



Carbon Credits Trading- Young and Emerging Market

This paper examines the conditions leading to climate change, initiatives for greenhouse gas abatement and the issues related to Carbon Trading. It details the modalities of carbon trading and business opportunities for various players and, its impact on the economy as a whole. This paper also discusses the technique of achieving economic benefits, while creating a new financial product and it's trading in a global scenario.

About the Author

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E. Parvathamma is a functional consultant, presently working for the Deutsche Bank account of Tata Consultancy Services (TCS). She has over thirteen years of experience in the Equity Market (Front Office, Mid Office and Back Office) and Derivatives Market both Exchange Traded (ETD) and Over The Counter (OTC). She also has vast experience in Depository and Custodial activities. She holds a Master Degree in Economics.

Currently, Global Warming is the latest topic being discussed across the globe. Based on the general awareness regarding this topic, I developed interest in it. I considered various measures that would contribute towards reduction of global warming. Being an economist and having worked in Over The Counter Derivatives (OTC) department for a leading European Investment Bank, I firmly believe that unless we attach monetary value to any product, it is difficult to achieve the goals, rather it would be considered as ineffective. The objective of this paper is to illustrate the dual benefits of monetary gains while addressing this environmental issue. One of the best and easy methods to attain this objective is to progressively create more products to achieve the advantage of comparative cost and faster liquidity for the market players. Derivatives would be appropriate instruments to deal with it. Derivative is a product, which derives its value from an underlying asset. For example: Equity, Bonds, FX, MM and so on. The relevance of this topic and my enhanced interest initiated me to choose this topic.

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Executive Summary

Global Warming is the current topic in the political agenda across the globe. Every country seems to be spending lot of time, energy, and money to find solutions to one of the major international problems of climatic change. Considerable efforts are being made by Governmental Authorities, Senior Politicians, Economists, Non –Governmental Organizations (NGO's) and various other firms to tackle this vital issue. Some of such initiatives are UN framework convention 1992 on climate change, and emergence of Kyoto Protocol 1997, and Bonn Agreement of 2001. Under these initiatives developed countries unanimously agreed to reduce greenhouse gas emission to save the planet from potential danger and provide clean and healthy environment for human life. Global warming is caused by greenhouse gases and it is pursued to be the greatest threat to the entire human life if it is not handled in an adequate manner.

Former U.S. Vice President Al Gore and United Nations Panel were jointly awarded the 2007 Nobel Peace Prize for their efforts to fight global warming. This was a chance to elevate public consciousness on this issue and was considered as an alarm bell for the scientific community.

Economists consider it as a new idea of converting this threat to an opportunity and utilizing this opportunity for the betterment of the environment while attaching monetary value with economic benefits. They propagate creating a monetary tool for mitigation of drastic climatic changes, which has immense benefits on human life and acts as a central tool for liquidity in the economy while reducing the emission of greenhouse gases. The idea generated is the brand new financial product called Carbon Trading. Carbon Trading is the brainchild of the Kyoto Protocol 1997.

Carbon Trading is in its nascent stage in terms of development, which requires time and effort to be groomed as one of the matured markets. The estimated market value of the Carbon Trading was approximately \$ 30 billion U.S. dollars in the year 2006.

Introduction

Carbon Credits Trading or Emission Trading refers to trading in Greenhouse gas emission certificates within the legal framework. It is a market-based scheme for environmental improvement that allows parties to buy and sell permits for emissions or credits for reductions. Emissions trading allow established emission goals to be met in the most cost-effective way by letting the market determine the lowest-cost pollution abatement opportunities.

Under such schemes, the environmental regulator first determines the total acceptable emissions and then divides this total into tradable units (often referred to as credits or permits). These units are then allocated to scheme participants with dual purpose while allowing the flexibility to meet their emission targets according to their own strategy.

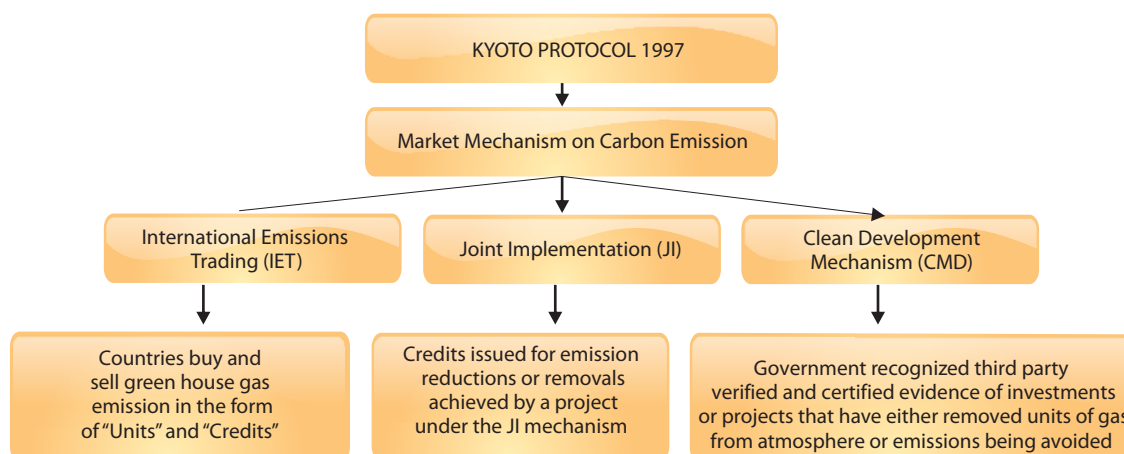
- Participants who emit pollutants must obtain sufficient tradable units to compensate for their emissions
- Participants who reduce emissions may have surplus units that they can sell to others, who find emission reduction more expensive or difficult

Historical Perspective

Emissions trading schemes were first developed in the 1960s and 1970s in the United States, motivated partly by dissatisfaction with the cost of the regulatory approaches to pollution control, they were first used to price, with a view to reduce nitrogen and sulphur oxides (NO_x and SO_x) emissions in the United States electricity industry.

Kyoto Protocol - 1997

The Kyoto Protocol is an amendment to the international treaty of United Nations Framework Convention on Climate Changes (UNFCCC) which is a legally binding agreement under which more than 169 industrialized countries have agreed to reduce greenhouse gas emissions to a level of 5.4% by 2012 keeping 1990 as the base. The objective of the protocol is the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Under this protocol, about 38 industrialized countries and the European Union forms a part of Annex-1 list, the remaining are part of Non-Annex 1 list of countries. Carbon Market is the brainchild of the Kyoto Protocol for controlling greenhouse gas emissions. Green house gases are emitted mainly by burning oil, gas, and coal that are resulting in perilous climate change. Each carbon credit represents one ton of carbon dioxide either removed from the atmosphere or saved from being emitted.



Certification Requirements

The certification requirements are as follows:

- Base line to be drawn up – a scenario in which one provides supporting evidence about the emission of greenhouse gases till 2012 without investment and compare this baseline with lower emission that will be achieved through investment.
- A validation or certification organization, acting as an independent third party validates the baseline. This organization works according to the "Accreditation Guidelines for the Validation and Verification of Joint Implementation (JI) projects" or according to the guidelines of the UNFCCC Executive Board accreditation Panel for Clean Development Mechanism (CDM) projects.
- The host country's government must provide approval for the transaction in carbon credits through a Letter of Approval. However, even if there is an MoU with the country in which one wants to invest, this letter has to be obtained from the country's government.

The following table gives the complete details of the types of Certificates and its usages

	White certificates (WhC) or Energy Efficiency Titles (EET)	Green certificates Tradable Green Certificate (TGC) scheme	Black certificates European Union Emissions Trading Scheme (EU ETS)
Definition	Energy savings certificates	Electricity produced with renewable energy sources	CO2 emissions certificates
EU Objective	1% of energy savings per year and 1.5% energy savings for the public sector	Increase of renewable energy source supply to 22% in the EU by 2010	Reduction of greenhouse gases emissions by 8% compared to the 1990's rate
Market	White Certificates Market Power Market	TGC and RECS market Power market	EU allowance market JI/CDM market Power market
Commodity traded	White Certificate = one unit of energy saved. In the UK, obligations can also be traded (on a 3 years running period)	Green certificate = a unit of renewable energy produced. Untill now, no harmonized unit exist. In the RECS system, one Green Certificate represents 1 MWh of renewable energy produced.	EU allowance = 1 ton of CO2 equivalent
Participants (mandatory / voluntary)	Electricity and gas suppliers (residential and commercial sectors)	Electricity production: Renewable Energy producers and importers Distribution companies Consumers	Energy intensive industry
Time frame	2002-2005 in the UK, with an expanded scheme from 2005 - 2008 2004-2008 in Italy Until 2010 in the EU	Initial phase 2001-2002 Aligned with EU Target by the year 2010	Two phases. 2005-2007: 5% of allowances can be auctioned. 2008-2012: auctioned allowances can reach up to 15% of the total allowances.

Source: Leonardo-energy.org

Carbon Pricing

The three key factors that should be considered in assessing market prices in the EU Emissions Trading Scheme (EU ETS) are as follows:

- Policy and regulatory issues
- Market fundamentals
- Technical indicators

Apart from the above some of the key determinants of price are as follows:

- Credit worthiness and experience of the project sponsor and the viability of the project
- Structure of the contract seller's capacity to pay the penalties
- Cost of validation and potential certification
- Host country support and willingness to cooperate
- Additional environmental and social benefits

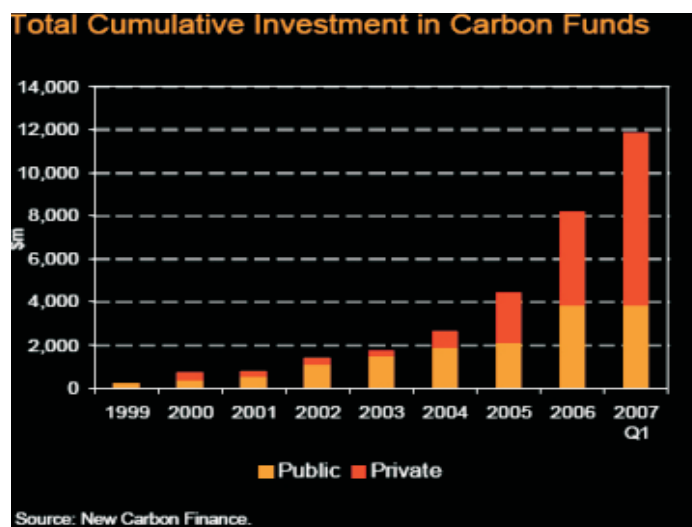
Carbon Trading Landscape

Following are the key players in carbon credit market



Carbon Funds

Carbon Funds are the significant features of the Carbon market. A carbon fund receives money from investors such as national governments and private players to participate in the carbon market. The number of funds has grown rapidly from \$350 millions in 2000 to \$6250 million by early 2007. The data on Carbon Funds is as follows:



Carbon Exchanges

A Carbon Exchange is like a Stock Exchange for pollution trading. Market forces drive the price of the carbon credits. These credits are called Carbon Financial Instruments. The trading can be exchange traded under regulated regime and can also be over the counter in nature.

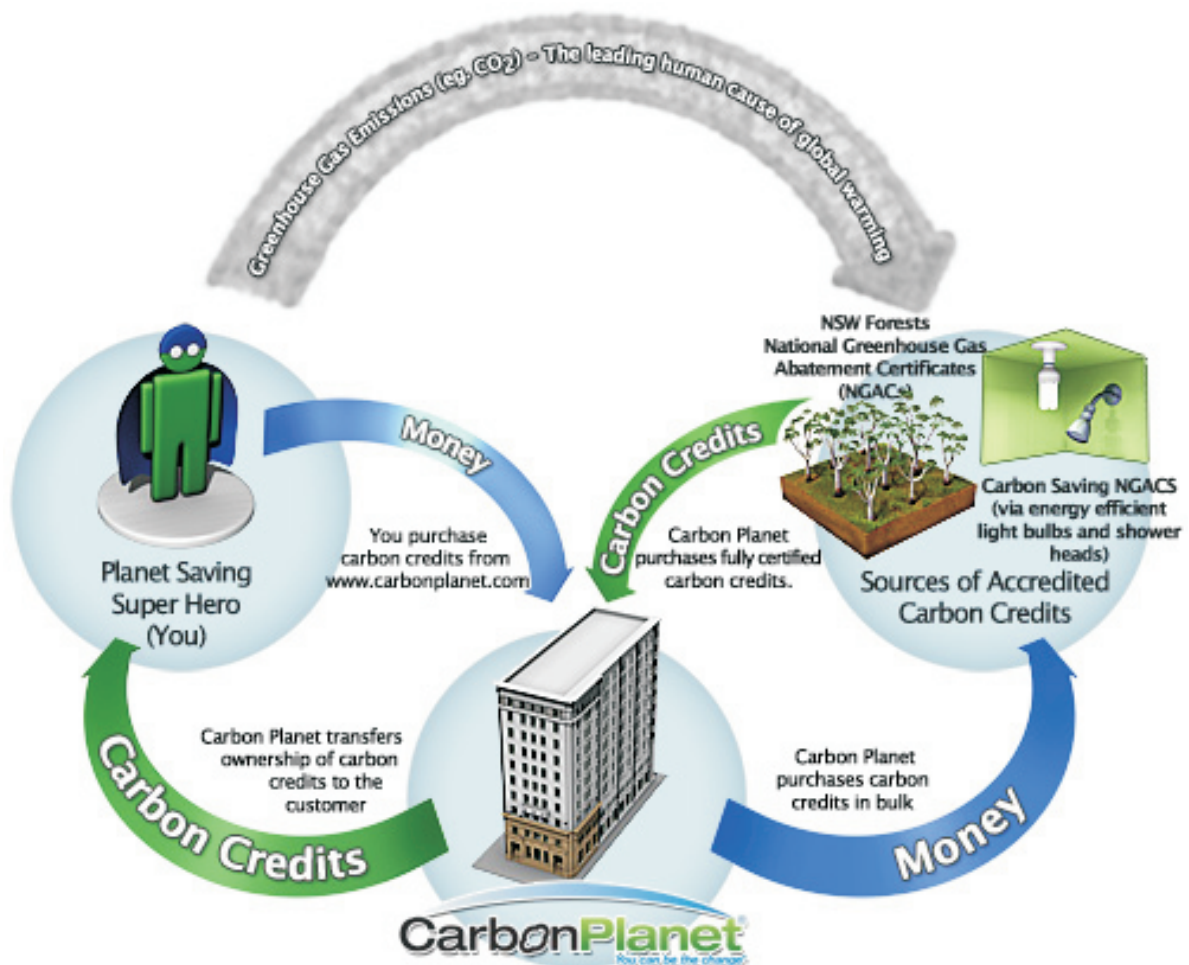
Chicago Climate Exchange popularly known as CCX was the first carbon exchange to start trading in six greenhouse gases in 2003. These gases include Carbon dioxide, Methane, Nitrous Oxide, hydro fluorocarbons (HFCs, a CFC substitute), per fluorocarbons (PFCs) and sulfur hexafluoride (SF₆).

The data available on carbon trading is given below:

CCX Products	First Quarter 2008	First Quarter 2007	Growth in %	March 2008	March 2007	Growth in %
CCX - Cash Market (in contracts)	196,831	70,334	180	82,946	17,271	380
U.S. Carbon Complex - Cash, Futures and Options (in metric tons)	24,309,100	7,033,400	246	10,181,600	1,727,100	490
CCFE - Futures Market (in contracts)	153,819	31,636	386	55,899	12,236	357

Source: ccx.com

The above table indicates that the trading volumes are increasing tremendously giving a positive indication of carbon trading in coming years.



Source: Carbonexchange.com

Emission Trading Registries

Emission reduction trading requires an emission trading registry. Similar to financial exchanges for stocks and bonds, an emission trading registry would facilitate a market for emission reduction credits. Registries typically assume no responsibility for the validity or legitimacy of the emission credit that is posted for sale. Their primary function is the clearing and settlement of the market trades.

Global Greenhouse (GHG) Registry

It is a web based platform that allows companies to disclose their worldwide greenhouse gases emission inventories and reduction targets. This registry provides a platform where information is globally consolidated and displayed, allowing for analysis across economic sectors and geographical regions. The California Action Registry serves as a voluntary greenhouse gas registry to protect, encourage, and promote early actions to reduce GHG emissions. This registry has developed a general protocol and additional industry specific protocols to provide guidance to those, who wants to maintain inventory of GHG emission. It has also developed a reporting tool to measure and maintain the back up data required and certification requirements.

Carbon Rating Agencies

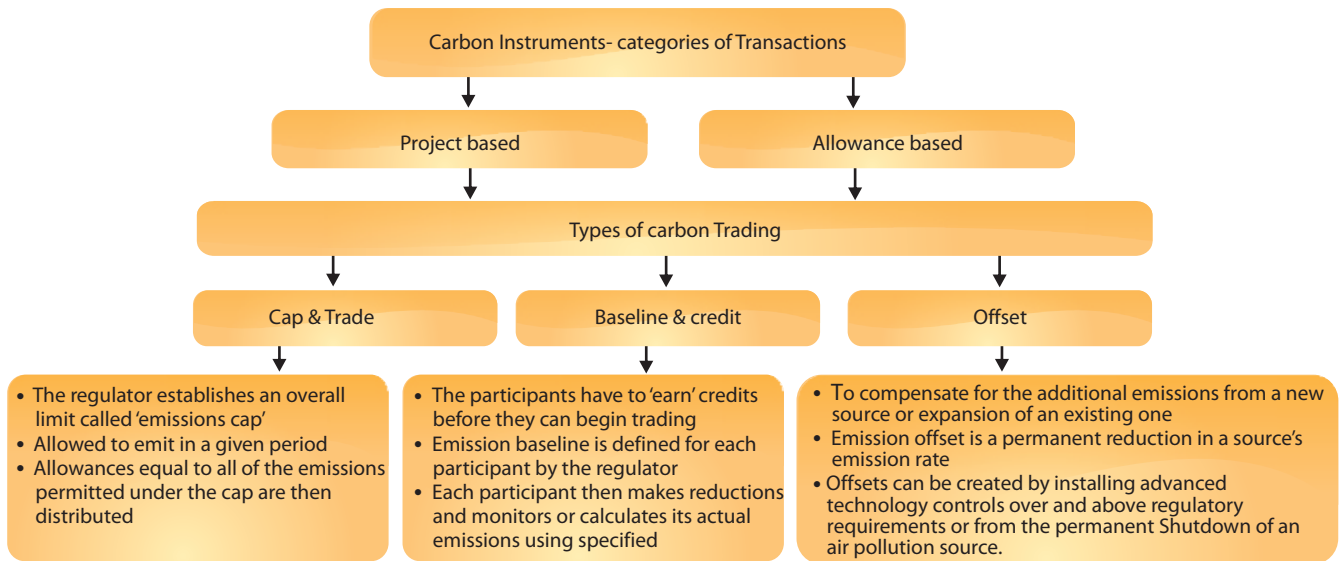
CDM projects are development projects and face many issues such as weak counterparties, low administrative capacity, local funding shortfalls, and a complex business environment. The carbon market is also facing regulatory risks such as constraints in the CDM registration process and long term uncertainty about the international policy framework particularly after 2012. The Carbon Ratings Agency would be the first agency to provide an independent, in-depth and comparable assessment of both regulatory risks and the less understood market-internal risks. Improved transparency and enhanced risk management including ratings are an integral part of the process that will make carbon a standard commodity, which will result in creation of a brand new asset class. At present, each emission reduction project is unique and has its own risk profile that market players currently struggle to assess. Rated assets will no longer be unique but will be comparable to other offset assets with the same rating. Ratings will also help in price discovery and intensify the penetration in the market.

These Carbon rating agencies should comprise of ratings experts, financial market professionals, UN climate change negotiators, and former senior managers from development agencies such as the World Bank. A combination which ensures risks facing carbon projects are taken into account in the ratings process. Senior economists, Stock Exchanges such as London Stock Exchange have settled on establishing such independent agencies which are bound to boost investments in the nascent market.

Carbon Trading Overview

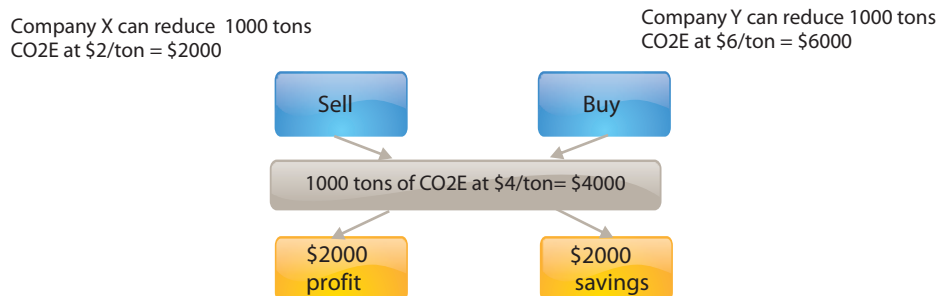
Carbon Transactions

These are defined as purchase and sale of contracts. These transactions can be grouped into two main categories namely, Allowance based transactions and Project based transactions. There are three basic types of emissions trading programmes as follows: 'cap and trade', 'baseline and credit' and 'offset'.

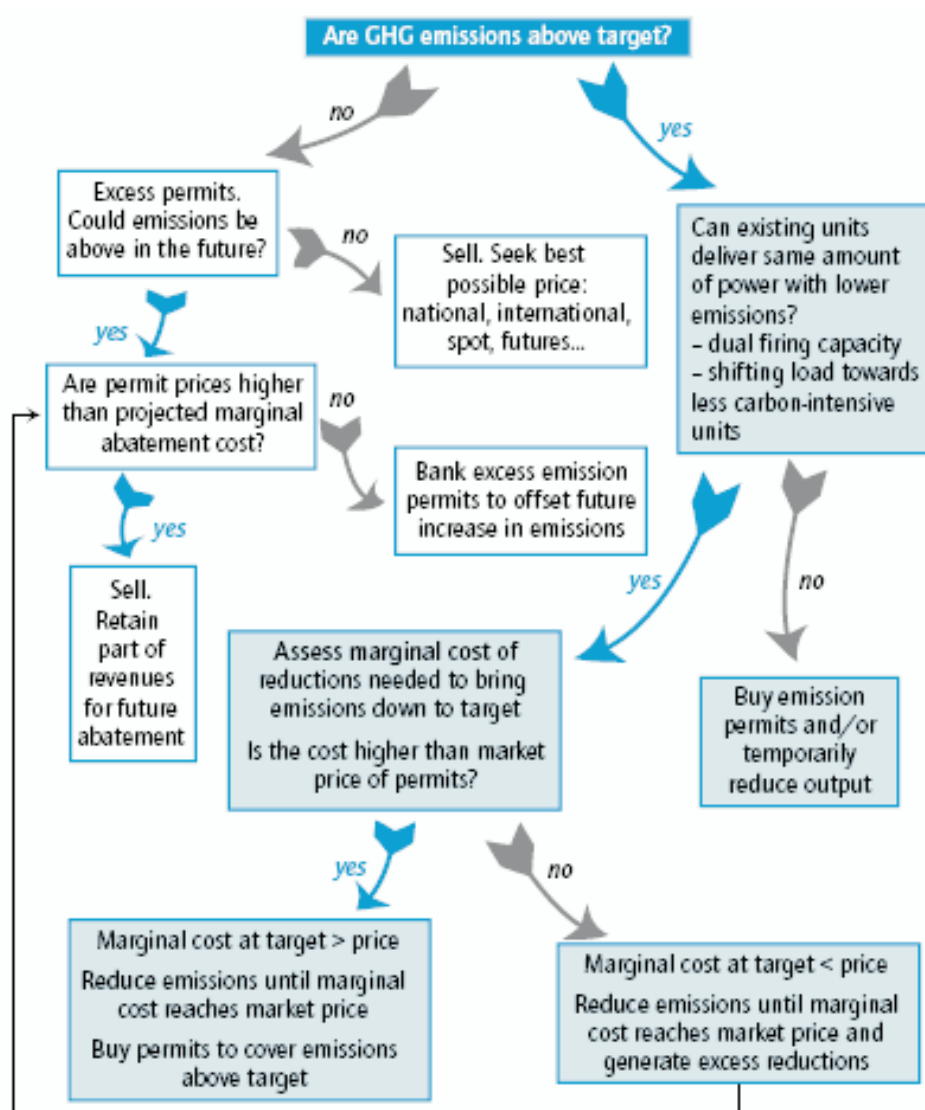


Carbon Trading Strategy

Carbon credit transactions involve the purchase of emission rights from those with the technical ability and economic feasibility to reduce greenhouse gas emissions or sequester additional carbon. Those who can reduce greenhouse gas emissions below current levels or sequester additional carbon will receive a carbon credit for each ton of carbon reduced or sequestered. Trading of carbon credits between buyers and sellers establishes the market price per carbon credit. If it is cheaper for greenhouse gas emitters to buy a carbon credit from another company rather than controlling additional emissions, they will buy credits. Sellers will want to sell credits if they can reduce greenhouse gas emissions or sequester additional carbon at a cost that is less than the price of the carbon credit. Emissions trading transforms the "right to emit a pollutant" to a tradable good and creates economic incentives for emissions reduction. Carbon credits are traded on ECX in Europe and CCX in the U.S. These contracts may be in the form of Spot, Forward, or Options transactions. Structured products can also be developed depending on the maturity level of the market. Emission traders can buy Carbon certificates from Joint Implementation and Clean Development programme projects.



Strategy of Carbon Trading: Decision Tree



Source: www.Internationaltradingagency.com

Carbon Credit Derivatives

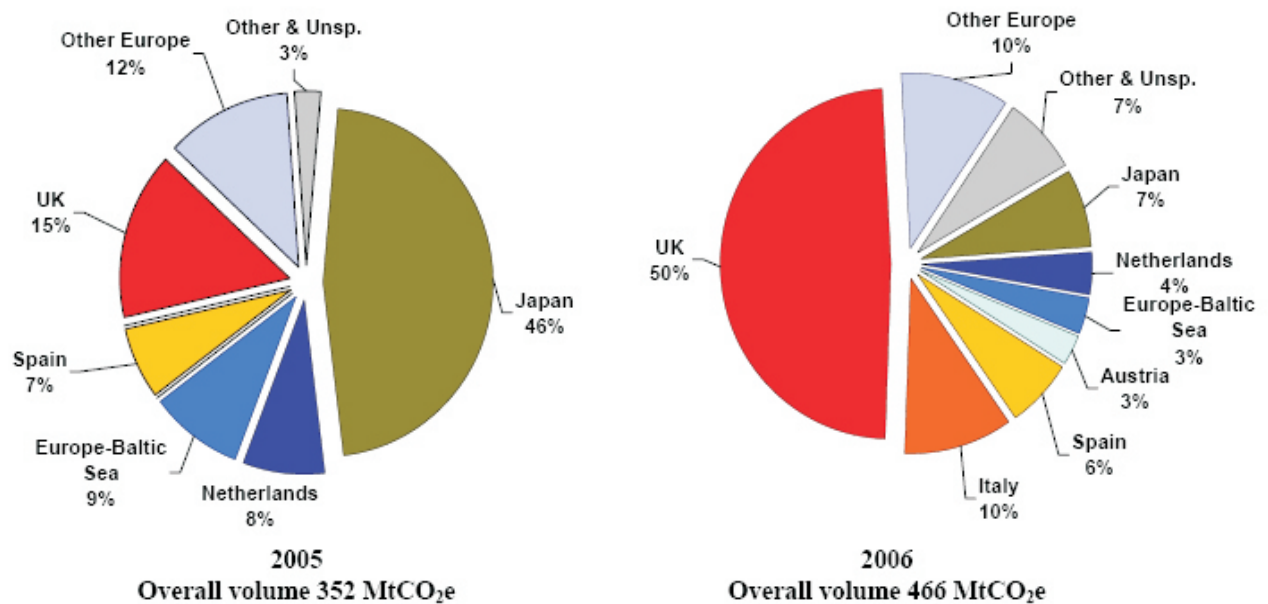
Kyoto Protocol has set quotas on the amount of gases countries can produce. Countries in turn set quotas to business lines. Businesses whose utilization is more than their quotas, must buy carbon credits to compensate for their excess emissions, while businesses that are below their quotas can sell their remaining credits. Carbon Credits are sold & bought in the international market at the prevailing market prices. This trade can be in the form of 'Spot' or 'Derivatives'

Derivative market tends to develop in large, competitive spot markets that are highly volatile. Market for Forwards and Futures are developed faster than the Spot market because of their inherent features. Derivative market plays two important roles, namely Hedging (Risk Transfer) and Price Discovery (Bids and Offers)

Derivative markets play an important role in the European Union emission trading scheme (EU ETS) by allowing market participants to reduce exposure to price risk, which will enable buyers and sellers to enhance their business plans. This market will be predominantly run by Hedgers and Speculators. By revealing the market's summary of the

underlying product value, the derivative markets inform those with a major stake in those commodities and financial instruments. The availability of these markets has provided the means to allow greater risk to be absorbed, thus facilitating growth and efficiency in each of the associated industries. Market users will have improved predictability of future business conditions, which allows for expansion of lending, and facilitates borrowing for business growth. These results can lead to reductions in prices and interest rates paid by consumers.

International Trading involves establishment of national registries in each country as a book keeping tool (similar to Securities keeping/recording system) Each national registry should connect to one centralized system to ensure a secure, compatible, and smooth integration of all similar systems across the globe.



Within Europe, U.K. has consolidated the leadership position as Carbon Finance hub of the world.

Personal Carbon Trading

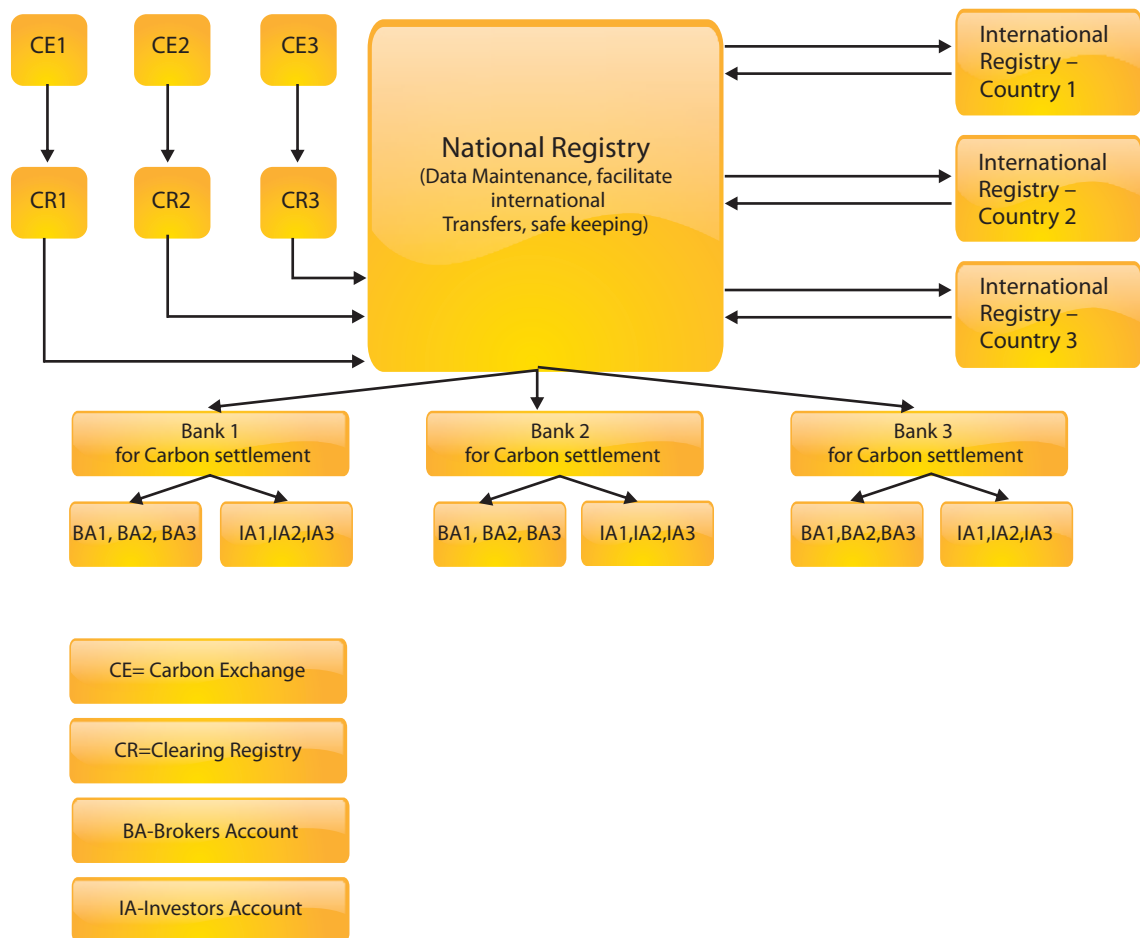
This refers to the act of equally allocating emissions credits to individuals on a per capita basis within the national carbon budgets. Individuals would then have to surrender these credits while buying fuel or electricity. Individuals wanting or needing more energy would be able to partake in emission trading to secure more credits as companies do now.

Proponents of carbon trading claim that it could increase carbon literacy thereby allowing individuals to make a fair contribution towards reducing carbon dioxide emissions. It could allow the burden of reducing emissions to be shared evenly throughout the economy rather than focusing all attention on business and governments and to encourage more localized economies.

It is an attractive idea because it increases awareness about socially responsible investment which brings together investment objective with socio-economic responsibility.

Structure of Carbon Trading Clearing System

The figure below displays broader view on the working of the Carbon Trading and clearing system and areas where big opportunities await the IT industry.

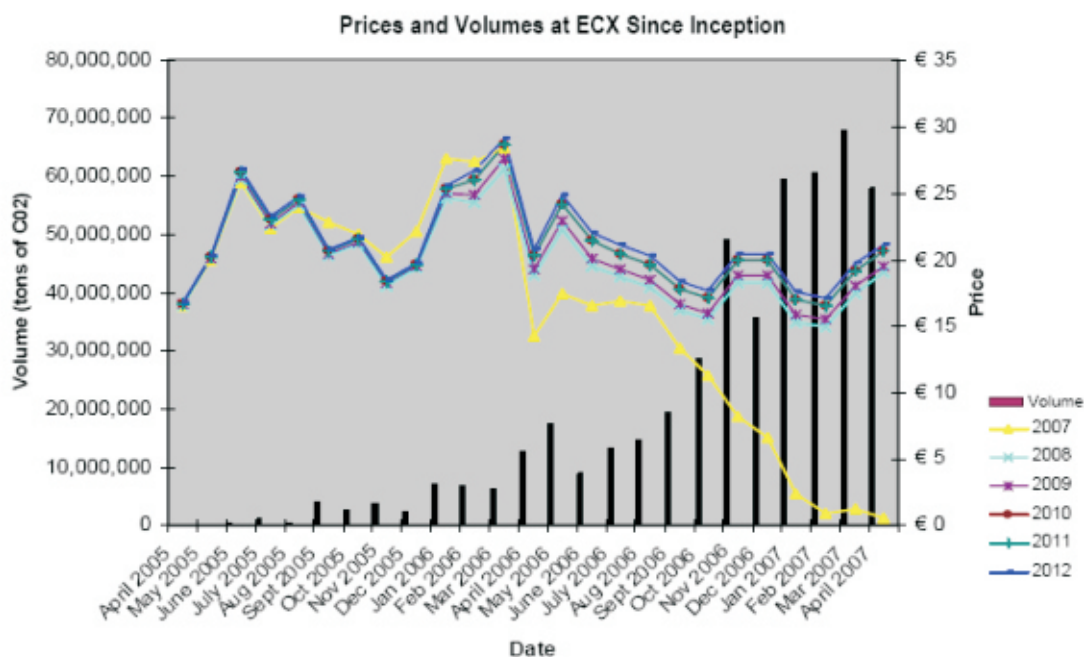


Perspective of the International Markets

According to Kyoto Protocol, the commitment period in which participants will have to meet their emission targets is from 2008 to 2012. Each participant country has to report its emission levels and net trades in the form of annual reports. Governments would probably impose penalty for non compliance with the expected emission objectives. Chicago Climate Exchange (CCX) saw a record breaking transacted volumes of 10.3 MtCO₂ in 2006 valued at \$ 38.1 million. CCX initiated the expansion plan to other regions which paved the way for formation of New York Climate Exchange (NYCX) and Northeast Climate Exchange (NECX). It also has closer ties with UK ETS. CCX announced its willingness to extend its reach to Asian countries such as India and China. Chicago Climate Exchange (CCX) is the world's first voluntary and legally binding rules based greenhouse gas emission reduction trading system.

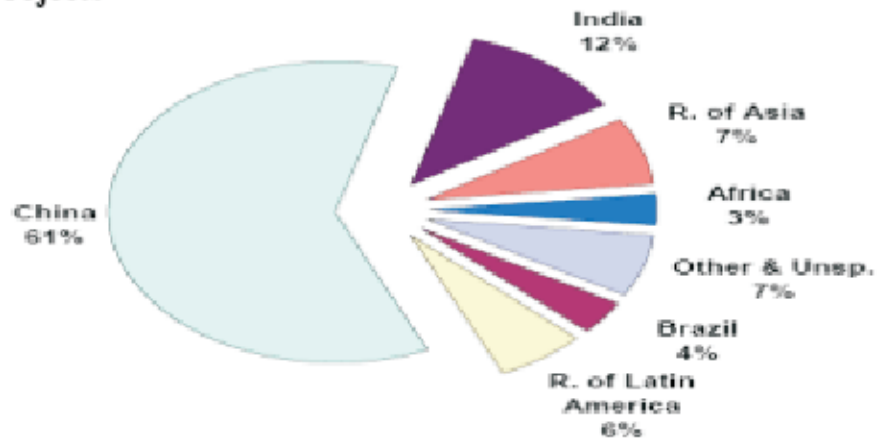
It is estimated that U.S. alone could create a primary market (asset formation) worth \$ 2.6 billion to 12 billion per year and the expected transactions worth \$ 10 billion to \$ 50 billion by 2012 as a result of churning out in secondary market (asset allocation) considering the multiple trading of the same asset.

The European Union's emissions trading scheme (EU ETS) accounted for 2/3rds of the traded volumes in the first half of 2007 with 775 million tones carbon dioxide changing hands worth € 11.5 billion. This market also led to the establishment of market infrastructure such as Carbon exchanges, traders, Fund Managers, Bankers, and specialists.

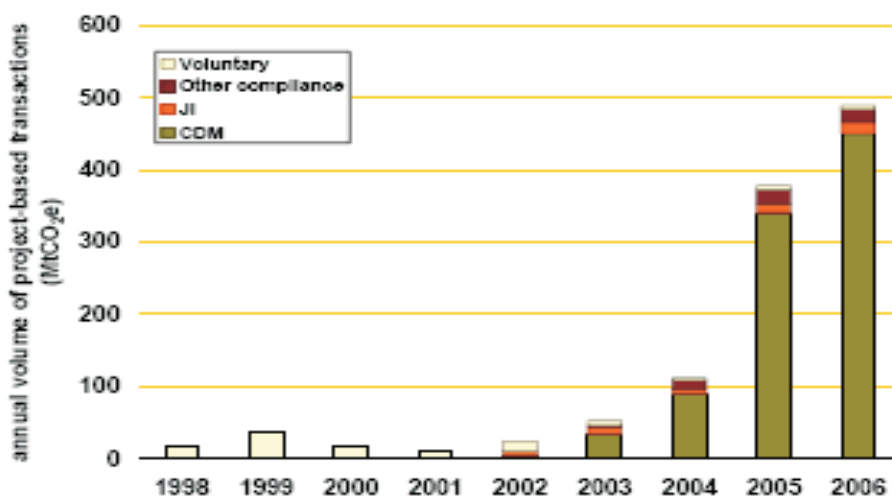


Bonn Agreement 2001 defines the rules of emission trading among industrialized countries. These rules are expected to strike the balance risk of overselling and risk of an inefficient market. The countries have agreed to avoid imposing strict caps in trading and other flexible instruments. Such provisions are intended to create a comfort zone for all participants.

Location of CDM Projects



Asia continues to dominate CDM markets with 80% of volumes transacted. China continued to hold the market power and maintained an informal pricing policy which was clearly acceptable to private European buyers, though Japanese buyers did not show much interest.



Indian Scenario: There is a new financial sector called carbon market waiting to take India by storm. Carbon is now a financial commodity, according to Karan Capoor, senior financial specialist, World Bank. Carbon is now priced and business managers take the carbon price into consideration along with other factors while making business decisions. India corners almost 12 per cent share of this market. India is a party to the United Nations framework on Convention on Climate Change. It acceded to Kyoto Protocol in August 2002 and one of the objectives of acceding was to fulfill pre-requisites for implementation of Clean Development Mechanism (CDM) projects, in accordance with the national sustainable priorities, where a developed country would take up greenhouse gas reduction project activities in developing countries and where the cost of greenhouse gas reduction projects are much lower.

With the Kyoto Protocol coming into force with effect from February 18, 2005, CDM could benefit India in the following manner:

- Flow of foreign investments is likely to increase from developed countries interested in reducing their Greenhouse gases.

- Capacity building in CDM projects' development and implementation.
- A cleaner path for India's rapid economic development.
- A share of certified emission reduction.

The small and medium industries are the major contributors to the Indian economy. However, these industries also generate pollution because of old technologies and high waste generation and other economic factors. They are known to cause 70% of the industrial pollution. CDM could help these sectors in introducing energy efficient technologies. Leading Sectors such as cement, sugar, paper, iron and steel, power that includes biomass cogeneration, and hydro and wind energy projects, can enter the CDM bandwagon.

There's little doubt that Asian giants India and China in particular will be big sources of credits. India is considered as the largest beneficiary, claiming about 31 percent of the total world carbon trade through the Clean Development Mechanism (CDM). It is expected to rake in at least \$5 billion to \$10 billion (Rs 22,500 crore to Rs 45,000 crore). Various initiatives from government and private players are already in the pipeline.

Tata Steel with the help of the new technology introduced in its coke-quenching plant in Jamshedpur, which could pave way to produce more than 1.7m carbon credits over the next decade. The Japanese government has already bought up Tata's entire reduction. Gujarat Fluorochemicals has struck a carbon credit transaction deal with Noble Carbon Credits of Singapore, which could be worth over Rs 1,000 crore. Such deals could be a small part of the huge market signaling the long sustained innings that could be staged with the help of commodity exchanges by embracing such novel innovations. India's vast natural resources and new generation's organized sector could well provide an important reason for the Indian industry to benefit from these products.

In this context, Multi-Commodity Exchange (MCX) and the National Commodity Exchange (NCDEX), India's premier commodity exchanges are getting ready for carbon trading. India's leading Business School IIM-Lucknow is all set to introduce a course on carbon markets.

India's biggest Nationalized Bank –State Bank of India says that analysts peg the global carbon trading market at \$100 billion by 2010 and the Indian carbon market has the potential to supply 30-50 per cent of the projected global market of 700 million CERs by 2012. SBI proposes to provide a single point delivery of services such as implementation of CDM projects, advisory services and value added products like securitization of carbon credit receivables, carbon credit delivery guarantees, and escrow mechanism for carbon credits, besides finance related to carbon credits/Clean Development Mechanism (CDM) under the Kyoto Protocol to its customers.

Due to India's vast forest and agricultural land, a significant opportunity lies ahead for India to earn carbon credits when energy saving and environment protecting methods are adopted. But this may be short lived as India is progressing towards being a developed country and these benefits will not be applicable forever. When India joins the league as a developed country, it has to strictly adopt the Kyoto protocol and it may turn out to be a potential buyer instead of a seller as it presently is.

Market size - Banks/Financial Institution's Participation

According to The World Bank the global carbon market, where government and industry limits on carbon dioxide emissions which are traded tripled from \$7.9 billion in 2005 to \$24.4 billion last year.

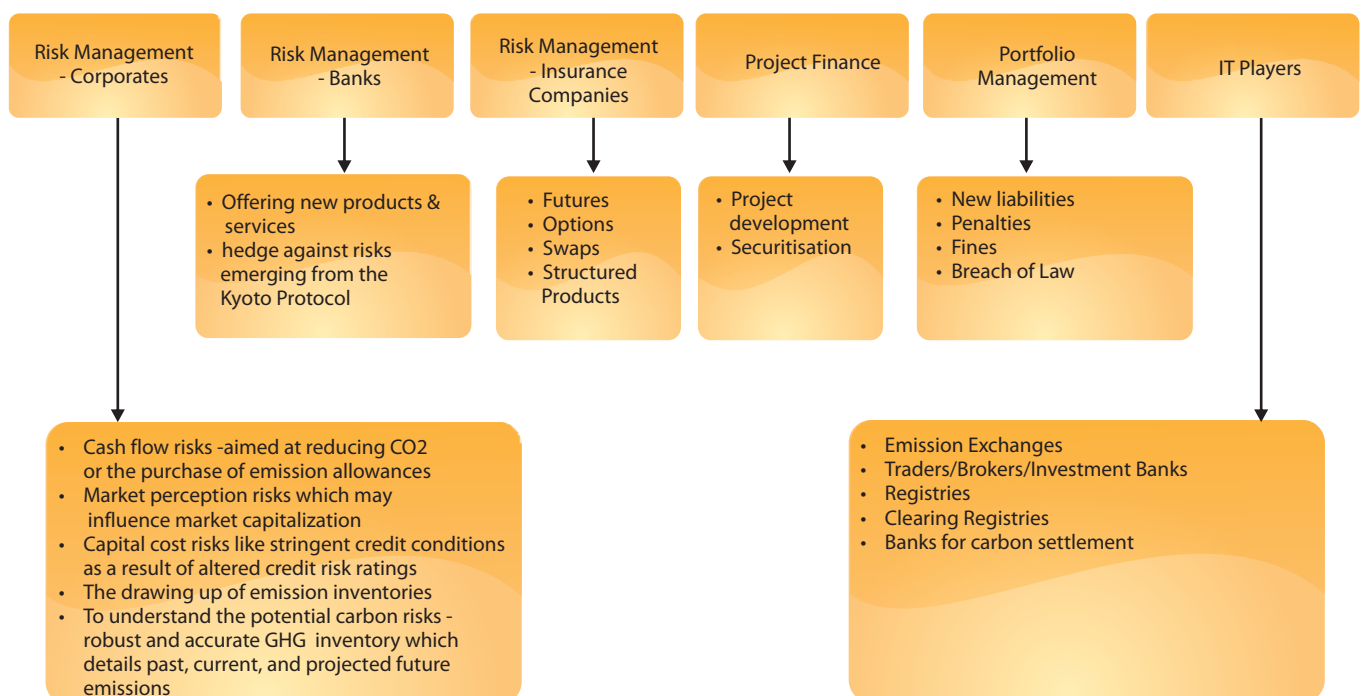
Leading Investment Bank Goldman Sachs investing \$23 Million in Climate Exchange in early 2007 is an evident factor that market players are looking forward to lucrative trading in this segment.

Fortis Bank has been positioning itself as a leader in the energy market, purchasing credits and selling them to companies that need to meet European pollution standards with offset carbon credits. Fortis Bank beat out 13 competing bids to win the rights to emit 808,450 metric tons (891,163 U.S. tons) of carbon dioxide with an offer of \$22.90 per metric ton, the exchange said in statement. It is referred to as the first sale on a regulated exchange. Brazil's Mercantile and Futures Exchange called Sao Paulo's sale of \$18.5 million in carbon credits to Dutch-Belgian Fortis Bank the first such sale to be held on a regulated stock market and a significant step toward institutionalizing the carbon market.

These numbers are relevant because they demonstrate that the carbon market has become a valuable catalyst for leveraging substantial financial flows for clean energy in developing countries

There has been a growing activity in this asset class not only from industrial companies, but also from new participants such as commercial firms, banks and financial institutions that recognise the attractiveness of this market for managing risks and earning returns on capital among various players across the globe.

Opportunities to Various Parties



Risk Management for Companies

Companies who are under this scheme must realize that CO₂ risk management will emerge as an important factor in their decision-making.

For individual companies the most important risk Categories resulting from emission reduction targets are as follows:

- Cash flow risks such as increased expenditure on measures aimed at reducing CO₂ or the purchase of emission allowances.
- Market perception risks which may influence market capitalization.
- Capital cost risks such as more stringent credit conditions as a result of altered credit risk ratings.
- The drawing up of emission inventories and measures taken to increase energy efficiency in future, play important roles in the financial rating process.
- To understand the potential carbon risks, companies should have in place a robust and accurate GHG inventory which details past, current, and projected future emissions. They should understand the marginal abatement cost options available from different GHG mitigation strategies and the tools that are available to achieve compliance within different GHG regulatory regimes

Risk Management from Bank's Perspective

Offering new products and services to reduce the risk of emissions trading for corporate customers is a new business challenge for banks. Furthermore, banks hold stakes in the companies affected by trading. Consequently, the risks and opportunities for those companies are also risks and opportunities for the banks. The complexity of emissions trading requires a wide range of products and services that effectively hedge against risks emerging from the Kyoto Protocol and the European trading scheme.

Portfolio Management Perspective

Banks can offer the service of Emission Allowances portfolio management while taking over the responsibility of their clients' emission allowance accounts. The most striking advantage of such a service is that it is not necessary to set up internal expertise in the affected companies, thus resulting in lower transaction costs. This can be a part of Derivatives desk as the products they can offer are derivative instruments such as Futures, Options and Swaps and any other structured products.

Futures: The purchase of emission allowances to be supplied in the future at a fixed price – currently the most common type of market-traded allowance

Options: A guarantee of the right to purchase or sell allowances at a fixed price within a defined period of time

Swaps: The exchange of payment obligations so that different allowance currencies can be exchanged.

Structured products: It can be a combination of any of the above linked to insurance products or interest rates or basket of currencies and so on.

Project Finance Perspective

An emission trading also offers potential business in the field of project finance – providing project developers with the chance to generate additional income sources by investing in energy-efficient technology. This applies to JI and CDM projects, where the inclusion of emission credits in the analysis of a project's credit quality could become imperative. In principle, the securitisation of these cash flows could either help to reduce the financing needs of a project developer or reduce the re-financing costs by embedding them into interest rate derivatives. Accordingly, emission certificates could help plant developers with new financing mechanisms, thereby leading to more sophisticated structures as the market expands.

Risk Management from Insurance Perspective

Insurance Products cover the legal obligation to reduce greenhouse emissions resulting in new liabilities, fines and penalties resulting from a breach of law would not be covered under Insurance policy. Inappropriate or inadequate management of climate risks, resulting in a failure to protect a company's interests would affect the decision of the Insurance Company.

IT Players

Setting up emission data management systems, Trading, and clearing systems, research and development activities which can deliver end to end solutions for emission management

Emission Exchanges: A platform to be built to facilitate faster and transparent carbon trading system along with margining and risk management tools in place.

Traders/Brokers/Investment Banks: Carbon trading dash boards can be created for Front office where it is traded, Mid office where risk mitigating tools are implemented along with reporting for senior management at regular intervals and for back office where trade confirmations/affirmations and reconciliations are done .

Registries: They maintain data of all debits and credits in the book entry form and act as custodians for Carbon credits. Bigger opportunity is towards setting up local registries, national registries, and international registries.

Clearing Registries: They maintain data of all the transactions traded on the exchange and act as counterparty for both sell and buy, thereby mitigating counterparty risks to ensure smooth settlement system, which helps to build the investors confidence in the entire carbon trading system.

Banks for carbon settlement: They maintain various types of accounts on behalf of investors and brokers (House Accounts and Non-house accounts) and facilitate smooth transfer of book entries across banks, which are specifically designated for carbon settlement.

Apart from the above, an effective and efficient emission measuring system to calculate emissions resulting from variables such as soil cultivation, fire management, fertilizer application, climate, different plant is the need of the hour. Further it is required to set up research and development activities on sustainable technologies to result in carbon reduction.

Benefits of Carbon Trading

It is perceived that carbon trading has several benefits. Some of them are listed below

General

- converting an environmental threat to a revenue generating opportunity
- Reduction in overall cost of meeting emission reduction targets
- Progressively improved definition of a price for carbon, particularly as the market becomes more liquid and active, and assuming that all carbon certificate products are fungible.
- The opportunity to generate income from activities that previously attracted no additional revenue, such as investment in emission reduction, renewable energy generation, greenhouse friendly fuels and carbon sequestration.

Specific

It can be a Derivative or Spot transaction on Exchanges or can be in Over the Counter in nature. In a Derivative transaction, trades can be based on monthly contracts or Vintage contracts. Carbon trading can be easily implemented with minimum additional cost as all other things are already in place. Re-invention of the entire system is not required. Some of the points are given below:

- Exchanges can provide the platform with no or minimum changes for carbon trading
- Same margining mechanism can be adopted
- Risk Management tools would be same with some fine tuning
- Trade details like contract size, tick size and son on can be based on the same logic

Conclusion

Though critics argue that carbon markets create disorder and leave much room for unverifiable manipulation and do little to solve pollution problems overall, as the groups that do not pollute sell their conservation to the highest bidder. But Carbon trading is an Administrative approach used mainly to control pollution by providing economic incentives for achieving reduction in emissions. Trading in these carbon credits is hyped as market solution which is a feel good factor. They provide ways to reduce greenhouse gas emissions by giving them monetary value. National policies should help in shaping this new and vibrant market, which is economically efficient. This market based instrument encourages the transition to a more sustainable economy. Certain flexible mechanisms are an effective way to reduce emissions at a lower cost, given their efficiency depends largely on their design. In other words without emission trading, objectives of reduction in greenhouse gases may not be met.

However, the successful development of an emission trading market largely depends on the volatility and liquidity of the market. Market access to international traders and financial intermediaries is one of the important factors in bringing liquidity in the market. Emission trading regime requires not only broad range of sectors but also sufficient volumes with adequate diversity of contracts available for trading. Market compatibility, transferability of instruments across the globe is another important condition for liquidity and cost effective emission reduction. It is pertinent to note that carbon trading has the potential to fulfill that dream of treating natural resources as assets attached with monetary value. Valuing resources gives greater incentive to conserve them. Economists feel that what is not valued is overused. It is not a bad idea to link carbon credits to the existing credit cards or petro cards with dual purpose of creating environmental awareness and to stimulate the liquidity in the carbon trading market.

Experts say that global carbon credit markets will have an established impact in the next 10 years and is expected to grow from \$ 10 billion to \$1 Trillion by 2010. Carbon traders across the world say that emission permits could become the world's largest market if all the developed economies agree to take part in the final phase of Kyoto Protocol implementation.

Considering the effects of economic value and environmental threats, we need to observe how these changes affect the IT Industry and financial market as a whole.

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