

CHAPTER-2

Kyoto protocol

2. Kyoto Protocol

The objective of the Kyoto Protocol is to achieve "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. The Kyoto Protocol is an agreement made under the United Nations Framework Convention on climate change (UNFCCC). Countries that ratify this protocol commit to reduce their emissions of carbon dioxide and five other greenhouse gases or engage in emissions trading if they maintain or increase emissions of these gases.

The Kyoto Protocol is a protocol to the international Framework convention on climate change with the objective of reducing Greenhouse gases that cause climate change. It was agreed on 11 December 1997 at the 3rd conference of the parties in Kyoto, and entered into force on 16 February 2005. The Kyoto Protocol now covers more than 160 countries globally and more than 60% of countries in terms of global greenhouse gas emissions. This treaty expires in 2012, and international talks began in May 2007 on a future treaty to succeed the current one

As of 2007, 180 parties have ratified the protocol. Of these, 36 developed countries (plus the EU as a party in its own right) are required to reduce greenhouse gas emissions to the levels specified for each of them in the treaty (representing over 61.6% of emissions from Annex I countries), with three more countries intending to participate. One hundred and thirty-seven (137) developing countries have ratified the protocol, including Brazil, China and India, but have no obligation beyond monitoring and reporting emissions.

Among various experts, scientists and critics there is some debate about the usefulness of the protocol, and there have been cost-benefit studies performed on its usefulness.

2.1 Principles of Kyoto Protocol

1. Kyoto is underwritten by governments and is governed by global legislation enacted under the UN'S aegis.
2. Governments are separated into two general categories: developed countries, referred to as Annexe I countries (who have accepted greenhouse gas emission reduction obligations and must submit an annual greenhouse gas inventory) and developing countries, referred to as Non-Annexe I countries (who have no greenhouse gas emission reduction obligations but may participate in the clean development mechanism).
3. Any Annexe I country that fails to meet its Kyoto obligation will be penalized by having to submit 1.3 emission allowances in a second commitment period for every ton of greenhouse gas emissions they exceed their cap in the first commitment period (i.e., 2008-2012).
4. By 2008-2012, Annexe I countries have to reduce their greenhouse gas emissions by a collective average of 5% below their 1990 levels (for many countries, such as the EU member states, this corresponds to some 15% below their expected greenhouse gas emissions in 2008). While the average emissions reduction is 5%, national limitations range from an 8% average reduction across the European Union to a 10% emissions increase for Iceland; but since the EU's member states each have individual obligations, much larger increases (up to 27%) are allowed for some of the less developed EU countries. Reduction limitations expire in 2013.
5. Kyoto includes "flexible mechanisms" which allow Annexe I economies to meet their greenhouse gas emission limitation by purchasing GHG emission reductions from elsewhere. These can be bought either from financial exchanges, from projects which reduce emissions in non-Annexe I economies under the Clean Development Mechanism (CDM), from other Annexe I countries under the Joint Implementation (JI), or from Annex I countries with excess allowances. Only Certified Emission Reductions (CER) accredited by CDM Executive Board can be bought and sold in this manner.

Under the aegis of the UN. Kyoto established this Bonn-Based Clean Development Mechanism Executive Board to assess and approve projects ("CDM Projects") in Non-Annexe I economies prior to awarding CERs. (A similar scheme called "Joint Implementation" (JI) applies in transitional economies mainly covering the former Soviet Union and Eastern Europe).

6. What this means in practice is the Non-Annexe I economies have no GHG emission restrictions, but when a greenhouse gas emission reduction project (a "Greenhouse Gas Project") is implemented in these countries, that Greenhouse Gas Project will receive Carbon credit which can be sold to Annexe I buyers.

There were fears that the cost of complying with Kyoto would be expensive for many Annexe I countries, especially those countries already are home to efficient, low greenhouse gas emitting industries, and high prevailing environmental standards. Kyoto therefore allows these countries to purchase (cheaper) carbon credits on the world market instead of reducing greenhouse gas emissions domestically and, this is seen as a means of encouraging Non-Annexe I developing economies to reduce greenhouse gas emissions through sustainable development. Since doing so it is now economically viable because the investment flows from the sale of Carbon Credits.

The entire Annexe I economies have established Designated National Authorities to manage their greenhouse gas portfolios under Kyoto. Countries including Japan, Canada, Italy, the Netherlands, Germany, France, Spain and many more, are actively promoting government carbon funds, and supporting multilateral carbon funds intent on purchasing Carbon Credit from Non-Annexe I countries. These government organizations are working closely with their utility, energy, oil, gas and chemical conglomerates to try to acquire as many Greenhouse Gas Certificates as cheaply as possible.

Virtually all of the Non-Annexe I countries have also set up their own Designated National Authorities to manage the Kyoto process (and specifically the "CDM process" where by these host government entities decide which Greenhouse Gas Projects they do or donot wish to support for accreditation by the CDM Executive Board)

The Objective of these opposing groups are quite different. Annexe I entities want Carbon Credits as cheaply as possible, whilst Non-Annexe I entities want to maximize the value of Carbon Credits generated from their domestic Greenhouse Gas Projects. The objective is to achieve “stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system”. 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.

"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 limitation represents a 29% cut). The goal is to lower overall emissions of six greenhouse gases –Carbon dioxide, Methane, nitrous oxide, sulphurhexa flouride, Hydroflorocarbons, and Perflorocarbons- averaged over the period of 2008-2012. National limitations 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.

It is an agreement negotiated as an amendment to United Nations framework convention climate change (UNFCCC which was adopted at the Earth summit in Rio de Janeiro in 1992). All parties to the UNFCCC can sign or ratify the Kyoto protocol, while non parties to the UNFCCC cannot. The kyotoprotocol was adopted at the third session of the conference of parties to the UNFCCC (COP3) in 1997 in Kyoto, Japan.

Common but differentiated responsibility: The United Nations Framework Convention on Climate Change (UNFCCC) agreed to a set of “common but differentiated responsibilities.” The parties agreed that

1. The largest share of historical and current global emissions of greenhouse gases has originated in developed countries.
2. Per capita emissions in developing countries are still relatively low.
3. The share of global emissions originating in developing countries will grow to meet their social and development needs.

In other words, China, India, and other developing countries were not included in any numerical limitations of the Kyoto protocol because they were not the main contributors to the greenhouse gas emissions during the pre-treaty industrialization period. However even without the commitment to reduce according to the Kyoto target, developing countries do share the common responsibility that all countries have in reducing emissions.

2.2 Emission trading

Kyoto is a 'cap and trade' system that imposes national caps on the emissions of Annex I countries. On an average, this cap requires countries to reduce their emissions by 5.2% below their 1990 baseline over the 2008 to 2012 period. Although these caps are national-level commitments, in practice most countries will devolve their emission targets to individual industrial entities, such as a power plant or paper factory. One example of a 'cap and trade' system is the EU emissions trading scheme (Euts). Other schemes may follow suit in time.

This means that the ultimate buyers of credits are often individual companies that expect their emissions to exceed their quota (their Assigned Allocation Units, AAUs or 'allowances' for short). Typically, they will purchase credits directly from another party with excess allowances, from a broker, from a JI/CDM developer, or on an exchange.

National governments, some of whom may not have devolved responsibility for meeting Kyoto obligations to industry, and that have a net deficit of allowances, will buy credits for their own account, mainly from JI/CDM developers.

These deals are occasionally done directly through a national fund or agency, as in the case of the Dutch government's ERUPT programme, or via collective funds such as the World Bank's Prototype Carbon Fund (PCF). The PCF, for example, represents a consortium of six governments and 17 major utility and energy companies on whose behalf it purchases Credits.

Since allowances and carbon credits are tradeable instruments with a transparent price, financial investors can buy them on the spot market for speculation purposes, or link them to future contract. A high volume of trading in this secondary market helps price discovery and liquidity, and in this way helps to keep down costs and set a clear price signal in CO₂ which helps businesses to plan investments. This market has grown substantially, with banks, brokers, funds, arbitrageurs and private traders, now participating in a market, valued at about \$60 billion in 2007. Emissions Trading PLC, for example, was floated on the London Stock Exchange's Alternative Investment Market (AIM) in 2005 with the specific remit of investing in emissions instruments. Although Kyoto created a framework and a set of rules for a global carbon market, there are in practice several distinct schemes or markets in operation today, with varying degrees of linkages among them.

Kyoto enables a group of several Annex I countries to join together to create a market-within-a-market. The EU elected to be treated as such a group, and created the EU Emissions Trading Scheme (ETS). The EU ETS uses EAUs (EU Allowance Units), each equivalent to a Kyoto Assigned Amount Units (AAU). The scheme went into operation on 1st January 2005, although a forward market has been existing since 2003. The UK established its own learning-by-doing voluntary scheme, the UK ETS, which ran from 2002 to 2006. This market existed alongside the EU's scheme, and participants in the UK scheme have the option of applying to opt out of the first phase of the EU ETS, which lasts through out 2007.

The sources of Kyoto credits are the Clean Development mechanism (CDM) and Joint Implementation (JI) projects. The CDM allows the creation of new carbon credits by developing emission reduction projects in Non-Annex I countries, while JI allows project-specific credits to be converted from existing credits within Annex I countries. CDM projects produce Certified Emission Reductions (CERs), and JI projects produce Emission Reduction Units (ERUs), each equivalent to one AAU. Kyoto CERs are also accepted for meeting EU ETS obligations and ERUs will become similarly valid from 2008 for meeting ETS obligations. CERs/ERUs are overwhelmingly bought from project developers by funds or individual entities, rather than being allowances like exchange trade.

Since the creation of Kyoto instruments is subject to a lengthy process of registration and certification by the UNFCCC, and the projects themselves require several years to develop, this market is at this point largely a forward market where purchases are made at a discount to their equivalent currency, the EU emission Allowance (EUA), and are almost always subject to certification and delivery (although up-front payments are sometimes made). According to IETA (International Emissions Trading Association), the market value of CDM/JI credits transacted in 2004 was EUR 245 m. It is estimated that more than EUR 620 m(Euro) worth of credits were transacted in 2005.

Several non-Kyoto carbon markets are in existence or being planned, and these are likely to grow in importance and numbers in the coming years. These include the New South Wales greenhouse gas Abatement scheme, the Regional Greenhouse Gas Initiative, Western climate Initiative in the United States, the Chicago Climate Exchange and the State of California's recent initiative to reduce emissions.

These initiatives, taken together may create a series of partly-linked markets, rather than a single carbon market. The common theme across most of them is the adoption of market-based mechanisms centered on carbon credits that represent a reduction of CO₂ emissions. The fact that some of these initiatives have similar approaches to certify their credit and makes it conceivable that carbon credits in one market may, in the long run, be tradeable in other schemes. This would broaden the current carbon market far more than the current focus on the CDM/JI and EU ETS domains. An obvious precondition, however, is a realignment of penalties and fines to similar levels, since these create an effective ceiling for each market.

India: India signed and ratified the protocol in August, 2002. Since India is exempted from the frame work of the treaty, it is exempted to gain from the protocol in terms of transfer of technology and related foreign investments. At the G-8 meeting in June 2005, Indian Prime Minister Manmohan Singh pointed out that the per-capita emission rates of the developing countries are a tiny fractions of those in the developed world. Following the principle of common but differentiated responsibility, India maintains that the major responsibility of curbing emissions rests with the developed countries, which have accumulated emissions over a long period of time.

However, the U.S. and other western nations assert that India, along with China, will account for most of the emissions in the coming decades, owing to their rapid industrialization and economic growth.

How Will Emissions Trading Work: The Kyoto Protocol establishes binding greenhouse gas emission targets for 38 countries. These targets take the form of an "assigned amount"- the number of metric tons of greenhouse gases (counted as carbon dioxide equivalent) that may be emitted by sources within the country during the five-year commitment period i.e from 2008 to 2012. Each country must make sure that its emissions during the five-year period do not exceed its assigned amount.

Articles 3 and 17 of the Kyoto Protocol allow countries with binding targets to lower the cost of meeting their targets by participating in international emissions trading. In emissions trading, one country transfers part of its assigned amount to another. This transfer of assigned amount lowers the number of tons of greenhouse gases, that the first country may emit between 2008 and 2012, and raises the number of tons, that the second country may emit by an equal amount. It is useful to think of each one-ton unit of assigned amount as a tradable allowance for one ton of emissions that may be transferred between countries.

Because the cost of controlling greenhouse gases differs by many times from country to country, emissions trading will allow enormous savings in meeting the Kyoto targets. Countries that have relatively inexpensive ways to control greenhouse gases have incentives to reduce emissions by more than their targets require, because they can sell tradable allowances, which other countries do not need. Countries facing the most expensive control measures have incentives to buy less costly allowances from others, and thereby increase the amount they may emit. Since greenhouse gases are global pollutants, the environmental impact on reducing them is the same no matter where the reductions take place. The same overall reduction is achieved, total costs are reduced, and both buyers and sellers gain from the savings allowed by trading.

While countries can benefit by engaging in emissions trading at the government-to-government level, far more savings are possible if countries also authorize their legal entities (companies, individuals, NGOs, etc.) to trade. The cost of controlling greenhouse gas emissions varies dramatically between companies both within the same country, and across borders. The private sector can be much more effective than governments in finding the lowest cost emission reduction opportunities. The greatest savings can come if private sector companies with the ability to reduce emissions are allowed to buy and sell allowances with other companies in the same country and with companies in other countries.

How Would a Country Engage in Emissions Trading: Trading rules should require a country that wants to trade, to have the necessary capacity and infrastructure to measure and report on its emissions of greenhouse gases, according to the requirements of Articles 5 and 7 of the Protocol. In addition, the rules should require the country to establish a national registry a computerized system to record who holds tradable allowances; to keep track of changes in allowance holdings due to emissions trading; and to show which allowances have already been used to cover past emissions, (these would be permanently retired) which remain available to be used against future emissions.

A country that wants to increase the number of tons of greenhouse gases that it is allowed to emit, could seek out other countries that are willing to sell some of their tradeable allowances. Buying and selling countries could arrange their transactions directly or use brokers or exchanges. Trades would be accomplished by removing allowances from the national registry of the selling country and adding them to the national registry of the buying country.

Trading rules should require each country to report to the Secretariat for the Framework Convention on Climate Change in Bonn at least once a year on the trades it has conducted and the appropriate increases or decreases in its assigned amount. These reports would be in addition to the annual reports, countries must make to the Secretariat on their greenhouse gas emissions. This information would serve as the starting point for determining whether a country had met its commitment to keep emissions within its assigned amount, as adjusted up or down by trading.

The emissions trading rules could be structured to give countries strong incentives to comply with basic requirements of the Protocol. For example, a country that came out of compliance with the Article 5 and 7 measurement and reporting rules, or that failed to maintain its national registry, could lose its eligibility to trade. The prospect of losing the savings available from trading could be a strong inducement to keep buyer countries in compliance. Likewise, the prospect of losing investment revenue could be a strong encouragement for seller countries to remain in compliance.

Comparing total greenhouse gas emissions in 2004 to 1990 levels, the US emissions were up by 16%, with irregular fluctuations from one year to another but a general trend was increase. At the same time, the EU group of 23 (EU-23) nations had reduced their emissions by 5%. In addition, the EU-15 group of nations (a large subset of EU-23) reduced their emissions by 0.8% during 1990 and 2004, while emission rise to 2.5% from 1999 to 2004. Part of the increases for some of the European Union countries are still inline with the treaty, being part of the Cluster of countries implementation (see objectives in the list above).

As of the year-end 2006, the United Kingdom and Sweden were the only EU countries on pace to meet their Kyoto emissions commitments by 2010. While UN statistics indicate that, as a group, the 36 Kyoto signatory countries can meet the 5% reduction target by 2012 and most of the progress in greenhouse gas reduction has come from the stark decline in Eastern European countries' emissions after the fall of communism in the 1990s

2.3 The Recent Updates on Kyoto Protocol

The recent update by Mr David Adam strongly supported the fact that the world should be united and implements a uniform policy for the success of the Kyoto Protocol. His views are briefly summarized below.

Figures released by the U.N. last month suggest that the world is on track to meet its Kyoto targets for green house gases i.e carbon dioxide, methane, nitrous oxide, Sulphurhexafluoride, hydrofluorocarbons and perfluorocarbons.

Emissions by the 40 industrialised nations that agreed binding cuts in pollution are down to 5 per cent of 1990 levels. But the drop has little to do with climate policies: the bulk of the decline is down to the collapse of the Soviet Union and the subsequent economic decline in Eastern Europe in the 1990's. Without these so-called "economies in transition," greenhouse gas emissions have grown by almost 10 per cent since 1990.

Yvo de Boer, executive secretary of the U.N. climate secretariat, said the figures showed emissions were rising once again in Eastern Europe. "The biggest recent increase in emissions of industrialized countries has come from economies in transition, which have seen a rise of 7.4 per cent in greenhouse gas emissions within the 2000 to 2006 time frame," he said. Among industrialized nations, 16 are on target to meet their Kyoto obligations, including France, the U.K., Greece and Hungary, the U.N. Some 20 countries are off-course, including Canada, Germany, Ireland, Italy, Japan, New Zealand and Spain. Nations that miss their Kyoto target in 2012 will incur a penalty of an additional third added to whatever cut they agree under a new treaty in Copenhagen.

Has Kyoto worked? "In terms of emission reductions achieved, the answer would be no, "A 5 per cent cut is a pretty small step on what will be a long and arduous journey. On the other hand, Kyoto has great success in putting architecture in place. Monitoring and verification systems, carbon markets, technology transfer and funds for adaptation have all been mobilized by Kyoto," he said. "I think this is a fabulous architecture that we can build on the road to Copenhagen." There are seven key issues on the road to Copenhagen.

Global Vision: The world has yet to formally agree a goal in the battle against global warming. This could be a maximum temperature rise, such as 2°C, or concentration of carbon dioxide in the atmosphere. More likely, it will be a vaguer 'direction of travel' such as the G8 pledge to halve global emissions by 2050.

Mitigation: The key issue - who will cut their carbon by how much and by when? To be meaningful, targets must be short term, perhaps something like 25-40 per cent by 2020 for the developed world.

Developing countries, such as China, could be allowed to increase pollution, as long as they reduce the rate of increase, and agree to take on proper reductions within 15 years or so.

Adaptation: How much rich countries will pay poorer ones to cope with floods and droughts. And how the developed world can make sure the promised money is paid.

Technology: How developing countries will access affordable clean technology to reduce emissions, such as carbon capture and solar power, developed by companies in industrialized countries.

Finance: How developed countries will provide funds for adaptation and mitigation in the developing world, and how those funds will be managed.

Forests: How developing countries with tropical forests be paid to keep them intact? Deforestation causes about a fifth of all greenhouse gas emissions.

Carbon trading and offsets: How the system such as the UN clean development mechanism and the European emissions trading scheme set up under Kyoto can be strengthened and expanded. It is clearly indicated the need for a global system for the better implementation of the Kyoto Protocol. Thus the concept proposed in this study has high relevance and applicability.

Challenges ahead in inventory estimation for the World: As discussed above the Kyoto protocol has given the world a chance to deal with the problem of environmental pollution in a competitive way. In other words the countries with lower emissions will be benefited by trading its carbon credits for monetary gains. However we assume the following problems in implementation of Kyoto protocol under present setup. The problems include

1. Different countries are adopting different methods of emission monitoring.
2. The system is not transparent.
3. There is no free accessibility of emission data of different countries.
4. There is possibility of unethical means of hiding the figures, reporting under values.
5. Problem arising out of such complexities.

The most important task to implement Kyoto protocol is to design and implement a global emission monitoring system of international standards which can perform the following tasks.

1. Countries monitoring of green house gases from monitoring stations from all over the world.
2. Updating the daily, weekly, monthly, and yearly values in to the spatial database on global servers.
3. Allowing access to the registered users to get the yearly data and current emissions of different countries.
4. Generating tables, graphs and reports of emission data of all the countries in user friendly environment.
5. Continuous updating of the data including information on trading of carbon credits of different countries.

In this thesis an attempt is made to design and implement such a network based hardware and software system, which can cater the needs of global community working under Kyoto protocol. This attempt includes the concept, design of emission monitoring system, design of required hardware system, design and implementation of software system and web based user friendly interface (prototype) to implement such global emission monitoring system. This work is submitted to the following objectives.

2.4 Objectives of the Present Work

1. To understand the global pollution levels especially the greenhouse gases in their various forms.
2. To attempt to design a computer network based system which can monitor and quantify the air pollutants globally.
3. To test the developed system for its practical applications and deliverables.
4. To evaluate its applicability at global level by designing a web based prototype.