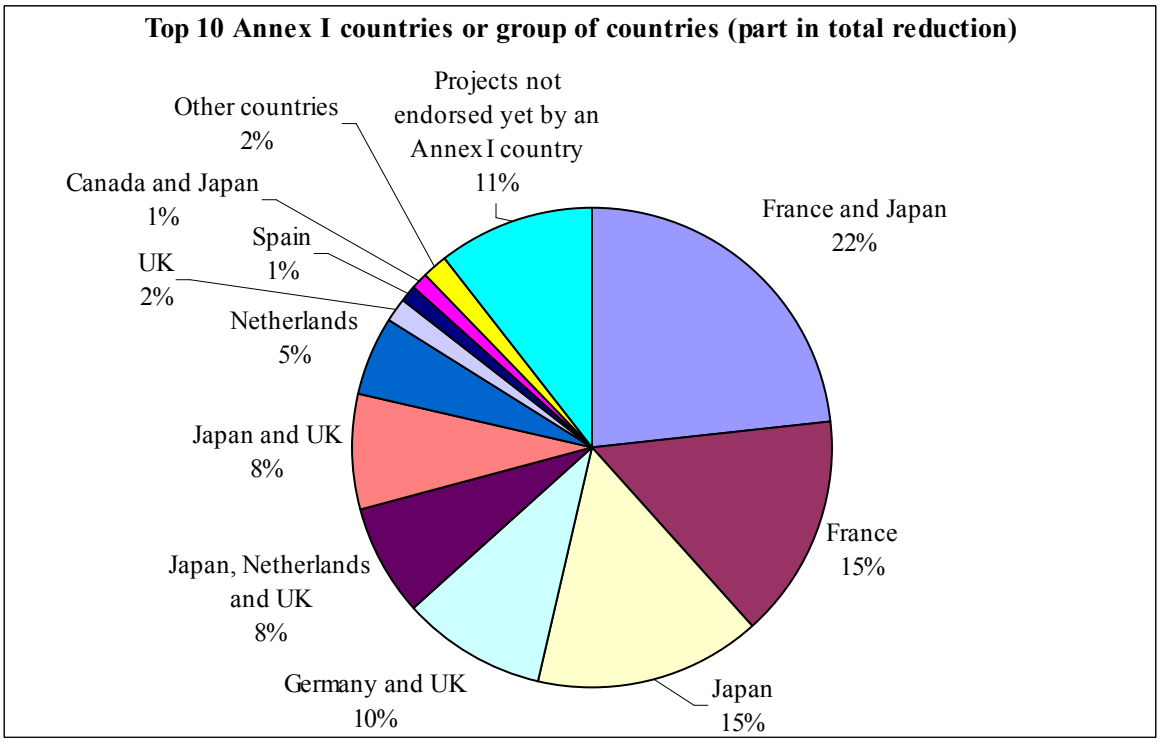
Title	Type of projects	Host Parties	Annex I Parties	Reductions in tCO_2e	Cumul. %
N2O Emission Reduction in Onsan, South Korea	Emission Reduction	South Korea	Japan, France	9,150,000	23%
N2O Emission Reduction in Paulínia, SP, Brazil	Emission Reduction	Brazil	France	5,961,165	38%
HFC23 Decomposition Project of Zhejiang Juhua Co., Ltd, P. R. China	Emission Reduction	China	Japan	5,789,682	53%
GHG emission reduction by thermal oxidation of HFC 23 at refrigerant (HCFC-22) manufacturing facility of SRF Ltd	Emission Reduction	India	Germany, UK	3,833,566	63%
Project for GHG emission reduction by thermal oxidation of HFC 23 in Gujarat, India.	Emission Reduction	India	Japan, Netherlands, UK	3,000,000	70%
HFC Decomposition Project in Ulsan	Emission Reduction	South Korea	Japan, UK	1,400,000	74%
Bandeirantes Landfill Gas to Energy Project (BLFGE)	Landfill Gas	Brazil	None yet	1,070,649	77%
Rang Dong Oil Field Associated Gas Recovery and Utilization Project	Emission Reduction	Viet Nam	Japan, UK	677,000	78%
Brazil NovaGerar Landfill Gas to Energy Project	Landfill Gas	Brazil	Netherlands	670,133	**80%**
Salvador da Bahia Landfill Gas Management Project	Landfill Gas	Brazil	Japan, UK	664,674	82%
Landfill gas extraction on the landfill Villa Dominico, Buenos Aires, Argentina	Landfill Gas	Argentina	Netherlands	588,889	83%
BII NEE STIPA	Wind Power	Mexico	Spain	309,979	84%
Meizhou Landfills Gas Recovery and Utilization as Energy	Landfill Gas	China	Austria	286,525	85%
Methane capture and combustion from swine manure treatment for Pocillas and La Estrella	Emission Reduction	Chile	Canada, Japan	247,428	85%
Nanjing Tianjingwa Landfill Gas to Electricity Project	Landfill Gas	China	UK	246,107	86%
Brazil MARCA Landfill Gas to Energy Project	Landfill Gas	Brazil	Japan, UK	231,405	87%
ESTRE's Paulínia Landfill Gas Project (EPLGP)	Landfill Gas	Brazil	None yet	212,558	87%
Koblitz - Piratini Energia S. A - Biomass Power Plant – Small Scale CDM Project	Biomass	Brazil	None yet	172,763	88%
El Molle – Landfill gas (LFG) capture project	Landfill Gas	Chile	None yet	160,130	88%
Abanico Hydroelectric Project	Small Hydro	Ecuador	Netherlands	156,660	88%
Rio Azul landfill gas and utilization project in Costa Rica	Landfill Gas	Costa Rica	Netherlands	156,084	89%
Essaouira wind power project	Wind Power	Morocco	None yet	156,026	89%
AWMS GHG Mitigation Project, MX05-B-06, Jalisco, México	Biomass	Mexico	None yet	147,953	90%
AWMS GHG Mitigation Project, MX05-B-01, México	Biomass	Mexico	None yet	147,380	90%

Remark: the 9 biggest projects (out of 135) account for 80% of emissions reductions.
Emission reductions from all CDM registered projects represented 39 $MtCO_2e$.

The exhaustive list is available at http://cdm.unfccc.int/Projects/registered.html

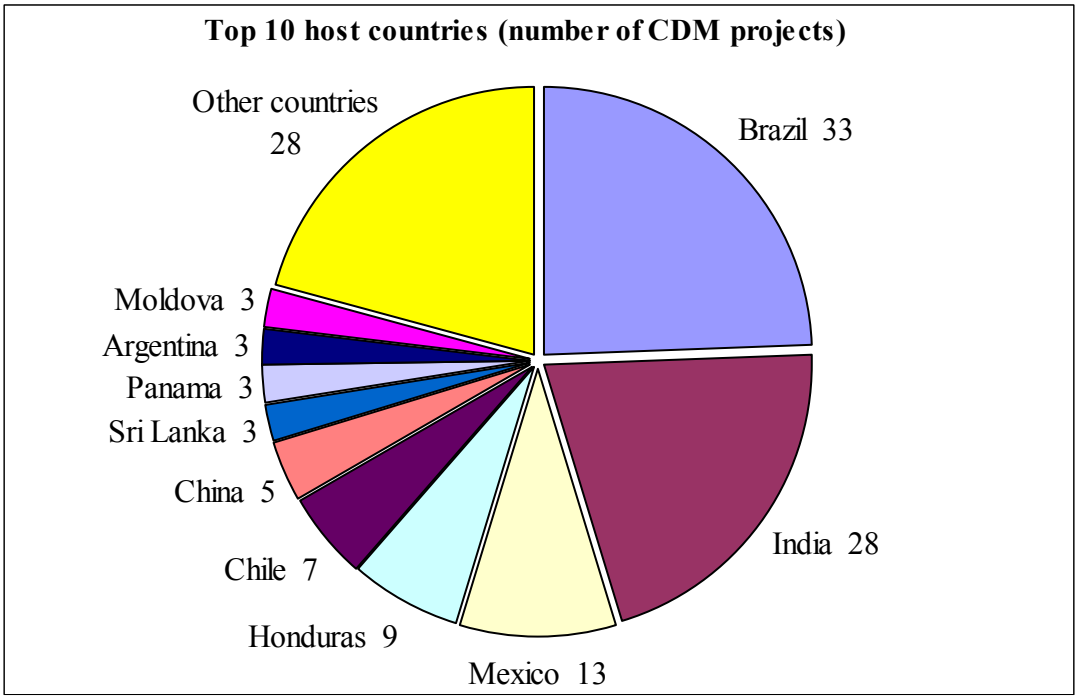
ANNEX III: REGISTERED CDM PROJECTS ON MARCH 6, 2006 SORTED BY ANNEX I COUNTRIES

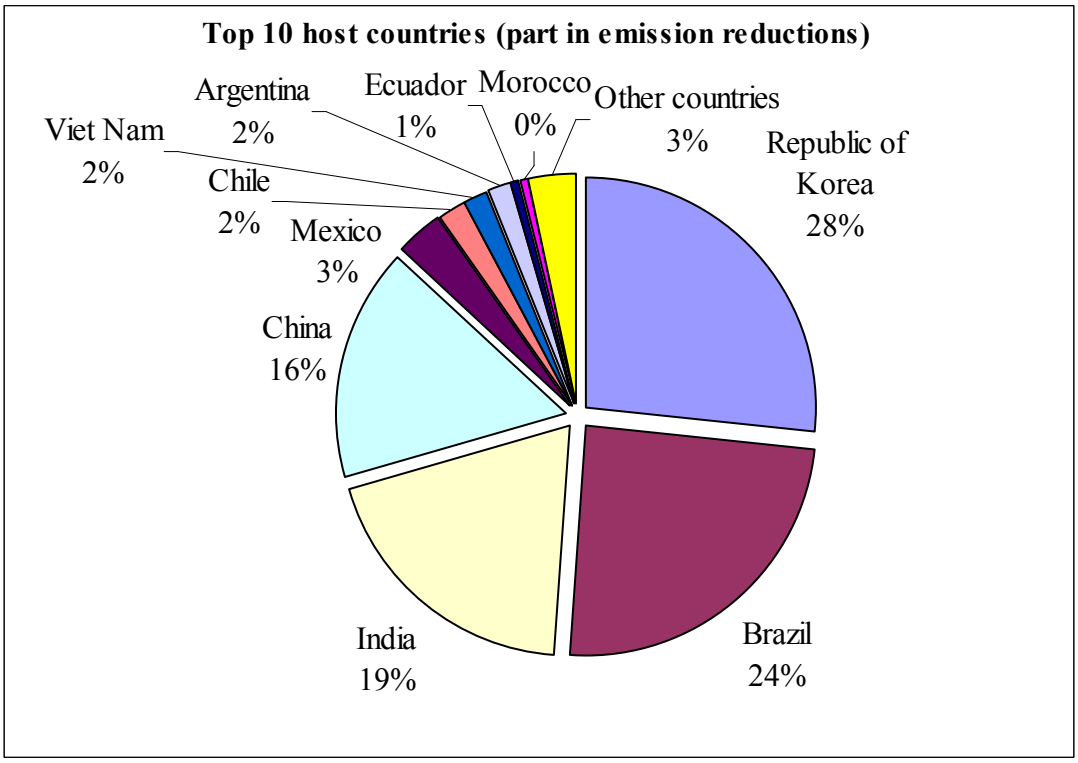




Remark: Some projects can involve several Annex I countries. As the sharing of credits is not necessarily known, the graph above shows both individual countries and groups of countries.

ANNEX IV: REGISTERED CDM PROJECTS ON MARCH 6, 2006
SORTED BY HOST COUNTRIES





South Korea has only registered 2 CDM projects but they are huge and account for 28% of all the CDM projects' emission reductions. China also has a few but big-scale projects. Mexico and Honduras on the contrary have many small-scale projects.

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FIG.1 http://www.earth-policy.org/Indicators/CO2/2004.htm
FIG.2 http://www.ipcc.ch/present/graphics/2001wg1/large/05.02.jpg
FIG.3 and 4 http://unstats.un.org/unsd/environment/air_greenhouse_emissions.htm
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FIG.10 Communiqué at http://www.dfat.gov.au/environment/climate/ap6/communique.html
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