

Chapter 1

Introduction

Warming of the climate is unequivocal and anthropogenic; this has now been confirmed by large number of scientific evidences. Earth's climate is rapidly changing, predominantly as a result of increase in emission of greenhouse gases caused by human activities. Concentration of carbon dioxide has gradually increased since the pre-industrial age i.e the year around 1750 and now it is approximately 40% more than that period. Rise in the concentration of carbon dioxide has been much steeper in the last 40 years. Apart from the carbon dioxide concentration of other greenhouse gases like methane, nitrous oxide, fluorocarbons etc have also increased significantly. Human activities mainly burning fossil fuels, deforestation and other changes in land use are changing the composition of the atmosphere and its properties. According to the 'Summary for Policy Makers' (2013) of the latest IPCC 5th Assessment, the globally averaged combined land and ocean surface temperature data show a warming of 0.85°C (0.65°C to 1.06°C), over the period 1880 to 2012¹.

There is compelling evidence that the rising levels of green house gases will have a warming effect on the climate through increasing the amount of infrared radiation (heat energy) trapped by the atmosphere "the greenhouse effect". In total, the warming effect due to all greenhouse gases emitted by human activities is now equivalent to 430 ppm of carbon dioxide concentration and rising at the rate of 2.3 ppm per year. Current levels of greenhouse gases are higher now than at any time in at least the past 650,000 years.

¹ Summary for Policy Makers', IPCC (2013)

If the current rate of emission is allowed to continue unabated, concentration of greenhouse gases will be twice the pre industrial level by the middle of current century. This kind of concentration of greenhouse gases is projected to raise the temperature by 2°C to 5°C or even higher. This level of warming on a global scale will be of unprecedented nature in the history of human civilization.

Climate change will affect the basic elements of life for people around the world - access to water, food production, health and the environment. Hundreds of millions of people could suffer hunger, water shortage and coastal flooding as the world warms. If the world does not act, the overall costs and risks of climate change will be equivalent to losing at least 5% of global GDP each year, now and forever. If a wider range of risks and impacts are taken into account, the estimates of damage could rise to 20% of GDP or more. In contrast, the cost of action for reducing greenhouse gas emissions to avoid the worst impacts of climate change, can be limited to around 1% of global GDP each year².

Human-induced climate change is described as an externality by the economists and the global climate as public good. Those who produce greenhouse gas emissions by producing electricity, use power to run their factories, flare off gases, cut down forests, heat their homes, use air conditioners, fly in planes or drive their cars do not have to pay for the costs of the climate change that results from their contribution to the accumulation of those gases in the atmosphere. But their action is leading to global warming which is affecting the society adversely. The whole society has to bear the cost. Climate change has a number of features that together distinguish it from other

² Stern N., The economics of Climate Change, The Stern Review (2006)

externalities. It is global in its causes and consequences; the impacts of climate change are persistent and develop over long run; there are uncertainties that prevent precise quantification of the economic impacts; and there is serious risk of major irreversible change with non-marginal economic effects.

1.2 Global Response: UNFCCC, Kyoto Protocol

In the nineteen eighties, growing consensus was built up among the scientists that global warming is taking place due to greenhouse effect caused by emission of greenhouse gases. Alarmed by the consequences of the global warming the countries came together under the aegis of United Nations. During the United Nations Conference on Environment and Development (UNCED), informally known as the Earth Summit, held in Rio de Janeiro from 3 to 14 June 1992, a treaty, the United Nations Framework Convention on Climate Change (UNFCCC) was signed. The objective of the treaty is to "stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system".

The treaty itself sets no binding limits on greenhouse gas emissions for individual countries and contains no enforcement mechanisms. In that sense, the treaty is considered legally non-binding. Instead, the treaty provides a framework for negotiating specific international treaties that may set binding limits on greenhouse gases. The UNFCCC was opened for signature on 9 May 1992; it entered into force on 21st March 1994 with many parties³.

³ As of May 2011, UNFCCC has 195 parties

With the objective of deciding a course of action, more than 160 nations met in 1997 in Kyoto, Japan to negotiate binding limitations on carbon emissions by developed nations, in accordance with the objectives of the United Nations Framework Convention on Climate Change (UNFCCC) signed five years earlier. The outcome of the meeting was the Kyoto Protocol which came into force in 2005 and, in which the industrialized countries and economies in transition-the so called Annex 1 countries agreed to cut their overall carbon emissions during the first commitment period (2008-2012) by an average of 5.2% (with countries varying in their commitments) relative to the levels emitted in 1990.

These countries could achieve emission reduction by decreasing internal emissions or by trading emissions with one another. In addition, Annex 1⁴ countries had the option of selecting an approach that minimised costs entailed in emission reduction. The Kyoto Protocol also introduced the Clean Development Mechanism (CDM) by which industrialized countries could purchase emission reduction credits or offsets from projects in non-Annex 1⁵ countries (mostly developing countries). CDM guidelines were developed for emission reduction through many different sectors including renewable energy and capture of methane from waste disposal sites. One of these was the forestry sector⁶.

⁴ Annex I: There are 41 Parties to the UNFCCC listed in Annex I of the Convention. These Parties are classified as industrialized (developed) countries and "economies in transition" (EITs).

⁵ Non-Annex I: Parties to the UNFCCC not listed in Annex I of the Convention are mostly low-income developing countries. Developing countries may volunteer to become Annex I countries when they are sufficiently developed

⁶ International Market for Forest Carbon Offsets: How these offsets are created and traded, Rohit Jindal, Sara Namirembe, November 2012

Kyoto Protocol strengthened the concept of emission trading under the compliance market, though it was already in vogue under various other mechanisms and protocols.

1.3 Impact of Climate Change

Impacts of global warming are being studied by the scientists at many universities and research centers across the world. The scientific investigations include computerized models using large amount of data on many relevant parameters gathered from different regions of the world. Impacts of climate change are already being felt by common observations like increased rainfall at several places, maximum temperature in summers showing rising trend, increasing frequency of the extreme events like cyclones, floods and droughts. The scientific studies have established impact of global warming in the following manifestations.

- Accelerating Sea Level Rise and Increased Coastal Flooding
- Longer and More Damaging Wildfire Seasons
- More Frequent and Intense Heat Waves
- Costly and Growing Health Impacts
- Increase in Extreme Weather Events
- Heavier Precipitation and Flooding
- Disruptions to Food Supplies
- Changing Seasons
- Plant and Animal Range Shifts
- Melting Ice
- Destruction of Coral Reefs

1.3 Emission Levels in the World and India

Emission level of greenhouse gases (GHGs) continues to show rising trend, though in the year 2012, rate of increase has been noticed slower than the previous years. Actual global emissions increased by 1.4% over 2011, reaching a total of 34.5 billion tonnes in 2012. The per capita average emission in the world stands at 4.9 tonnes. GHG emission from the top 10 countries in the world, in which India ranks at number 3 is presented in the Table 1 given below.

Table 1.1 Annual CO₂ Emissions Estimates of Top Ten Countries

Country	CO ₂ emissions (in thousand tonnes)	Emission per capita (in tonnes)
World	34,500,000	4.9
China	9,860,000	7.1
United States	5,190,000	16.4
India	1,970,000	1.6
Russia	1,770,000	12.4
Japan	1,320,000	10.4
Germany	810,000	9.7
South Korea	640,000	13.0
Canada	560,000	16.0
United Kingdom	490,000	7.7
Mexico	490,000	4.0

Source - EDGAR (database created by European Commission and Netherlands Environmental Assessment Agency), 2012

India's emission of GHGs in different sectors for the year 2007 has been presented in the Ministry of Environment & Forests report published in 2010. The sector wise emissions from India is given in the Table 1.2.

Table 1.2 India's Sector Wise Emission Levels

Sector	GHG emissions by Sector in 2007 (million tons of CO ₂ eq)	% of Total
Electricity	719.30	37.76
Transport	142.04	7.46
Residential	137.84	7.24
Other Energy	100.87	5.30
Cement	129.92	6.82
Iron & Steel	117.32	6.16
Other Industry	165.31	8.68
Agriculture	334.41	17.56
Waste	57.73	3.03
Total Without LULUCF	1904.73	
LULUCF	-177.03	
Total With LULUCF	1727.71	

Source : INCAA, MoEF, Government of India, 2009

1.4 Climate Change: A Global Externality

Human induced climate change is an externality. Those who cause emission of greenhouse gases (GHGs) as a result of some economic activity share the responsibility of causing climate change but the polluters neither via market nor in other ways face consequences of the costs of their actions. Emitters do not have to

compensate those who lose out because of climate change. The externality is not corrected through any institution or market unless policy intervenes.

The climate is public good: nobody can be excluded from enjoying its benefits and one person's enjoyment of the climate does not diminish the capacity of others to enjoy it too. Markets do not automatically provide the right type of public goods, because in the absence of public policy there are limited or no returns to private investors for doing so. Thus, climate change is an example of market failure involving externalities and public goods. Given the magnitude and nature of consequences the climate change is likely to cause, it has profound implications for economic growth and development. All in all, it must be regarded as market failure on the greatest scale the world has seen.

Climate change is an externality that is global in reach, both its causes and consequences. Both involve deep inequalities that are relevant for policy. The incremental impact of a tonne of GHG is independent of where in the world it is emitted.' But the volume of GHGs emitted globally is not uniform. Historically, rich countries have produced the majority of GHG emissions. Though all countries are affected by climate change, they are affected in different ways and to different extents. Developing countries will be particularly badly hit, for three reasons; their stronger dependence on agriculture; their vulnerability because of lack of resources and their location in the warmer regions of the world.

1.4.1 Solution to the market Failures

In the standard theory of externalities, there are four ways in which negative externalities can be addressed

- (i) A tax can be introduced so that emitters face the full social cost of their emissions i.e. a carbon price can be established that reflects the damage caused by emissions
 - (ii) Quantity restrictions can limit the volume of emissions, using a command and control approach
 - (iii) A full set of property rights can be allocated among those causing the externality and those affected so that bargaining can take place
- In this case, future generations also, that are not there to bargain may be included

In practice cap-and-trade systems tend to combine aspects of the second and third approach above. They control the overall quantity of emissions, by establishing binding emissions commitments.

1.5 Emission Trading and Carbon Market: An Overview

Carbon markets have emerged as an outcome of the national and international attempts to mitigate the growth in atmospheric concentrations of GHGs. There are two broad types of carbon market (a) compliance market, made up of emitters who are obligated to reduce their emissions under national or international laws and (b) voluntary market, in which organisations voluntarily reduce their carbon emissions. Most economists argue that an efficient, international carbon market will reduce GHG emissions at the lowest cost, allowing polluters that are unable to abate their own emissions cheaply to invest in projects globally that can reduce emission at lower cost.

A well-functioning carbon market is essential for driving low-carbon investments and achieving global mitigation objectives in a cost efficient manner.

Carbon trading is a form of emissions trading that specifically targets carbon dioxide (calculated in tonnes of carbon dioxide equivalent or tCO₂e). Emission trading works by setting a quantitative limit on the emissions produced by emitters. Most of the trading in carbon markets in the world is done in the unit of tonne of CO₂ equivalent, where equivalent accounts for the impact of other greenhouse gases (if any) in terms of the impact of CO₂. Emission trading allows nations and the industries therein to meet their obligation of emission reduction as determined under a relevant national law or international treaty.

A carbon credit, or carbon offset, is a financial unit of measurement that represents the removal of one tonne of carbon dioxide equivalent (tCO₂e) from the atmosphere.

Emission and carbon credit trading is generally done in two ways

(i) Over the Counter (OTC) – Individuals and firms purchase carbon credit either directly from the developers of the carbon mitigation projects or they can buy the same from an exchange.

(ii) Emissions trading - also known as 'Cap and Trade', is a market-based approach to address climate change. In emission trading, a firm which has been assigned emission allowance can sell its unutilized emission allowance (by emitting less than the allocated limit) to other industry which has not been able to reduce its emission to the allowed limit.

1.5.1 The 'Cap'

The basic principle involves setting a limit on the total quantity of GHG emissions allowed to be released over a given period of time. Each participant in the scheme receives an individual cap or allowance.

1.5.2 And the 'Trade'

The trading part establishes a market for these permits by allowing organisations to buy and sell depending on whether they have a shortfall or surplus in allowances. (e.g. a participant who emits less than their allowance can sell the unused balance to another participant who has exceeded their allowance). Emissions' trading encourages companies to continually reduce emissions – the more permits they don't use, the more money they can make from selling that excess.

1.5.3 Offsetting

Most emissions trading schemes also allow participants to purchase carbon credits from GHG emission reduction projects (in developing countries). One credit equals one tonne of emissions saved. As long as these credits are certified to the correct level, they can count towards the emitter's target back home. However, to ensure that emitters are making a significant contribution to controlling their own emissions, and are not just buying their way out of their obligations, offset usage in trading schemes is usually limited to a proportion of the overall emissions target.

An emissions trading scheme, when functioning well, results in overall emissions remaining within the cap, while individual participants have the flexibility of a market-based mechanism within which to operate.

Essence of emission trading is in finding cost efficient solutions to the carbon mitigation. In a flexible carbon market which allows sale and purchase of carbon credits from different sectors and from all regions of the world, the buyer will look for cheaper option for meeting his compliance commitment, in the free market environment this will always push for cost efficiency. The market will also generate motivation for innovation in the cost efficient abatement technologies.

1.5.4 Emission Trading and Coase Theorem

The motivating principle behind creating emissions markets is the Coase Theorem, which states that - if the property rights are well defined then in the absence of transaction costs, the involved parties can bargain to a mutually beneficial and efficient outcome. Coase's model assumes perfectly operating markets and equal bargaining power among those arguing for property rights. For climate change, the property rights are for emissions (permits or quotas). In practice, transaction costs are never zero, so bargaining to a mutually beneficial outcome could be costly, perhaps so costly that exchange wouldn't occur at all. This concept is important for the possibility of market-based environmental policy. In Coase's model, efficiency, i.e., achieving a given reduction in emissions at lowest cost is promoted by the market system.

1.6 Carbon Market Size

Carbon market in the world has grown rapidly in the last few years. In 2010-11, the total size of the global carbon market was US\$ 175.6 billion and the total transacted volume of offsets was 8.7 billion tonnes of CO₂e. The European Union Emission Trading

Scheme (EU ETS) is the largest carbon market in the world. Under EU ETS, carbon offsets worth US\$ 147.9 billion were traded during 2011.

1.7 Climate Change Mitigation and India

Currently, the topmost priority for India is economic development and poverty alleviation. Meeting these national imperatives would certainly create pressure on energy demand, which would lead to increased carbon emissions. Energy is needed for economic growth, for improving the quality of life and increasing opportunities for development. In India over 450 million people do not have access to electricity and about 700 million use biomass as primary energy resource for cooking⁷. Ensuring a regular supply of clean energy is essential for nurturing inclusive growth, meeting the millennium development goals and raising India's human development index. The biggest challenge facing our country is that besides ensuring energy security of the nation, India also needs to develop its infrastructure and enhance its industrial production and reduce the GHG emissions from these sectors as well. Based on studies, estimates of India's GHG emission in 2031, vary from 4.0 billion tonnes to 7.3 billion tonnes of CO₂ In absolute terms. The lower end of this estimate is more than double of the current emission level. Though in per capita terms the emission level in 2031 would vary from 2.77 to 5 tCO₂ eq, which would be among the lowest in the world.

⁷WRIEF, (2012), India Second National Communication to UNFCCC

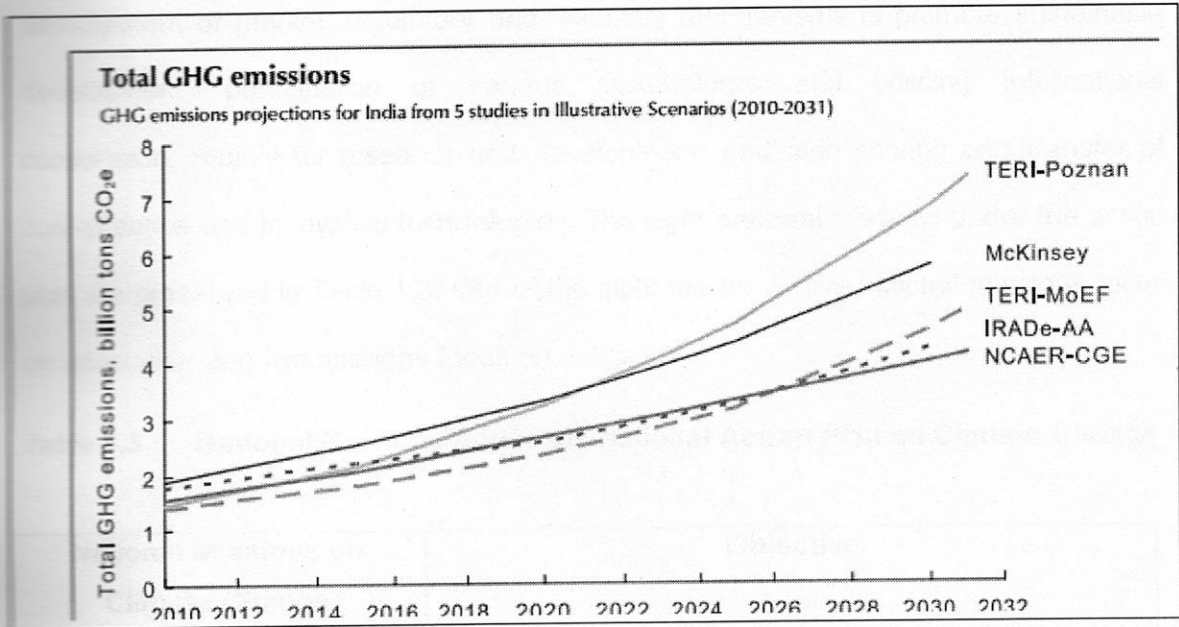


Fig 1.1 Projection of GHG emission from India

Source – India's GHG Emissions Profile: Results of Five Climate Modelling Studies (2009), MoEF,

1.7.1 National Action Plan on Climate Change - A Multipronged Strategy for Sustainable Development

Recognizing the importance of climate change issues, a Council on Climate Change was established in June 2007, under the chairmanship of the Prime Minister of India, to co-ordinate national action for assessment, adaptation, and mitigation of climate change. NAPCC identifies a number of measures to promote India's development objectives, while also yielding co-benefits for addressing climate change effectively. NAPCC outlines eight national missions based on the principles of protection of poor and vulnerable sections; enhancement of ecological sustainability; efficient and cost-effective strategies for end-use demand side management; deployment of appropriate

technologies for both adaptation and mitigation of greenhouse gas emissions; development of market; regulatory and voluntary mechanisms to promote sustainable development; participation of various stakeholders and building international cooperation, mainly for research and development; and also sharing and transfer of cost-effective and innovative technologies. The eight national missions under the action plan are presented in Table 1.3. Out of the eight missions, five national missions focus on adaptation and two missions focus on mitigation.

Table 1.3 National Missions under the National Action Plan on Climate Change

National Missions on Climate Change	Objective
National Solar Mission	20,000 MW of Solar power by 2020
National Mission for Enhanced Energy Efficiency	10,000 MW of energy savings by the end of 11th FYP in 2012
National Mission on Sustainable Habitat	Energy efficient buildings, transport, waste management systems, energy efficiency as an integral component of urban planning, improving the resilience of infrastructure, community based disaster management, capacity building
National Water Mission	Increasing water use efficiency by 20 per cent through regulatory mechanisms with differential entitlements and pricing; formulating basin level management strategies; and establishing water conservation measures

National Mission for Sustaining the Himalayan Ecosystem	Understand the glacial changes through glacial monitoring, participatory management of Himalayan ecosystems
National Mission for a Green India	Six million hectares of afforestation over degraded land by the end of the 12th Five year plan (2017)
National Mission for Sustainable Agriculture	Drought proofing, climate risk management, improving productivity of rain fed agriculture
National Mission on Strategic Knowledge for Climate Change	Assess vulnerability and identify responses to climate change through high quality and focused R&D

1.7.2 Clean Development Mechanism (CDM) in India

India ratified the Kyoto Protocol in August 2002, with the objective of implementation of Clean Development Mechanism (CDM) projects in India in accordance with national sustainable priorities. India has been one of the highest recipients of CDM finances Out of 2346 CDM projects registered with the CDM Executive Board, 532 projects, comprising 22.49% are from India⁸. Most of the projects from India are in the sectors like energy efficiency, fuel switching, industrial processes, municipal solid waste and renewable energy. It is estimated that the potential value of the carbon credits from all the CDM projects in pipeline is over 5.5 billion USD.

There have been some initiatives of emission trading in India at the modest level. Market mechanisms for renewable energy and energy efficiency have been set up. In

⁸ Climate Change Mitigation In India, UNEP/GRID Arendal & Development Alternatives(2013)

the field of energy efficiency, the Perform Achieve and Trade (PAT) system is aimed at large and energy-intensive industries. It involves setting an energy consumption goal for each participating facility, followed by a three-year-reduction phase. If the reduction target is overachieved, the facility gets tradable energy permits, which may be bought by consumers falling short of their set goals. Also, in the year 2011, India has implemented a Renewable Energy Certificates (REC) trading system, a scheme to trade surplus renewable energies across state boundaries. Every REC represents one MWh of either solar or non-solar renewable energy; purchases of RECs are treated as consumption of such. The aim of this scheme is to promote the use of renewable energy even in Indian states that have low renewable energy capacities. This way, utility companies may fulfill their targets to purchase a certain percentage of renewable energies at the best price without having to rely on local conditions. The REC Mechanism divides renewable energy generation in two components, the actual electricity, which can be sold at an agreed tariff, and a REC certificate which is traded at India's two major power exchanges, IEX⁹ and PXIL¹⁰.

1.8 Rationale for Creating a Domestic Carbon Market

As explained in the previous sections, climate change due to excessive emission of greenhouse gases in the atmosphere is a serious threat to the humanity, globally. The poor and developing countries are more vulnerable to the impacts of climate change. India has a unique position as far as this whole set of related issues of greenhouse gas

⁹ INDIAN ENERGY EXCHANGE LTD. (IEX) is India's premier power trading platform. Providing a transparent, neutral, demutualized and automated platform for physical delivery of electricity, IEX enables efficient price discovery and price risk management for participants of the electricity market, including industries eligible for open access.

¹⁰ Power Exchange India Limited (PXIL) is India's first institutionally promoted Power Exchange that provides innovative and credible solutions to the Indian Power Markets.

emission, development pathways, mitigation and adaptation strategies are concerned. As explained in the section 1.7, India is well aware of its responsibility towards reducing green house gas emission while not sacrificing the pace of development which is imperative for the country, given the large poverty, unemployment, need for infrastructure growth and for improving quality of millions of people. There will be huge requirement of power generation and industrial growth while consumption level of people improves and country's GDP grows at the desired pace. As a sovereign country, India is free not to put any limitation on its growth in meeting the limit of GHG emission levels from the country whether committed by self or imposed by the international community under any signed treaty. India's stand in this regard has been made very clear in various international conventions and conferences of parties (COP) of UNFCCC held annually.

But there is another aspect of this growth versus emission reduction debate. There are also opportunities in climate change mitigation and adaptation actions as many of these actions lead to self good. On one hand emission reduction actions are generally the environmental friendly paths which are in tune with the sustainable and holistic development, there are also opportunities of income generation by way of generating certified emission reduction (CER) or carbon credits. India has already been a major beneficiary (second only to China) under clean development mechanism (CDM). India has earned over 1700 million USD from the carbon credits in the renewable energy sector of CDM alone.¹¹ Total earning to various firms and agencies in India from CDM by the year 2012 is estimated over 5.5 billion USD. The CDM financial benefit earned by

¹¹ Climate Change Mitigation In India, UNEP/GRID Arendal & Development Alternatives(2013)

India is only small fraction of the global carbon market which at present is of the size of over 180 billion USD. The CDM projects mentioned above have achieved reduction in emission on one hand and have generated significant earning to the participating firms; it is a win-win situation.

The firms which have benefitted under the CDM are mostly big firms who could afford huge transaction cost in getting the project design document (PDD) prepared by hiring consultants, could pay the registration fees etc. The minimum transaction cost of CDM project in the year 2004 was 57,193 USD¹². In the international carbon market, transaction cost is very high and this is one major barrier for large scale participation of the small firms in such international mechanisms or markets.

Let us now consider the domestic scenario. It is always a welcome proposition to receive foreign capital from the developed countries that have been largely responsible for the high emissions of greenhouse gases and this should continue to happen with more and more capable firms and agencies participating in the international carbon markets and earn revenue. But with a larger perspective of the country, greater good from the emission trading would be realized if the benefits flow to the rural population in widespread manner and while doing so we also improve agro-ecology and strengthen ecosystem services in the country. As briefly mentioned above, given the high transaction cost and relatively complex rules and procedures of converting abatement action into the acceptable projects in the international mechanisms and carbon markets, the aforesaid desirable objectives may not be met. It would be in the wider national interest to create a carbon market within the country which harnesses the benefits of

¹² Transaction Costs of CDM Projects in India – An Empirical Survey, Matthias Krey (2004), p. 76

carbon credits and emission trading for improving economy of the villages and along with this it also contributes towards better environment and ecology in the country. A domestic carbon market can be created in tune with the national circumstances, addressing to the national priorities. A domestic carbon market having achieved maturity and credibility would be attractive to the international markets too and then carbon credits of the domestic market may find buyers in the international market. The route of developing a domestic carbon market, allowing it to mature and then linking it to the international carbon market, as shown in the following schematic diagram, would be a sound and nationally appropriate strategy.

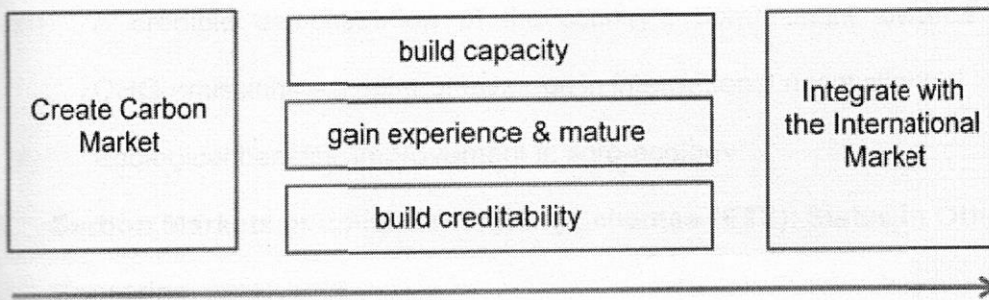


Fig 1.2 Path way for the Carbon Market

Advantages of domestic carbon market have been briefly enlisted as follows-

- (i) Reduction in transaction cost
- (ii) Simplification of procedures and methodologies while adhering to the principles of generating verified and measured carbon credits
- (iii) Flexibility of selecting sectors both for emission allowances as well as for abatement leading to generation of carbon credits
- (iv) Flexibility in directing the capital flow to the desired sector/activity according to the national priorities

- (v) Capacity building at various levels for various activities of carbon market; understanding the market concept, processes and procedures of creating carbon credits, measurement and monitoring emissions, measurement and monitoring of sequestered or abated carbon, verification, economics, trading, carbon finance etc
- (vi) Wider participation including farmers by raising agroforestry plantations, Gram Sabhas, small firms
- (vii) Generating sizable economy and employment opportunities
- (viii) A new avenue of tax revenue for the Government
- (ix) A credible demonstration of the country's commitment towards reducing GHG emissions – a point of leverage in international negotiations
- (x) Ecological benefits, improvement in agro-ecology

1.9 Carbon Markets or Emission Trading Schemes (ETS): Status in Other Countries

Carbon pricing mechanisms are important policy instruments for mitigating greenhouse gas emissions that are increasingly implemented in countries or sub-national regions because of their flexibility and cost-effectiveness. Two main types can be distinguished: (a) emission trading schemes (ETS) ('cap and trade') for large businesses and (b) a carbon tax on the purchase of fossil fuels (coal, oil, gas). The European Union was the world's pioneer by launching their Emissions Trading System (ETS) in 2005, to reduce CO₂ emissions in a cost-effective and economically efficient way. Several others followed: in 2007 initiatives for an ETS were taken in seven US States, four Canadian provinces, in Australia and, one year later, also in New Zealand. In addition, carbon

taxes exist in Australia (fixed price scheme), British Columbia, Denmark, Finland, Ireland, Japan, Norway, Sweden and Switzerland. Plans to introduce a carbon tax exist in the United Kingdom (in 2013) and in South Africa (in 2015).¹³

Several countries have already established domestic carbon market or emission trading schemes for in-country trade in certified emission reductions (CERs) or carbon credits e.g. US, European Union, China, Australia and New Zealand to name a few. There are other countries that have already announced their plans to establish domestic carbon markets and some of them are on the verge of setting up the carbon markets for their respective countries. Main objective behind establishing carbon markets in most of these countries is not only to use them as an effective instrument to reduce their national GHG emission but inter-alia also to derive benefit of encouraging investment in rural sector, develop payment for ecosystem services (PES) systems and develop capacity in the country for carbon trading and running market for the same. Examples of few countries viz Brazil, China, Kazikstan, South Korea, and Mexico are presented below.¹⁴

1.9.1 Brazil

Brazil adopted a National Climate Change Law (PNMC) in December 2009, which includes a GHG reduction commitment of 36.1 – 38.9% against BAU projections. In order to reach this target, the law envisages, among others, financial and economic mechanisms that are national in scope and referring to mitigation and adaptation to climate change

¹³ Trends in Global CO2 Emissions 2013 Report, PBL Netherlands Environmental Assessment Agency Institute for Environment and Sustainability (IES) of the European Commission's Joint Research Centre (JRC) (2013)
¹⁴ Domestic Emission Trading Systems in Developing Countries – State of Play and Future Prospects (2011) by Wolfgang Sterk and Florian Mersmann

Brazil's National Climate Change Law mainly deals with the reduction of emissions from deforestation by 80% in 2020, as deforestation accounts for 75% of Brazilian emissions. It further implements the Brazilian Emissions Reduction Market (MBRE). The law states that The Brazilian Emissions Reduction Market (MBRE) shall be operated in commodities, futures and stock exchanges, and in over-the-counter trading companies authorized by the Securities and Exchange Commission of Brazil – CVM, where negotiations for securities representing certified avoided greenhouse gas emissions shall take place. (PNMC, Art. 9) .

The MBRE is already in place. It operates as a stock exchange for voluntary reduction permits and holds regular auctions in voluntary carbon units derived from renewable biomass projects as well as CERs. The MBRE is largely operated by private actors. It serves to create the basis for a Brazilian domestic carbon market by installing a secure trading environment for carbon credits.

1.9.2 China

Reports indicate that China is considering absolute caps on carbon emissions from its industry and to initiate a nation-wide ETS in 2015. In October 2010, proposals to gradually create an emissions trading market over the coming five years were approved by the Central Committee of the Communist Party. Initially, trading systems are to be developed regionally, with the province of Guangdong taking the lead because of their energy data, which is exceptionally good compared to other provinces.

The China Beijing Environment Exchange (CBEEEX) and Blue Next founded the Panda Standard, as the first chinese domestic voluntary carbon standard, designed to provide transparency and credibility in the nascent Chinese carbon market and to advance

Government's poverty alleviation objectives by encouraging investments in China's rural economy. Panda standard will support the Government's commitment to reduce the greenhouse gas emissions, help develop national capacity in domestic voluntary carbon markets and as a first focus, promote agriculture, forestry and other land use GHG offset projects.

1.9.3 Kazakhstan

Kazakhstan has announced that it is willing to introduce a carbon trading system. At the moment, a joint project of Climate Focus and the Dutch government supports the country in the design of a domestic ETS. A draft law has been proposed, which would allow the ETS to start. It seems likely that the targets will fall in line with the voluntary targets set by the Kazakh government to reduce domestic emissions by 15% or 39 MtCO₂e¹⁵ compared to 1992 until 2025, and up to 25% or 65 MtCO₂e until 2050, and that the national allocation plan will include associated caps for the system. The proposed system would cover activities in industry, oil and gas, energy, mining and metallurgical and chemical industries, agriculture and transport. The draft law envisages a combination of market and administrative mechanisms. Installations above a threshold of 20,000 tCO₂e per year would receive an allocation whereas installations with emissions below this threshold would be subject to a CO₂ tax. Installations above 20,000 tCO₂e would have to annually submit trading units corresponding to their emissions. In addition to allowances, they would also be allowed to submit CERs, ERUs and credits from domestic projects. Domestic projects would be allowed in the areas of mining and smelting, agriculture, housing and utilities, planting of forest and grassland

¹⁵ 1 MtCO₂e = 10⁶ tonnes of CO₂e

areas, prevention of land degradation, renewable energy, recycling of municipal and industrial waste, transport, and energy-efficient construction. Companies that fail to submit allowances would have to pay fines and be subject to criminal prosecution. However, these sanctions would not free companies from submitting the required amount of trading units.

Furthermore, Kazakhstan has announced cooperation with Russia, Ukraine and Belarus for the creation of a regional trading system.

1.9.4 Mexico

Mexico launched a National Strategy on Climate Change (ENAC) in 2007, Mexico also elaborated a Special Program on Climate Change 2009-2012 (PECC) under which it aims to reduce emissions by 51 million tCO₂e./year in 2012 compared to business as usual (BAU). Mexico also has committed to achieve a 30% reduction from BAU levels by 2020 under the condition that financial and technological support is made available by industrialised countries (Mexico 2008). One of the measures deemed appropriate to mitigate GHG emission in the ENAC was the creation of a domestic ET system. Steps to a consolidated national ET scheme included

- I. Establishment of a carbon credit exchange system with capped values
- II. Promotion of carbon credit trading with other economic sectors, public or private, managed via projects with simplified criteria, based on the CDM.
- III. Integration of chosen economic sectors within a national "cap and trade" scheme, with capped carbon prices set by central government
- IV. Coupling of the national cap and trade scheme with existing international schemes, whether derived from the Kyoto Protocol or not (ENAC 2007).

Under the World Bank's Partnership for Market Readiness, Mexico has been one of the first eight countries to receive an initial grant of 350.000 USD in order to build up domestic capacities for the implementation of carbon markets.

1.9.5 South Korea

The Republic of Korea has pledged to reduce its emissions by 30% by 2020 against BAU. Its Framework Act on Low Carbon, Green Growth (April 2010), stipulates in Article 46, that

'The government may operate a system for trading emissions of greenhouse gases by utilizing market functions in order to accomplish the State's target of reduction of greenhouse gases; the method of allocation of the allowable quantity of emission, the methods of registration and management, and the establishment and operation of an exchange shall be provided by another Act separately.'

This article may in due time lead to a fully functional cap-and-trade system in South Korea. Original plans included a three-year cap-and-trade scheme starting 2013 and covering over 470 enterprises across all sectors with emissions above 25.000 tonnes CO₂/year. Together, these account for 60% of Korea's total greenhouse gas emissions of about 600 million tonnes per year. After the first phase, trading periods were to be expanded to 5 years. Banking and borrowing of permits were to be allowed under the proposed system, as well as direct trading among participants and the use of CERs generated through CDM projects. Ten percent of the credits were to be auctioned, while 90% were to be allocated for free.

1.9.6 Australia

In August 2011, the Australian government approved the Carbon Farming Initiative (CFI) which regulates the creation and trade of carbon credits from farmland and forestry projects that polluters can use to meet mandatory emission reductions targets. CFI entered into operation in December 2011. This is a precursor of the government's plans to price carbon emissions from mid-2012¹⁶. Eligible projects involve establishment and management of permanent native forests on cleared or partially cleared land. The methodology was developed in consultation with industry and the farming community and assessed by the independent Domestic Offsets Integrity Committee. Projects that adversely impact water availability, biodiversity conservation, employment, local communities or access to land for agriculture will be excluded.¹⁷

The following table gives status of various countries with respect to emission trading schemes.

Table 1.4 Overview of existing, emerging and potential emission trading schemes

ETS Status	Scope	Offsetting
EU27	Implemented	National CDM and JI credits
Australia	Implemented	National CDM and JI credits Domestic offsets
New Zealand	Implemented	National CDM and JI credits
Switzerland	Implemented	National CDM and JI credits

¹⁶ Forest Carbon Asia Brief No.4, Policy Updates April 2011 to January 2012, Rise and spread of national and sub-national forest carbon schemes

¹⁷ www.climatechange.gov.au/cfi

Kazakhstan	Implemented	National Domestic offsets
California	Implemented	Sub-national Bilateral offsets Domestic offsets
Quebec	Implemented	Sub-national Domestic offsets
South Korea	Scheduled	National Domestic offsets
Japan	Under consideration	National
Ukraine	Under consideration	National
Turkey	Under consideration	National
China	Under consideration	National Domestic offsets
Brazil	Under consideration	National
Chile	Under consideration	National
Source: World Bank, 2013		

1.10 The Present Study

Study for the dissertation titled 'Forest Carbon Market in India: Delineating a Policy and Execution Framework' is an attempt to analyse the concept of emission trading and carbon market, the opportunities it offers towards payment of ecosystem services and examine how this can be gainfully applied in Indian situation. The study looks at two problems; one, the greenhouse gas emissions from the country which is the third highest in the world though a remote third, and the other one, the ecological challenges which the country is facing in the form of soil impoverishment and erosion, water scarcity, desertification, degrading agro-ecology etc. Studying experiences of other countries and the economic analysis of the emission trading, the present study attempts

to develop a concept of the carbon market in India. The study further seeks to delineate a policy and execution framework for the conceptualized domestic carbon market.

An appropriate solution is seen in the wider extension of agroforestry practice in the country, which can sequester significant amount of carbon on one hand and also contribute towards addressing to the ecological problems. With additional income from the carbon credits, agroforestry can be a significant source of income augmentation to the farmers and with spin off activities, has potential to generate significant level of employment in the villages. Further, there can be a model where, the biomass (wood) produced from the agroforestry can be locally utilized in producing electricity with positive feedback in the form of enlarging income and employment opportunities in the villages, also this will lead to additional earning of carbon credits for bio-energy generation avoiding fossil fuel. The study looks into the policy and execution issues involved if such a model is to work in India. As ancillary exercise, potential of carbon sequestration from the agro-forestry practice in India under a set of assumptions has also been undertaken.

The specific objectives of the study are as follows

- estimate potential of carbon sequestration from agroforestry practice in India and value the same in monetary terms under a set of realistic assumptions
- analyse ways by which demand for the forest carbon credits can be created
- conceptualise a forest carbon market for India

- analyse and enunciate policy requirements for creating the forest carbon market in India in the light of Coase theorem and other principles of economics
- analyse and spell out framework for operationalising the forest carbon market in the country

1.10.1 Limitations of the Study

Limitations of the study have been briefly mentioned below

- (i) Due to paucity of time, surveys of some relevant institutions and places like commodity exchange, India Energy Exchange (IEX Ltd), agroforestry practices in various regions, could not be undertaken.
- (ii) Since the study is about introducing a new concept of carbon market, there was no pre existing data on price of carbon credit, transaction cost in the domestic carbon market; the analysis therefore was done on the assumed values of carbon credit price and transaction costs.
- (iii) The study though succeeds in analyzing various issues related to a domestic market which introduces a new commodity of carbon credits of agroforestry origin and attempts to evolve a policy and execution framework for the same, however, a detailed analysis on many policy questions like introducing minimum support price (MSP) for the carbon credits created from agroforestry, creating a separate segment for compliance of carbon credits being generated from some activities with larger social, economic and environmental benefits like agroforestry could not be carried out due to the short time frame available for the study.