RELEVANCE OF CLEAN DEVELOPMENT MECHANISM AND ITS RELATIONSHIP WITH ISO 14001 IN THE BACK DROP OF INDIAN ENVIRONMENTAL CONTEXT

A DISSERTATION WORK

SUBMITTED IN PARTIAL FULFILLMENT FOR THE DEGREE OF

MASTER OF TECHNOLOGY

IN

ENVIRONMENTAL SCIENCE & TECHNOLOGY

BY

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JULY 2009

Candidate's Declaration

I, hereby declare that the work presented in the dissertation entitled "**Relevance of Clean Development Mechanism and its Relationship with ISO 14001 in the Backdrop of Indian Environmental; Context"** in partial fulfillment of the requirement for the award of the degree of Masters of Technology(Environmental Science and Techanology), Department of Biotechnology and Environmental Sciences (DBTES), Thapar University, Patiala, is an authentic record of my own work, under the guidance of Dr. Susheel Mittal, Dean (R & SP, Thapar University) and Mr. S.K. Mehta, Director (IQMS, NOIDA, Uttar Pradesh). The report has not been submitted for the award of any other degree or certificate in this or any other University.

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Acknowledgement

I, consider it a great privilege to express my deep sense of gratitude to Dr. Susheel Mittal, Dean, R & SP whose patient and timely counseling and constant encouragement has helped immensely in completing this task.

I am highly indebted to my Co- guide Mr. S.K. Mehta, Director, IQMS, for his inspiring guidance, constructive criticism, appreciation and unwavering encouragement during the entire period of this investigation.

I am highly obliged to Dr. N. Das, Head of Department of Biotechnology and Environmental Science for support and allowed to do the dissertation from out of University campus.

I am extremely grateful to Dr. Anita Rajor, Lecturer, Department of Biotechnology and Environmental Science for providing me excellent co-operation, encouragement to complete this work.

I am very grateful to IQMS staff especially to Mayank and Nidhi who helped me a lot in completing this work.

I would like to express my heartful gratitude to Col. P.K. Goyal, Sampurnanand Sing, Nagesh Vikram Singh, Manmohan Lal, Rishipal, Ravi and all other classmates for their help and support.

I do not find words to express my feeling and deep gratitude to my parents whose everlasting encouragement, love and blessings made me able to complete this work.

I also acknowledge the help received from persons who helped me directly or indirectly.

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Content

Introduction

Climate change resulting from human activities is one of the most important environmental challenges in the world. Carbon dioxide (CO_2) and other greenhouse gases (GHG) are emitted into the air coming from several sectors of economic activity, and each year these emissions continue to rise. As they accumulate in the atmosphere, GHG increase the risk of negative environmental impacts from climate change. Many governments are developing actions to reduce GHG emissions through national polices that include the introduction of emissions trading programs, voluntary programs, energy or carbon taxes, and regulations and standards on energy efficiency and emissions (WBCSD, 2004). If GHG emissions need to be reduced to minimize the risk of dangerous climate impacts, then the resources and innovation of businesses are surely required (WRI, 2004). Many companies have experience in reducing their emissions and have identified business opportunities in the global carbon credit market. As a consequence, they need to understand and manage their GHG risks to establish a long term success, remain alive in a competitive globalization and be prepared for future national or regional climate policies.

As the environment has become an increasingly important issue to business, there has been a corresponding rise in the use of environmental management tools (Cole, P. 2003). These tools can help organizations to improve their environmental performance and sustainability to control climate change impacts around the world. Environmental Management in organizations and governments can be achieved using standards and programmes (MacDonald, J. 2005). Related to climate change, such standards introduce organizational concepts to identify, quantify, monitor and verify GHG emissions in an environmental management way. In other words, it means environmental management on climate change.

CDM

The Clean Development Mechanism, or CDM, was a late invention in the negotiation of the Kyoto Protocol. The 1997 Kyoto Protocol, a milestone in global efforts to protect the environment and achieve sustainable development, marked the first time that

governments accepted legally-binding constraints on their greenhouse gas emissions. The protocol also broke new ground with its innovative "cooperative mechanisms" aimed at cutting the cost of curbing these emissions. As it does not matter to the climate where emission reductions are achieved, sound economics argues for achieving them where they are least costly. The Protocol therefore includes three market-based mechanisms aimed at achieving cost-effective reductions.

— International Emissions Trading (IET), Joint Implementation (JI), and the CDM.

The Clean Development Mechanism (CDM) is a mechanism defined by the Kyoto Protocol, whereby projects with a component that includes the reduction of Green House Gas (GHG) emissions are implemented. The CDM is the only mechanism in the Kyoto Protocol that involves non-Annex 1 countries, by enabling them to host emission reduction project on their territory.

It has two fold objectives:-

- To assist countries not included in Annex 1 to the UNFCCC ("developing countries") in achieving sustainable development, and
- To allow countries that are included in Annex 1 to the UNFCCC and have inscribed Specified greenhouse gas (GHG) emission target in Annex B to the Kyoto Protocol (the traditional industrialized countries) to acquire Certified Emission Reduction (CERs) from CDM project activities undertaken in Non-Annex 1 Parties and count them towards their Kyoto targets.

The critical factor for the successful operation of CDM transaction is an active international market for certified emission reduction units (CERs) as a result of intervention to reduce GHG emissions. An international market has to facilitate partnership between several bodies, namely project developers, investors, independent auditors, national authorities in host and recipient countries and the international agencies that are responsible for implementing the Kyoto Protocol. Because of differing interests of the various players, there is a danger that CDM transaction may get bogged down in bureaucracy, resulting in investors or other parties losing interest. Thus, a successful international market framework for CDM transaction must be driven by a number of fundamental principles. The framework must:

1. Result in agreed sustainable development that meets national objectives for the host country (Kyoto Protocol) and not just emission reduction (ER) through CERs for the recipient country.
2. Help maximize the generation or supply of cost-effective CERs.
3. Provide reliable information and secure access for the buyers of CERs.
4. Provide legal recourse for both buyers and sellers of CERs.
5. Meet the needs of a wide spectrum of potentially diverse project types and proponents.
6. Provide a real incentive for a broad base of investors to invest in CDM projects and just attract a limited band of "green" investors.
7. Result in CDM project that are additional to defined baselines.

The CDM, contained in Article 12 of the Kyoto Protocol, allows governments or private entities in industrialized countries to implement emission reduction projects in developing countries and receive credit in the form of "certified emission reductions," or CERs, which they may count against their national reduction targets. The CDM strives to promote sustainable development in developing countries, while allowing developed countries to contribute to the goal of reducing atmospheric concentrations of greenhouse gases.

International community goes far beyond the CDM and has to do with the stringency of the Kyoto targets, with the uncertainty over the costs of meeting these targets. What matters here is that the debates leading to Marrakesh had a lasting influence on the rules and the operations of the CDM.

Background

Concerns about Green House Gas (GHG) emissions and consequent Global Warming and other climate change problems have prompted the world community to think of viable solutions to the problem. The United Nations Framework Convention on Climate Change (UNFCCC) provided the required platform to discuss the issues and to identify mechanisms to address the global problem. One of the products of this initiative was the Kyoto Protocol, which sets legally binding targets for cutting developed country's emissions.

Within the Kyoto Protocol, the Clean Development Mechanism (CDM) is a Cooperative Mechanism between the Kyoto Protocol signatory developed countries (Annex-1 countries) and signatory developing countries (Non Annex-1 countries). It is a flexible mechanism that allows the Annex-I countries to achieve their GHG emission reduction targets by investing in projects in non Annex-I countries. CDM is designed to assist the signatory developed countries to meet their emission reduction targets while also contributing to the sustainable development of the signatory developing country and ultimately achieving the goals of the UNFCCC.

The History of CDM

The CDM, initially proposed as a Clean Development Fund (CDF) by Brazil, was meant to be a fund for non-compliance penalties of developed countries, which would facilitate emission reduction projects in developing countries. According to Goldemberg (1998), the CDM was a result of a political compromise when the US wanted emissions trading with mandatory reduction commitments for all countries. This was unacceptable to the G77 and China. Voluntary commitments suggested as an alternative, was also not accepted. Under the leadership of US, the CDM emerged as a form of "joint implementation for credit", thus combining the ideas of "joint implementation" and "emissions trading" (Toman and Cazorla, 2001) and involved certified voluntary developing country participation. (Earth Negotiations Bulletin, 1997).

Through the CDM projects, Annex 1 countries could gain emissions reduction credits in developing countries. The CDM was resisted by India and China. It was a way to make developing countries participate (Panayatou, 1998; Mwandosya, 1998; Toman and Cazorla, 2001), which had been refusing to take on commitments till then (Cavard etal, 2001). The CDM would also prepare developing countries to face possible future emission limitations or reduction commitments (Sinisalco etal, 1998; Panayatou, 1998).

The CDM

Article 12 of the Kyoto Protocol explains that the purpose of CDM is to assist Non-Annex 1 parties in achieving sustainable development and to contribute to the ultimate objective of the Convention. CDM would assist the Annex 1 Parties in achieving cost-effective GHG mitigation. Annex 1 parties could take up projects in developing countries

(i.e. Non Annex 1 countries), which would generate "certified emission reductions" that could be used by Annex 1 Parties to offset their own commitments.

CDM is a private sector effort

First, the CDM was expected to be largely a private sector driven effort. This would be so because the bulk of emissions in Annex 1 countries arise from the private sector (thus they would need to seek cost efficient solutions such as CDM) and private sector capital flows in towards developing countries in the 1990s rose faster than that of overseas development assistance (Kete etal, 2001). The primary goal of the CDM was to guide foreign corporate investment into developing countries towards sustainable development (Grubb, 1999).

Efficiency and Equity perspective in the CDM

The basic theory of emission trading drives the economic rationale behind the CDM. The CDM allows for cost efficient reduction of GHG emissions by locating the project where the marginal abatement costs are the lowest. Countries differ with regard to marginal abatement costs because of their different dependencies on production activities that emit GHGs, resource efficiency and dependence or access to energy sources (Ott and Sachs, 2000). Under these conditions both trading entities gain as long as the costs of reduction differ. The CDM promoters herald it as a win-win partnership for both developed and developing countries. For industrialized countries, CDM could be additional to Joint Implementation in achieving cost efficient emission reductions; for developing countries CDM could be a new channel for financial assistance, investments to promote sustainable development, technology transfer from developed nations and a vehicle for promotion of equity to achieve more holistic objectives of the Kyoto Protocol. (Goldemberg, 1998). The CDM has however aroused a mixed set of assessments and expectations with regards to who would benefit the most. Skeptics point out the flaws in this rosy situation of mutual gain.

When CDM is implied as cost effective this means that industrialized countries have acquired something that would be otherwise expensive to obtain in their own country. The cost incurred in a CDM project is in lieu of a carbon credit. This credit is taken from the account of the developing country and subtracted from the emission budget of the developed country.

It is thus necessary that the developing countries also get fair or equitable gains. In order to gain the most cost efficient solution equity could be put at stake.

Some Technical and Operational issues in the CDM

Tied to technical complexity is the issue of technical and institutional capacity of the host country to carry out CDM projects. A typical CDM project requires significant technical knowledge as indicated by the activities in a typical CDM project cycle depicted in Table 1

Table 1: A Typical CDM Project Cycle

Phase	Typical Activities	Key Institutions
1. Project development, design and financing.	Project identification and formulation, conducting feasibility and baseline studies, financing, seeking government approval and assurance (CDM projects for certification might need to fulfill certain criteria some of which may be: extent of technology transfer, existence of agreements for sharing project benefits, project liability), insurance options in case of project failure.	National governments, Project developers, NGOs, Development Banks and other investors, Insurance institutions.
2. Validation and Registration	Approval of project baseline and additionality, ensuring adequate monitoring provisions, ensuring public comment, registering project with CDM Executive board.	Independent third parties, CDM Executive Board
3. Project Implementation	Technology implementation, technology maintenance.	Project operators
4. Project Monitoring	Checking project performance, keeping records Technology maintenance.	Project operators
5. Verification, Certification and Issuance of Credits	Assessing quantity of emission reductions achieved verification of emission reductions, certification and issuance of certified emission reductions.	Independent third parties, CDM Executive Board

Besides the technical and operational difficulties involved it would also be worthwhile to note that emission trading as a market-based instrument is not so popular in certain countries. For example, the traditional approach in Europe has been to rely more on carbon taxes than emissions trading.

Types of CDM

Four different types of CDMs have been proposed:

1. **Bilateral CDM:** In this model, most of the CDM activities such as project selection, financing and sharing of credits are worked out directly between Annex 1 and Non-Annex 1 parties on a project-by-project basis. The bilateral CDM is preferred more by the private sector and industrialized countries. The CDM is seen as a key flexibility instrument whose main purpose is to reduce compliance costs (Yamin, 1998).

   Activities are favored by the private sector, industrialized countries and several large developing countries where the majority of the foreign direct investment is concentrated and where the markets are relatively better developed than e.g. markets in Africa. Another concern with the bilateral projects is the high transaction that might favor more capital-intensive projects rather vis-a-vis the small renewable energy projects. It might not lead to investment in the key sectors that the developing countries might want to develop. Bilateral CDM, which depends on a project transaction, might also not be very favorable to the developing country parties, which lack the capacity to negotiate CER prices placing the developing countries on an unequal footing with the developed country partner.

2. **Multilateral CDM:** This is also known as the portfolio approach where funds from Annex 1 countries are collected in a centralized fund and then channeled towards project activities in developing countries (in an entity like the Prototype Carbon Fund in the World Bank). Since the developing countries do not directly negotiate with the private sector, the power imbalance between negotiators is not as much as in the case of the bilateral CDM. This approach will also mitigate the geographical imbalances that might occur in project investments where some developing countries are favored over others.

3. **Unilateral CDM:** The whole exercise of project development, financing, and all the associated risks are concentrated in the host countries. Thus the host countries should have enough capacity and resources to select, develop, finance and operate a CDM project on their own. Unilateral projects are expected to be more consistent with developing country priorities. The concern regarding the low hanging fruit could be

suitable addressed through this type of CDM as developed countries will no longer be able to avail the cheapest and the most attractive options. In fact since there are no rules that specify as to what constitutes a CDM project, policies such as removal of coal subsidy policies or price reforms in the energy sector can be treated as policy projects as well under unilateral CDM.

4. **Hybrid CDM:** This is like unilateral model in which all project selection and development occurs through the domestic institutions. Financing is sought from domestic and international sources to finance a portfolio of projects through a centralized mechanism (multilateral CDM).

Benefits of CDM

The basic principle of the CDM is simple developed countries can invest in low-cost abatement opportunities in developing countries and receive credit for the resulting emissions reductions, thus reducing the cutbacks needed within their borders. While the CDM lowers the cost of compliance with the Protocol for developed countries, developing countries will benefit as well, not just from the increased investment flows, but also from the requirement that these investments advance sustainable development goals. The CDM encourages developing countries to participate by promising that development priorities and initiatives will be addressed as part of the package. This recognizes that only through long-term development will all countries be able to play a role in protecting the climate.

From the developing country perspective, the CDM can:

- Attract capital for projects that assist in the shift to a more prosperous but less carbon- intensive economy;
- Encourage and permit the active participation of both private and public sectors;
- Provide a tool of technology transfer, if investment is channeled into projects that replace old and inefficient fossil fuel technology, or create new industries in environmentally sustainable technologies; and,
- Help define investment priorities in projects that meet sustainable development goals. Specifically, the CDM can contribute to a developing country's sustainable development objectives through:

- Transfer of technology and financial resources;
- Sustainable ways of energy production;
- Increasing energy efficiency & conservation;
- Poverty alleviation through income and employment generation; and
- Local environmental side benefits

CDM entail not only carbon reduction benefits, but also produce a range of environmental and social benefits within developing countries. Sustainable development benefits could include reductions in air and water pollution through reduced fossil fuel use, especially coal, but also extends to improved water availability, reduced soil erosion and protected biodiversity. For social benefits, many projects would create employment opportunities in target regions or income groups and promote local energy self-sufficiency. Therefore carbon abatement and sustainable development goals can be simultaneously pursued.

Many options under the CDM could create significant co-benefits in developing countries, addressing local and regional environmental problems and advancing social goals. For developing countries that might otherwise give priority to immediate economic and environmental needs, the prospect of significant ancillary benefits should provide a strong inducement to participate in the CDM.

Potential for CDM in India

The broad potential of GHG emission in key sector can understand by reviewing and summarizing existing studies that analyze India`s GHG emissions profile and their mitigation options.

A comparative analysis of GHG emissions from the energy sector (fuel combustion in different sectors) in 1994 with the estimates for 2000 shows an increase from 744 to 922 $MTCO_2$. The bulk of this increase is in the energy and transformation sector, and for the most part includes fuel consumed for power generation (Figure-1)

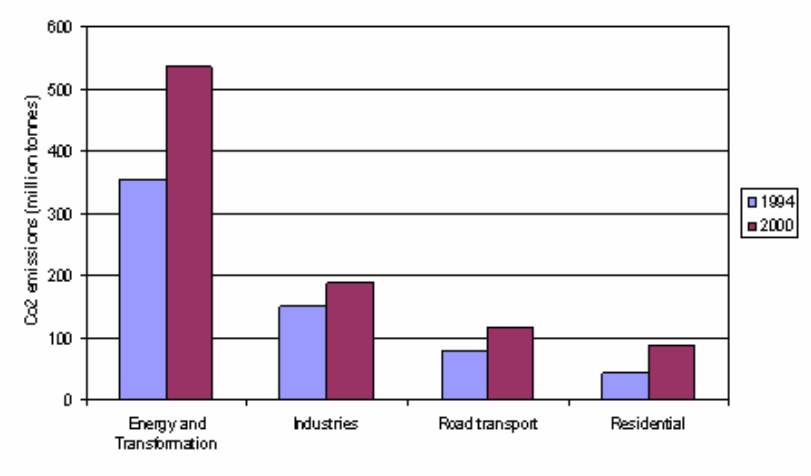

Figure-1GHG emissions from fuel combustion

Source: National Communication (2004).

Given the predominance of the energy sector, the following areas have been identified for mitigating GHG emissions:

1. Electric power generation;
2. Renewable energy;
3. Industry — energy efficiency;
4. Transport; and
5. Municipal waste.

The potential reduction in GHG emissions up to the year 2012 (period 2004–2012) has been estimated at 417 $MTCO_{2eq}$ and is presented in Figure 2.

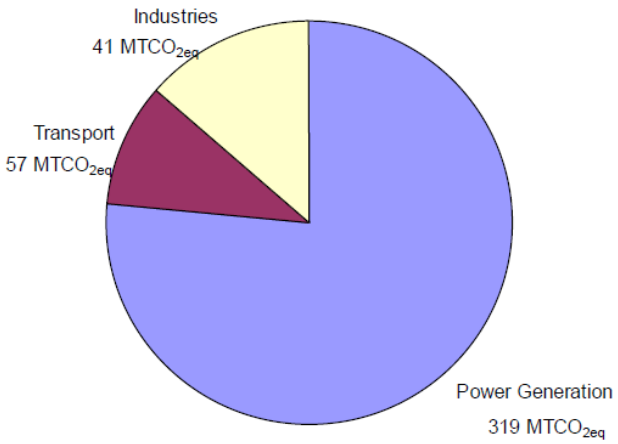

Figure-2 GHG mitigation potential in India in key sectors

Source: National Communication (2004).

CDM potential in India's electric power sector

Figure 3 shows that the GHG mitigation potential of 319 $MTCO_{2eq}$ through 2012 can be realized through fossil fuel utilization improvement (102 $MTCO_{2eq}$), municipal solid waste (MSW) to energy (63 $MTCO_{2eq}$) and renewable energy technology (154 $MTCO_{2eq}$).

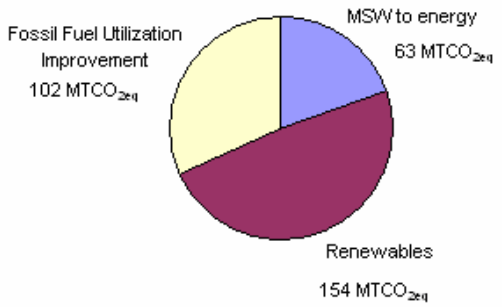

Figure-3 GHG mitigation potential from power generation in India

Source: National Communication (2004).

CDM potential in renewal energy (RE) technology

The Government of India is making a concerted effort to promote renewal energy technology. Fifty-five per cent of the 80 projects approved by the Indian CDM Authority are in the RE sector. Ministry for Non-conventional Energy Sources (MNES) prepared between 1993 and 1996 a set of guidelines for "Promotional and Fiscal Incentives by State Governments for Power Generation from Non-Conventional Energy Sources". These guidelines were designed to bring about a level playing field for power generation from renewable energy sources. Salient features included a preferential tariff of 4.5 ct /kWh beginning in 1993 with a 5 per cent annual escalation, allowing third party sale and captive use, ensuring timely payment of purchased electricity, long-term Purchasing Power Agreements (PPA), providing grid connectivity, creating the infrastructure for power utilization, streamlining the procedures for various statutory clearances, and exemptions from certain sales tax and electricity duty. In addition, concessionary duties for imported

RE equipment were granted to RE providers, and arrangements were made for soft loans and a long-term debt facility.

The Government of India has announced that 10 per cent of the new electrical power capacity of 100,000 MW to be installed between 2002 and 2012 will be from RE.

The renewable energy plan is as follows:

Table-2 Renewable energy plan

Sector	Target
Wind energy	5000 MW
Biomass power, including cogeneration	3000MW
Small hydropower	2000MW
Municipal, industrial and urban waste	400MW
Solar thermal	250MW
Solar photovoltaic cell	30MW
Total	10680MW 10,000MW(approx.)

Source: Indian Renewable Energy Development Agency

The RE plan includes the following:

- Electrification of all unelectrified villages to the extent possible in a decentralized mode;
- Minimum cooking energy from renewable for all households;
- Cost-effective energy for water pumping, irrigation, drinking and rural electrification; and
- More women's participation in RE programmes for their employment and empowerment.

Table- 3 Economics of renewable energy

Sector	Capital cost (million $/MW)	Generation cost ($/Kwh)
Small hydroelectric	0.69 to 1.38	0.023 to 0.046
Wind energy	0.80 to 0.92	0.046 to 0.063

Biomass power	0,69 to 0.92	0.04 to 0.046
Bagasse cogeneration	0.57 to 0.69	0.04 to 0.046
Biomass gasification	0.57 to 0.69	0.03 to 0.34
Solar photovoltaic	5.70 to 6.89	0.23 to 0.37

Source: Indian Renewable Energy Development Agency

Barriers in commercializing biomass energy projects

Technical

- Diverse biomass resources and possible biomass — specificity of technologies;
- Low energy density and large bulk;
- Seasonality, particularly in the case of agricultural residues;
- Localized price sensitivity due to relatively high cost of transportation; associated vulnerability of bioenergy projects;
- Minimum size of sugar plant is 2,500 tons crushed per day (TCD);
- Inadequate technical and managerial skills, and trained manpower;
- Inadequate technology, design, development of biomass handling, storage, transportation and retrieval system; and
- Perception of "bio-resources" as low-tech fuels.

Financial

- Most of the sugar plants are in the cooperative sector;
- Reluctance on the part of financial institutions (FIs) to fund bioenergy projects;
- FIs demand a high debt equity ratio (1:1) for funding bioenergy projects, resulting in a large contribution from the promoter; and
- Limited domestic and international funds for biomass energy projects.

Utility/SEB-related

- There is no compensation for grid fluctuations/failure by SEB;
- There is no cost sharing with RE developers for installation of transmission lines/grid evacuation equipment; and
- Clear-cut carbon trading mechanisms are not in place.

Financing from IREDA for renewable energy projects

The Indian Renewable Energy Development Agency offers attractive financing schemes, such as loans of up to 85 per cent of the project cost and up to 75 per cent of the equipment cost; a 5 to 14 per cent rate of interest; a moratorium of up to three years in loan repayment; and a repayment period of up to ten years. For biomass projects (except bagasse), the maximum loan amount is 70 per cent of the project cost.

CDM projects in renewable energy

One of the biggest barriers that CDM project developers face is the additionality issue. If a CDM project receives assistance from the Government, such as a mandated purchasing power agreement with the State Electricity Board or an attractive tariff for the sale of electricity, the project is not considered additional by the UNFCCC Executive Board, and thus it is ineligible for CDM approval and CDM revenue. Nevertheless, 44 CDM projects on renewable energy have received host-country approval from the Ministry of Environment and Forests, the designated national authority for CDM in India. The majority of these projects are in the biomass (41 per cent), bagasse (23 per cent) and hydroelectric (23 per cent) sectors. The distribution of these 44 projects by sector is shown in Figure 4.

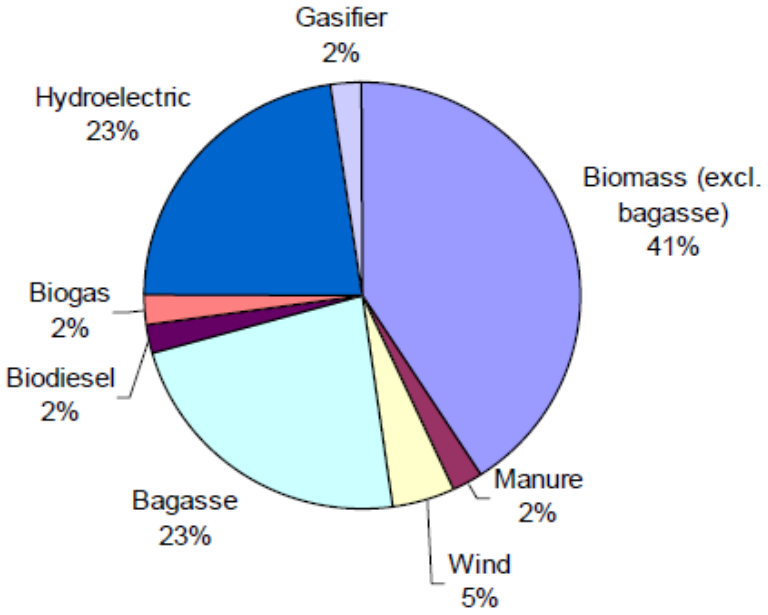

Figure-4 Distribution of RE projects, by sector

Source: Ministry of Environment and Forest, Government of India

Status of CDM projects in India

During the past couple of years, the efforts towards capacity building for CDM intensified in India. The progress in CDM project development has been particularly spectacular over the last few years. The number of projects in the CDM pipeline increased more than nine fold from 38 in August 2005 to 1812 by February 2009. Of these, the CDM Executive Board (EB) has registered 392 projects as on 1st February 2009.

Table number-4 Basic Information

Project Status	Number of Projects
CDM projects registered at CDM executive board	392
CDM projects at or after the validation stage	1,420

Source: IGES CDM Project Database

Sectoral composition

The distribution of the number of projects according to project type shows that Renewable Energy (RE) projects take the lead, particularly those proposing to generate biomass power through agricultural wastes, including the bagasse-based co-generation projects (Table-5). Hydro, wind, biogas and solar are other forms of renewable energy proposed to be tapped through CDM, although projects on solar energy are yet to be registered. Among the non- RE technology projects in the CDM pipeline, those aimed at improving the energy efficiency in industry, largely through waste heat recovery. Seventeen projects pertaining to industrial process in cement industry, four to fossil fuel switch and five to thermal oxidation of hydrofluorocarbon (HFC-23) are also registered. Several others of similar scope are in the registration cycle. Some other projects in the area of capturing fugitive emissions, reforestation, landfill gas, transport and energy efficiency in services are at validation stage. In terms of generated carbon credits, the RE projects have the second largest share, despite of being nearly 60% in number. The HFC-23 projects, numbering only five in CDM pipeline, have maximum share of the total Certified Emission Reductions (CERs).

Due to very high global warming potential of HFC-23, the average CER generation from a HFC-23 project is over 50 times higher than an average renewable energy project. Overall, a similar trend is discernible in the international CDM market; the bulk of CERs (46.5%) from the projects in various non-Annex B countries together, will also be generated from projects on destruction/reduction of HFC-23 and N_2O (Fenhann 2006)

Table -5 Basic Data on Registered CDM Projects

	N. of Projects	Average Annual Emission Reduction (tCO_2)	Total ERs by 2012 (tCO_2)	Amount of Issued CERs (tCO_2)
Biomass	129	34,825	31,131,852	4,784,585
Wind power	69	44,891	20,912,886	4,980,793
Waste gas/heat utilization	57	92,808	33,695,032	7,717,785
Hydro power	45	73,511	12,986,388	1,152,565
Energy efficiency	44	23,795	7,705,675	783,806
Cement	17	116,077	16,806,437	1,153,451
Fuel switch	11	378,953	21,138,002	1,125,542
Biogas	9	33,039	1,907,283	372,312
HFC reduction	5	2,123,438	82,578,575	34,973,106
Methane avoidance	3	122,964	1,282,448	0
Methane recovery & utilization	1	64,599	569,990	75,896
Transportation	1	41,160	236,811	0
Other renewable energies	1	562	3,936	0
Total	**392**	**88,148***	**230,955,315**	**57,119,841**

Source: IGES CDM Project Database

ISO 14001

An Environmental Management System (EMS) is a framework that allows your organization to consistently control its significant impacts on the environment, reduce the risk of potentially costly pollution incidents, ensure compliance with environmental legislation and continually improve your business operations.

Establishment of standardized EMS is one of the most effective ways to support continual development of preventative efforts in organization's environmental practice. Several models for EMS have been developed recently and ISO 14001 is the last and the most popular standard in this series. However, EMS standard provides no guarantee that pollution prevention approach will be applied, thus efficiency of EMS will be reduced. EMS standards usually focus on the quality of management procedure, but do not define level of environmental performance.

The spirit of ISO 14001

In the simplest of terms, and condensing the whole concept of ISO 14001 into one sentence, we can say that fundamentally the Standard requires an organization to:

"Control and reduce its impact on the environment"

In simple terms, the Standard requires an organization to state how it goes about controlling and reducing its impact on the environment: doing in practice what it has stated in its environmental policy; recording what has occurred; and learning from experience.

What obligation does this impose upon an organization? ISO 14001 requires an organization to control its impacts on the environment. All aspects of business activity cause changes in the environment to a greater or lesser extent. Organizations deplete energy sources and raw materials and generate products and waste materials. These changes are referred to as environmental impacts. ISO 14001 defines an environmental impact as:

> "Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, products or services"

Identifying and assessing the significance of environmental impacts is a critical stage in an organization's preparatory stages for ISO 14001. Thus the organization needs to understand that by operating its processes, by manufacturing its products or supplying its services, it is depleting natural resources and using non-renewable energy sources. At the same time it is also producing by-products in the form of waste materials.

During the period of planning the implementation, some organizations have wondered how the ISO 14001 system will operate at the point in time when all the environmental objectives of the organization have been fulfilled and where, perhaps, further improvements would be subject to the law of diminishing returns. What does the organization do next? Will ISO 14001 certification be lost? Does the organization attempt to improve in environmentally trivial areas, performing a meaningless paperwork exercise merely to generate evidence that the system is still alive, in order to retain certification?

The reality is that once the initial significant environmental impacts have been controlled and minimized, the other hitherto less significant impacts become more significant and a new cycle of improvement begins. Thus the cycle is never-ending and there is continuous improvement of the organization's environmental performance.

Two illustrations from history demonstrate (with hindsight) that our knowledge of environmental issues is usually flawed and that we, as individuals and organizations, acted in an environmentally responsible way based upon the knowledge available to us at that time:

- The use of CFCs (ozone-depleting chemicals) was not thought to be an environmental issue. We now know that it has a highly significant global environmental impact with possible long-term damage to our quality of life on Earth.
- Similarly, the widespread use of asbestos was at one time not thought to be an environmental issue nor a safety hazard.

Thus, the rules can change. New knowledge comes to light and new, tougher legislation will always be around the corner. Therefore, this status of 'zero or trivial significant environmental impacts' will never occur.

It is also tempting for a cynic of environmental management to compare two similar organizations manufacturing the same products. Although they manufacture the same products, one of them is noted for having a higher impact upon the environment than the other:

- Producing more waste to landfill
- Using more energy due to older plant
- Has more breaches of legislation – violations of discharge consents, for example
- Is visually offensive due to old, badly sited buildings
- Has more smell and noise nuisance

An EMS does not seek to be comparable – it proves only that each organization is seen to be committed to taking appropriate and practical steps to reduce their environmental impacts (within their individual capability and level of technology).

Providing that both organizations can demonstrate such commitment, the certification body will allow certification. This is the concept of the EMS: it is an improvement process, rather than a method for stating that, at any one point in time, one organization is performing better than another.

The clauses of the Standard evolve from this simple common sense investigation of an organization's activities with some additions and enhancements (for example, ensuring mechanisms are in place to make a company aware of new and impending legislation). As the reader will note from reading the Standard itself, it is not a long document and is written concisely, with only six main clauses. It is generic in style, as it is intended to be applicable to any manufacturing or service industry.

Background

The ISO (International Organization for Standardization) is a worldwide federation founded in 1947 to promote the development of international manufacturing, trade and communication standards.

The 1990s saw the development of environmental management systems (EMSs) designed to provide a framework for organizations that were trying to incorporate environmental objectives into their decision making (Boiral and Sala 1998, Green and La

Fontaine 1996, Miller 1998, Porter and van der Linde 1995, Powers 1995). ISO 14001 is a standard for EMSs that has attracted global attention since its introduction in 1996. However, for the most part, decision makers in environmental management lack practical guidelines on the most effective ways of implementing the ISO 14001 standard (Cantin, pers. comm., 1997; Kirkland and Thompson 1997). If the gap between EMS theory and practice can be bridged, and ISO 14001 becomes widely implemented, the standard could have a substantial impact on reducing the rate of environmental damage.

ISO 14001 is a voluntary standard that can be considered the carrot to go along with the stick of "command and control" environmental regulation (Cascio in Lewis1997, 75). One requirement of the EMS standard is for the training of employees in areas related to environmental awareness and technical, environmental competence. Educating employees about environmental issues is one of the most promising contributions that ISO 14001 can make to the future of environmentally sustainable management practices. A key advisor in the development of the standard felt that "[command and control's] ultimate failure is that employees don't think of the environment as their responsibility" (Cascio in Lewis 1997, 75). Training and awareness programs are key strategies in the implementation of an integrated EMS and, hence, in improving corporate environmental performance (Ecotec 1992, IW 1998, Kirkland and Thompson 1997, Lawrence and Morell 1995).

ISO 14001 is an internationally accepted standard that defines the requirements for establishing, implementing and operating an Environmental Management System.

The standard recognizes that you may be concerned about both your own profitability and managing environmental impacts. ISO 14001 integrates these two motives and provides a refreshingly workable methodology to achieve an effective Environmental Management System.

It's not just a 'paper' standard – it demands the commitment of whole organization. If the environment benefits and profits are enhanced, stakeholders see rewards.

An Environmental Management System (EMS) assists organizations in identifying the environmental interests of its stakeholders such as customers, shareholders, employees, local residents, regulators, local authority etc.

ISO 14001 provides an organization with a structured approach to planning, implementing and managing an EMS.

Operating an effective EMS can:

• Provide cost savings through the reduction of waste and more efficient use of natural resources (electricity, water, gas and fuels).
• Tighten production processes, yielding better efficiency and reduction in the risk of incidents.
• Improve internal communications and morale - often leading to sound environmental solutions suggested by staff, who are the ultimate owners of the business processes.
• Ensure that the organization is better placed to avoid future fines and penalties from not meeting environmental legislation.
• Reduce insurance costs through demonstrating better risk management.
• Lead to a better public perception of the organization and the potential to gain a competitive advantage, leading to improved sales opportunities.
• Lead to better community awareness of the impact of your activities on local residents (noise, smell, dust, vibration, etc.).

CDM

National CDM Authority

The Ministry of Environment and Forests (MoEF) is the nodal ministry dealing with climate change and CDM issues in India. It established the Designated National Authority (DNA) in December 2003 as the National CDM Authority (NCDMA). The NCDMA is chaired by the Secretary of MoEF. The other members are the Secretary, Ministry of External Affairs, the Secretary, Ministry of Finance, the Secretary, Department of Industrial Policy and Promotion, the Secretary, Ministry of Non-conventional Energy Sources, the Secretary, Ministry of Power, the Secretary, Planning Commission and the Joint Secretary of Climate Change, MoEF. The Member-Secretary of the NCDMA is the Climate Change Director of MoEF.

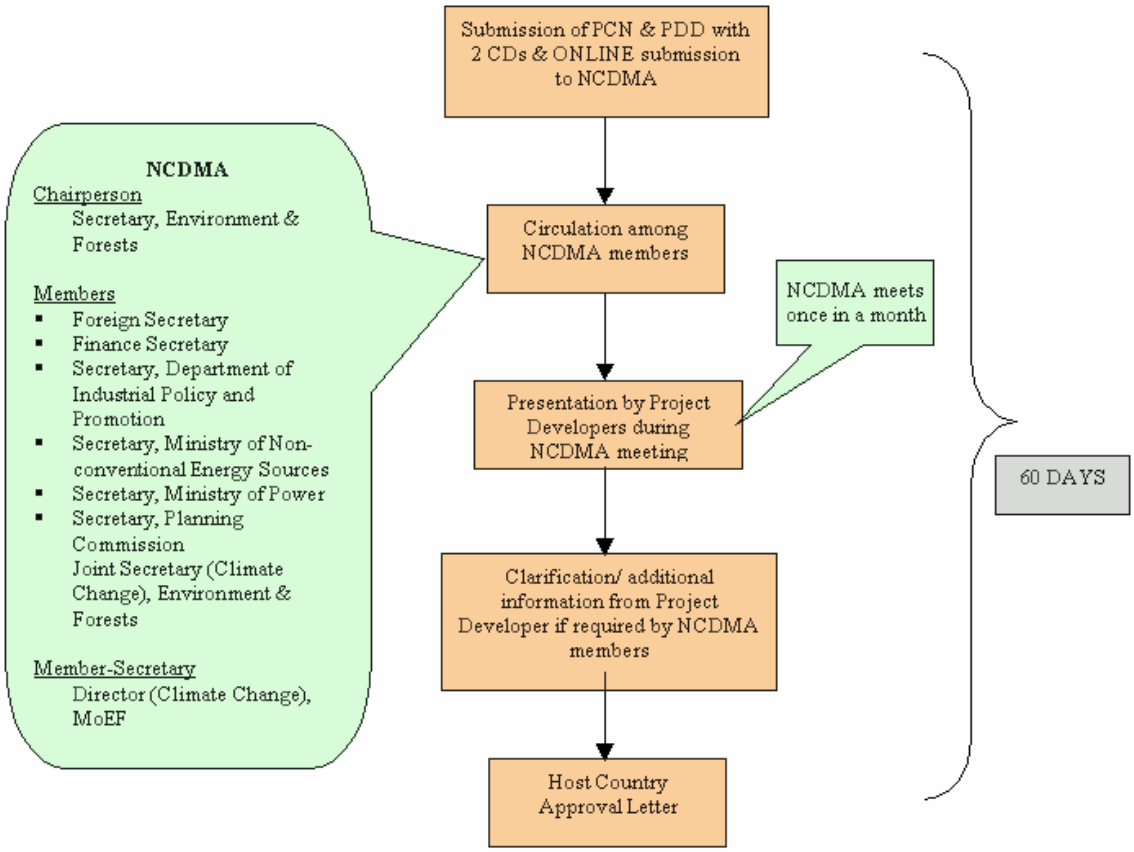

Fig. 1 Approval Process for a CDM Projects

The above flow diagram depicts the approval process for a CDM project. The project developers first submit the Project Concept Note (PCN) and the Project Design Document (PDD). These documents are circulated for review by the NCDMA members, who then call the project developers for a presentation at a regularly scheduled once-a-month meeting. Any clarifications/additional information from the project developers are sought when required by the NCDMA members. If all the requirements are met, India gives host country, the approval. The entire process for host country approval takes 60 days. No fees are charged by the National CDM Authority. The project developers then present their documents to the CDM Executive Board for approval and registration.

Indian CDM National Authority's approval criteria

A project proposal should establish the following in order to qualify for consideration as a CDM project activity:

Additionality:

- Emission additionality, the project should lead to real, measurable and long-term GHG mitigation. The additional GHG reductions are to be calculated with reference to a baseline.
- Financial additionality, the funding for CDM project activity should not lead to diversion of official development assistance. The project participants may demonstrate how this is being achieved.
- Technological additionality, the CDM project activities should lead to transfer of environmentally sound technologies and know-how.

Sustainable development indicators

It is the prerogative of the host party to confirm whether a clean development mechanism project facilitates sustainable development in its country. Also, a CDM should be oriented towards improving the quality of life of the very poor from an environmental standpoint. The following aspects should be considered when designing CDM project activity:

1. Social well-being; The CDM project activity should improve the quality of life of people through poverty alleviation, job creation, social disparity removal and the provision of basic amenities.

2. Economic well-being; The CDM project activity should attract additional investment consistent with the needs of the people.

3. Environmental well-being; The project should include a discussion of its impact on resource sustainability, resource degradation, biodiversity friendliness, impact on human health and reduction of pollution levels in general.
4. Technological well-being; The CDM project activity should lead to transfer of environmentally sound technologies, with priority given to renewable and energy efficiency projects consistent with best practices in order to assist in upgrading the technological base.

Baselines

The project proposal must clearly and transparently describe the methodology used to determine baselines. Methodologies should:

- Create baselines that are precise, transparent, comparable and workable;
- Avoid overestimation;
- Be homogeneous and reliable;
- Indicate potential errors;
- Establish system boundaries of baselines;
- Describe clearly intervals between baseline updates of baselines;
- Highlight the role of externalities (social, economic and environmental);
- Include historical emission data sets wherever available; and
- Mention the lifetime of the project cycle clearly.

Baselines should be created on a project-by-project basis except for those categories that qualify for simplified procedures. The project proposal should indicate the formulae used for calculating GHG offsets in the project and baseline scenario. Leakage, if any, should be described. For the purpose of project concept notes (PCN), default values may be used with justification. Determination of the base project, which would have come up in the absence of the proposed project, should be clearly described in the project proposal.

Financial indicators

The project participants should highlight the following financial aspects:

- Flow of additional investment;
- Cost-effectiveness of energy saving;
- Internal rate of return (IRR) without accounting for CERs; IRR with CERs;

- Liquidity, NPV, cost/benefit analysis, cash flow, and so forth, establishing that there is a strong probability that the project will eventually be implemented;
- Agreements reached with the stakeholders, if any, including power purchase agreements, memorandum of understanding, and so forth;
- Inclusion of indicative costs related to validation, approval, registration, monitoring and verification, certification and share of proceeds; and
- Available funds, financing agency, and a description of how it is sought to achieve financial closure.

Technological feasibility

The proposal should include the following technical elements:

- The proposed technology/process;
- Product/technology/material supply chain;
- Technical complexities, if any;
- Preliminary designs and schematics for all major equipment needed, design requirements, manufacturer's name and details, and capital cost estimates;
- Technological reliability;
- Organizational and management plan for implementation, including timetable, personnel requirements, staff training, project engineering and CPM/PERT-Chart.

Risk analysis

The project proposal should clearly state risks associated with a project, including apportionment of risks and liabilities as well as insurance and guarantees, if any.

Credentials

The credentials of the project participants must be clearly described.

ISO 14001

Clause 4.1: General Requirements

The organization shall establish, document, implement, maintain and continually improve an environmental management system in accordance with the requirements of this international system and determine how it will fulfill these requirements.

The organization shall define and document the scope of its environmental management system.

Clause 4.2: Environmental Policy

Top management shall define the organization`s environmental policy and ensure that, within the defined scope of its environmental management system, it

a) Is appropriate to the nature, scale and environmental impacts of its activities, product and services,
b) Include a commitment to continual improvement and prevention of pollution,
c) Includes a commitment to comply with applicable legal requirements and with other requirements to which the organization subscribe which relate to its environmental aspects,
d) Provide the framework for setting and reviewing environmental objectives and targets,
e) Is documented, implemented and maintained,
f) Is communicated to all persons working for on behalf of the organization, and
g) Is available to the public.

Clause 4.3: Planning

4.3.1 Environmental Aspects

The organization shall, implement and maintain a procedure (s)

a) To identify the environmental aspects of its activities, products and services within the defined scope of the environmental management system that it can control and those it can influence taking into account planned or new developments, or new or modified activities, products and services, and
b) To determine those aspects that has or can have significant impact (s) on the environment (i.e. significant environmental aspects).

The organization shall have document this information and keep it up to date.

The organization shall ensure that significant environmental aspects are taken into account in establishing, implementing and maintaining its environmental management system.

4.3.2 Legal and Other Requirements

The organization shall establish, implement and maintain a procedure (s)

a) To identify and have access to the applicable legal requirements and other requirements to which the organization subscribes related to its environmental aspects, and
b) To determine how these requirements apply to its environmental aspects.

The organization shall ensure that these applicable legal requirements and other requirements to which the organization subscribes are taken into account in establishing, implementing and maintaining the environmental management system.

4.3.3 Objectives, targets and programme(s)

The organization shall establish, implemented and maintain documented environmental objectives and targets, at relevant functions and level within the organization.

The objectives and targets shall be measurable, where practicable and consistent with the environmental policy, including the commitments to prevention of pollution, to compliance with applicable legal requirements and other requirements to which the organization subscribes, and to continual improvement.

When establishing and reviewing its objectives and targets, an organization shall take into account the legal requirement and other requirements to which the organization subscribe, and its significant environmental aspects. It shall also consider its technological options, its financial, operational and business requirements, and the view of interested parties.

The organization shall establish, implement and maintain a programme(s) for achieving its objectives and targets, programme(s) shall include

a) Designation of responsibility for achieving objectives and targets at relevant functions and level of the organization.
b) The means and time-frame by which they are to be achieved.

Clause 4.4: Implementation and operation

4.4.1 Resources, roles, responsibility and authority

Management shall ensure the availability of resources essential to establish, implement, maintain and improve the environmental management system. Resources include human resources and specialized skills, organizational infrastructure, technology and financial resources. Roles, responsibility and authorities shall be defined, documented and communicated in order to facilitate effective environmental management.

The organization`s top management shall appoint a specific management representative(s) who, irrespective of other responsibilities, shall have defined roles, responsibilities and authority for

a) Ensuring that an environmental management system is established, implemented and maintained in accordance with the requirements of this international standard,
b) Reporting to top management on the performance of the environmental management system for review, including recommendations for improvement.

4.4.2 Competence, training and awareness

The organization shall ensure that any person(s) performing task for it or on its behalf that have the potential to cause a significant environmental impact(s) identified by the organization is (are) competent on the basis of appropriate education, training or experience and shall retain associated records.

The organization shall identify training need associated with its environmental aspects and its environmental management system. It shall provide training or take other action to meet these needs, and shall retain associated records.

The organization shall establish, implement and maintain a procedure(s) to make persons working for it or on its behalf aware of

a) The importance of conformity with the environmental policy and procedure and with the requirements of the environmental management system,
b) The significant environmental aspects and related actual or potential impacts associated with their work, and the environmental benefits of improved personal performance,
c) Their roles and responsibility in achieving conformity with requirement of the environmental management system, and
d) The potential consequences of departure from specified procedure.

4.4.3 Communication

With regards to its environmental aspects and environmental management system, the organization shall establish, implement and maintain a procedure(s) for

a) Internal communication among the various level and function of the organization,
b) Receiving, documenting and responding to relevant communication from external interested parties.

The organization shall decide whether to communicate externally about its significant environmental aspects, and shall document its decision. If the decision is to communicate, the organization shall establish and implement a method(s) for this external communication.

4.4.5 Control of documents

Document required by the environmental management system and by this international standard shall be controlled. Records are a special type of document and shall be controlled in accordance with the requirements given in 4.5.4.

The organization shall establish, implement and maintain a procedure(s) to

a) Approve documents for adequacy prior to issue,
b) Review and update as necessary and re-approve documents,
c) Ensure that changes and the current revision status of documents are identified,
d) Ensure the relevant version of applicable documents are available at point of use,
e) Ensure that documents remain legible and readily identifiable,

f) Ensure that documents of external origin determined by the organization to be necessary for the planning and operation of the environmental management system are identified and their distribution controlled, and
g) Prevent the unintended use of obsolete documents and apply suitable identification to them if they are retained for any purpose.

4.4.6 Operational control

The organization shall identified and plan those operations that are associated with the identified significant environmental aspects consistent with its environmental policy, objectives and targets, in order to ensure that they are carried out under specified conditions, by

a) Establishing, implementing and maintaining a documented procedure(s) to control situations where their absence could lead to deviation from the environmental policy, objectives and targets, and
b) Stipulating the operating criteria in the procedure(s), and
c) Establishing, implementing and maintaining procedures related to the identified significant environmental aspects of goods and services used by the organization and communicating applicable procedures and requirements to suppliers, including contractors.

4.4.7 Emergency preparedness and response

The organization shall establish, implement and maintain a procedure(s) to identify potential emergency situations and potential accidents that can have an impact(s) on the environment and how it will respond to them.

The organization shall respond to actual emergency situations and accidents and prevent or mitigate associated adverse environmental impacts.

The organization shall periodically review and, where necessary, revise its emergency preparedness and response procedures, in particular, after the occurrence of accidents or emergency situation.

The organization shall also periodically test such procedures where practicable.

Clause 4.5: Checking

4.5.1 Monitoring and measurement

The organization shall establish. Implement and maintain a procedure(s) to monitor and measure, on a regular basis, the key characteristics of its operations that can have a significant environmental impact. The procedure shall include the documenting of information to monitor performance, applicable operational controls and conformity with the organization`s environmental objectives and targets.

The organization shall ensure that calibrated or verified monitoring and measurement equipment is used and maintained and shall retain associated records.

4.5.2 Evaluation of compliance

4.4.2.1 Consistent with its commitment to compliance, the organization shall establish, implement and maintain a procedure(s) for periodically evaluating compliance with applicable legal requirements.

The organization shall keep records of the periodic evaluations.

4.5.2.2 The organization shall evaluate compliance with other requirements to which it subscribes. The organization may wish to combine this evaluation with the evaluation of legal compliance referred to in 4.5.2.1 or to establish a separate procedure(s).

The organization shall keep records of the results of the periodic evaluations.

4.5.3 Nonconformity, corrective action and preventive action

The shall establish, implement and maintain a procedure(s) for dealing with actual and potential nonconformity(ies) and for taking corrective action and preventive action. The procedure(s) shall define requirements for

a) Identifying and correcting nonconformity(ies) and taking action(s) to mitigate their environmental impacts,
b) Investigating nonconformity(ies), determining their cause(s) and taking actions in order to avoid their recurrence,
c) Evaluating the need for action(s) to prevent nonconformity(ies) and implementing appropriate actions designed to avoid their occurrence,

d) Recording the result of corrective action(s) and preventive action(s) taken, and
e) Reviewing the effectiveness of corrective action(s) and preventive action(s) taken,

Action taken shall be appropriate to the magnitude of the problem and the environmental impacts encountered.

The organization shall ensure that any necessary changes are made to environmental management system documentation,

4.5.4 Control of records

The organization shall establish and maintain records to demonstrate conformity to the requirements of its environmental management system and of this international standard, and the result achieved.

The organization shall establish, implement and maintain a procedure(s) for the identification, storage, protection, retrieval, retention and disposal of records.

Record shall be and remain legible, identifiable and traceable.

4.5.5 Internal audit

The organization shall ensure that internal audits of the environmental management system are conducted at planned intervals to

a) Determine whether the environmental management system
    1) Conforms to planned arrangements for environmental management including the requirements of this international standard, and
    2) Has been properly implemented and is maintained, and
b) Provide information on the results of audits to management system.

Audit programmes shall be planned, established, implemented and maintained by the organization, taking into consideration the environmental importance of the operation(s) concerned and the results of previous audits.

Audit procedure(s) shall be established, implemented and maintained that address

- The responsibilities and requirements for panning and conducting audits, reporting results and retaining associated records,
- The determination of audit criteria, scope, frequency and methods.

Selection of auditors and conduct of audits shall ensure objectivity and the impartiality of the audit process.

Clause 4.6: Management review

Top management shall review the organization`s environmental management system, at planned intervals, to ensure its continuing suitability, adequacy and effectiveness. Reviews shall include assessing opportunities for improvement and the need of changes to the environmental management system, including the environmental policy and environmental objectives and targets. Records of the management reviews shall be retained.

Input to management reviews shall include

a) Result of internal audits and evaluation of compliances with legal requirements and with other requirements to which the organization subscribes,
b) Communication(s) from external interested parties, including complaints,
c) The environmental performance of the organization ,
d) The extent to which objectives and targets have been met,
e) Status of corrective and preventive actions,
f) Follow-up action from previous management reviews,
g) Changing circumstances, including developments in legal and other requirements related to its environmental aspects, and
h) Recommendation for improvement.

The output from management reviews shall I include any decisions and actions related to possible changes to environmental policy, objectives, targets and other elements of the environmental management system, consistent with the commitment to continual improvement.

Literature Review

CDM

The CDM has its history in the larger debates on linkages between 'climate change' and 'SD,' two concepts which emerged in research and policy in the late 1980s. Historically the concepts have remained largely divided for a long period of time. While the climate change debate has been natural science-driven, the SD debate has been framed in a more social and human science oriented approach. The historical divide is well analyzed and described in the literature (Cohen et al. 1998; Michaelis 2003; Najam et al. 2003; Swart et al. 2003). The divide continued until around 2001–2002, when the International Panel on Climate Change (IPCC) in the Third Assessment Report and delegates at the World Summit on Sustainable Development created platforms to direct the focus towards integration and linkages between climate change and SD. Since then an emerging and growing literature has dealt with the following issues identifying synergies and trade-offs between climate change and SD: (1) Views from the South (Davidson et al. 2003; Najam et al. 2003; Sokona et al. 2002), (2) Equity (Ghersi et al. 2003; Metz et al. 2002), (3) Adaptation and Poverty (Bloom 2004; Burton and May 2004; Devereux and Edwards 2004; Huq and Reid 2004) and (4) The CDM's contribution to SD.

The actual birth of the CDM took place in the process leading up to the Kyoto negotiations. After adoption of the Kyoto Protocol – including the CDM – in 1997. Then it has been called by many names: 'the Kyoto surprise,' 'the win–win mechanism,' 'a bridge between North and South' and 'the front-runner of the Kyoto Regime' (Grubb et al.1999; Matsuo 2003). The names reflect the initial optimism and high expectations that the CDM would reconcile major differences between the North and the South over climate change and development. As the agreement on CDM took place in the final stages of the negotiation process, there was little time left to discuss terms and conditions and hence it was decided upon without provisions on how it should be operated. It was not until COP7 in Marrakesh in 2001 that the Executive Board for the CDM was established and the main part of the 'rule book' was decided upon. When the institutional set-up governing the CDM was discussed and decided upon, developing countries argued

that an international standard for SD would impinge on their sovereignty (Figueres 2005). Hence, the responsibility for achieving SD was delegated to Designated National Authorities (DNAs) at national level. Since then the issue about the CDM's contribution to SD has not directly been addressed in international policy negotiations. Rather, it has been repackaged and addressed indirectly in debates about 'programmatic CDM' (Baron and Ellis 2006; Figueres 2005) and in the research literature.

Theoretically different approaches and definitions of SD exist, but in which is the focus of this review. For a theoretical introduction see chapters two and three in Markandya and Halsnæs (2002). In the methodological literature there seems to be a consensus that SD encompasses at least three dimensions: the social, the economic and the environmental dimensions (Kolshus et al. 2001; Najam et al. 2003; Olhoff et al. 2004). Included in the social dimension is poverty alleviation and equity as general criteria. When it comes to practical and concrete assessments of sustainability impacts of CDM projects there is no single, authoritative and universally accepted approach or methodology applicable to any CDM project regardless of project type and location. As DNAs are delegated the authority to confirm whether a CDM project assists in achieving SD or not, actual definitions vary according to what different host countries consider as their development priorities. Problems with this pragmatic approach to defining SD are identified in the literature. One problem is the fact that different stakeholders give priorities to different aspects of SD (Brown and Corbera 2003; Kim 2003). As power relations among stakeholders are unequal, it is often the resource-strong stakeholders who are able to define the terms for the carbon trade (Nelson and de Jong 2003). A second problem is the tendency for non-Annex I countries to compete to attract CDM investments and create an incentive to set low sustainability standards, which can lead to the problem known as 'a race to the bottom' (Sutter 2003). In addition, a critique is raised that SD criteria are not clearly defined by the DNAs (Brown et al. 2004), which re-enforces the question of who should assure the sustainability of CDM projects and how?

Early studies from 2000–2001, before the Marrakesh Accords, try to analyze the possible future contribution of the CDM to SD. Three studies aim to predict, respectively, how far the CDM will advance SD goals (Austin and Faeth 2000), whether the CDM will further or impede SD (Banuri and Gupta 2000), and whether the CDM can be a leverage for

development (Mathy et al. 2001). A fourth study argues for the inclusion of community forestry projects in the CDM based on significant co-benefits such as rural development and biodiversity (Klooster and Masera 2000). Common to the studies is a lack of CDM project data, as it is too early in the CDM's development for sufficient evidence to be available. Instead, the studies use data based on, for example, literature reviews from potential CDM projects in Brazil, India and China (Austin and Faeth 2000), simulation and modeling of the leverage effect of CDM investments on development (Mathy et al. 2001), or assessments of the impact of CDM investment on SD using three different economic approaches (Banuri and Gupta 2000).

Erik Haites and Stephen Seres (2008) has analyzed the claims of technology transfer made by project participants in the project design documents for 3296 registered and proposed CDM projects. It finds that roughly 36% of the projects claim to involve technology transfer, which accounts for 59% of the estimated annual emission reductions, indicating that projects claiming technology transfer are, on average, substantially larger than those that make no technology transfer claim. It also finds that about 30% of unilateral projects, 40% of projects with foreign participants and 30% of small-scale projects claim technology transfer, as compared to 36% of all projects. The study concludes that technology transfer is more common for larger projects.

ISO 14001

In recent years, as a result of growing economic and social pressures, companies have reconsidered their attitude to the environment. A firm's ability to respond to environmental pressure determines its relationship with stakeholders and, therefore, the achievement of sufficient social legitimacy to protect their profits. A valid response to institutional pressure regarding environmental affairs is ISO 14001 certification (Bansal and Bogner 2002). This voluntary, international standard, created in 1996 by the International Organization for Standardization (ISO), enables firms to inform stakeholders of the application of an Environmental Management System (EMS). The ISO 14001 standard defines EMS as "the general part of management that includes the organizational structure, the activity planning, the responsibilities, the practices, the procedures, the processes and the resources to develop, implement, carry out, and revise the environmental policy and keep it up to date." In brief, and according to Boiral

(2007), ISO 14001 represents both an internal management tool and a way of advertising an organization's legitimacy among stakeholders.

Although voluntary ISO 14001 certification does not guarantee a specific level of improvement in environmental performance. There is empirical evidence (for example Potoski and Prakash 2005 or Link and Naveh 2006) that this standard does help to improve the environmental performance of organizations. Indeed, when an organisation obtains ISO 14001certification, it means that it meets a series of requirements aimed at reducing its impact on the natural environment. According to Link and Naveh (2006), these requirements can be summarized as follows: the development and adoption of an environmental policy to which top management is committed; the design of a planning process that identifies all environmental requirements and defines objectives and targets for environmental improvement; the clear definition and assignment of responsibility for environmental management, in addition to programmes for training, increasing awareness and developing skills among employees; the availability of a system for checking and taking corrective action and a system for monitoring, reporting and prevention; and the establishment of a management review process which guarantees continuous improvement.

Environmental management literature focused on the study of economic repercussions of ISO 14001 certification is usually based either on case studies that are difficult to generalize (as in Darnall et al. 2000; Rondinelli and Vastag 2000 or Boiral 2007) or on subjective measures related to manager perception (as in Delmas 2001; Melnyk et al. 2002; Montabon et al. 2000 or Link and Naveh 2006).

The paper (Jill Gravender et al,) discusses the environmental and organizational effectiveness of ISO 14001 in the United States from a corporate perspective. The findings of the research suggest that the ISO 14001 standard is a helpful management tool—it encourages firms to commit to environmental stewardship and pollution prevention. The majority of surveyed firms stated that the overall benefits outweighed the cost, and that they had noted an improvement in environmental performance, internal communications, and competitive advantage as a result of implementing the standard. Surprisingly few firms experienced significant constraints in obtaining ISO 14001 certification. However, several managers did express concern with the potentially

negative legal ramifications of voluntary disclosure of environmental actions or liabilities associated with the auditing component of the standard. Matouq Mohammed (2000) found ISO 14001-based EMS has had a great effect on a firm's environmental status as certified firms have claimed that natural resources such as fuel, water, and paper consumption have been more efficiently managed after adopting the system. Implementation of the system causes the firms to consider the role of the local people and the government in more effectively involving the local people in the firm's daily environmental activities. It also helps to enhance the environmental awareness among the local people. Adopting the system also promotes a better relation within the enterprises affiliated to the same group.

On the other hand, the results obtained do not suggest clear evidence that the economic impact of ISO 14001 certification is negative for more polluting and more internationalized firms (Joaquín C., et al., 2009). There are sound economic and business reasons for developing Environmental Management Systems. Some companies still fight environmental standards that actually could enhance their competitiveness, but there will always be competitors who take a pro-active stance on environmental issues and these are the companies that will win in the 21st century. Others must start to recognize that environmental improvement is an economic and competitive opportunity, and that ISO 14001 can be an important element in modern business survival (Sally L Goodman et al., 1998). Although there is extensive theoretical and empirical literature regarding the relationship between environmental and economic performance, there is no consensus regarding the sign of this relationship. Indeed, although a growing movement—under the "It Pays to be Green" hypothesis—(Porter 1991; Porter and Van der Linde 1995; Hart and Ahuja 1996; Russo and Fouts 1997; Konar and Cohen 2001; King and Lenox 2002) replaces the traditional perspective that there is a trade-off between environmental and economic results, recent empirical research still finds a negative or insignificant relationship (e.g. Filbeck and Gorman 2004; Telle 2006 or Ziegler et al. 2007).

Discussion and Findings

CDM is an agreement between different international bodies (between developed and developing countries) to develop and implement system worldwide to ensure sustainable development.

It is also an effort to honor various organizations and countries, which have involved and have contributed systematically in the growth while saving the environment.

Application of ISO standard to CDM projects has the strategic advantages like:

a. Encourage alignment and integration of business and environmental efforts.

b. Facilitates coordination and improves control

c. Produces consistency between projects around the world (potential for economies of scale and advances on the learning curve)

d. Reduces uncertainty and decreases risk

This new initiative has legal implications in terms of fixing responsibilities to the erring unit; provision for granting credits to those who reduce the carbon emissions (popularly known as carbon credits) is a revolutionary step.

Simultaneously the availability of a highly refined environment management system, generally referred as EMS or ISO 14001, has certainly played a vital role in the implementation of CDM in the contemporary scenario of ecological environment.

Major feature of CDM are-

A. Sustainable development
B. Technology transfer
C. Foreign investment

A) Sustainable Development

Development of a system or a process is expected to leave behind; its early signs of presence, development which is sustainable is the only type which is acceptable. But its cost is much higher than an un-organized development, because development is expected

as sustainable only if it does not result in degrading of the ecosystem. For differentiating the development from sustainable development a robust EMS is needed. Some feature (as detailed below) ISO 14001 are highly suitable to quantify the above said difference.

Environmental Policy: Environment policy of an organization is defined by the management prior to its implementation. This ensures commitment to continual improvement and prevention of pollution, a commitment to comply with all applicable legal requirements for its own environmental policy defined at the beginning. ISO 14001 under this clause binds the organization to make its policy public.

Relevance to CDM- Under this clause an organization has an obligation to continually improve and prevent pollution there by implementing cleaner mechanism continually.

James E. Haklik has also identified that sustainable development (a feature of CDM) can be achieved through implementation of ISO 14001. He has identified clauses like environmental aspects (4.3.1), general requirement (4.1) environment policy (4.2) and training awareness and competence (4.4.2) more relevant to the CDM.

These clauses of ISO14001 shall be useful in terms of; awareness of the impact of sustainability, exception of responsibility to ensure sustainability, reduction of harmful impacts and community responsibility while implementing the CDM.

B) Technology Transfer

One of the major agreements in Kyoto protocol was that the CDM must ensure transfer of technology between the developing nations and the developed nations. It has been seen that after the establishment of CDM in 1996 there is hardly any transfer of technology reported in literature as a consequence of implementation of CDM. In our opinion although there are some feature of ISO 14001 that must result in transfer of technology but these are not sufficient so as to actually attract the transfer of technology.

Clauses of ISO 14001 which support the transfer of technology-

1. General requirements; since it ensures documentation of all procedures and practices transfer of technology is facilitated.

2. Resources roles, Responsibility and Authority (4.4.1); since under this clause the management ensures the availability of resources like human resources specialized and

skilled man power organizational infrastructure, technology and financial Resources, the transfer of technology becomes convenient and hence physical moreover organization top management is expected to appoint specific management representative to ensure the implementation of environment management system. It can also recommend the steps needed to ensure improvement in the existing technology. Hence importing or exporting of the new technologies is also favored in the existing ISO 14001 system.

C) Foreign Investment As one of the important decision taken in CDM is to make provision for the purchase or sale of carbon credits the idea behind the sale and purchase process is to put pressure on an organization to definitely achieve the commitments to reduce GHG emissions and establishment who told to earn certain number of carbon credits is not able to achieve the targets then it has to buy the credits from some developing countries on payment basis.

As per clauses 4.1 (general requirements) In order to ensure continual improvement in EMS, an establishment needs to minimize GHGs emissions. When such Establishment is not able to significantly reduce GHGs emission then foreign investment is the only option left to earn carbon credits and hence qualify for ISO 14001 clause 4.1. Therefore ISO 14001 is universal in its nature and is generally found in synergy with any other international protocol establishment or yet to be established for saving the environment.

There are many issues related to CDM implementation can be addressed through ISO 14001 few are listed below:

Project steps	Key issues	Solution through ISO 14001
Project conceptualization	The project developers are often not sure whether a project being undertaken by them will be eligible for CDM.	An ISO 14001 certified unit must have a regular data of emission which can be helpful in claiming the CER
PDD preparation	The data for developing the baseline case are difficult to obtain in many cases. The available methodologies are limited, but the EB is constantly approving new methodologies. Demonstrating additionality can be difficult. The services of a consultant for PDD preparation may prove expensive.	An ISO 14001 certified unit needs to maintain emission record as per clause No. 4.4.4, which can be used to project the baseline.
Monitoring and verification	Rigorous monitoring and verification contribute to transaction costs, which can make smaller projects financially unviable, although rules for small-scale projects provide relief.	Data from ISO 14064 clauses can be helpful in reducing transaction cost as it provides UP desirable in CDM

Potoski and prakash (2006) discussed whether FDI inflows encourage the adoption of ISO 14001 among the host country`s firms. MNCs critics are correct, then FDI inflow should be associate with low level ISO 14001certification. If FDI supporters are correct, then we expect to find the opposite

Conclusion

CDM project cycle requires performance of specific project management activities to acquire CER credits in synergy with ISO 14001 management system which provides flexible internationally recognized environmental management frame work. It has the advantages of simplified project registration, easier execution of annually required activities, improved control, less uncertainty and reduced risk.

ISO 14000 environmental management tools can be successfully applied to CDM projects to ensure that projected CER credits from these projects are realized.

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