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Research Article

A STUDY OF CARBON CREDIT MARKET AND FINANCIAL FEASIBILITY OF CDM PROJECTS IN INDIA

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ABSTRACT

Today the biggest threat that our planet faces is global warming. As the revolution in the industrial and life cycle, the CO2 level in the earth atmosphere rises. To delay the time of global warming, global economy has taken one of the initiative called Carbon Credit. On Wednesday 16 February 2005, some 8 years after the world's nations came together in Kyoto in Japan in 1997 to discuss global warming; the Kyoto protocol finally came into force. It has covered six greenhouse gases.

In line with the above, the carbon credit market overview and future potential of the market covered by literature analysis. The research addresses technologies adopted by organizations and baselines, factors and risk level associated with the different registered Clean Development Mechanism (CDM) projects in India. It has also examine the barriers faced by selected organizations and the impact of CDM projects for running the carbon credit project. Further the study evaluated the financial analysis of CDM Projects in India.

The CDM projects needs to be eco-friendly create employability as well as feasibility of the CDM projects plays an important role among all the aspects. Global market condition and monitoring cost of the CDM projects were highly affecting CDM projects in energy organizations. Out of all the risk associated with project, capital cost over-run risk, operational risk and supply risk were found to be influencing the CDM projects. The organizations which had registered CDM projects do not necessary to go for carbon trading because they had contract with the foreign party.

Data analysis also revealed that organizations which had gone for carbon trading mostly prefer forward contract because of carbon pricing fluctuations. The result of research shows that large scale CDM projects do not differ with reference to organization and project profile, except financial aspects, administration, operation and time span of the project. The research contributes to the field by demonstrating different parameters of CDM project in India. Finally, the research identifies and recommends areas for future studies.

INTRODUCTION

Climate change has evolved as the most persistent environmental problem. Physical and biological systems are affected by changing ecosystems and causing extinction of species due to temperature increase and would have a social impact and adversely affect human health. As a result of the economic costs and risks of extreme weather, climate change could have a severe impact on economic growth and development. Consequently, climate change has effects on a company's active in a wide variety of sectors and countries. It cannot be 'purely' environmental issue because it is closely linked to concerns about energy security due to dependence on fossil fuels and oil. The electrical energy consumption is an important parameter which represents the economic growth of the country. About two billion population of the world is reported to have no access to the benefits of electrical energy. In India, about 360 million people are still deprived of enjoying direct benefits of electrical power. Cost of generating new energy is three times the cost of various measures of saving energy.

According to a World Bank study (2009), India can reduce its annual electricity usage by 183.5 billion Kilo Watt Hour (kWh) by investing 10 billion dollars to meet the energy requirement of the country, it is required to effectively manage available resources. The conventional fuel resources have been found to be depleting very fast that creates a need for some renewable form of energy which could add to the energy mix of India. The climatic conditions, geographical landscape and the natural

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resources available in a particular region affect the energy generated from renewable sources. A need has therefore been felt to determine which renewable energy resources should be given priority so that a strategic decision could be taken to help the policy makers and private entrepreneurs to finance such projects. Thus it would be possible to derive the maximum benefit out of the available renewable resources. The electrical energy consumption by the consumers is directly dependent on the GDP of the country, average temperature of the country, cost of the energy etc. The GHGs emissions which are produced as a result of power plants, transport sector, industries etc. lead to increase of the global temperature over the last few decades. This is causing much concern to a few countries like Maldives, Fiji and Bangladesh which are likely to face grave consequences as a result of the global temperature rise as per the report of Intergovernmental Panel on Climate Change (IPCC, 2007).

In India, the major part of electricity generation is based on coal which comprises about 66% of the total installed capacity (IEA, 2006). Thus, the coal contributes a major portion of the GHGs emissions. During 11th Five year plan, the renewable energy sector witnessed tremendous changes in the policy to increase the contribution of solar energy in the energy mix of the country. During the 11th plan period, there has been addition of 14660 MW taking the total installed renewable energy to 24915 MW, with wind power contributing over 10000 MW. This clearly exhibits how renewable energy contributes to energy mix in India. (MNRE, 2012-13). Carbon emission reduction has been imposed on the developed countries under the Kyoto protocol agreement. Some of the developed countries had reduced the GHGs emission while other countries like USA is still not ready to agree with the conditions imposed by Kyoto protocol. This can be one of the reasons for delay the mission of global emission reduction. Developing nations with fast pace of economic growth like China, India, and Brazil etc. has join this initiative called Kyoto protocol phase I.

The agreement helps the developing counties to implement renewable energy sources in both domestic and commercial sector. There has been a visible impact of renewable energy in the Indian energy scenario during the last five years. Apart from contributing about 12.96 per cent in the national electricity installed in energy efficiency improvement measures. The installed capacity of India is about 150 GW and the actual need is about 167 Giga Watt (GW). Thus there is a deficit of about 17 GW at present. The power which is extracted from the renewable resources is about 15,695 Mega Watt (MW) (Ministry of New and Renewable Energy-MNRE report, 2009-10). capacity, renewable energy based decentralized and distributed applications have benefited millions of people in Indian villages by meeting their cooking, lighting and other energy needs in an environment friendly manner. It has also resulted in social and economic benefits such as cooking in smoky kitchens, minimization of the risks of contracting lung and eye ailments, employment generation at village level, the improvement in the standard of living and creation of opportunity for economic activities at village level. India has taken a voluntary commitment of reducing emission intensity of its GDP by 20-25 per cent from 2005 levels by 2020. The increased share of renewable energy in the coming years will contribute towards achieving this goal. India occupies the fifth position in the world with a wind power installed capacity of 22.5 GW. During the year 1,333 MW wind power projects were commissioned. (MNRE, 2014-15).

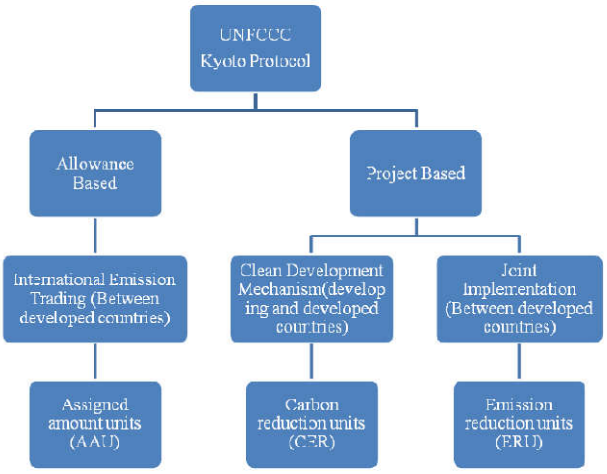

Figure 1 Kyoto Protocol Mechanisms

Background of the Study

The Kyoto protocol finally came into force in February 2005 and marked a shift from negotiation to concrete action. According to the Protocol, Annex-I parties have the binding quantified reduction commitments to reduce their greenhouse gases (GHGs) emissions by 5.2% below their 1990 level during the period 2008 to 2012 (IISD, 2009). The study tries to understand the concept in detail and scenario in India. The focus of the study is to determine the different aspects considered by the organisation for the Clean Development Mechanism (CDM) projects, factors and barriers faced by the energy sector organisation, and the risk associated with the CDM projects. The study also covers in detail the impact of CDM projects, carbon trading and corporate social responsibility. Dependent variables mentioned earlier are further compared with independent parameters such as technology used for the CDM projects, type of the organizations, turnover of the organization, no of years serves in the industry. The research model further supports the research phases.

Rationale of the Study

Carbon Credit is concept which has now become an opportunity for trading but the major challenge in the global market is global warming. All countries have initiated efforts from their end to fight with global warming. Though carbon credit has been emerged as one of the strategy to deal with the global warming, but the organisation which has implemented this concept are very low in number. The Kyoto Protocol has its impact on micro as well as macro level of the economy. Energy sector has registered highest number of projects that leads to focus on the energy sector organizations. The study tries to focus on the large scale projects in energy sector organisations in India for detailed analysis of different parameters.

Purpose of the Study

In Clean Development Mechanism (CDM), a developed country can 'sponsor' a greenhouse gas reduction project in a developing country. The developed country would be given credits for meeting its emission reduction targets, while the developing country would receive the capital investment and clean technology or beneficial change in land use. This study aims to have in-depth knowledge about the concept called Kyoto Protocol (KP). The study examined the aspects considered for the Clean Development Mechanism (CDM) projects, barriers as well as factors affecting CDM projects. On the other hand, the study also focuses on the impact of CDM projects in India. The past literature has covered some of the aspects from the study on foreign organisations. Energy sector (renewable/non-renewable sources) is considered to be highest registered CDM projects (2219 number of projects) up to 2012. Hence, this study aims to contribute to existing knowledge by testing the hypothetical association between criteria of CDM projects among different classification of project as well as organisations.

Significance of the Research

There are various challenges which affect the global market, prominent among them being global warming. To meet the challenges of global warming, various methods were initiated, one of them being Kyoto Protocol. The greenhouse gases market has shown valuable impact on the global market. The researcher plants the roots for the greenhouse gases market in 90's. Finally it came into proper framework in 1997 named as Kyoto Protocol.

Considering the importance of the subject the need is felt to undertake the research work related to carbon credit with focus on the organisation who has already registered the projects. The study has therefore focused on the following aspects: • Study the concept through existing literature. • Evaluating the CDM mechanisms in developing country like India.•Analyze the aspects considered by the energy sector organisation for CDM Projects. • Studying the factors as well as barriers affecting CDM projects in India. • Studying the impact of CDM projects on energy sector organisation, while the study also covered the risk associated with CDM projects.

Objectives of the Study

1. To review the global carbon credit market with respect to global climate change and GHGs emissions, Kyoto protocol and its mechanisms and carbon trading.
2. To assimilate the various technologies and parameters considered by organisations and also examine the factors and risk level associated with registered CDM projects in India.
3. To examine the barriers faced by selected organisations for CDM projects and the impact of CDM projects on functions of organisations.
4. To evaluate the impact on the profitability of the companies associated as private entities with the CDM projects in India (by calculating net profit with and without CDM revenue) applying suitable tools of financial analysis.

Scope of the Study

The scope of the study refers to the parameters under which the study examines Registered CDM projects in India. The study focuses on carbon credit market in India, The Indian nodal agency for carbon credit is NCDMA and CDM cell in India. The result of the study may be specifically applied to only a niche segment of CDM projects. The sampling frame is defined as energy sector organisations in India which have registered their large scale CDM projects for carbon emission reduction (CER) up to 2017 under NCDMA (Kyoto protocol phase I).

Research Design

Malhotra and Das (2009) describe the research design as the formidable problem that follows the task of defining the research problem is the preparation of the design of the research project. Decisions regarding what, where, when, how much, by what means concerning an inquiry or a research study constitute a research design. Different research designs can be conveniently described if it is categorized as: (1) research design in case of exploratory research studies; (2) research design in case of descriptive and diagnostic research studies, and (3) research design in case of hypothesis-testing research studies.

Research design in case of exploratory research studies: Exploratory research studies are also termed as formularize research studies. The main purpose of such studies is that of formulating a problem for more precise investigation or of developing the working hypotheses from an operational point of view. The major emphasis in such studies is on the discovery of ideas and insights. As such the research design appropriate for such studies must be flexible enough to provide opportunity for considering different aspects of a problem under study. Inbuilt flexibility in research design is needed because the research problem, broadly defined initially, is transformed into one with more precise meaning in exploratory studies, which fact may necessitate changes in the research procedure for gathering relevant data.

Research design in case of descriptive and diagnostic research studies: Descriptive research studies are those studies which are concerned with describing the characteristics of a particular individual, or of a group, whereas diagnostic research studies determine the frequency with which something occurs or its association with something else. The studies concerning whether certain variables are associated are examples of diagnostic research studies. As against this, studies concerned with specific predictions, with narration of facts and characteristics concerning individual, group or situation are all examples of descriptive research studies. Most of the social research comes under this category.

Research design in case of hypothesis-testing research studies: Hypothesis-testing research studies (generally known as experimental studies) are those where the researcher tests the hypotheses of causal relationships between variables. Such studies require procedures that will not only reduce bias and increase reliability, but will permit drawing inferences about causality.

Research design selected: The most important criterion for deciding the type of research design is the research question. Therefore, the present research uses descriptive research design

to study the nature and facts of variables listed above and carbon credit. 4.8Sampling Design Malhotra and Das (2009) classified sample designs into two types viz., non-probability sampling and probability sampling.

Non-probability sampling: Non-probability sampling is that sampling procedure which does not afford any basis for estimating the probability that each item in the population has of being included in the sample. Non-probability sampling is also known by different names such as deliberate sampling, purposive sampling and judgment sampling. In this type of sampling, items for the sample are selected deliberately by the researcher; his choice concerning the items remains supreme. In other words, under non-probability sampling the organizers of the inquiry purposively choose the particular units of the universe for constituting a sample on the basis that the small mass that they so select out of a huge one will be typical or representative of the whole.

Probability sampling: Probability sampling is also known as 'random sampling' or 'chance sampling'. Under this sampling design, every item of the universe has an equal chance of inclusion in the sample. It is, so to say, a lottery method in which individual units are picked up from the whole group not deliberately but by some mechanical process.

Sample design selected: The samples are defining in terms of numbers of energy sectors organisations. Sample organisations are selected based on the data availability and convenience. Here the sampling design used is non-probability convenience sampling.

Target population: The companies who had registered CDM projects under NCDMA in Kyoto protocol phase I (till 2017) in India.

Target group: In India, the companies from energy sector (Renewable/Nonrenewable) who has registered their projects on large scale basis till year 2012 for carbon emission reduction with NCDMA. There are total 33 organisations that had registered large scale CDM projects in India.

Sample size: Top management employees from energy sector organisations were approached for data collection. Phone calls were made with the potential respondents before going for data collection to give them brief outline about the study and the objectives of the study. Based on the convenience of the respondents, the data has been collected through semi structured questionnaire which was responded by the energy sector organisations in India which has already registered their large scale projects under NCDMA till 2012. For the primary study, 22 organisations had been covered for the study. Respondents for the sample are General Managers or Managing directors or Project managers at the sampling unit which is the Organisation. The list of Organisations has been attached in Appendix B.

Data Collection

The present study incorporates the collection of both primary and secondary data for an in depth study. Primary data are collected through semi structured questionnaire. The questionnaire was pretested with pilot study and minor modifications were made to the questionnaire. The data has been collected through personal interviews, telephonic interviews and through e-mail. Secondary data are collected from periodicals, journals, research papers, articles, magazines, newspapers, web-sites and other reference material available from various sources.

Statistical Tools Applied

Levin and Rubin (1998) described the data analysis tools and hypothesis testing. Data analysis is an attempt to organize and summarize the data in order to fulfill the objectives. Varieties of analytical and statistical tools are used for coding and decoding of data, analysis of data and for establishing relationship among various factors. Special software named, Statistical Package for Social Science (SPSS), used for analysis.

As stated earlier, the computation of certain indices or measures along with searching for patterns of relationship that exists among the data groups. Analysis, particularly in case of survey or experimental data, involves estimating the values of unknown parameters of the population and testing of hypotheses for drawing inferences. Analysis may, therefore, be categorized as descriptive analysis and inferential analysis (Inferential analysis is often known as statistical analysis). "Descriptive analysis is largely the study of distributions of one variable. This study provides us with profiles of companies, work groups, persons and other subjects on any of a multiple of characteristics such as size, composition, efficiency, preferences, etc. This sort of analysis may be in respect of one variable (described as univariate analysis), or in respect of two variables (described as bivariate analysis) or in respect of more than two variables (described as multivariate analysis).

When the test applied (to test the hypothesis) without a model, it is known as distribution-free test, or the nonparametric test. Non-parametric tests do not make an assumption about the parameters of the population and thus do not make use of the parameters of the distribution. In other words, under non-parametric or distribution free tests, the researcher does not assume that a particular distribution is applicable, or that a certain value is attached to a parameter of the population. Following nonparametric tests have been used for this research.

Cronbach -Alpha: Cronbach's alpha is the most common measure of internal consistency ("reliability"). It is most commonly used when you have multiple Likert questions in a survey/questionnaire that form a scale and you wish to determine if the scale is reliable.

The Kruskal-Wallis Test: This test is conducted in a way similar to the U test described above. This test is used to test the null hypothesis that 'k' independent random samples come from identical universes against the alternative hypothesis that the means of these universes are not equal. This test is analogous to the one-way analysis of variance, but unlike the latter it does not require the assumption that the samples come from approximately normal populations or the universes having the same standard deviation.

Chi-square Test: The chi-square test for independence, also called Pearson's chi-square test or the chi-square test of association, is used to discover if there is a relationship between two categorical variables. When the researcher choose

to analyze your data using a chi-square test for independence, need to make sure that the data you want to analyze "passes" two assumptions. These two assumptions are: The data has two variables should be measured at an ordinal or nominal level (i.e., categorical data). The two variables should consist of two or more categorical, independent groups.

Mann-Whitney U Test: The Mann-Whitney U test is used to compare differences between two independent groups when the dependent variable is either ordinal or continuous, but not normally distributed. For example, the Mann-Whitney U test use to understand whether attitudes towards pay discrimination, where attitudes are measured on an ordinal scale, differ based on gender (i.e., your dependent variable would be "attitudes towards pay discrimination" and your independent variable would be "gender", which has two groups: "male" and "female"). Alternately, you could use the Mann-Whitney U test to understand whether salaries, measured on a continuous scale, differed based on educational level (i.e., your dependent variable would be "salary" and your independent variable would be "educational level", which has two groups: "high school" and "university"). The Mann-Whitney U test is often considered the nonparametric alternative to the independent t-test although this is not always the case

Data analysis

CDM Projects Profile and Company Profile

Time span of the CDM projects

Table 1 Time span of the CDM projects

Particulars	Phase I (1to 7years)	Phase II (8to 14years)	Phase III (15 to 21years)
Time span	8	9	5

Interpretation: Majority of the energy sector organizations had registered their CDM projects for the Phase I (1 to 7 years) and Phase II (7 to 14 years).

Technology adopted for CDM Projects

Table 2 Technology adopted for CDM Projects

Particulars	Solar	Wind
Technology adopted for CDM Projects	11	11

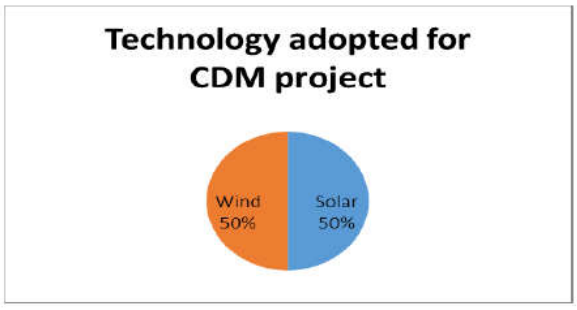

Figure 1 Technology adopted for CDM Projects

Interpretation: From the above table, it is interpreted that out of 22 organisations, 11 organisations used wind technology and 11 organisations used solar technology. • Carbon credit can be deployment of corporate social responsibility

Table 3 Deployment of corporate social responsibility

Particular	No	Yes
Deployment of CSR	4	18

If Yes, than degree of deployment of Corporate Social Responsibility

Table 4 Degree of deployment of Corporate Social Responsibility

Particular	Very Low	Low	Neutral	High	Very High
Degree of deployment of CSR	0	1	3	13	1

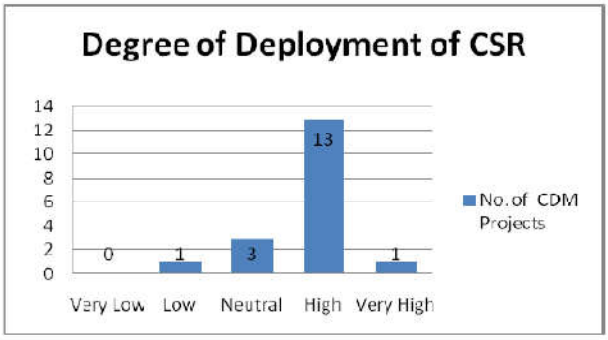

Figure 2 Degree of deployment of corporate social responsibility

Interpretation: From the above table, it can be interpreted that out of 22 organizations, 18 organizations agree upon deployment of corporate social responsibility. From 18 organizations, 14 organizations said that the degree of deployment of CSR is high. So CDM Projects is affecting CSR.

Aspects considered for CDM Projects by energy sector organizations

Table 5 Aspects considered for CDM Projects

Aspects considered for CDM Projects	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)	Weighted Average
Reduce pollution level	0	2	4	7	9	
	0	4	12	28	45	17.8
Eco-friendly	0	1	1	1	19	
	0	2	3	4	95	20.8
Positive impact on human well-being	0	1	2	3	16	
	0	2	6	12	80	20
Does not make environment safe	0	1	2	3	16	
	0	2	6	12	80	20
Sound technology	0	2	2	4	14	
	0	4	6	16	70	19.2
Technology affect positive on company	0	0	3	7	12	
	0	0	9	28	60	19.4
Technology help in development of economy	0	1	7	8	6	
	0	2	21	32	30	17
Up gradation of Technology	1	3	5	11	2	
	1	6	15	44	10	15
PDD is real	1	0	3	6	12	
	1	0	9	24	60	18.8

Proper methodology for CER	0	1	2	3	16	
	0	2	6	12	80	20
Create employability	1	1	3	5	12	
	1	2	9	20	60	18.4
Reduce poverty	1	3	6	7	5	
	1	6	18	28	25	15.6
Improve quality of life	0	4	4	7	7	
	0	8	12	28	35	16.6
Attract additional investment	0	2	2	12	6	
	0	4	6	48	30	17.6
Clear time span	0	0	2	8	12	
	0	0	6	32	60	19.6
Clear baseline	0	0	1	10	11	
	0	0	3	40	55	19.6
Impact on resource sustainability	0	3	4	10	5	
	0	6	12	40	25	16.6
Precise baseline	0	2	3	6	11	
	0	4	9	24	55	18.4
Need of transparent projects	0	2	0	8	12	
	0	4	0	32	60	19.2
Comparable projects need	0	0	10	5	7	
	0	0	30	20	35	17
Feasibility of the projects workable	0	0	2	6	14	
	0	0	6	24	70	20
Avoid overestimation	1	0	2	8	11	
	0	0	6	32	55	18.6
Methodology of baseline is homogeneous	0	3	1	10	8	
	0	6	3	40	40	17.8
Reliable baseline	0	0	2	10	10	
	0	0	6	40	50	19.2
Define potential error	0	1	0	10	11	
	0	2	0	40	55	18.4
Updated baseline	0	0	5	7	10	
	0	0	15	28	50	18.6

Interpretation: After taking weighted average of all the aspects considered by the energy sector organisations for CDM Projects, the result reveals that eco-friendly, positive impact on Human well-being and proper methodology of CER are playing vital role compare to other aspects considered by the organisations for the CDM Projects.

Factors affecting CDM Projects

Table 5 External factors affecting CDM Projects

External Factors	No. of Organisations
Global Market	19
Economy Growth	8
Carbon Trading	12
Political Changes	11
CDM Mechanisms	11
Trade Relations	2

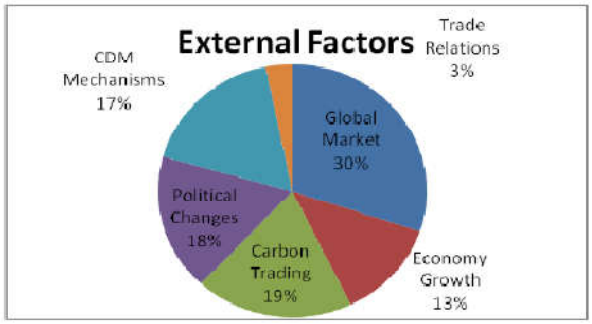

Figure 3 External factors affecting CDM Projects

Interpretation: From the above graph, it can be interpreted that Global market condition is highly affecting the CDM Projects. Other than Global market, Carbon Trading and political changes also affects the CDM Projects.

Table 7 Internal factors affecting CDM Projects

Internal factors	No. of organizations
Monitoring cost	13
Adopting technology	8
HR Practices	1
Management	10
others	1

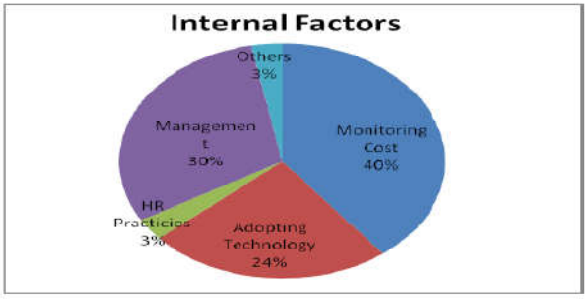

Figure 4 Internal factors affecting CDM Projects

Interpretation: From the above graph, it can be interpreted that monitoring cost of the CDM Projects is highly affecting the CDM Projects which is 40%. Other than monitoring cost, management and technology also affects the CDM Projects.

Barriers faced by the energy sector organization for the CDM Projects

Table 8 Barriers faced by the organization for the CDM Projects

Barriers	No. of organizations
Technological	7
Institutional	6
Governance	3
Co-operation	1
Others	14
Total	31

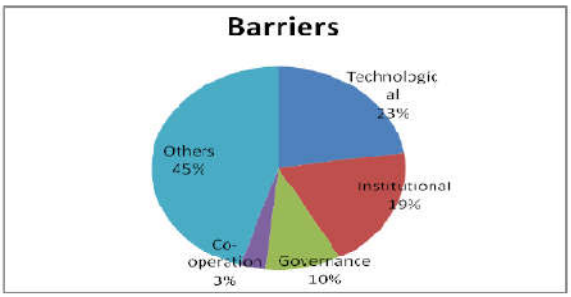

Figure 5 Barriers faced by the energy sector organizations

Interpretation: From the above graph, the result reveals that other barriers is contributing high and in others the respondent focuses on financial barriers. Technological berries is also affecting CDM Projects. Impact of CDM Projects on energy sector organizations.

Table 9 Impact of CDM Projects on energy sector organizations

Impact of CDM Projects	Very Low	Low	Neutral	High	Very High
Administration	3	5	10	3	1
Operations	1	2	9	8	2
Finance	0	0	4	14	4
Human Resource	1	3	11	7	0
Technology	1	2	8	7	4
Marketing	2	5	8	6	1
Management	0	1	9	11	1
Stakeholder	0	0	5	15	2
Competitors	3	4	8	7	0
Economy	0	2	7	7	6

Interpretation: The above data shows that the CDM Projects has an impact on financial aspect, management aspects and stakeholders of the energy sector organization.

Risk involved in CDM Projects

Table 10 Risk involve in CDM Projects

Risk involve in Projects at different level	Low(Less than 20%)	Moderate (20 to 40%)	Medium (40 to 70%)	High (More than 70%)
Planning Phase				
Feasibility Risk	5	8	7	2
Permit/License Risk	6	6	6	4
Construction Phase				
Time Over-run Risk	2	4	7	9
Capital Cost over-run Risk	1	6	12	3
Operation Phase				
Technology Risk	7	4	8	3
Market Risk	6	3	5	8
Supply Risk	8	4	5	5
Operation Risk	8	3	5	6
Political/Legal Risk	6	4	6	6
Financial Risk	4	3	5	10
Counterparty Risk	5	3	8	6

Interpretation: There are different category of the risk involved in different stages of the CDM Projects life cycle. Among all time over-run risk, capital cost over-run risk and financial risk had high degree of the risk compare to other risk as per the response from energy organizations.

Data analysis

Financial Analysis of CDM Projects in India

Project 1: 12 MW Bundled Wind Power Project in Tenkasi, Tamilnadu (0796)

Brief Description

- The project activity is the installation of 16 Wind Electric Generators (WEGs) in Tenkasi of Tirunelveli District in Tamil Nadu, Southern India.
- The project activity generates electricity and sells it to the State grid thereby displacing electricity that would have been generated from predominantly thermal source.
- Electricity generated from the project activity displaces approximately 22,552.2 tCO_2e (tonnes of Carbon dioxide equivalent) annually. During the initial crediting period of ten years the quantity of Carbon dioxide emission reductions achieved would be 225522 tCO_2e.
- The expected lifetime of the project is twenty years.

Project participants

- NEG Micon (I) Private Limited is the primary coordinator of the project and the other promoters are individual entities whose WEGs are part of the project activity.
- NEG Micon (I) Private Limited a 100% subsidiary of NEG Micon A/S Denmark having a market share of 28% globally, has installed about 700 WEGs across the country adding about 500 MW to the National grid.

Technical Description

- The project involves the installation of 750 kW Wind Electric Generators of NEG Micon. The WEGs are ideal for Indian meteorological conditions. The NM 48/750 kW WEG with a rated output of 750 kW is one of the machines well known for its best performance. The NM 48/750 kW WEG is a stall regulated machine with a cut-in speed of 4 m/s and a cut-out speed of 25 m/s.
- The NM 48/750 kW machine is type tested and certified by DNV, Denmark A/S. The technical design of the WEGs is from NEG Micon A/S, Denmark where a dedicated team of professionals are actively involved in design and testing.
- NEG Micon (I) Private Limited has been effective in technology transfer. NEG Micon (I) Private Limited has setup manufacturing plants in Chennai and Pondicherry.

Financial Analysis

The total project cost is estimated at Rs.4881 lacs out of these Rs.1920 lacs would be funded in the form of equity and Rs.2961 lacs in the form of loans from banks. The cost of capital for the given capital structure is 10.91%.

Table 2 Financial analysis without CDM revenue (Rs. in Lacs)

		2003	2004	2005	2006	2007	2008
1	Total revenue (without CDM)	927	927	927	927	927	927
2	Less: Operational Cost						
	-- Operation and Maintenance Cost		71	76.1	81.6	87.4	93.7
	--Insurance	18.3	18.3	18.3	18.3	18.3	18.3
	Total Expenses	18.3	89.3	94.4	99.9	105.3	112
3	PBIDT (1-2)	909	838	833	827	821	815
4	Depreciation	244	244	244	244	244	244
5	Interest	244	244	195	147	98	49
6	PBT [3-(4+5)]	420	349	393	436	479	522
7	Tax	33	27	31	34	38	41
8	PAT (6-7)	387	322	362	402	442	481
9	Add Depreciation	244	244	244	244	244	244
10	Net Cash Accruals (Cash Inflow)(8+9)	631	566	606	646	686	725
11	Less: Use of funds (Cash Outflow)						
	Capital Expenditure (Debt- 1921 + Equity- 2961 = 4882)						
	Repayment of term loan		592	592	592	592	592
	Total Cash Outflow:		592	592	592	592	592
12	Surplus/Deficit (10-11)	631	(26)	14	54	94	133

		2009	2010	2011	2012	2013	2014
1	Total revenue (without CDM)	927	927	927	927	927	927
	Less: Operational Cost						
	-- Operation and Maintenance Cost	100.5	107.7	115.4	123.7	132.6	142.1
	--Insurance	18.3	18.3	18.3	18.3	18.3	18.3
	Total Expenses	112	118.7	126	133.7	142	150.9
3	PBIDT (1-2)	808	801	793	785	776	766
4	Depreciation	244	244	244	244	244	244
5	Interest						
6	PBT [3-(4+5)]	564	557	549	541	532	522
7	Tax	44	44	43	42	42	41
8	PAT (6-7)	520	513	506	498	490	481
9	Add Depreciation	244	244	244	244	244	244
10	Net Cash Accruals (Cash Inflow)(8+9)	764	757	750	742	734	725
	Less: Use of funds (Cash Outflow)						
	Capital Expenditure (Debt- 1921 + Equity- 2961 = 4882)						
	Repayment of term loan						
	Total Cash Outflow:						
12	Surplus/Deficit (10-11)	764	757	750	742	734	725
	IRR Without CDM revenue				9.49%		

Source: Researcher's own study

Table 3 Financial analysis with CDM revenue (Rs. in Lacs)

		2003	2004	2005	2006	2007	2008
1	Total revenue (without CDM in lacs)	927	927	927	927	927	927
	CDM Revenue	158	158	158	158	158	158
	Total revenue (with CDM revenue in lacks)	1085	1085	1085	1085	1085	1085
2	Less: Operational Cost						
	-- Operation and Maintenance Cost		71	76	82	87	94
	--Insurance	18	18	18	18	18	18
	Total Expenses	18	89	94	100	106	112
3	PBIDT (1-2)	1066	995	990	985	979	973
4	Depreciation	244	244	244	244	244	244
5	Interest	244	244	195	147	98	49
6	PBT [3-(4+5)]	578	507	551	594	637	680
7	Tax	45	40	43	47	50	53
8	PAT (6-7)	533	467	508	548	587	626
9	Add Depreciation	244	244	244	244	244	244
10	Net Cash Accruals (Cash Inflow)(8+9)	777	711	752	792	831	871
11	Less: Use of funds (Cash Outflow)						
	Capital Expenditure (Debt- 1921 + Equity- 2961 = 4882)						
	Repayment of term loan		592	592	592	592	592
	Total Cash Outflow:		592	592	592	592	592
12	Surplus/Deficit (10-11)	777	119	160	200	239	278

		2009	2010	2011	2012	2013	2014
1	Total revenue (without CDM in lacs)	927	927	927	927	927	927
	CDM Revenue	158	158	158	158	158	158
	Total revenue (with CDM revenue in lacks)	1085	1085	1085	1085	1085	1085
2	Less: Operational Cost						
	-- Operation and Maintenance Cost	100	108	115	124	133	142
	--Insurance	18	18	18	18	18	18
	Total Expenses	119	126	134	142	151	160
3	PBIDT (1-2)	966	959	951	943	776	766
4	Depreciation	244	244	244	244	244	244
5	Interest						
6	PBT [3-(4+5)]	722	715	707	699	532	522
7	Tax	57	56	55	55	42	41
8	PAT (6-7)	665	659	652	644	490	481
9	Add Depreciation	244	244	244	244	244	244
10	Net Cash Accruals (Cash Inflow)(8+9)	909	903	896	888	734	725
11	Less: Use of funds (Cash Outflow)						
	Capital Expenditure (Debt- 1921 + Equity- 2961 = 4882)						
	Repayment of term loan						
	TotalCash Outflow:						
12	Surplus/Deficit (10-11)	909	903	896	888	734	725
	IRR With CDM revenue				12.18%		

Without considering the CDM revenues for the above project the IRR works out to 9.49% and with CDM revenues, it works out to 12.18%. The cost of capital for the given capital structure is 10.91% and hence the project is viable only after considering CDM revenues.

CONCLUSION

The current study deals with the energy sector organisations that had registered large scale CDM Projects and implemented in India till 2012. (Kyoto Protocol Phase I). The study has examined aspects considered for registration, factors affecting CDM projects, barriers faced by organisation, risk involved in projects, impact on organisations, carbon trading and carbon financing and corporate social responsibility. There is various renewable energy sources used for the CDM Projects.

The data shows that solar and wind technologies are the major used technology by the organisations for CDM Projects because of geographical location of India. Waste Management and biogas technology can be used by the organisations and that is an opportunity available for organisations. As per NCDMA, there are list of aspects to be considered by the organisation for registration of the projects. Through study it has been identified that projects need to be eco-friendly, create employability and feasibility of the CDM Projects are vital aspects to be considered. The findings further revealed that there are certain external and internal factors affects the CDM Projects.

In last few years, changes in the global economy has played a vital role in implementing the projects as an external factor and lack of skilled manpower has increased the monitoring cost is considered as an internal factor. The result of the study indicate that there various risks involved in the CDM Project life cycle. Out of all the risks associated with Projects, capital cost over-run risk, operational risk and supply risk were found to be influencing the CDM Projects. CDM Projects also affects organisation functions. Finance, Stakeholder and Management are most affected functions in organisation by CDM Projects. With perspective of no. of employees, only administrative function was analyzed as being affected. The major source for carbon financing used by the energy sector organisations are equity and loans.

The organisations which had registered CDM Projects do not necessary to go for carbon trading because they had contract with the foreign Organisations. Some of the organisations which had gone for carbon trading mostly prefer forward contract because of carbon pricing fluctuations. As per the current trend, Corporate Social Responsibility has given high priority by the Organisations and the study revealed that carbon credit play positive role for the deployment of CSR. The degree for the deployment of CSR is high as per the respondents of energy organisations. Majority of the energy sector organisations had registered single Projects.

By the discussion with the representative of energy organization, there are very less organisations who wish to register other projects. This will affect the future of the Kyoto protocol phase II. The energy organisations think that they were not able to get expected return from carbon pricing and other hand the cost of the project is also increased. Till the carbon credit will not reach up to proper pricing, there are less energy organisations who wish to register projects in near future.

Implications of the Study

The study presented various concepts that related to CDM Projects. The study contributes to the society where the contemporary issue has been focused that help the society for better understanding of the concept and decide the new strategy for delay the global warming. The governing bodies also get some facts that help them for designing future strategies. It helps for the organisations for better understanding and important criteria need to be focus. It also derived the relation of CDM Projects and organisations functions. The research helps the economy to understand the Annexure I and Annexure II classifications and Kyoto protocol mechanisms defined by UNFCCC. It also presented the future potential of Kyoto protocol phase II that will help the researcher for the further research.

References

Brown (2004) How do CDM projects contribute to sustainable development? Tyndall Centre for Climate Change Research Technical Report 16.

Brunt (2005) Delivering Sustainable Development Benefits through the Clean Development Mechanism-Promoting the developmental benefits of the CDM: An African Case Study. Sustainable Development, Alberta: Pembina Institute.

Cabraal (2005) Productive uses of energy for rural development. *Annual Review of Environmental Resources* 30 , 117-144.

Cames (2003) CDM Host Country Institution Building, Mitigation and Adaptation. Strategies for Global Change 8: 201-220.

Chung (2007) A CER Discounting Scheme could Save Climate Change Regime after 2012. Climate Policy 7 , 171-176.

Cosbey (2007) Market Mechanisms for Sustainable Development: How Do They Fit in the Various Post-2012 Climate Efforts. The Development Dividend Project, phase III. International Institute for Sustainable Development(IISD).

Curnow (2009) Implementing CDM – A guidebook to host country legal issues. Baker and McKenzie and UNEP Risoe Centre.

Grubb (1999) The Kyoto Protocol: A Guide and Assessment.. RIIA, Earthscan , 256-268.

Haya (2009) Measuring Emissions Against an Alternative Future: Fundamental Flaws in the Structure of the Kyoto Protocol's Clean Development Mechanism. Energy and Resources Group Working Paper ERG09-001. University of California, Berkeley.

Ilskog (2008) Indicators for Assessment of Rural electrification—An Approach for the Comparison of Apples and Pears. *Energy Policy*, 36(7) , 2665-2673.

Ilskog (2008) And then they Lived Sustainably Ever After? - Assessment of Rural Electrification Cases by Means of Indicators. *Energy Policy*, 36(7) , 2674-2684.

Kalia (2011) Sustainability - The Way Ahead for Banking and Financial Institutions. Ernst and Young.

Kamel (2007) Capacity Development for CDM Project: Guidebook to financing CDM Projects. UNEP, Ecosecurities.

Kolshus (2001) Can the Clean Development Mechanism Attain Both Cost-effectiveness and Sustainable Development Objectives? CICERO Working Paper

Lohmann (2006) Carbon trading – A critical conversation on climate change, Privatization and power. Development Dialogue Dag Hammarskjöld Foundation, Corner House.

Labatt (2007) Carbon Finance: The Financial Implication of Climate Change. Hoboken, New Jersey, John and Wiley and Sons Inc.

Leggett (1996) Climate Change and the Financial Sector: The Emerging Threat. The solar solution.

Legros (2009) The Energy Access Situation in Developing Countries: A Review Focusing on the Least Developed Countries and Sub-Saharan Africa. United Nations Development Programme (UNDP), World Health Organization , New York, USA.

Lloyd's (2006) Climate change-adapt or bust. 360 Risk Project Catastrophy Trends.

Matschoss (2007) The Programmatic Approach to CDM: Benefits for Energy Efficiency Projects. CCLR The Carbon and Climate Law Review, Volume 1 (2): , Lexxion , 119-128.

Mendis (2004) The clean development mechanism: making it operational. Environment, Development and Sustainability 6(1) , 183-211.

Michaelowa (2008) Empirical Analysis of Performance of CDM Projects, Political Economy and development. Climate policy.

Michaelowa (2005) Transaction costs, institutional rigidities and the size of the Clean Development Mechanism. Energy Policy 33 , 511-523.

Michaelowa (2003) Transaction costs of the Kyoto Mechanisms. Climate Policy 3 , 261-278.

Michealowa (2007) Additionality determination of Indian CDM projects. Can Indian CDM project developers outwit the CDM Executive Board? Climate Strategies.

Modi (2004) Energy Services for the Poor (Commissioned paper for the Millenium Project Task Force 1). Climate Change.

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