Carbon Credit and its Relevance in the Present Scenario : A Study from the Indian Perspective

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Abstract

There is an emerging global consensus that fighting climate change is a major challenge of the 21st century. Changes in the global environment are increasingly challenging businesses around the world. Companies are now expected to integrate environmental concerns into their strategic management. The emergence and popularization of the international climate change debate has created an increasingly relevant focus upon the potential of low carbon opportunities within the corporate sector. Presently, there is a need for awareness of carbon trading since it is a key policy instrument for low carbon business growth. The importance of carbon credit trading is significant in an emerging economy like India. Accordingly, the study analyzed the relevance of carbon credit trading in India as well as the opportunities to reduce carbon footprints, which can even help to improve the bottom line of organizations.

Keywords : **carbon credit, carbon market, low carbon economy, GHGs, carbon disclosure project (CDP), climate change, clean development mechanism (CDM)**

JEL Classification : Q54, Q55, Q56

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The Earth has an atmosphere of proper depth and chemical composition. Environmental destruction by pollution and other physical means is deteriorating the capacity of the earth to produce the natural resources upon which we depend (Living Planet Report, 2004). The drive for economic growth presents both worries and opportunities for sustainable development. While environmental sensitivity is an important element of the development process, in practice, there is considerable variance between economic and environmental goals. This untenable development can be anticipated as society moving into a funnel in which room to maneuver is becoming more and more narrow per capita (Cook, 2004).

Climate change and global warming attributed to emission of greenhouse gases (GHGs) from human activities are a major threat to our survival and well being. Environmental damage is caused by green house gas emissions, which are predominantly carbon based. Globalization and liberalization brought a paradigm shift in the consumption pattern of the people of the country. Liberalization also changed the ecological footprint of the average Indian. Today, people are encouraged to consume and spend, and in turn, encourage industrial and economic growth. The drive for economic growth presents both worries and opportunities for sustainable development. While environmental sensitivity is an important element of the developmental process, in practice, there is considerable variance between economic and environmental goals.

Climate change is now an important environmental challenge. Till date, the most significant effort to address this challenge is the Kyoto Protocol [as put into operation in 1997] in the UN Framework Convention on Climate Change (UNFCCC). It allows developed countries to reach their emission targets through different

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'Flexibility Mechanisms', such as, Emission Trading, Joint Implementation, and Clean Development Mechanism (CDM). For CDM host countries (i.e. developing countries not listed in Annex I of the Kyoto Protocol), the goal of the CDM is to help them "achieve sustainable development and to contribute to the ultimate objective of the Convention" [UNFCCC, 1997: Article 12(2)]. Motivated by the requirements of the Kyoto Protocol and regional programmes, growing international carbon markets have resulted in new capital flows, and there are even considerable financial and technical resources available to developing countries, including India, through carbon credits trading in both mandatory and voluntary markets. India may also benefit by linking the national system for emission trading to the global emission trading scheme for CO2 in the future. The initiation of the carbon trading programme might take India as a pathfinder in environmental regulation amongst emerging economies (Duflo, Greenstone, Pandey, & Ryan, 2010).

Literature Review

The novelty of carbon trading scheme and their policy importance present a unique research opportunity on both the theoretical and policy levels. Developing and emerging countries like India, Brazil and China are particularly important in terms of the supply and generation of CDM credits to the market. Study on the markets facilitates a better understanding of how they are developing and functioning, and is essential in giving the markets the best chance to succeed (Knox, 2009). The study underwent extensive literature research, academic research, relevant industry reports, CII and international consultancy organization's reports like PWC, KPMG, WBCCC, Ernst & Young etc.

Literature about carbon credit in a developing country like India reveal that awareness of carbon credit trading stays well behind on a global scale despite the perceived importance by the companies. A careful study of the literatures indicates that there are ample opportunities to study more on this subject. A greater focus on the perceptions of the Indian companies about carbon trading could provide some useful insights as to how Indian companies can be motivated towards carbon credit trading. This study focuses on enormous opportunities to invest in efficient, clean technologies and resource efficient infrastructure which could be inspiring and beneficial for the Indian companies in securing global solutions to reduce carbon footprints and at the same time to improve the bottom line.

Waldegren (2012) stated that emission trading preceding carbon trading was initiated in the late 1970s in the US. The market slowly developed by the engagement of private sector and the emergence of new interest groups. Carbon credit is also perceived as a major market-based instrument. The global carbon market started functioning by the adoption of the Kyoto Protocol and its 'flexibility mechanisms'. But over the years, carbon credits and carbon permits are traded in the global carbon market much like any other commodity such as gold, silver, coffee, or grain (Waldegren, 2012). Lecocq & Ambrosi (2007) stated that the CDM has exhibited to a large extent its power as a tool to engage developing countries in mitigating climate change. They noted that the CDM represents only the tip of the iceberg of the potential of market mechanisms and other approaches to mitigate climate change in developing countries. Effective international market mechanisms are required to facilitate countries in meeting their targets in a cost-effective manner and to encourage the participation of developing countries in meeting the goal of the UNFCCC (Murphy, Drexhage , & Wooders, 2009).

The emerging economies of Asia and Latin America, which represent the major share in expected growth in emissions can be benefited through investment in low-carbon intensive production by the developed countries and it is also pointed out that carbon trading could be a solution to the climate change to a very large extent (Barwaldt, Leimbach, & Muller, 2009). China has witnessed a rapid establishment of many "climate exchanges", "carbon exchanges" or "environment exchanges" in recent years. China today has more than one hundred other "exchanges" either launched or under development, all aiming to trade carbon in the future (Han, Olsson, Hallding, & Lunsford, 2012). The global carbon trading market is distinctive for the developing

countries since buyers are only from industrialized countries. According to Manea (2011), the carbon market is the fastest growing market in financial history and has the possibility to be the largest global commodity market within the next decade . Now banks are also playing an important role to act as financiers of emission reduction projects and bring together buyers and sellers on a common platform through credit mechanism (Gupta, 2010).

Carbon market could be an important solution to climate change because creating market and putting a price on carbon emissions can cut emissions more efficiently than direct regulation (Whittington, 2009). The carbon price might encourage new technologies and activities to help businesses in reducing carbon emissions. Many companies presently use an internal carbon price to calculate the value of future projects and to guide investment decisions.

According to findings from Carbon Disclosure Project (2013), many major publicly traded companies in the United States have integrated an "internal carbon price" as a core element in their ongoing business strategies. Such carbon pricing has become standard operating practice in business planning. In World Bank (2013) report 'Mapping Carbon Pricing Initiatives' it is stated that the main challenge for the global community will be to find a balance between the emerging plethora of carbon pricing schemes, which allow progress on carbon pricing initiatives at the national level and global incentives to reduce emissions, which would allow the world to remain below a 2°C limit.

Objectives of the Study

The industrialisation and fast growth of developing countries poses a fundamental question for legislators and researchers working on environmental sustainability, low carbon innovation and green growth. The question is whether the industrial, economic, and social transformation of developing and emerging countries will follow traditional high carbon growth trajectory or manage to strive towards more low carbon sustainable growth pathways. This study ,therefore, aims to :

(i) give an overview of the carbon market,

(ii) explore the rationale of the carbon credit trading policy in India,

(iii) discuss a few case studies in India about useful and effective low carbon business practices that might benefit a wide range of companies in terms of carbon credit trading.

Methodology

With these stated objectives in view, a number of companies availing carbon credit benefit in various sectors like power, transport, iron and steel were considered and five companies have been chosen for our study. Regarding the source of data, the study has taken help of literature survey as included in, journals, magazines, books, news papers, and websites.

Importance of Carbon Credit Trading

Carbon trading is a key policy instrument. It has emerged in response to the challenge of climate change. Though trading of carbon credits on its own is not sufficient to avert catastrophic climate change but its benefits are likely to be beneficial beyond immediate emission reductions. Carbon trading represents a significant first step in the highly problematic switch to a low carbon economy.

Through the establishment of Carbon Markets, reduction in GHG emissions became a tradable commodity

because of the following reasons. First, Trading of carbon credit itself gives carbon a *price.* If carbon has a price, then this will push companies to invest in alternatives.Second, Trading acts as a *platform* that plays an important role in encouraging deeper emission cuts in the future. Third, carbon trading does not seek to *stop* emissions completely, but more to provide the incentive for significant reduction. Fourth, it does not sell itself as a solution for climate change- recognizing implicitly that this is a challenge so substantial that *any solution* will help the situation, not address it entirely.

Carbon Market

Fixing a price to carbon emissions and developing markets to trade them is considered to provide financial incentives to push emitters to undertake emission reduction efforts. Firms with high emissions required to pay a price for each tonne of CO_2 which they are emitting - called the 'carbon price' and they can buy credits from those who have reduced their emissions below the target level. This trading forms the basis of the carbon market. Carbon markets and carbon trading have gained traction globally. Carbon credits, carbon allowances, carbon offsets, verified emission reductions and many other terms are often used interchangeably. Across all platforms and whatever names traded can simply be thought of as a new commodity 'carbon' (Dickinson & Hagen, 2009).

Globally the concept of carbon credits and carbon trading originated from the Kyoto Protocol of UNFCCC in 1997. This mandates that countries who have ratified the Kyoto Protocol must meet set emission reductions, while other countries and companies are voluntarily reducing their emissions through voluntary carbon markets. The generation and trading of carbon credits is a key constituent to achieve these emission reductions. Carbon credits are measured in tons of carbon dioxide (CO_2). Each credit is equivalent to one ton of CO_2, with a monetary value on the cost of polluting the air. Placing a value on carbon aims to prevent it from being emitted in the first instance and to make its removal from the atmosphere financially viable. (Kumari, Divya, Revanth & Swetha, 2013).

↳ **Compliance Market:** The compliance market (otherwise known as the regulatory market) refers to the markets that subsists to facilitate those with emission caps imposed on them by any regulatory body to buy or sell carbon credits for compliance as per regulation. Compliance markets are created and regulated by mandatory regional, national and international carbon reduction regimes, such as the Kyoto Protocol , the European Union's Emissions Trading Scheme etc. Compliance Market generates and trade GHG emission reduction known as Certified Emission Reductions (CERs) that are regulated and directly initiated under Kyoto Protocol's Clean Development Mechanism. (CDM). These are expressed in tons of carbon dioxide (CO2) equivalents. Compliance market is the product of the flexible mechanism established by Kyoto protocol adopted in the conference of the UNFCCC in 1997 (State of the Voluntary Carbon Market, 2013).

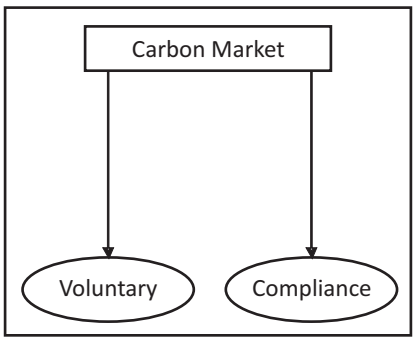


Table 1. Old Carbon Trading Scheme

Scheme	Year	Objective
Kyoto Protocol (KP)	2005	The target was to reduce emission level by 5% below 1990 levels by 2008-12. The second commitment period has been started from 2013. Country can reduce emission under the Clean Development Mechanism (CDM)
European Union Emission Trading Scheme (EU-ETS)	2005	Mandatory for all 27 EU members. The target is to reduce emissions by 21% below 2005 levels by 2020.
New Zealand Emission Trading Scheme	2010	Mandatory and the target is to reduce greenhouse gas (GHG) emission between 10 and 20 percent on 1990 levels by 2020.
Northeast U.S. Regional Green House Gas Initiative (RGGI)	2009	Launched with the objective of reducing emissions by 10 percent below 2009 levels by 2018.
Japan: Tokyo Metropolitan Trading Scheme	2010	Launched to cut emissions by 25 percent by 2020 from 1990 levels.

↳ **Voluntary Market :** The voluntary market functions outside the compliance market. Voluntary markets support activities to reduce emissions not mandated by policy makers. This market is a place where any individual, business, government and NGO can participate. This market is unregulated and includes a range of different trading relationships. Companies that purchase credits for this reason do so to enhance their brand value with a customer base that wants to purchase goods and services from environmentally-credible companies (Tananbaum & Palla, 2009). Voluntary market generate and trade GHG emission reduction outside Kyoto Protocol is measured according to internationally agreed methods and are quantified in standard units called Verified Emission Reductions (VERs). Historically, voluntary carbon markets have served as sources of experimentation and innovation in the carbon markets for reaching , to reach poorer and smaller communities in developing countries.

The Carbon market has had a fortunes first few years of experience, but it could still grew into a powerful mechanism for tackling climate change and rewarding green business. In spite of the uncertainty in the present emission trading market, the general consensus is that emission/carbon market will be reinforcing in future. Since the new mechanism is presumed to push an additional burden of responsibility onto developing countries and would require developing countries to significantly alter their emissions trajectory, this new mechanism can be applied more broadly. The Durban conference has finally forced all big polluters, including emerging economies such as India, China to limit their green house gas emission. Countries agree for the first time to work towards a pact imposing curbs on GHG emission on all large polluters, including emerging economies such as India and China. Prior to Durban Conference, the global emissions agreement under the Kyoto Protocol, developing countries could voluntarily commit to emissions reductions. The Durban Conference brought a mandate to negotiate a new international binding agreement at the international level by 2015 and it was embedded that all major emitters including emerging economies like India , China and Brazil need to take ambitious emission reduction commitments to combat climate change ("Durban Climate Change Conference 2011 latest...," 2011).

International emission trading has being prominently discussed as a policy instrument for mitigating global greenhouse gas emissions in academia and politics (Table 1) (Stern 2007). There is an increasing awareness that in Asia-Pacific that carbon trading could be efficient and economic way to reduce GHGs emission (Table 2). The global carbon market witnessed the approval of an ambitious plan that will bring a nationwide cap-and-trade scheme to Australia, Quebec, California, Mexico, Republic Korea, Brazil, etc. in the near future.

↳ **Carbon Funding and Purpose :** The world bank carbon finance initiatives has established a number of technical assistance facilities for capacity building and project preparation and also extending carbon market by

Table 2. Emerging Emission Trading Scheme

India: Perform, Achieve and Trade Scheme	India has pledged a 20 to 25 percent reduction in emissions intensity from 2005 levels by 2020. Trading is set to begin in 2014 after a three-year roll out period.
South Korea Emission Trading Scheme	The Government of South Korea has a set a 2020 emission reduction target of 30 percent below projected " business as usual ". Trading is expected to begin in 2015.
China: Pilot Carbon Trading Scheme	China approved pilot carbon trading in seven provinces and cities in 2011 and a national trading scheme is expected by 2016.
Australia: Clean Energy Bill	The target of the Australian Government is to cut emissions by 5 percent below 2000 levels by 2020. A market based trading scheme is expected by 2015.
California Climate Change Law (AB 32)	Launched in 2013 with the target to cut the State's emissions to 1990 levels by 2020. This covers emissions from manufacturing, power plants and transportation fuels.
Western Climate Initiative (WCI)	Launched in 2013 with the target to cut emissions by 15 percent below 2005 levels by 2020. It covers California, Quebec and possibly Ontario.
Brazil (SCE EPC)	The SCE EPC is a simulated ETS with 22 majr companies. Allowances can be traded through the exchange platform BVTrade.

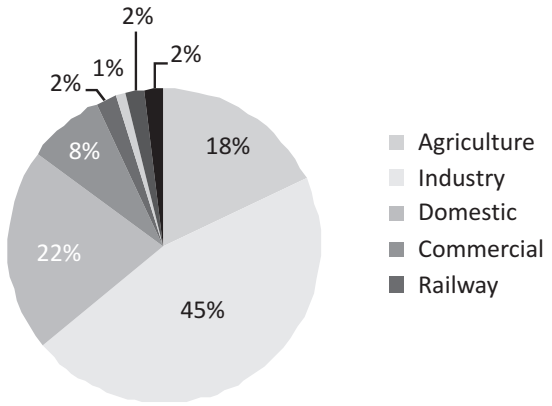
Source: Adapted from G. Han, M. Olsson, K. Hallding, & D. Lunsford (2012). China's Carbon Emission Trading: An Overview of Current Development, Fores Study: 2012:1. Retrieved from http://www.sei-international.org/mediamanager/documents/Publications/china-cluster/SEI-FORES-2012-China-Carbon-Emissions.pdf

Table 3. Carbon Fund Facilities

Fund	Country	Purpose
World Bank's Umbrella Carbon Facility (UCF)	World bank	UCF of World Bank was established to handle large greenhouse gas reduction purchase under the Kyoto Protocol flexible mechanism. Approximately, 75% of the money in UCF represents private capital.
Clean Development Mechanism Fund (CDMF)	China	CDMF is established to finance climate change mitigation projects in priority sectors like renewable energy, energy efficiency, coal mine methane recovery and use.
Netherlands Clean Development Mechanism Facility (NCDMF)	Netherland	NCDMF was established to support CDM projects in developing countries in exchange for emission reductions. This fund also support in promoting sustainable development and creating carbon market.
The Danish Carbon Fund (DCF)	Denmark	This fund was established to provide support for CDM projects. DCF's project portfolio includes energy efficiency, waste management, renewable energy, oil and gas.
The Spanish Carbon Fund (SCF)	Spain	SCF was established to support projects from South Asia, East Asia and Pacific, Latin America. The project includes solid waste management, energy efficiency, HCF-23 destruction, Transportation and hydropower.
The Community Development Carbon Fund (CDCF)	World Bank	CDCF was established to support projects of the community level in the poorest countries. CDCF intends to develop carbon market by developing small scale methodologies for CDM projects.
Bio Carbon Fund (BioCF)	World Bank	BioCF helps in expanding carbon markets for emission reduction in agriculture, forestry and other land uses
Italian Carbon Fund (ICF)	Italy	ICF was established to support projects from North Africa, South Asia, East Asia and Pacific, Middle East.
The Carbon Partnership Facility (CPF)	World Bank	CPF is the World Bank's new carbon finance instruments. CPF is providing carbon finance to long term projects. CPF will be pioneer in broadening the use of the CDM. CPF will bring together industrial country buyers and developing country sellers of emission reductions.
The Forest Carbon partnership Facility (FCPF)	World Bank	FCPF has the objective for capacity building for REDD+.FCPF focuses on the reduction of emission from deforestation and forest degradation.
The Carbon Finance Assist (CF-Assist)	World Bank	CF-Assist was established to help developing countries and economies in transition to develop local expertise base to enable them to develop projects for carbon markets.
CDCF+	World Bank	CDCF + helps LDCs and poor communities to prepare and implement small scale carbon project, provide technical assistance to project owners to bring the project to validation stage and provide technical training for effective monitoring.

Source: Adapted from Carbon Finance (2010): Carbon Finance at the World Bank. Retrieved from http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/For_Web_CF_at_WB-web.pdf

Figure 1. Energy Consumption in India : Sector Wise



Source: Adapted from Energy Statistics Report (2014)
Retrieved from http://mospi.nic.in/mospi_new/upload/Energy_stats_2014.pdf

providing carbon finance to both developing countries and economies in transition (Table 3).

India's Perspective

At the Durban climate change convention, India agreed for new global post-2020 climate regime that may impose emission cut target for all major polluting nations including India though its per capita emission would continue to be much lower than that of developed nations in the next 25 years. A significant part of citizens still lack access to electricity and the low energy consumption of the backward class generally contributes to low per capita emissions. The growth of the service sectors has increased drastically over the years, and the contribution of the services to the growth of GDP is significant at present. As the service sector has lower carbon intensity than industry, the overall GHG emission on a per capita basis remains low.

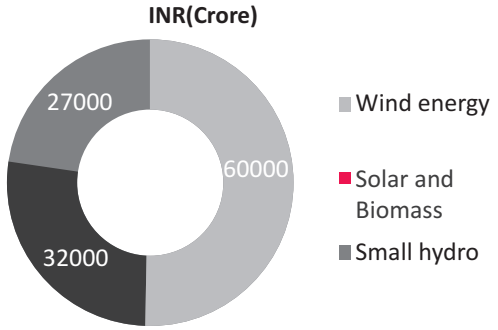
The Indian economy, which is facing growth challenges and hard competition from other developing economies like China need to take into consideration new growth dynamics in the wake of natural resource constraints. Improvement in the economic and environmental efficiency of production can be achieved with improved technology and knowledge transfer from more advanced economies (United Nations Environment Programme, (UNEP), 2011). There is an opportunity for massive investment of industrial and capital assets in the near future due to growth of the Indian economy and thus, India can opt for efficient, clean technologies, and resource efficient infrastructure. Environmentally conscious investment decisions can allow the country to leapfrog into an era of carbon-efficient advanced technologies and this could bring foreign direct investment in new and modern technologies (CII Discussion Paper, 2008).

The issue of emission needs special focus in India since India being one of the largest and rapidly growing developing countries. India's energy demand is in rapid increase in recent years. The Figure 1 shows that industry is the major area of power consumption. Indian manufacturing industries play a significant role in the country's economic growth.

However, to be globally competitive, this sector has to upgrade the technologies and should achieve energy as well as emission efficiency. Explicit policy measures should be formulated to support medium sized and older firms to upgrade technology and invest in technology import and research & development pertaining to eco-innovation to reduce CO2 emission (Sahu & Narayanan, 2013).

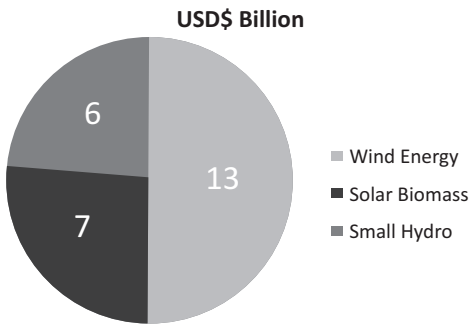
Demand for fossil fuels has soared in developed and developing countries in the past decade. Businesses and industry are demanding more energy, whether to power new electrical appliances coming on to the market or to automate business processes. In addition to that the rise in growth in the resource intensive Manufacturing

Figure 2. Energy Efficiency Market (INR)



Adapted from: The Climate Group. (2011). India's clean revolution. . Retrieved from http:// www.theclimategroup.org /_assets/files/Indias-Clean-Revolution -Report-March-2011.pdf

Figure 3. Energy Efficiency Market ($)



Adapted from: The Climate Group. (2011). India's clean revolution. Retrieved from http:// www.theclimategroup.org /_assets/files/Indias-Clean-Revolution

sector is enabled and facilitated by an increasing rate of material use leading to diverse impacts to the environment. According to the National Productivity Council of India, the cost of environmental damage has been estimated at approximately $32 billion (Planning Commission, Government of India, 2012).

To envision a more sustainable future and a transition away from today's fossil-fuelled economies, emissions trading has become the most favoured policy instrument despite its current failures (Putinelu, 2012). India's energy efficiency market will be treble to INR 351,500 crore (USD 77 billion) in the next 10 years driven by demand in buildings, industry, transport and energy storage. All enterprises in India including small are also increasingly realizing the opportunities presented by low carbon economy. By 2020 the wind energy market is expected to be worth INR 60,000 crore (USD 13 billion), solar and biomass INR 32,000 crore (USD 7 billion) each and small hydro INR 27,000 crore (USD 6 billion) (Fig. II & III) (The Climate Group,2011).

Realizing that the market is changing, and not to be left out in the global race, Indian businesses are beginning to take on climate change as a business issue. What is needed now is for the government of India to design a frame work and to engage with the government of the world and private sector for a low carbon future. Those countries that succeed in attracting private capital into low-carbon growth areas, cleaner and renewable energy, energy efficiency and decarbonization will enjoy manifold payback in terms of new jobs, technological innovation, research and development, more resilient and secured energy system and eventually stirring to sustainable economies.

Rationale for Developing a Carbon Credit Trading Policy in India

India has already developed national climate change policy and the NAPCC of the Government of India published in 2008 demonstrated India's willingness to participate in the global mitigation effort as long as this effort was self-determined and did not hamper economic growth (Jha,2009) Along with prioritizing India's development imperatives, the NAPCC, for the first time, established a concrete framework to address climate in the domestic context.

India is a large emerging economy with a great diversity of geographical regions, biodiversity and natural resources. In India, there is a growing focus on energy and resource efficiency across all major industries. International environmental regulations can bring financial benefits in low carbon business, e.g. carbon credit and selling of Renewable Energy Certificates and opportunities based missions such as National Mission on

Table 4. Benefits of Carbon Credit Trading

Economic	Social	Environmental
Opportunities for innovation	Energy efficiency using clean technology	Combating against climate change
Availability of international finance	New market and new employment opportunities	Moving to low carbon pathway
Development of new industry	Community support	Sustainable use of natural resources
Accessing new technology	International commitment	Increasing awareness of environmental issues

Energy Enhanced Efficiency (NMEEE), National Solar Mission (NSM).

Acceleration of the private sector's role in low carbon growth in India requires a favorable and stable policy environment. The rationale for creating Policy for the Trading of Carbon Credits in India is based on the need for a developing a framework within which the country can generate carbon credits which can be sold on the international market in order to facilitate the development of initiatives and projects for renewable and alternative energy, energy conservation and efficiency, and reforestation. From social and environmental perspective, sustainability issues are transforming the competitive landscape, motivating organizations to change the way they think about business, markets, technologies, regulation and business environment.

According to International Emission Trading Association (IETA, 2012), carbon trading is an investment opportunity to businesses in terms of low carbon investment and is very much alive in the minds of industry. This study highlighted on a string of positive and legislative achievement in Asia and North America. Carbon trading schemes have great potential to lower greenhouse gasses while minimizing costs for industries. A Carbon Trading Policy can bring forth the following economic, social and environmental benefits (Table 4).

Establishment of domestic carbon trading market is essential for the price of carbon. Now this the right time to go for the development of carbon finance in the financial institute of India and at the same time to encourage private funds in terms of climate change. There is an urgent need to establish a financial mechanism for emission reductions. This can be established only when there is regulated, unified and standardized market in the country.

Company Case Studies

Large companies in India with their constant endeavors have been pursuing innovative ecological practices to fight against climate change. These companies have successfully identified low carbon schemes with a modern approach and have started earning carbon credits by implementing the same. Their experiences offer valuable lessons for others with similar opportunities. This section focuses upon the experiences and perceptions of five companies. These case studies have a clean sustainability approach and could be inspiring and interesting examples for others.

(1) CESC : CESC Limited is an integrated power utility company. CESC Ltd. was incorporated in the year 1978 with the name The Calcutta Electric Supply Corporation (India) Ltd. In the year 1983, the company commissioned the Titagarh generating station, with a capacity of 240 MW, which marked the beginning of a new approach to solve the State's power shortage. They serve 2.4 million customers within 567 square kilometers of Kolkata and Howrah, delivering safe, cost-effective, and reliable energy to their consumers. In the year 2001, the company's Titagarh Thermal Power Station was awarded the ISO 9002 certification. CESC is one of India's foremost private sector companies with a market capitalization of US $ 35 billion and a turnover of US $ 7 billion. CESC has recognized climate change adaptation as a key long-term business

strategy, and has developed low carbon oriented quality standards for services and solutions that also meet the current and emerging need of climate-related strategies.

A carbon dioxide emission reduction project of CESC at its Budge Budge power generating station has got approval from the United Nations Framework Convention on Climatic Change (UNFCCC) for carbon credit, which it claims is the first for a coal-fired power plant in the world. A thermal power plant of CESC, one of the oldest power companies in Asia, has become eligible for carbon credit. Another clean development mechanism (CDM) project at Titagarh is in the pipeline for approval from UNFCCC. These projects have been validated by consultant DNB of Norway ; 40,000 units of carbon credit from all these projects could increase the bottom-line by ₹ 4 crore approximately. Despite a revenue line, carbon credit trading could assist the company to access cheap global funds and exclusive private equity funds for future green projects ("CESC's Budge Budge unit gets carbon credit nod," 2006).

(2) RELIANCE POWER : Reliance Power Ltd., a part of the Reliance Anil Dhirubhai Ambani Group, is India's leading private sector power generation company. The company is engaged in the development, construction, and operation of power generation projects and has the largest portfolio of power projects in the private sector. The project portfolio of Reliance Power includes three Ultra Mega Power Projects (UMPPs) of 3,960 MW each, world's largest Concentrated Solar Power (CSP) Project, and one of the largest photovoltaic (PV) and wind projects of India (Reliance Power, 2012).

(i) Tilaiya UMPP: Jharkhand Integrated Power Ltd., a SPV established to implement the Tilaiya UMPP. Tilaiya UMPP is another 3,960 MW pit-head based super-critical power plant in Jharkhand, India. Tilaiya UMPP was registered under CDM framework which will help it to earn 21.3 million carbon credits.

(ii) Krishnapatnam UMPP : Coastal Andhra Power Ltd., a SPV established to implement the Krishnapatnam UMPP. Krishnapatnam UMPP is a 3,960 MW imported coal based super-critical power plant in Andhra Pradesh, India. Krishnapatnam UMPP is a CDM project and entitled to earn approximately 12.3 million carbon credits.

(iii) Sasan UMPP: Sasan Power Ltd., a SPV established to implement a 3,960 MW pit-head based super-critical power plant in Madhya Pradesh, India. Sasan has qualified for carbon credits, which will help it to earn approximately 22.4 million carbon credits.

(iv) Samalkot: Samalkot Power Ltd., a SPV established was to implement a 2,460 MW combined cycle gas turbine technology based power plant, in Andhra Pradesh, India. This CDM project is entitled to earn 55.5 million carbon credits.

(v) Dahanu Solar: Dahanu Solar Power Pvt. Ltd., a SPV has developed a 40 MW PV project in Rajasthan, India. This is one of the largest PV projects registered under CDM. Dahanu Solar is entitled to earn approximately 0.7 million carbon credits.

(vi) Vashpet Wind: Reliance Clean Power Pvt. Ltd., a SPV has commissioned a 45 MW large - scale wind farm in Maharashtra, India. This wind farm would entitle the company to earn 0.7 million carbon credits.

(3) ADANI POWER : Adani Power, a subsidiary of Adani Enterprises and part of the Adani Group, a global integrated infrastructure player, had bagged carbon credits by the installation of the phase III of its 4,620 MW

power plant in Mundra, Gujarat, under the clean development mechanism from UNFCCC. This project makes the Mundra plant world's first coal fired power project to receive carbon credits. With this CDM project, the plant is expected to generate about 1.8 million certified emission reductions (CERs) each year. The company is expected to earn INR 600 crore by trading these carbon credits during the first 10 years of its operations ("Adani Power's Mundra plant to earn ₹ 600 crore in carbon credits," 2012).

(4) TATA SPONGE IRON LTD. (TSIL) : Tata Sponge was initially set up as a joint venture company between Tata Steel and the Industrial Promotion and Investment Corporation of Orissa Limited (IPICOL). Over the years, TSIL has been setting benchmarks in its industry vertical in reducing its carbon footprint with green cover within and around the plant premises, producing power from waste heat in its twin captive power plants, keeping emissions well under prescribed norms, and becoming a zero-discharge company. The company invested in diverse energy conservation by conserving electricity by replacing high power consuming equipment with low ones, installed VVF, cut off power to idle equipment during shut downs, and so forth. TSIL is registered with UNFCCC for its CDM project to use waste heat in its 7.5 MW power plant and was entitled to earn ₹ 2 crore in carbon credits from CDM (The Global Compact, 2007).

(5) DELHI METRO RAILWAY CORPORATION (DMRC) : DMRC is a joint venture of Govt. of India and Govt. of National Capital Territory of Delhi. This PSU was established for implementation and operation of rail based mass rapid transit system in Delhi and other adjoining areas of NCR. Besides construction and operation of Delhi Metro, DMRC is providing consultancy services to other domestic as well as international metro projects. DMRC is the first rail-based project in the world to be registered by the UNFCCC under the clean development mechanism (CDM). This CDM project started with the support of the Japan Carbon Finance Ltd. It has become the world's first rail project to earn carbon credits because of using regenerative braking system in its rolling stock. The company has earned ₹ 2.41 crore by selling of 82,000 units of carbon credits ("DMRC earns ₹ 2.4 cr through carbon credit," 2011).

Implications

Climate change has become a threat which business can no longer ignore. Climate change can result in biodiversity loss. The economic sectors of India like agriculture, fisheries, forestry, infrastructure, and tourism are also affected by climate change. Low carbon knowledge and putting carbon management in practice could be useful for managers in providing favorable conditions in support of firms' climate change adaptation measures.

In India, there is a growing focus on energy and resource efficiency across all major industries. International environmental regulations can bring financial benefits in low carbon businesses, for example, carbon credit and selling of renewable energy certificates and opportunities based missions such as National Mission on Energy Enhanced Efficiency (NMEEE) and National Solar Mission (NSM). Even though the perception of carbon credit trading is being accepted in controlling greenhouse gas emissions in big organizations in India, but many organizations, including SMEs, are yet to seize the benefit of this perception - less carbon emission, use of modern technology, improvement in productivity and quality, availing carbon funds, and improving bottom line through selling of carbon credits (Dutta & Roy, 2014). Company size is also a factor in implementing a carbon management strategy by a company. Smaller companies usually find it difficult to implement low carbon management in practice, while larger companies are relatively focused upon this issue due to their resource availability and pressure of the stakeholders (Matthews, 2012). However, companies, irrespective of size, must be well aware of the opportunities of carbon credit trading that will help them transition their own companies from high-carbon to low- carbon growth pathways.

Conclusion

To achieve low-carbon growth, corporates are expected to focus on a decarbonization strategy. Given that India is one of the fastest-growing economies in South Asia, promising a growth of over 8%, second only to China, it is expected that more and more companies will strategically include the climate change issue in their business agendas. Companies need to contribute with their strength of finance, technology, managerial efficiency, and entrepreneurial spirit to shift towards offering low-carbon climate friendly products and services. This contribution will reduce carbon emissions and create a carbon credits trading regime in India that will provide access to the international carbon market. Environmental integrity can be viewed as an important feature of the carbon credit mechanism, which is envisioned as important for the continued efforts to address climate change. The study demonstrates that it will be important to give more attention to the credibility of the theory of carbon reductions underlying the creation of carbon credits.

Limitations of the Study and The Way Forward

Despite theoretical soundness and broad scope of this study, it is necessary to clarify limitations. The perceived limitation of the study is the unavailability of corporate data. This limitation offers an opportunity to expand the study based on primary data from the concerned companies. This study uses some theories and concepts from environmental economics, statistics, survey reports, literatures of many areas relating to the environment (e.g. climate change, low carbon, carbon dioxide emission, etc.). However, this study does not try to raise questions related to the validity of these theories and concepts.

Many studies are being undertaken in carbon trading, but it appears that there is no parallel study about the relevance of such a trading market in India. The corporate world may benefit by trading of carbon while executing their business plans. Businesses have an important role in climate change mitigation through reduction in their own direct emissions from the use of their products and services. Reducing carbon emissions as a business strategy is emerging. Presently, carbon trading is being initiated in many developed and emerging economies. Therefore, it is expected that Indian companies must try to exploit the underlying benefits of this concept. Present literatures have given direction from different perspectives of carbon trading, but little consideration has been given to the rationale of carbon credit trading policy in India. It is, so far, not established what measures are needed for encouraging Indian companies to grab carbon trading opportunities as a battle against climate change.

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