A study of Carbon Credit Market in India (Gujarat)

A thesis submitted to Gujarat Technological University

for the Award of

Doctor of Philosophy

In

Management

By

Avani Nareshbhai Shah

[119997392004]

GUJARAT TECHNOLOGICAL UNIVERSITY

AHMEDABAD

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under supervision of

Dr. Narayan Baser

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DECLARATION

I declare that the thesis entitled **"A study of Carbon Credit Market In India (Gujarat)"** submitted by me for the degree of Doctor of Philosophy is the record of research work carried out by me during the period from **September 2011** to **September 2016** under the supervision of **Dr. Narayan Baser** and this has not formed the basis for the award of any degree, diploma, associateship, fellowship, titles in this or any other University or other institution of higher learning.

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[A STUDY OF CARBON CREDIT MARKET IN INDIA (GUJARAT)] A Thesis submitted to Gujarat Technological University for the Award of Doctor of Philosophy in [Management] by [Avani Nareshbhai Shah] [119997392004] under supervision of [Dr. Narayan Baser] GUJARAT TECHNOLOGICAL UNIVERSITY AHMEDABAD [Month – Year of Submission] CHAPTER-[1] [Introduction] ??? General Introduction As per Kolk et al., 2009 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 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). 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 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

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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 CO_2 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 organisations and baselines, factors and risk level associated with the different registered Clean Development Mechanism (CDM) projects of energy sector organisations in Gujarat. It has also examine the barriers faced by selected organisations and the impact of CDM projects for running the carbon credit project. Drawing upon the research from energy sector organisations of Gujarat in Kyoto protocol phase I, this study proposes the number hypothesis relating to baselines, factors, risk level, barriers, and impact of CDM projects, carbon trading and corporate social responsibility. Based on the normality of the dataset, the non-parametric tests were used.

The result of the research shows that solar and wind technologies are the major used technology by the energy sector organisations for CDM projects in Gujarat. 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 organisations. 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 organisations 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

organisations 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 organisation 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 focusing on energy sector of Gujarat. Finally, the research identifies and recommends areas for future studies.

Key words: Global warming, Kyoto Protocol, CDM project and Energy sector

Acknowledgement and / or Dedication

I wish to express my sincere gratitude to those individuals who have supported me throughout my journey of the doctoral research. First and foremost, I would like to thank God for giving me the opportunity to finish this process. My deep appreciation goes to my supervisor Dr. Narayan Baser, whose valuable advice has enabled me to complete my doctoral research in time. The completion of the doctoral work could not have been possible without flawless support and guidance of DPC members: Dr. Mahendra Sharma and Dr. Akash Patel. Special thanks to foreign co-supervisor Prof. Gregor Radonjič for giving his valuable insights.

I also acknowledge Honorable Dr. R.K.Gajjar (I/C Vice Chancellor, Dean Ph.D. Section), Dr. N.M.Bhatt (Dean, Ph.D. Section), Mr. J.C.Lilani, (I/C Registrar), Ms. Mona Chaurasiya, (Research Coordinator), Mr. Dhaval Gohil and staff members of Ph.D. section for their assistance and support. Very special gratitude goes to Director of my institute and my dearest colleagues for their continuous support and encouragement.

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List of Abbreviation

BEE - Bureau of Energy Efficiency

CAGR - Compound annual growth rate

CCS - Carbon capture and storage

CDM - Clean Development Mechanism

CER - Certified Emission Reduction

CO_2 - Carbon dioxide

CO_2e - Carbon dioxide equivalent

COP - Conference of Parties

CSR - Corporate Social Responsibility

DCs - Designated Consumers

DNA - Designated National Authority

DOE - Designed Operational Entity

EB - Executive Board

ECX - European Climate Exchange

EPBT - Energy Payback Time

EPF – Energy Production Factor

ERUs - Emission Reduction Units

ET - Emissions Trading

EU - European Union

EU ETS - European Union Emissions Trading Scheme

FY - Financial Year

GATT - General Agreement on Tariffs and Trade

GDP - Gross Domestic Production

GFL – Gujarat Florochemical Ltd.

GHGs - Green House Gases

GW - Giga Watt

HCA - Host Country Approval

ICAI - The Institute of Chartered Accountants of India

IET - International Emission Trading

IEX – Indian Energy Exchange

IISD – Indian Institute of Sustainable Development

IPCC- Intergovernmental Panel on Climate Change

JI - Joint Implementation

KP - Kyoto Protocol

kWh - Kilo Watt Hour

LCA - Life cycle analysis

LCCE – Life Cycle Conversion Efficiency

LUCF - Land-use change and forestry projects

MNRE - Ministry of New and Renewable Energy

MOP - Ministry of Power

MTOE - Million ton of oil equivalent

MW - Mega Watt

NCDEX - National Commodity and Derivatives Exchange Ltd

NCDMA - National CDM Authority

OECD - Organisation for Economic Co-operation and Development

ODA- Official Development Assistance

PAT - Perform, Achieve and Trade

PCN - Project Concept Note

PDD - Project Design Document

PoAs - Program of Activities

PV – Photovoltaic

PXIL – Power Exchange India Ltd.

SEC – Specific Energy Consumption

TWh - Terawatt hours

UNCED - United Nations Conference on Environment and Development

UNFCCC - United Nations Framework Convention on Climate Change

WTO - World Trade Organization

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Key Terms

Kyoto Protocol: An international agreement that aims to reduce carbon dioxide emissions and the presence of greenhouse gases. Countries that ratify the Kyoto Protocol are assigned maximum carbon emission levels and can participate in carbon credit trading. It is an agreement came into force 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.

Certified Emission Reductions (CERs): CER is equal to one metric ton of Carbon dioxide equivalent (CO_2e).

Clean Development Mechanism (CDM): In 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.

Large scale CDM projects: The technology to be employed by the project activity is equal and more than 15 MW considered to be large scale CDM project.

Carbon Credit: A permit that allows the holder to emit one ton of carbon dioxide.

Carbon Trade: An international agreement that aims to reduce carbon dioxide emissions and the presence of greenhouse gases. Countries that ratify the Kyoto Protocol are assigned maximum carbon emission levels and can participate in carbon credit trading.

CHAPTER-1

Introduction

1.1 General Introduction

As per Kolk et al., 2009 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 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).

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 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 11^{th} 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 11^{th} 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

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).

1.2 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 with focus on Gujarat. 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.

1.3 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 Gujarat for detailed analysis of different parameters.

1.4 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 on organisation of energy sector of Gujarat. 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.

1.5 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 as well as Gujarat.
- Analyse the aspects considered by the energy sector organisation for CDM Projects.
- Studying the factors as well as barriers affecting CDM projects in Gujarat.
- Studying the impact of CDM projects on energy sector organisation, while the study also covered the risk associated with CDM projects.

1.6 Structure of the Thesis

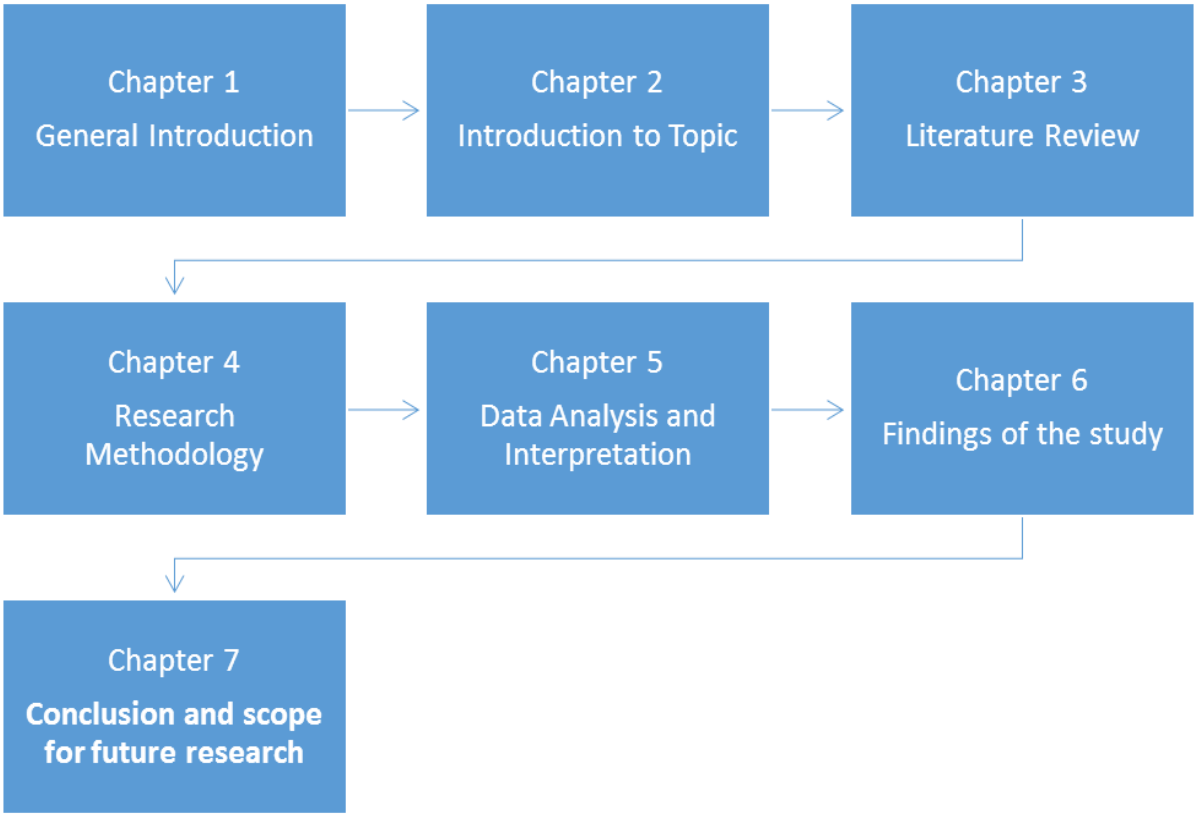

Figure 1.1: Structure of Thesis

Chapter two provides the overview about the concept called carbon credit and energy industry in India. The chapter covers the concept generation of carbon credit, legal framework with respect to India and Gujarat. It also introduces some of the facts and figures about the energy sector of the global as well as Indian market. CDM provides trading of greenhouse gases reductions that is measured in terms of Certified Emission Reduction (CER) where each CER is equal to one metric ton of Carbon dioxide equivalent (CO_2e). So this chapter also introduced the need of CER in energy industry in India.

Chapter three introduces the review of literature covering the global warming and GHGs emission, Kyoto Protocol, and legal aspects of the concept. It also emphasised on the CER Market in India and Gujarat.

Chapter four explores the debate over empirical studies concerning the topic investigated, in order to find the research variables and develop the research model. Accordingly, this chapter starts by presenting the conceptual framework developed, define variables and justify the research hypotheses. The chapter explains and discusses methodological issues required for conducting the research. It also covers different topics such as types of research paradigms and designs, the research methods selected, sampling procedures, the data analysis technique used and finally research plan for the primary data collection and its analysis.

Chapter five focuses on the data analysis of the samples that are energy sector organisations who had registered their large scale CDM projects up to 2012 through questionnaire by applying statistical tools.

Chapter six reviews and summarised the findings obtained from the data analysis. Furthermore, this chapter also gives the broader overview of the findings from literature review.

Chapter seven explores the study and provides the conclusion of the study, contribution of the research as well as the direction for future research.

CHAPTER-2

Introduction to Topic

2.1 Introduction

The chapter aims to explain the main concepts called “Carbon Credit”. This chapter spread out in different sections covering global warming, Kyoto protocol, CDM framework in India as well as Gujarat and Energy sector scenario. It also focused on CDM governance in India and process of submitting CDM project under NCDMA. This chapter also covers the Energy sector and its future potential.

2.2 Background of the Global Climate Change

One of the environmental threats our planet faces today is global warming. When carbon dioxide is released into the atmosphere, it acts like the ceiling of a greenhouse, trapping solar energy and retarding the escape of reflected heat. It is therefore a species—the most important species—of a "Greenhouse Gas." Since the dawn of the industrial revolution in the mid-eighteenth century, the concentration of CO_2 in the Earth’s atmosphere has risen approximately 30%. The rate of growth for CO_2 emissions continues to increase, with the rate much higher for the ten years of period 1995-2004 compared to the previous 24 years of period 1970-1994 (IPCC 2007). Scientist estimates that as a result of global climate change, the earth average temperature would increase up to six and one half degree Fahrenheit by 2100. All the nations needs to work together to prevent this sort of disruption of natural and human systems on planet. To delay the cause of global climate change, a group of states, local governments, and private organisations, aligned in a formal request under the clean air act to regulate the emissions of the six main GHGs measured as the equivalent in carbon dioxide.

The targets for the first commitment period of the Kyoto Protocol cover emissions of the six main greenhouse gases, namely: Carbon dioxide (CO_2); Methane (CH_4); Nitrous oxide (N_2O); Hydro fluorocarbons (HFCs); Perfluorocarbons (PFCs); and Sulphur hexafluoride (SF_6) Das (2008).

Drawing on expert opinions across the globe, the IPCC concluded that "emissions resulting from human activities are substantially increasing the atmospheric concentrations of greenhouse gases which will enhance the greenhouse effect, resulting on average in an additional warming of the Earth's surface." Pathak et al. (2009) emphasized on the scientific consensus as global warming “one of the major environmental challenge”. There is a need to develop GHGs mitigation strategies to reduce the adverse impacts of climate change. Biogas technology provides an excellent opportunity for mitigation of GHGs and reducing global warming through (1) replacing firewood for cooking, (2) replacing kerosene for lighting and cooking, (3) replacing chemical fertilizers and (4) saving trees from deforestation. It creates business opportunity to a growing global market in which industrial polluters in developed countries that cross administered emission limits of GHGs fund clean technology projects in developing countries. This mechanism helps to generate “carbon market,” the emission reduction translated into currency called ‘carbon credits’ (Ball 2007). The notion of carbon credits is rooted in the Kyoto protocol, which allows industrialized countries that agree to carbon caps to meet their quotas in part by bankrolling emission reducing projects at sites where the task will be less expensive.

2.3 Kyoto Protocol

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. As IISD (2009) described that during the Third Conference of Parties (COP) of UNFCCC (which was agreed at the Earth Summit at Rio-de-Janeiro in 1992); the protocol has described six greenhouse gas emissions. The implementation of concept got delayed for more than 7 years, because there were difficulties in obtaining the necessary number of ratification from the countries, who accounted for 55% of carbon dioxide equivalent emissions of 1990 level. As the initial stage, 141 countries of the world have ratified the protocol, although a few

major GHGs emitting countries have not. India, along with most of the European Countries and Many other developing counties, has ratified the protocol; although USA and Australia have not (IISD, 2009).

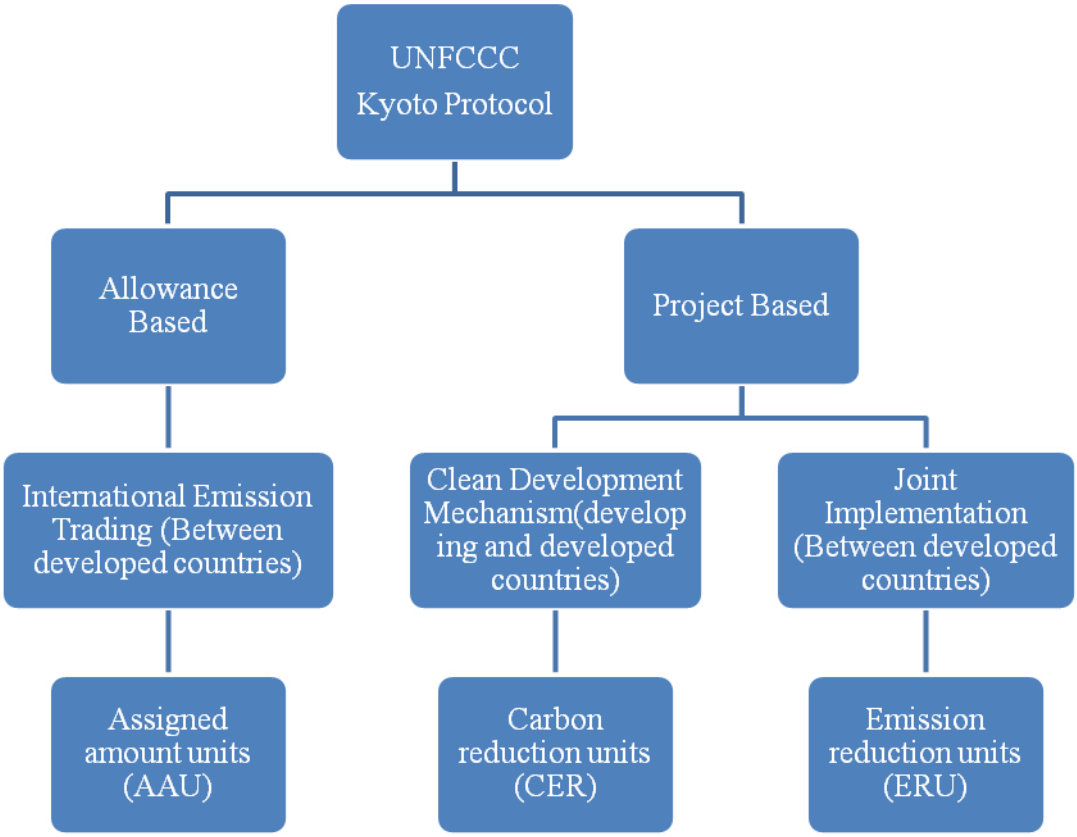

Figure 2.1: Kyoto protocol mechanisms

(Source: www.unfccc.in)

The Kyoto Protocol has brought out three mechanisms for GHG emission abatement. They are: (i) Joint Implementation (JI) (ii) Clean Development Mechanism (CDM) (iii) International Emission Trading (IET). The CDM and JI are international crediting mechanisms under the KP, which is an international agreement under the United Nations Framework Convention on Climate Change (UNFCCC) to limit GHG emissions. The KP sets binding GHG emissions targets for industrialized countries (known as 'Annex B countries'), amounting to an average of 5.2% compared with 1990 levels over the commitment period 2008-2012 (UNFCCC, 2011a).

- **Joint Implementation (JI):**

In Joint Implementation, a developed country with relatively high costs of domestic greenhouse reduction would set up a project in another developed country. They produce Emission Reduction Units (ERUs) just like CERs in CDM.

- **Clean Development Mechanism (CDM):**

In Clean Development Mechanism (CDM), a developed country can 'sponsor' a greenhouse gas reduction project in a developing country where the cost of greenhouse gas reduction project activities is usually much lower, but the atmospheric effect is globally equivalent. 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.

- **International Emission Trading:**

Here, the Annex I countries can trade in the international carbon credit market to cover their shortfall in allowances. Countries with surplus credits can sell them to countries with capped emission commitments under the Kyoto Protocol.

All these mechanisms are market-based. The first two are project based, wherein the third one allows the developed countries to sell surplus emission of one country to another developed country. CDM Projects are of importance to us amongst the rest as only Clean Development Mechanism Projects are applicable to India and has potential opportunity for India in terms of transfer of technology, investment, carbon trading, profits and most of all environmental benefits (The Institute of Chartered Accountants of India- ICAI, 2009).

According to Poudyal et al., 2011, there are factors which lead to participation in green projects including credibility and reputation, relationship with stakeholders, cost reduction, operational effectiveness, and compliance with business and legal agreements. It has also been argued that environmental performance indirectly generates higher revenue for businesses through reduction of production costs, product differentiation ability, and market access. These factors may motivate businesses to either adopt cleaner technology or to invest

part of their profit in green projects such as environmental improvements, wildlife conservation.

Carbon offsets exist as a new socio-ecological interface in the management of the environment and economy. Offsets are tools to manage anthropogenic climate change and, in some cases, contribute to international sustainable development; carbon dioxide is the most common anthropogenic greenhouse gas (IPCC 2007). The calculation of ton of carbon dioxide equivalent (i.e. tCO2e) arises from the need to develop a common benchmark of the global warming potential of the six greenhouse gasses over a 100-year span by using the global warming potential of 1 ton of carbon as a baseline indicator. In contrast to emissions allowances that are allocated and either given away or auctioned by governments in cap and trade systems, offsets employ specific technologies or forestry mechanisms to reduce emissions in specific projects activities (Stavins, 2008).

The Protocol's provisions have set the stage for the member states of the European Union to address their commitments using a regional cap-and-trade system. By far the largest existing active cap-and-trade program in the world is the European Union Emissions Trading Scheme (EU ETS) for CO_2 allowances, which has operated for the past couple of years. Although the first phase, a pilot program from 2005 to 2007, permitted only trading in CO_2, the second phase, from 2008 to 2012, potentially broadens the program to include other GHGs. In its first 2 years of operation, the EU ETS has produced a functioning CO_2 market, with spikes in trading activity occurring along with major price changes. Apart from some problems with the program design and early implementation, it would soon to provide a definitive assessment of the system's performance (Perdan et al. 2011).

2.4 Project Cycle of Clean Development Mechanism (CDM)

Sarkar (2010) has focused on the carbon credit development in India. The Clean Development Mechanism (CDM) is one of the initiatives taken by developed countries to meet their GHGs emission reduction commitments by investing in GHG mitigation projects in developing countries under the head of UNFCCC. The CDM will serve as a symbiotic association between the Annexure I and Non Annexure I country parties where both the countries benefited from the association. Through this mechanism, developed nation derived the

benefits from the association by achieving GHG emission abatement targets by implementing projects in developing nations at a lower cost. The projects were implemented within national boundaries; the developing country parties would be also benefited by receiving new sustainable technologies and funding aids helping to achieve the objectives. The other benefits to the developing country parties would be in terms of increased income, employment generation, alleviation of the poor and improvement of ambient air quality and standards of living.

CDM provides trading of greenhouse gases reductions that is measured in terms of Certified Emission Reductions (CERs) where each CER is equal to one metric ton of Carbon dioxide equivalent (CO_2e). Trading of CERs can take place between those countries who have agreed emissions reductions targets under UNFCCC (Annex-1 countries) and those who have not yet agreed to emission reductions targets (Non Annex countries). Out of the 3 Kyoto mechanisms, CDM is the only mechanism for the developing world which encourages cleaner development in developing countries and brings infusion of investments and technologies in developing countries. It provides an opportunity to adopt cleaner technologies and be paid for emission reductions. CDM undergoes through a project cycle involving four stages (IISD, 2009) such as:

- Project Development
- Validation and Registration
- Project Monitoring
- Verification, Certification and Issuance of Certified Emission Reductions (CERs)

2.5 Carbon Tax

Hetman (2009) describes the energy trade and WTO law dimensions. GATT and WTO provide the underpinnings to the global trading system. Without those rules, the ordered processes of international commerce, including trade in energy goods and services, would be at risk. In the context of efforts aimed at reducing greenhouse gases (GHGs), including measures implementing the UNFCCC, the Kyoto Protocol. The GATT/WTO trade law

dimension is increasingly pertinent as proposals percolate to the surface involving use of border taxes or adjustments of one sort or another to deal with GHG reductions, including climate-change bills introduced in the US Congress.

2.6 Carbon Market Development in India

India signed the UNFCCC on 10 June 1992 and ratified it on 1 November 1993. Under the UNFCCC, developing countries such as India do not have binding GHG mitigation commitments in recognition of their small contribution to the greenhouse problem as well as low financial and technical capacities. The ministry of environment and forest is the nodal agency for climate change issues in India. It has constituted working Groups on the UNFCCC and Kyoto Protocol. Looking at India's CDM scenario in terms of corporate participation, Big corporations such as Tata, Reliance, Ambuja, Birla, Bajaj, and many others, who ritually emit millions of tons of carbon dioxide into the biosphere and earn handsome returns in the name of 'clean development mechanism'. Ever since the unique mitigation strategy of carbon trading was conceptualized in the Kyoto Protocol, India seems to have been one of the busiest countries to put the concept into action (NFFPFW, 2011). By the end of 2012, India had 2784 CDM projects registered with the UNFCCC, taken together; the projects claim to reduce a whopping 722,827,037 tons of CO_2 equivalent in Kyoto protocol phase I (meaning that the same amount of tradable CERs will be credited to the projects, if UNFCCC registers them all). The projects will able to reduce about 1520 million tons of GHGs till 2020 (MNRE, 2009-10).

Power Exchange India Ltd (PXIL), Mumbai and Indian Energy Exchange (IEX) Delhi had on March 30, 2011 opened First trading session for trading of Renewable Energy Certificates (RECs). 532 RECs issued, 424 were sold successfully. Though there was sizable demand for Solar RECs, no trade concluded on any of the exchanges, since none of the solar energy projects has been accredited/ issued any solar REC, so far. The Ministry of Power (MOP), Government of India, under the proposed "Perform, Achieve and Trade (PAT)" Scheme, has developed a market based mechanism to drive delivery of additional energy savings on a cost effective basis. Under proposed scheme MOP, has notified 563 Designated Consumers (DCs) in eight industrial sectors viz. thermal power plants, fertilizers, cements, pulp and paper,

textiles choir-alkali, iron and steel and aluminums. The DCs would be required to comply with the energy conservation norms and prescribed standards as per the EC Act 2001. The mechanism will further call for a setting up of baseline for individual targets for saving at plant level and the issuance of Energy Saving Certificates (EScerts) which will be traded over the counter as well in the energy exchanges. The energy efficiency improvements targets would be unit specific i.e. each DC would be required to reduce its specific energy consumption (SEC) by a fixed percentage, based on its baseline SEC. Bureau of Energy Efficiency (BEE) is designated as the overall regulator and dispute resolution agency and Energy Efficiency Service Ltd. (EESL) as the process manager in the entire mechanism. The first cycle of PAT is started in April 2011 with the aim to cover aforesaid eight industrial sectors to achieve higher energy efficiency in a span of three years. The subsequent PAT cycle will include more sectors. PAT aims at increase in industrial energy efficiency by bringing down energy consumption by 5%, amounting to an avoided capacity of over 5,600 MW over the three-year period. The ministers from Basic countries felt that the agreements made during the earlier conference on climate change at Cancun, Mexico couldn't serve as a substitute to the Bali Road Map and a number of issues particularly; issues of equity, intellectual property rights and trade which were very important to countries were not addressed (MNRE, 2009-10).

Table 2.1: Replacement and Technology

Year	Annual reduction		Cumulative reduction	
	Normal replacement	Accelerated replacement	Normal replacement	Accelerated replacement
2003	23	31	23	31
2004	24	34	47	65
2005	26	40	73	105
2006	29	44	102	149
2007	32	47	134	196
2008	35	50	169	246
2009	37	52	206	298
2010	41	54	247	351
2011	44	56	290	407
2012	47	58	337	465
2013	50	60	388	524
2014	54	62	442	586
2015	54	61	496	647

2016	54	60	550	707
2017	54	59	603	765
2018	54	58	657	823

(Source: Bernstein et al., 2006)

Table 2.2: Total Carbon Emissions from the Consumption of Energy

Table: (Million Metric Tons)					
Particulars	2008	2009	2010	2011	2012
North America	6869.07	6397.26	6604.21	6482.33	6298.31
Bermuda	0.75	0.71	0.70	0.59	0.61
Canada	574.24	544.89	541.46	551.59	550.83
Greenland	0.64	0.65	0.65	0.62	0.60
Mexico	452.79	421.12	431.30	446.23	453.83
Saint Pierre and Miquelon	0.09	0.09	0.09	0.09	0.15
United States	5840.55	5429.80	5630.02	5483.21	5270.42
Central & South America	1220.36	1198.00	1272.49	1335.24	1399.62
Antarctica	0.26	0.24	0.07	0.14	0.10
Antigua and Barbuda	0.66	0.67	0.67	0.59	0.59
Argentina	170.43	169.46	174.60	194.61	196.00
Aruba	1.07	1.04	1.04	0.90	0.88
Bahamas, The	5.08	3.60	3.60	3.64	3.84
Barbados	1.49	1.51	1.41	1.44	1.31
Belize	1.04	0.47	0.47	0.47	0.68
Bolivia	14.00	13.00	13.26	14.45	17.28
Brazil	427.40	406.96	449.06	476.60	500.23
Cayman Islands	0.49	0.55	0.56	0.54	0.47
Chile	65.44	72.51	78.26	78.49	81.51

Colombia	63.14	63.47	65.97	70.58	74.90
Costa Rica	7.13	6.93	7.02	6.67	7.29
Cuba	29.09	29.26	28.32	27.88	25.99
Dominica	0.13	0.13	0.13	0.14	0.13
Dominican Republic	19.32	18.13	18.59	20.70	20.80
Ecuador	27.12	30.41	32.70	34.73	37.23
El Salvador	5.93	5.93	5.92	6.35	6.37
Falkland Islands (Islas Malvinas)	0.05	0.05	0.05	0.05	0.05
French Guiana	1.06	0.82	0.99	1.07	1.04
Grenada	0.29	0.27	0.27	0.27	0.43
Guadeloupe	2.35	2.13	2.13	2.19	2.33
Guatemala	10.92	11.73	11.17	12.52	13.07
Guyana	1.52	1.64	1.63	1.68	1.66
Haiti	2.01	2.25	2.12	2.09	2.09
Honduras	7.91	7.21	7.54	8.03	10.33
Jamaica	12.55	9.29	9.18	9.62	12.75
Martinique	2.45	2.67	2.68	2.80	2.84
Montserrat	0.09	0.08	0.08	0.09	0.09
Netherlands Antilles	10.59	12.21	11.56	12.15	11.84
Nicaragua	4.50	4.49	4.46	4.82	5.29
Panama	14.98	15.87	17.50	17.18	16.23
Paraguay	3.83	4.09	4.44	3.99	3.87
Peru	36.29	37.05	42.29	42.22	53.58
Puerto Rico	34.37	28.99	32.35	26.76	26.81
Saint Kitts and Nevis	0.27	0.27	0.27	0.27	0.25
Saint Lucia	0.43	0.41	0.41	0.42	0.42

Saint Vincent/Grenadines	0.23	0.20	0.20	0.20	0.27
Suriname	1.95	2.05	2.01	2.19	2.27
Trinidad and Tobago	49.56	47.83	52.30	52.17	51.27
Turks and Caicos Islands	0.08	0.17	0.17	0.16	0.16
Uruguay	8.00	9.06	8.47	8.37	7.59
Venezuela	161.79	157.56	160.91	171.12	184.79
Virgin Islands, U.S.	12.93	15.21	15.56	13.75	12.41
Virgin Islands, British	0.12	0.11	0.11	0.12	0.16
Europe	4581.15	4279.52	4375.66	4348.06	4263.26
Albania	4.37	2.82	3.80	4.08	3.96
Austria	69.99	65.26	70.06	69.34	66.68
Belgium	153.53	134.71	137.19	140.13	139.14
Bosnia and Herzegovina	21.06	21.58	21.95	27.51	26.00
Bulgaria	50.61	44.74	48.02	52.56	48.85
Croatia	21.74	20.05	19.27	17.83	20.18
Cyprus	9.82	9.23	8.90	8.73	8.80
Czech Republic	99.10	92.10	94.69	94.35	91.15
Denmark	51.91	48.83	49.55	45.31	40.51
Faroe Islands	0.70	0.72	0.73	0.77	0.75
Finland	53.62	50.94	57.83	51.61	46.81
France	421.56	386.37	385.73	374.32	364.54
Germany	812.61	758.18	801.36	784.38	788.32
Gibraltar	4.55	4.86	4.95	4.75	3.95
Greece	106.04	99.83	92.87	92.08	87.56
Hungary	56.01	51.90	52.16	52.17	47.90
Iceland	3.72	3.32	3.27	3.59	3.50

Ireland	44.87	38.92	39.47	36.21	35.49
Italy	449.75	407.63	416.82	411.56	385.81
Kosovo	6.29	7.23	7.78	7.56	7.58
Luxembourg	11.96	11.44	12.16	11.63	11.69
Macedonia	8.98	8.41	7.97	8.69	8.08
Malta	3.18	6.68	8.00	7.52	6.56
Montenegro	2.16	1.55	2.22	16.91	19.72
Netherlands	229.53	222.93	233.48	239.74	239.61
Norway	40.03	44.72	44.81	41.65	41.06
Poland	294.70	286.47	304.72	308.10	289.45
Portugal	56.14	57.10	53.81	53.16	51.20
Romania	93.88	81.17	78.29	89.48	86.06
Serbia	51.57	49.73	49.86	43.88	41.38
Slovakia	38.30	35.18	36.84	35.04	32.08
Slovenia	17.42	16.11	15.94	15.99	15.87
Spain	354.70	327.80	312.40	318.23	312.44
Sweden	54.71	51.84	58.52	54.04	51.08
Switzerland	45.26	43.90	41.99	41.92	42.97
Turkey	272.90	269.06	269.37	294.91	296.93
United Kingdom	563.87	516.19	528.89	488.31	498.88
Eurasia	2534.58	2211.98	2437.91	2551.37	2671.98
Armenia	11.08	10.01	10.50	11.50	12.12
Azerbaijan	43.18	34.09	32.47	32.23	35.14
Belarus	66.95	61.12	64.36	67.73	67.13
Estonia	6.32	5.22	4.96	5.53	5.69
Georgia	5.79	6.53	6.40	5.90	6.26

Kazakhstan	196.67	172.83	183.58	206.86	224.22
Kyrgyzstan	5.84	8.30	8.40	8.66	9.28
Latvia	8.03	7.92	7.83	8.05	7.90
Lithuania	18.12	13.39	14.24	15.19	16.69
Moldova	7.32	6.62	6.70	6.63	9.41
Russia	1629.09	1479.04	1661.51	1710.03	1781.72
Tajikistan	6.87	2.43	2.65	2.96	2.97
Turkmenistan	59.81	51.80	52.79	54.87	64.98
Ukraine	342.40	245.53	274.97	298.14	290.38
Uzbekistan	127.12	107.15	106.56	117.09	123.17
Middle East	1630.85	1740.68	1807.43	1959.43	2035.65
Bahrain	29.91	30.21	30.59	30.25	32.20
Iran	512.05	562.58	564.30	594.46	603.59
Iraq	104.17	112.59	113.54	119.95	130.74
Israel	68.74	66.91	71.92	74.37	80.36
Jordan	19.30	19.63	20.66	18.15	16.86
Kuwait	78.10	82.24	90.10	100.46	105.68
Lebanon	14.65	19.85	18.89	20.63	16.44
Oman	43.75	46.04	52.73	53.68	62.85
Palestinian Territories	3.01	2.04	2.04	2.59	3.01
Qatar	63.50	68.41	69.77	81.48	99.17
Saudi Arabia	421.64	437.69	468.73	551.39	582.67
Syria	54.41	61.63	65.52	63.19	50.92
United Arab Emirates	193.94	208.79	217.65	228.67	234.06
Yemen	23.69	22.09	20.98	20.15	21.28
Africa	1152.38	1145.85	1156.73	1168.66	1205.70

Algeria	106.92	113.99	112.71	122.13	133.92
Angola	23.08	24.47	26.59	29.76	31.61
Benin	3.36	4.51	5.06	5.21	4.58
Botswana	4.34	4.32	5.05	4.67	3.92
Burkina Faso	1.38	1.70	1.73	1.68	1.41
Burundi	0.36	0.20	0.20	0.19	0.32
Cameroon	7.54	8.31	8.55	8.06	6.22
Cape Verde	0.32	0.38	0.38	0.39	0.39
Central African Republic	0.34	0.34	0.34	0.34	0.44
Chad	0.26	0.25	0.25	0.26	0.26
Comoros	0.12	0.15	0.13	0.15	0.16
Congo (Brazzaville)	5.96	6.46	6.79	6.84	6.69
Congo (Kinshasa)	2.73	2.63	3.17	2.83	2.48
Cote divoire (IvoryCoast)	6.39	6.52	6.62	6.80	6.40
Djibouti	1.71	1.16	1.16	1.39	1.80
Egypt	181.29	185.02	191.39	199.42	206.29
Equatorial Guinea	4.68	5.41	5.48	5.12	5.61
Eritrea	0.73	0.51	0.51	0.47	0.74
Ethiopia	6.42	6.98	6.45	7.13	8.21
Gabon	4.67	4.26	4.54	5.35	5.44
Gambia, The	0.38	0.44	0.48	0.43	0.47
Ghana	7.39	7.49	9.11	9.25	9.10
Guinea	1.35	1.43	1.43	1.43	1.39
Guinea-Bissau	0.46	0.41	0.41	0.42	0.46
Kenya	11.20	11.75	12.70	13.14	13.45
Lesotho	0.24	0.23	0.55	0.45	0.27

Liberia	0.69	0.55	0.54	0.59	0.54
Libya	56.78	58.00	62.11	40.68	54.60
Madagascar	2.81	1.86	1.88	1.84	2.89
Malawi	1.19	0.96	0.97	0.99	1.91
Mali	0.70	0.70	0.70	0.74	0.77
Mauritania	2.76	1.89	1.89	1.61	2.41
Mauritius	5.04	4.48	4.70	4.87	5.32
Morocco	37.25	41.99	43.53	42.92	39.35
Mozambique	2.38	2.54	2.55	3.55	4.79
Namibia	3.30	3.30	3.13	3.26	3.72
Niger	1.29	1.21	1.32	1.31	1.41
Nigeria	99.16	78.96	73.76	83.13	86.40
Reunion	2.82	2.94	2.94	2.84	2.77
Rwanda	0.72	0.76	0.76	0.80	0.77
Saint Helena	0.01	0.01	0.01	0.02	0.01
Sao Tome and Principe	0.14	0.13	0.13	0.14	0.14
Senegal	6.08	5.89	5.95	6.22	7.14
Seychelles	1.03	1.17	0.98	1.24	1.30
Sierra Leone	1.26	1.40	1.40	1.44	1.31
Somalia	0.87	0.81	0.81	0.76	0.86
South Africa	489.97	477.56	473.77	471.52	473.16
Sudan and South Sudan	12.10	18.13	18.57	19.40	13.94
Swaziland	1.03	0.98	0.98	0.97	0.94
Tanzania	6.01	6.57	6.30	7.11	9.30
Togo	2.74	1.33	1.41	1.45	1.63
Tunisia	18.27	18.79	19.16	20.12	20.27

Uganda	1.97	3.28	3.39	3.40	2.55
Western Sahara	0.31	0.27	0.27	0.27	0.32
Zambia	2.25	1.95	2.19	2.57	3.05
Zimbabwe	7.81	8.10	8.82	9.56	10.12
Asia & Oceania	11656.21	12462.34	13405.03	14309.90	14435.77
Afghanistan	1.59	6.41	7.16	8.03	8.55
American Samoa	0.66	0.60	0.28	0.45	0.61
Australia	429.61	434.76	422.67	426.46	420.63
Bangladesh	51.40	55.94	57.84	59.21	63.50
Bhutan	0.28	0.33	0.35	0.36	0.32
Brunei	10.62	7.27	8.36	8.71	8.68
Burma (Myanmar)	14.84	11.90	11.91	12.41	13.34
Cambodia	4.18	4.08	4.10	4.61	6.05
China	6166.57	6816.10	7446.52	8126.69	8106.43
Cook Islands	0.09	0.07	0.07	0.07	0.15
Fiji	2.34	1.36	1.33	1.37	1.54
French Polynesia	0.99	1.06	1.10	1.07	1.07
Guam	1.77	1.07	0.91	2.03	1.77
Hong Kong	78.88	89.56	91.87	94.30	88.63
India	1448.99	1642.93	1714.73	1752.68	1830.94
Indonesia	370.19	405.70	414.55	450.08	456.21
Japan	1216.25	1104.91	1180.58	1200.27	1259.06
Kiribati	0.04	0.06	0.06	0.06	0.06
Korea, North	69.20	66.26	63.98	66.56	67.00
Korea, South	521.77	524.44	581.02	650.45	657.09
Laos	1.42	1.45	1.52	1.53	1.62

Macau	2.39	1.80	1.52	1.63	1.69
Malaysia	171.32	175.33	190.28	195.70	198.79
Maldives	0.89	1.06	1.06	1.07	1.12
Mongolia	7.19	7.67	8.22	8.39	11.36
Nauru	0.19	0.18	0.18	0.17	0.17
Nepal	2.95	3.28	3.54	3.76	3.64
New Caledonia	2.95	2.95	3.07	3.18	3.07
New Zealand	40.73	37.42	37.23	37.66	37.89
Niue	0.01	0.00	0.00	0.00	0.00
Pakistan	136.31	138.83	139.90	141.97	146.89
Papua New Guinea	4.55	3.23	3.28	3.38	3.38
Philippines	74.42	69.36	78.08	83.27	83.95
Samoa	0.18	0.17	0.17	0.16	0.16
Singapore	155.24	192.38	228.62	205.44	207.96
Solomon Islands	0.23	0.19	0.21	0.22	0.27
Sri Lanka	12.44	12.88	11.80	14.43	15.23
Taiwan	290.38	259.56	286.90	311.34	307.15
Thailand	255.09	267.88	273.09	293.36	290.72
Timor-Leste (East Timor)	0.35	0.19	0.19	0.33	0.50
Tonga	0.20	0.19	0.19	0.18	0.19
U.S. Pacific Islands	0.29	0.30	0.35	0.30	0.29
Vanuatu	0.12	0.12	0.12	0.15	0.17
Vietnam	104.75	109.81	124.82	135.09	131.73
Wake Island	1.34	1.27	1.29	1.33	1.29
World	29644.60	29435.62	31059.46	32154.99	32310.29

(Source: Total Carbon Dioxide Emissions from the Consumption of Energy, retrieved from http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=90&pid=44&aid=8 accessed on May 20, 2012)

2.6.1 Guidelines for the registration of CDM project (Approval Process retrieved from http://www.cdmindia.gov.in/approval_process.php assessed on May 15, 2012.)

As the National CDM Authority of India (NCDMA) has clearly describes the guidelines for registration of CDM projects. The following parameters have been covered by the authority:

Purpose

The purpose of the CDM is defined in Article 12 of the Kyoto Protocol to the UNFCCC. The CDM has a two-fold purpose: (a) to assist developing country parties in achieving sustainable development, thereby contributing to the objective of the convention, and (b) to assist developed country parties in achieving compliance with part of their quantified emission limitation and reduction commitments under Article 3.

Eligibility

The project proposal should establish the following in order to qualify for consideration as 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 procurement of Certified Emission Reduction (CERs) should not be from Official Development Assistance (ODA).

Sustainable Development Indicators

It is the prerogative of the host party to confirm whether a Clean Development Mechanism project activity assists it in achieving sustainable development. The CDM projects should also be oriented towards improving the quality of life of the poor from the environmental standpoint.

Following aspects should be considered while designing CDM project activity:

- Social well-being: The CDM project activity should lead to alleviation of poverty by generating additional employment, removal of social disparities and contribution to provision of basic amenities to people leading to improvement in quality of life of people.

- Economic well-being: The CDM project activity should bring in additional investment consistent with the needs of the people.

- Environmental well-being: This should include a discussion of impact of the project activity on resource sustainability and resource degradation, if any, due to proposed activity; bio-diversity friendliness; impact on human health; reduction of levels of pollution in general;

- Technological well-being: The CDM project activity should lead to transfer of environmentally safe and sound technologies that are comparable to best practices in order to assist in up gradation of the technological base. The transfer of technology can be within the country as well from other developing countries also.

Baselines for CDM project

The project proposal must clearly and transparently describe methodology of determination of baseline. It should confirm to following:

- Baselines should be precise, transparent, comparable and workable;

- Should avoid overestimation;

- The methodology for determination of baseline should be homogeneous and reliable;

- Potential errors should be indicated;

- System boundaries of baselines should be established;

- Interval between updates of baselines should be clearly described;
- Role of externalities should be brought out (social, economic and environmental);
- Should include historic emission data-sets wherever available;
- Lifetime of project cycle should be clearly mentioned;

The project proponent could develop a new methodology for its project activity or could use one of the approved methodologies by the CDM Executive Board. For small scale CDM projects, the simplified procedures can be used by the project proponent. The project proposal should indicate the formulae used for calculating GHG offsets in the project and baseline scenario. Leakage, if any, within or outside the project boundary, should be clearly described. Determination of alternative project, which would have come up in absence of proposed CDM project activity should also be described in the project proposal.

2.6.2 Approval procedure for program of activities (PoAs)

The Coordinator/ Managing Entity of a PoA is required to submit the PoA-DD, CPA-DD, CPA-DD (Typical) & PCN to the National CDM Authority for HCA. CPAs (joining a PoA) that do not require any approval from any state /central agency e.g. replacement of bulbs, energy efficiency measures etc., the Coordinator/ Managing Entity of the PoA shall post facto inform the Member Secretary, NCDMA , the salient details of CPAs added on a bi-annual basis. However for CPAs that needs any state / central clearance, such CPAs shall be submitted to the National CDM Authority for approval as in the case of project based CDM activities.

2.6.3 Procedure for submitting CDM project reports to the national CDM authority

The National CDM Authority (NCDMA) is a single window clearance for CDM projects in the country. The project proponents are required to apply to the administrator of National CDM Authority through the website by filling the User Registration form. Upon acceptance of the request, the project proponent shall fill in online the Project Concept Note (PCN) and also upload the Project Design Document (PDD). During the initial period, up to September

2009 , or as notified by National CDM Authority, the project proponents shall also submit 15 hard copies of PCN and PDD in proper format to Member Secretary, NCDMA along with soft copies in CDs, though covering letter signed by the project proponent. The National CDM Authority examines the documents and if there are any preliminary queries the same are asked from the project proponents. The project proposals are then put up for consideration by the National CDM Authority. The project proponent and his consultants are normally given about 10-15 days' notice to come to the Authority meeting and give a brief power point presentation regarding their CDM project proposals. Members seek clarifications during the presentation and in case the members feel that some additional clarifications or information is required from the project proponent, the same is informed to the presenter. Once the members of Authority are satisfied, the Host Country Approval (HCA) is issued by the Member-Secretary of the National CDM Authority.

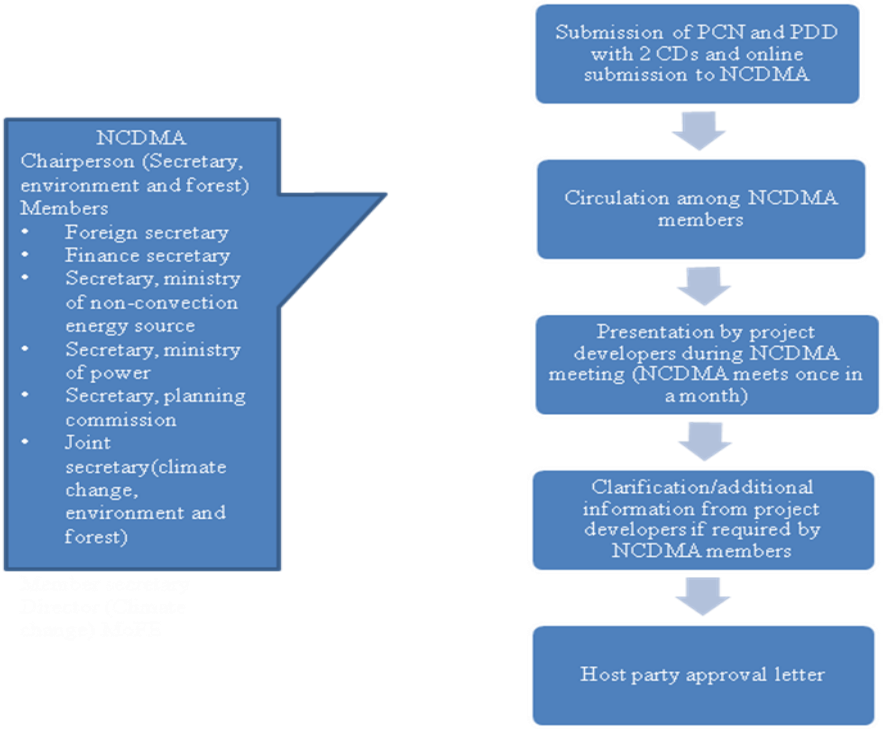

Figure 2.2: Approval process of CDM project in India

(Source: IISD, 2009)

2.6.4 Governance of the CDM

The CDM is a governed mechanism that embraces a wide range of stakeholders. It transcends levels of national and areas of governmental decision making. The following data focuses on the CDM's regulatory framework, which comprises its institutional roles and functions and the project cycle process.

CDM Institutions

The CMP acts as the supreme body of the Kyoto Protocol with the Executive Board (EB) being the main centralized regulatory body. The CMP decides on the broader policy framework and the strategic development of the CDM and it is the EB that translates these to the project level. When implementing the CMP's decisions, the EB engages in subsidiary law-making; both through direct rule-making and by its decisions as an adjudicator (Streak, 2007). In essence the EB takes decisions on methodologies and projects, mandates reviews and is assisted in these tasks by its support structure: The Designed Operational Entity (DOEs) that serve as the validators and verifiers of projects and emission reductions and the DNAs that exercise their support functions at a decentralised level. The credibility of the CDM governance therefore depends on the integrity and robustness of this regulatory framework and assesses in the following sections.

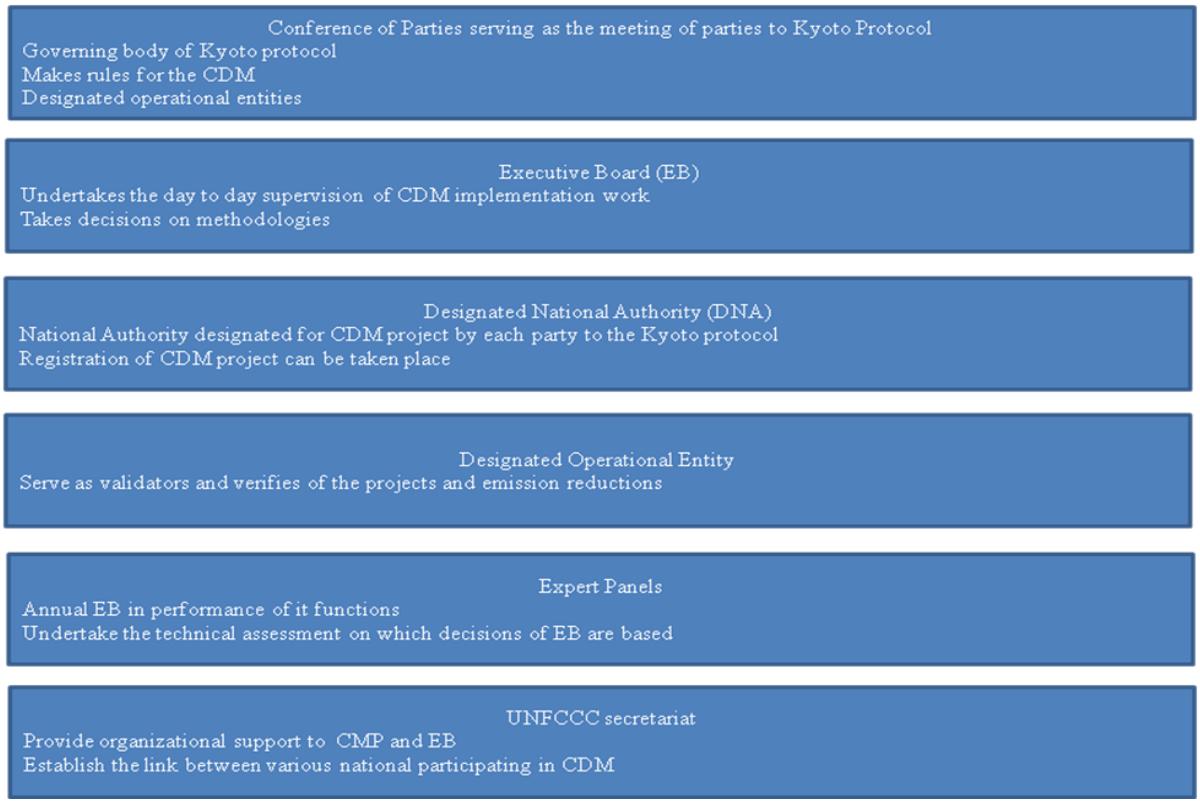

Figure 2.3: Regulatory institutional structure

(Source: Regulatory Institutional structure adopted from UNCTAD CDM guide document retrieved from http://www.unctad.org/en/docs/cdm2009_en.pdf assessed on June 1,2012)

2.6.5 The CDM project cycle

Figure 2.4 explains the CDM project cycle. The basic operational principle of the CDM is the crediting of greenhouse gas (GHG) emissions reductions generated by project activities implemented in developing countries. The figure shows a step-by-step process from preparation of the project design document (PDD) to issuance of Certified Emissions Reduction credits (CERs) indicating the decision making bodies at each stage. The validation of PDDs by DOEs is one of the most crucial steps in the governance of the CDM, hence the importance of clear validation standards, procedures and guidelines, and strict principles for the accreditation of DOEs. Other AEA 9 phases from approval to issuance of CERs are also areas that are affected by the governance of the EB. We will focus on all aspects of the project cycle in the following sections.

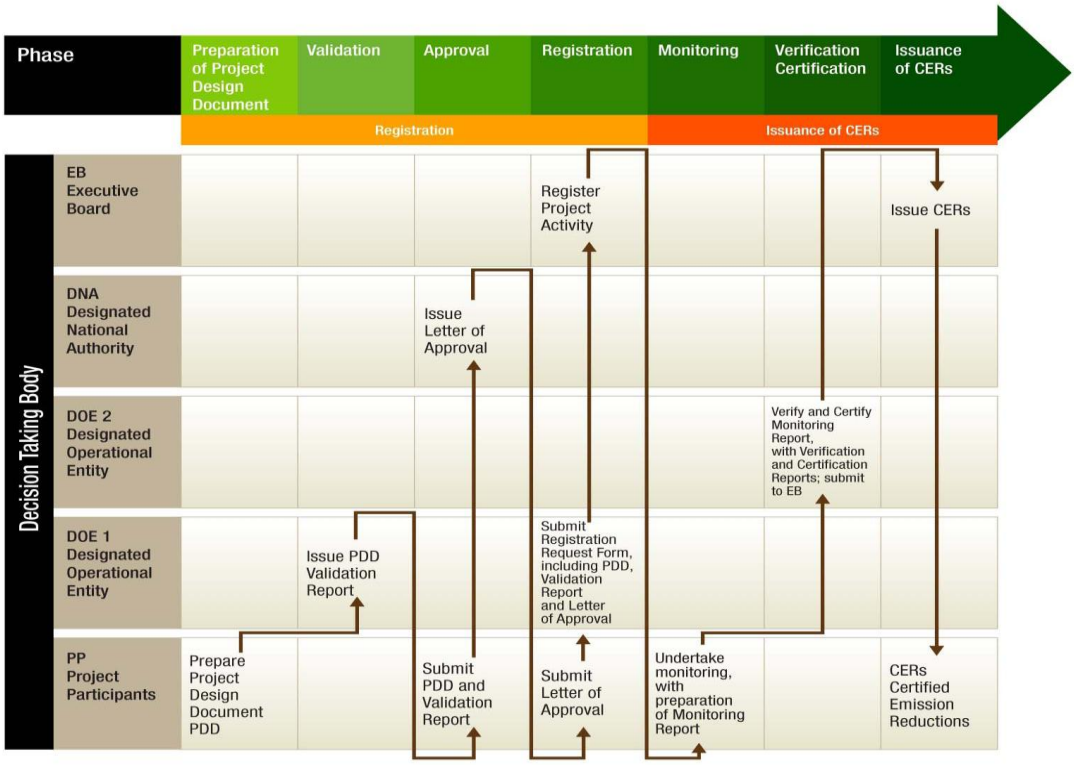

Figure 2.4: CDM project cycle

(Source: CDM Project Cycle adopted from UNCTAD CDM guide document retrieved from http://www.unctad.org/en/docs/cdm2009_en.pdf assessed on June 1,2012)

2.7 Clean Development Mechanism (CDM) in Gujarat

Gujarat is the first state in India to sign such a MoU with the World Bank. Under this agreement, Gujarat has launched a campaign to reduce carbon emissions from the state. Emissions from industries and steps like safe handling of solid wastes were also taken under this campaign. In return, the World Bank will provide financial incentives to the state. Emissions from industries and steps like safe handling of solid wastes will also be taken under this campaign. However, the new trend is going to trigger another trade in the enterprising state of Gujarat. Till now carbon credit trade was limited to a very few industries in the state. With the government's plan to launch a campaign for carbon emission control, this trade is bound to get a boost now (vibrant Gujarat, 2013).

India is the leading country in the world with the second rank in carbon emission reduction earning after China. China accounted for more than 55% of total CER issued under UNFCCC, where as 15% of total CER issued are of India. Gujarat is the first state in the country accounted Rs.127, 021,481 CER issued till 2012 that 18% of the total CER in India. There is still huge potential for the development of the project in exploring CDM potentialities through future planning and documentation.

Table 2.3: States contribution to India economy for total CER up to 2012

Name of States/Country	No of Projects	CER up to 2012	% of contribution to Total CER
Multi State	84	1,323,143	0.18
Andhra Pradesh	206	86,823,972	12.01
Arunachal Pradesh	1	156,393	0.02
Assam	13	852,579	0.12
Bhutan	1	529,914	0.07
Bihar	8	750,896	0.10
Chhattisgarh	104	27,368,203	3.79
Delhi	16	3,823,996	0.53
Goa	4	1,186,500	0.16
Gujarat	351	127,021,481	17.57
Haryana	35	4,512,243	0.62
Himachal Pradesh	91	17,273,314	2.39
J&K	4	9,686,384	1.34
Jammu & Kashmir	2	128,326	0.02
Jharkhand	32	24,046,731	3.33
Karnataka	250	69,697,979	9.64
Kerala	16	642,032	0.09
Madhya Pradesh	70	8,787,799	1.22

Maharashtra	367	61,620,089	8.52
Meghalaya	4	1,598,429	0.22
Multi State	97	25,330,436	3.50
Orissa	79	22,794,520	3.15
Pondicherry	1	139,332	0.02
Pondicherry	2	14,674	0.00
Punjab	74	12,157,425	1.68
Rajasthan	218	63,178,620	8.74
Sikkim	10	9,973,169	1.38
Tamil Nadu	355	51,882,998	7.18
Tripura	1	4,427,526	0.61
Uttaranchal	36	19,454,380	2.69
Uttar Pradesh	163	37,813,167	5.23
Uttarakhand	13	1,030,493	0.14
West Bengal	76	26,799,892	3.71
Total	2784	722,827,037	100.00
No of Projects : 2784		**CER up to 2012 : 722827037 tonnes**	

(Source: Sate wise Approved Projects retrieved from http://www.cdmindia.gov.in/reports_new.php assed on Feb. 28, 2013.)

2.7.1 Functions of CDM cell in Gujarat

CDM cell works in various areas to get maximum benefit for Government Projects for getting more revenue in terms of CERs from various projects.

Capacity Building: The cell shall work in developing technical capacity in Governmental organizations regarding taking benefit of CDM Scheme of UNFCCC in development projects.

Facilitation Centre: The cell work in facilitation of all Government projects, and single coordination point from government shall help in speed up of process.

Technical Advice: The cell can bring the most knowledgeable and skilled experts for CDM for handling all projects and can provide 360 degree technical solution for the project including development of methodology, Project Design Document (PDD) etc. The cell also keeps some consultants on panel for their constant expert advice.

Administration: The cell can manage all statutory administration for projects like project registration with National Authority, UNFCCC Office etc.

Nodal Agency for the State: The cell can be a fulltime body of State Government for all CDM related activities including providing necessary support to private CDM projects from state.

Bundling of similar CDM projects at state level can be carried out in coordination of the cell. Thus the CDM cell becomes a common platform for all the State Government Organizations.

2.8 Energy Sector in India

Power or electricity is one of the most critical components of infrastructure, affecting economic growth and wellbeing of nations. The existence and development of adequate power infrastructure is essential for sustained growth of the Indian economy. With a production of 1,006 terawatt hours (TWh), India is the fifth largest producer and consumer of electricity in the world after US, China, Japan and Russia. The Indian power sector is one of the most diversified in the world. Sources for power generation range from commercial sources such as coal, lignite, natural gas, oil, hydro and nuclear power to other viable non-conventional sources such as wind, solar, and agriculture and domestic waste. The demand for electricity in the country has been growing at a rapid rate and is expected to grow further in the years to come. In order to meet the increasing requirement of electricity, massive addition to the installed generating capacity in the country is required.

2.8.1 Sources of renewable energy (GENI, 2006)

- **Hydro Power**

The hydroelectric power refers to the energy produced from water (rainfall flowing into rivers, etc). Consequently, rainfall can be a good indicator to investors looking for a location to implement or build a new hydroelectric power plant in India. India utilizes twelve primary hydroelectric power plants: Bihar (3), Punjab, Uttaranchal, Karnataka, Uttar Pradesh, Sikkim, Jammu & Kashmir, Gujarat, and Andhra Pradesh (2).

- **Solar Energy**

Because of its location between the Tropic of Cancer and the Equator, India has an average annual temperature that ranges from 25°C – 27.5 °C. This means that India has huge solar potential. The sunniest parts are situated in the south/east coast, from Calcutta to Madras. Solar energy has several applications: photovoltaic (PV) cells are placed on the roof top of houses or commercial buildings, and collectors such as mirrors or parabolic dishes that can move and track the sun throughout the day are also used. This mechanism is being used for concentrated lighting in buildings. Photovoltaic (PV) cells have a low efficiency factor, yet power generation systems using photovoltaic materials have the advantage of having no moving parts. PV cells find applications in individual home rooftop systems, community street lights, community water pumping, and areas where the terrain makes it difficult to access the power grid.

- **Wind Energy**

India is surpassed only by Germany as one of the world's fastest growing markets for wind energy. By the mid 1990s, the subcontinent was installing more wind generating capacity than North America, Denmark, Britain, and the Netherlands. The ten machines near Okha in the province of Gujarat were some of the first wind turbines installed in India. These 15-meter Vistas wind turbines overlook the Arabian Sea.

- **Biomass Energy**

Biomass includes solid biomass (organic, non-fossil material of biological origins), biogas (principally methane and carbon dioxide produced by anaerobic digestion of biomass and combusted to produce heat and/or power), liquid bio fuels (bio-based liquid fuel from biomass transformation, mainly used in transportation applications), and municipal waste (wastes produced by the residential, commercial and public services sectors and incinerated in specific installations to produce heat and/or power). The most successful forms of biomass are sugar cane biogases in agriculture, pulp and paper residues in forestry and manure in livestock residues. It is argued that biomass can directly substitute fossil fuels, as more effective in decreasing atmospheric CO_2 than carbon sequestration in trees. The Kyoto Protocol encourages further use of biomass energy (GENI, 2006).

2.8.2 Market size

Electricity production in India (excluding captive generation) stood at 911.6 TWh in Financial Year (FY) 13, 4 per cent growth over the previous fiscal. Over FY 07–13, electricity production expanded at a compound annual growth rate (CAGR) of 5.5 per cent. The Planning Commission's 12th Plan projects that total domestic energy production would reach 669.6 million ton of oil equivalent (MTOE) by 2016–17 and 844 MTOE by 2021–22.

As of October 2013, total thermal installed capacity stood at 156.5 giga watt (GW), while hydro and renewable energy installed capacity totaled 39.8 GW and 28.2 GW, respectively. Nuclear energy capacity remained broadly constant at 4.8 GW. The growth in energy demand in India would be the highest among all countries by 2030–35, beating even China, according to the 2014 energy outlook report by British oil giant BP. India is the 4th largest country with regard to installed power generation capacity in the field of renewable energy sources and much is waiting to be discovered by it. Wind, Hydro, Biomass and Solar are main renewable energy sources. India has tremendous potentialities to harness the much- needed energy from renewable sources and is considered as one of the ideal investment destinations for renewable energy equipment manufacturers and service providers. Wind energy has posted the highest growth. India could become top player in world's solar market. India intends to provide a reliable energy supply through a diverse and sustainable fuel mix that addresses major

national drivers. These include security concerns, commercial exploitation of renewable power potential, eradication of energy poverty, ensuring availability and affordability of energy supply and preparing the nation for imminent energy transition. The market in India for the RE business is growing at an annual rate of 15%. The scope for private investment in RE is estimated to $3 billion approx. This growth is expected to continue in the coming years as stricter environmental norms and regulatory pressure are placed on Indian industries. Best prospects in sub-sectors that continue to show a high growth rate.

Energy consumption and climate change are highly correlated. Leading enterprises increasingly understand the links between greenhouse gas (GHG) emissions and energy consumption. Companies need short-term solutions to optimize energy usage and better understand their GHG emissions. In the long term, organisations want to optimize the usage and financial impact of energy and reduce GHG emissions. Energy is a key contributor to carbon and other GHG emissions.

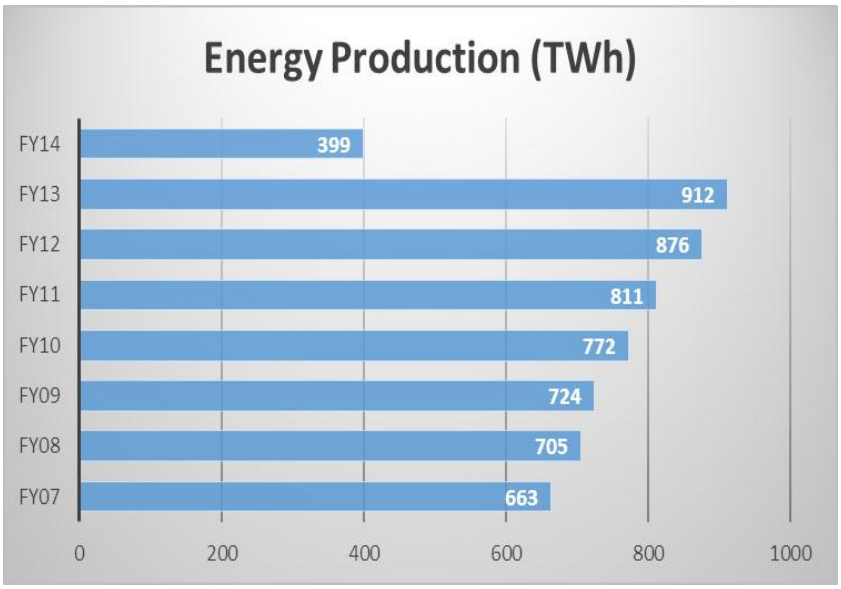

Figure 2.5: Electricity Production

(Source**:** GENI, Overview of Renewable Energy Potential of India retrieved http://www.geni.org/globalenergy/library/energytrends/currentusage/renewable/Renewable-Energy-Potential-for-India.pdf assed on June 15, 2015)

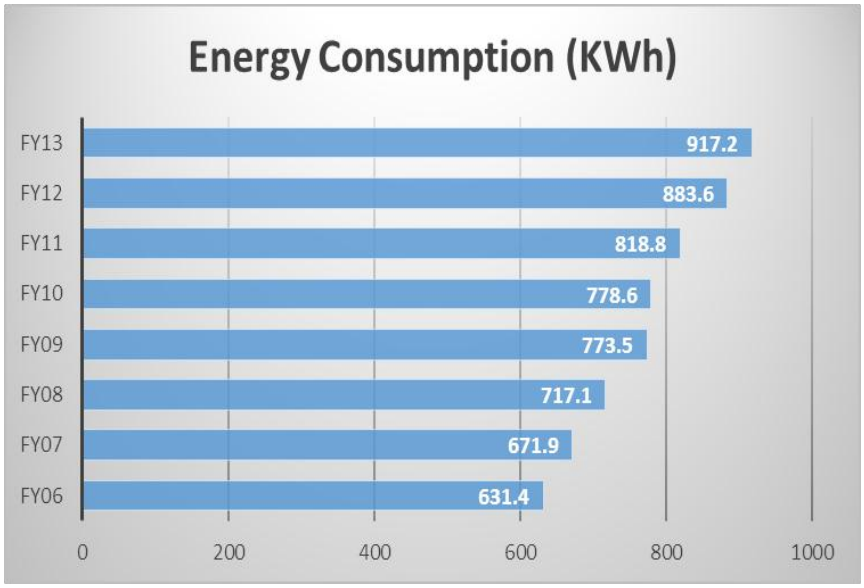

Figure 2.6: Electricity Consumption

(Source**:** GENI, Overview of Renewable Energy Potential of India retrieved http://www.geni.org/globalenergy/library/energytrends/currentusage/renewable/Renewable-Energy-Potential-for-India.pdf assed on June 15, 2015)

2.8.3 Future potential of energy sector

Wind energy is the largest renewable energy source in India; projects like the Jawaharlal Nehru National Solar Mission (aims to generate 20,000 MW of solar power by 2022) is creating a positive environment among investors keen to tap into India's potential. The country offers unlimited growth potential for solar photovoltaic (PV) industry as well. India is endowed with vast potential of solar energy and is quickly developing itself as a major manufacturing hub for solar power plants. A projection in the 12th Plan document of the Planning Commission indicates that total domestic energy production of 669.6 million tons of oil equivalent (MTOE) will be reached by 2016-17 and 844 MTOE by 2021-22. This will meet around 71 per cent and 69 per cent of expected energy consumption, with the balance to be met from imports, projected to be about 267.8 MTOE by 2016-17 and 375.6 MTOE by 2021-22 (Energy Statistics, 2013).

Table 2.4: Estimates of potential capacities from renewable energy sources (in MWs)

Sources	Approx. Potential
Biomass Energy	19500
Solar Energy	20000
Wind Energy	47000
Small Hydropower	15000
Ocean energy	50000

(Source**:** GENI, Overview of Renewable Energy Potential of India retrieved http://www.geni.org/globalenergy/library/energytrends/currentusage/renewable/Renewable-Energy-Potential-for-India.pdf assed on June 15, 2015)

CHAPTER-3

Literature Review

3.1 Introduction

A literature review focuses on the published information within a certain time period. The data for the literature review taken from journals, working paper, newspaper articles, government reports etc. the literature review classified into sub sections such as: global warming and GHG emissions, Kyoto protocol and CDM, legal aspects and carbon trading, carbon credit market India and Gujarat. From the literature, the variables has been identified and covered for the study.

3.2 Global Warming and GHG Emissions

The emerging issue that is Global warming focused by each country and they started to delay the burning issue result. Burning of fossil fuels is a major source of industrial greenhouse gases (GHGs) emissions, especially for power, cement, and steel, textile, and fertilizer industries. The major GHG emitted by these industries are carbon dioxide, methane, nitrous oxide, HFCs, etc. which all increase the atmosphere's ability to trap infrared energy and thus affect the climate, leading to global warming. As there are various factors that affect CO_2 emissions: country GDP, income level, industrialization, weather effect. Due to temperature increases, it already affects physical and biological systems by changing ecosystems and causing extinction of species, and will increasingly have a social impact and adversely affect human health. It has been a long time since the first deliberations on regulation of greenhouse gas emissions started, almost two decades ago, until sufficient ratification and thus entry into force of the Kyoto Protocol, in early 2005. The concept of carbon credits came into existence as a result of increasing awareness of the need for controlling emissions.

As the issue came in highlight in 21st century, the research had been started. The recent studies gives an idea about the implementation of Clean Development mechanism in different industries and companies and the lacking points where the economy and companies need to be cleared. P. David (2003) stipulated the social cost of carbon is an important factor for developing this concept. Cost–benefit analysis is also one the approach that will help the economy to set the standards where this social cost just equals the incremental cost of controlling emissions. The past study was based on the UK government's assessment of the cost. This study emphasizes on incorporating adaptive behavior so still it requires time for adoption as an integral part. Cost–benefit analysis is not work under the long-term percepts but, in the short run at least, a comparison of cost and benefits is required.

Forest MSW (2005) stipulated that wood compares favorably to competing materials Timber from plantations performs well compared to competing materials. One study has indicated that timber can store up to 15 times the amount of carbon that is released during its manufacture. GHGs release in manufacture of construction materials covered different products that are as follows. Aluminum and copper are the two major industries that release highest CO_2 through manufacturing process.

In 2007, the Intergovernmental Panel on Climate Change (IPCC) released its fourth assessment report. The conclusions of this long-running analysis of studies on climate change and its effects are widely accepted as the consensus of the world's scientific community. Wara (2008) stipulates that Global warming is one of the most difficult and important environmental challenges facing the international community. The most significant effort to address climate change is the Kyoto Protocol. Since 2004 it has grown rapidly and is now a critical component of developed-country government and private-firm compliance strategies for the Kyoto Protocol. To address a global environment problem with market based mechanism, Global market has done their first attempt called the Clean Development Mechanism (CDM) of the Kyoto Protocol. The CDM is a carbon credit market where sellers, located exclusively in developing countries, can generate and certify emissions reductions that can be sold to buyers located in developed countries.

S. Robert (2008) stipulated that so far there is no structured policy to reduce the emissions of carbon dioxide and other greenhouse gases, majority of the previous researches were focused on the western countries. With reference to the emerging issue – global warming, majority of the country across the globe have started showing their serious concern for this issue, and need has been raised to form a structured policy to have fair distribution of emission allowances which also exert positive impact on the economy of the country.

Doran (2007) had emphasis that Human activity is motivating unwanted climate change that resulting from the emissions of greenhouse gases (GHGs) into the atmosphere. To avoid theserious and potentially appalling environmental, economic and health consequences associated with an increasing global temperature, everyone has to reduced and slowed for global emissions of GHGs.

B. Robert (2009) found that there is broad agreement that the climate is warming: air and ocean temperatures are higher, snow and ice are melting, and sea levels are rising. Further, natural systems are being affected: plant and animal ranges are moving towards the poles, and there are changes in fish and algae due to rising ocean temperatures. The IPCC found that the warming of the climate was very likely due to anthropogenic GHGs emissions. GHGs emissions from humans have increased by 70% between 1970 and 2004.With current climate change policies, GHG emissions are projected to continue to increase this century. Further, there is no single technology that will mitigate the problem of climate change; a range of policies and innovations is required. The report lists both energy efficiency and individual behavior modification as suggested GHGs mitigation strategies. Kolk (2009) stipulates climate change is seen as the most pressing environmental problem of our time by many companies, policymakers and other stakeholders. It is currently also at the forefront of attention in view of attempts to conclude a successor to the Kyoto Protocol that expires in 2012. Over the past decade climate change has evolved as the most pressing environmental problem of our time. Particularly due to temperature increases, it already affects physical and biological systems by changing ecosystems and causing extinction of species, and will increasingly have a social impact and adversely affect human health. It has been a long time since the first deliberations on regulation of greenhouse gas emissions started, almost two decades ago, until sufficient ratification and thus entry into force of the Kyoto Protocol, in

early 2005. The adoption of the Kyoto Protocol in 1997, however, had already set some things in motion, such as an emissions trading scheme in the EU (the EU-ETS which started on 1 January 2005). Moreover, as the Kyoto Protocol expires in 2012, there is a large uncertainty as to future emission reduction targets and policy arrangements at various levels. This also affects emissions trading and the Clean Development Mechanism (CDM) which was designed as an integral part of it.

Barnwal et al. (2008) stipulates the life cycle energy metrics and CO_2 credit analysis. In this research paper, life cycle energy metrics, such as energy payback time (EPBT), energy production factor (EPF) and life cycle conversion efficiency (LCCE), and mitigation of CO_2 emissions for a hybrid photovoltaic/thermal (PV/T) greenhouse dryer have been analyzed. The EPBT of the hybrid PV/T greenhouse dryer has been analyzed on an energy basis. The net CO_2 mitigations and carbon credit earned by using a hybrid PV/T greenhouse dryer have also been highlighted. Krey et al. (2009) emphases on the delay participation and technology failure, these two factors affect the green house gases emissions in 21^{st} century. The feasibility of limiting greenhouse gas concentrations and associated global mean temperature increase to 2 °C above preindustrial levels has recently attracted considerable scientific and policy attention. Whether or not such low targets can be achieved in the long-term depends on a number of assumptions about, for instance, technological change and the willingness of countries to immediately join a post-Kyoto agreement to limit anthropogenic climate change. The research paper distinguish between “first-best scenarios” with full participation, and “second-best scenarios” with delayed participation of Brazil, China, India, and Russia in 2030. Efficiency and enhanced energy conservation play an important role across all scenarios. In addition, carbon capture and storage (CCS) is found to be important for achieving particularly low forcing targets as well as for avoiding pronounced overshoot of the target in the medium-term. The most important finding was significant delay in the participation of major emitter’s leads to the unattainability of the most stringent forcing targets. Moreover, delayed participation may lead to excessive additional global mitigation cost that may even exceed the mitigation costs of the most stringent forcing targets in the best case with full participation. Bouvart et al. (2009) covered the life cycle of GHGs emissions and selection of technology. The European DYNAMIS project is part of the HYPOGEN quick-start program and aims at investigating viable routes for large-scale cost-effective

combined hydrogen and electricity production with integrated CO_2 Capture and geological Storage (CCS). This paper presents the environmental evaluation carried out for each technology option studied, producing Hydrogen and Electricity with CCS. The methodology used is based on life cycle analysis (LCA) principles and concentrates on the assessment of two criteria: greenhouse gas (GHG) emissions and non-renewable primary energy consumption. CCS leads to significant GHG emissions reduction on the whole studied pathways of electricity and H2 production; this decrease ranges from 70% to 82% when considering CO_2 capture rates between 80.3% and 96.1%. However, this technology requires significant additional energy consumption mainly associated to CO_2 capture processes.

The Australian Government production commission (2011) undertakes a research study into effective carbon prices that result from emissions-reduction policies in Australia and other key economics. It was estimates the effective carbon price per tonne of CO_2 faced by the electricity generation sectors in these economies, and selected industries drawn from manufacturing and transport sectors in these and other countries where relevant and data permitting. AUSTRAC (2011) covered the scam was identified in Australia and the problem faced in that case. Australian victimized into sending more than AUD 3.5 million to accounts in Taiwan. Many of the victims were small business operators, self-funded retirees or investors seeking ethical investment opportunities. The company came to AUSTRAC's attention after three suspicious matter reports (SMRs) were submitted by an Australian bank over a two-day period. The reports outlined complaints by customers, living in different states, who had been cold-called about a carbon credits investment scam. Two of the customers had previously sent funds overseas to the company, but had since been contacted and asked to transfer more money for further 'investment opportunities'.

Simon et al. (2011) encountered the win-win scenario has been done for climate change development specially focusing on stove replacement program with carbon finance and study the possibilities for the same. They focuses on the improved cook stove technologies form an important, if asymmetrical, environment–development interface, and illustrate the mutually supported local (development) and global (climate change) benefits of continued improved stoves use. In practice, there are a number of challenges to achieving effective 'win-win' outcomes—including cultural, financial, governance and technological barriers. Carbon

finance provides an opportunity to fund scalable. Nicholson et al. (2011) stipulates the carbon pricing and relative competitiveness about the low-carbon base load generating technologies. Here the research paper define and apply a set of fit-for-service criteria to identify technologies capable of supplying base load electricity and reducing GHGs by amounts and within the timescale set by the Intergovernmental Panel on Climate Change (IPCC). Only five current technologies meet these criteria: coal (both pulverised fuel and integrated gasification combined cycle) with carbon capture and storage (CCS); combined cycle gas turbine with CCS; Generation III nuclear fission; and solar thermal backed by heat storage and gas turbines. The analysis of the data shows nuclear power to be the standout solution for low emissions base load electricity, in terms of cost and ability to meet the timetable for GHG abatement. Further, nuclear power's relative competitiveness increases as the carbon price rises.

Guo et al. (2011) examined the carbon emissions in Chinese energy policy. The estimation of CO_2 emissions reduction potential in China is an important issue for China's energy policy. In this paper, data envelopment analysis (DEA) is used to evaluate the carbon emission performance of 29 Chinese provincial administrative regions (Tibet and Taiwan are not included since of data lack) by computing potential carbon emission reductions for energy conservation technology (ECT) and energy structural adjustment (ESA). Since the Chinese National Assessment Report on Climate Change was published in 2006, a low-carbon economy has been advocated by the Chinese government. A series of policies to prompt the development of non-fossil energy has been proposed to reduce carbon emissions and mitigate climate change. As the largest developing country in the world, China has the highest CO_2 emissions at 6.468 billion tones in 2007 corresponding to 4.9 tons per capita. The Chinese GDP accounts for no more than 6.2% of the world's total production, whereas China accounts for 20.85% of the world's total carbon emissions.

Bharti et al. (2011) focused on carbon credit from composting of municipal solid waste. The Municipal Solid Waste (MSW) used in formation of windrow was collected from the NERIST campus. Loss on Ignition (LOI) was measured which represents the amount of carbon and remaining ash in solid waste samples after ignition. As an absolute measure of biodegradable carbon, LOI provides an excellent measure of biological decomposition in a composting

process. Only, biodegradable components of waste are converted into CO_2 during the composting process.

3.3 Kyoto Protocol and CDM

In 1992 at the Rio Earth Summit nations from around the world met and agreed to voluntarily reduce greenhouse gases (GHGs) emissions benchmarking 1990 levels. The Rio Treaty was not legally binding and because reducing emissions would likely cause great economic damage; many nations would not meet the goal. Representatives from around the world met again in December of 1997 at a conference in Kyoto to sign a revised agreement. The negotiators agreed to legally binding, internationally enforceable limits on the emission of greenhouse gases as a key tenet of the treaty. By 2012 the industrialized countries would be obliged to cut their GHGs emissions by an average of 5% relative to their base-year emissions in 1990. At the global level, countries around the world have expressed a firm commitment to strengthening international responses to the risks of climate change. India has the potential to generate at least 500 million carbon credits, which is worth about 3 billion USD (IISD, 2009).

Zhang (2005) covered the effective implementation of clean development mechanism projects in China. China is widely expected as the one of the host country of Clean Development Mechanism Projects for the clear institutional structure, and implementation strategy. The implementation of CDM Projects learned to improve capacity building assistances, the establishment of streamlined and transparent CDM procedures and sound governance. By gaining real experience, China will reduce perceived risks and lower the barriers to CDM projects.

Paula et al. (2007) covered the international climate policy has developed in a series of international agreements over the last 15 years. The original treaty, the United Nations Framework Convention on Climate Change (UNFCCC) was signed in 1992. Since it entered into force in 1994, the Parties to the Convention meet annually at the Conference of the Parties (COP). In the framework of the Kyoto Protocol negotiated in Kyoto in 1997, the industrialized countries - also known as Annex B countries as they are listed in Annex B of the Kyoto Protocol1 - finally adopted legally binding quantitative constraints, in which they agreed to reduce greenhouse gas emissions by 5.2 per cent below their 1990 level on average

over a first commitment period of 2008-2012. As Annex I of the UNFCCC list the industrialized countries that were members of the OECD (Organisation for Economic Co-operation and Development) in 1992, plus countries with economies in transition, including the Russian Federation, the Baltic States, and several Central and Eastern European States. Under the Convention, these countries agreed to reduce GHGs emissions to 1990 levels by the year 2000. Annex B of the Kyoto Protocol lists the industrialized countries that signed the Protocol in 1997 and thus have emission reduction targets for the period 2008-2012. Countries in both lists are the same, except for Belarus and Turkey that do not figure in Annex B.

Paula et al. (2007) examined the parameters to evaluate the performance of the projects: Host country; unilateral or bilateral character of the project; type of project developer; project category and type; project size and designated Operational Entity in charge of validation. In the in-depth case studies, three further key CDM project parameters have been assessed: the quality of the additional argumentation, the quality of the stakeholder consultation and the quality of the expected sustainability benefits as stated in the PDDs.

Olsen (2007) focused on the clean development mechanism for contributing to the development of economy. The challenges of how to respond to climate change and ensure sustainable development are currently high on the political agenda among the world's leading nations. The Clean Development Mechanism (CDM) is part of the global carbon market developing rapidly as part of the Kyoto response towards the mitigation of global warming. One of the aims of the CDM is to achieve sustainable development in developing countries, but uncertainty prevails as to whether the CDM is doing what it promises to do. The past studies on the CDM have been carried out since its birth in 1997 including peer-reviewed articles and reports from the grey literature. The objective behind this literature is how CDM will help the sustainable development but the result shows that CDM is not that much contributing for Sustainable development for the Kyoto.

B. Emily, C. Esteve and E. Manuel (2008) covered the issues discussed politics in pre-Kyoto to COP-9 related to operations of Kyoto Protocol and eligibility for the projects under the CDM sinks. In 1997, the Kyoto Protocol of the United Nations Framework Convention on Climate Change (UNFCCC) established the Clean Development Mechanism (CDM) as one of

its flexibility instruments, together with Joint Implementation (JI) and Emissions Trading (ET). The emphasis on sustainable development was recognized in the mechanism's stated purpose to 'assist Parties not included in Annex I in achieving sustainable development and in contributing to the ultimate objective of the Convention' (Kyoto Protocol, Article 12), which differentiates it from the other two flexible instruments (both exclusive for Annex I countries). By the mid 1990s the concept of sinks was firmly on the agenda, including under provisions for the joint implementation of policies between Parties set out in the Convention. A pilot project phase of Activities Implemented Jointly (AIJ) was established at the first Conference of the Parties (COP-1) in 1995, and in 2002, 157 pilot projects have been proposed with 13% in the land use and forestry sector.

C. Oscar, H. Robyn, W. Russell (2008) examined that GHG, CO_2 are two main components in the atmosphere that is the reason that CER is getting focused in the international market. Several approaches to accounting for carbon sequestration in LUCF projects have been proposed. The emission of greenhouse gases, particularly carbon dioxide, and the consequent potential for climate change are the focus of increasing international concern. Temporary land-use change and forestry projects (LUCF) can be implemented to offset permanent emissions of carbon dioxide from the energy sector. To identify the permanent emissions of carbon dioxide from energy sector, there are many approaches for cost evaluation. In this research paper they focused on Australian forestry system concerning investors and landholders. Not only the chemical and manufacturing industries but also agricultural industry was going for accounting of CER.

Stewart et al. (2009) covered the risks, opportunities and preparedness related to financial sector and climate change association. Climate change is one of the most significant challenges that face by business, government and the society. The impact on financial sector that was not clear at initial phase. Financial sector will be critical to climate change response due to its role as a provider of capital and advice that influence the business and consumers. Through the climate change, asset value as well as business performance and risk associated with it is also affected. The financial sector also impacted by regulatory changes in relation to environmental law. To minimize the disparities, they have to translate into systematic sector.

Janelle Knox-Hayes (2009) emphasised on that there is an opportunities to develop carbon financial service industry. Carbon markets differ from other markets in terms of the scope of government involvement—the commodity of exchange is a regulatory creation and emissions reductions are registered and verified by government. The construction of carbon markets requires not only capital and resources, but also shared expertise and social connectivity, which is built through the use of complementarities. Financial intermediaries, such as exchanges, banks and brokerages help develop and improve the liquidity of carbon trading. As with legal firms, these institutions use Type 2 inter-firm complementarities to transfer expertise from existing sectors and develop carbon information. The development of a new market, particularly a market with enough potential scope and scale to require independence, amplifies the complexity of complementarities. It is likely the carbon market will be a trillion dollar (or euro) market within the next decade.

Mizrach (2010) examined that Kyoto also created a Clean Development Mechanism (CDM) which provides incentives for developing countries to lower their carbon emissions. These projects, the majority of which are in China and India, generate primary Certified Emission Reductions (pCERs) which serve as substitutes for emissions in the EU ETS. Nearly 2500 projects have been approved by the CDM executive board which produce an annual average of 389:3 million CERs. CDM credits have, since 2007, traded in secondary markets (sCERs). Volumes reached 887 MMtCO2e in 2009.The European Climate Exchange (ECX) has emerged as the major trading venue. In 2009, it handled 78% of EUA trading volume and almost 97% of the CER activity. Because CO_2 is a global pollutant, that .linkage between emissions trading schemes is emerging as a substantive issue.

C. Nitin and L. Shubhangi (2011) stipulates the potential for the energy projects under clean development mechanism and voluntary market. Climate change is one of the greatest environmental threats facing the world today. To tackle this problem, a protocol was adopted in Kyoto in 1997 which establishes legally binding commitments to developed countries to bring down the emissions of six major greenhouse gases by 5.2% compared to the year 1990. Three flexibility mechanisms have been provided to developed countries to achieve the target of emission reduction under this protocol and one of them is the Clean Development Mechanism (CDM), which allows industrialized nations or private entities therein to

implement emission reduction projects in developing countries and receive credits in the form of Certified Emission Reduction (CERs), which may be counted against their national reduction targets. The paper discusses about the scope of hydroelectric and wind projects in the CDM market in India and also looked at the options available other than the CDM market, namely the Voluntary Carbon Market. It also identifies to what extent the potential of these projects could be harnessed and also presents the key challenges to making full use of these opportunities.

Galinato et al. (2011) examined that the effect of the Clean Development Mechanism regulations that create temporary certified emission reductions on harvesting decisions, land use allocation, and the carbon supply in forest plantations. Under the accounting rules set during the 2003 Conference of the Parties (COP) in Milan under the United Nations Framework Convention on Climate Change (UNFCCC), forest projects can accumulate carbon credits called temporary certified emission reductions (tCERs) and long-term certified emission reductions (lCERs).The important aspect is to decide the proper policy of CDM regarding the amount of supply and rotation interval choices. Here the author emphasis on how increase or decreases in demand for carbon affects the CDM policy/program. The policy also emphasis on getting tCERs approval, there are two criteria: First, the host country must have ratified the Kyoto Protocol and must establish a Designated National Authority (DNA) to determine sustainability of crediting projects within the country. Second, any land that is to be converted into carbon forest plantations must have been without forest cover between December 31, 1989, and the start of the projects activity.

3.4 Legal Aspects of Carbon Emissions

H. Lawewnce L. (2009) focused on legal frame of carbon emissions in the international market. The rules in General Agreement on Tariffs and Trade and the World Trade Organization Agreement provide the underpinnings to the Global Trading System. Without those rules, the energy goods and services would be a risk. The various proposals, will affect cross-border energy trade in an important way. To overcome from that question, every country must have within legal obligation. Carbon Taxes and related national GHG- emission control schemes applying to the products which have been covered under GATT and WTO

rules and disciplines. Notwithstanding international treaties such as the UNFCCC and the Koto protocol, WTO member states still have to justify carbon-reduction measures applied at the border. Avi-Yonah et al. (2009) focused on the major tow policies related to CO_2 emissions. During the 2008 presidential campaign, both major party candidates supported cap and trade. Many of the mainstream environmental groups advocate cap and trade and, in an unusual alliance, their position is shared by many industry groups. A cap and trade system therefore is likely to be the focal point of domestic legislation during the Obama Administration and whatever international agreement follows the Kyoto Protocol, which expires in 2012. A carbon tax would enable the market to account for the societal costs of carbon dioxide emissions and thereby promote emission reductions, just like a cap and trade sys-tem. A carbon tax would be easier to implement and enforce, however, and simpler to adjust if the resulting market-based changes were either too weak or too strong. A carbon tax also would produce revenue that could be used to fund research and development of alternative energy and tax credits to offset any re-gressive effects of the carbon tax. Because a carbon tax could be implemented and become effective almost immediately, it would be a much quicker method of reducing greenhouse gas emissions than a cap and trade system. F. David et al. (2011) stated that Climate change and the actions taken against this global threat continue to be on the top agenda of politicians, economists, businesses, lawyers and other parts of the society. One of the instruments to achieve this global objective is carbon trading. Carbon trading aims to reduce emissions of greenhouse gases by providing for economic incentives. Carbon trading has implemented this idea by the modification of a ‘cap & trade’ scheme: a specific budget of greenhouse gas emissions is set up by regulators based on international agreements (cap) and is then divided up into tradable units (emissions allowances). Emitters of greenhouses gases have to acquire these allowances (trade) in order to be allowed to continue with their activities.

Galle et al. (2011) discussed about Carbon tax. To see the central problem of the rebate scheme, the author considered: Would you rather be poor for eleven months and rich for one or middle-class the whole year round? From the way they behave, it looks like most people would prefer the latter-a "smooth" income is better than an income with the same total value but more peaks and valleys. That is because the pain of the lows is, typically, worse than the satisfaction of the pinnacles. Thus, we save up for rainy days, or insure against them,

transferring money from ourselves when we are wealthy to ourselves when we are poor. Here evidence that, at a minimum, human cognition and credit markets will play large roles in the ultimate fairness of any carbon tax. There are several solutions that could mitigate these distributional impacts while allowing climate change prevention to move forward. The consumers have focused here on carbon pricing as the most politically salient example of the importance of timing in the delivery of government benefits, but it may not be the most significant in terms of overall welfare.

Machado et al. (2011) covered the accounting treatment for carbon credit. This paper analyzed about the might superiority using the real options models on top of traditional Discounted Cash Flows (DCF) most because the flexibility of exercising or not the put option of carbon in counterpoint of the log price and how to valorize the advance down payment of carbon credits using the derivatives methodology in a simple example based on actual CCX data, demonstrating the similarity of this kind of business with the financial derivatives. Considering the presupposition that the negotiable carbon credits are intangible assets, in other words, it is clear that such credits will generate future benefits in cash flow, their value are relevant and it is possible to measure it with certain precision In the light of IAS20, which regulates the accounting for, and in the disclosure of, government grants and in the disclosure of other forms of government assistance, it is necessary debit intangible assets and credit Net Worth, inside the group of Capital Reserves, to be transferred for P&L in the moment of the consumption of such permissions. Regarding the carbon credits value the emission is based on historical cost, but the trading is by fair value, the IAS37, which regulate accrual, provision and contingencies, demand the necessity to create the liability of that difference. Dhana et al. (2011) covered the carbon offset market and providers. Carbon offsets are allowances that represent one unit of carbon dioxide emissions that are linked to climate change. The emergence of carbon offsets has spawned a new and growing industry of “carbon offset providers.” These entrepreneurial ventures facilitate the trading of carbon credits between private entities and publicly traded organizations around the world by promoting and financing specific emission- reducing projects. These projects are financed via the buying and selling of offsets by individuals, groups, and firms interested in sustainability. The concept of carbon neutrality has been in popular usage for over a decade, although it originally emerged from modeling research on pollution reduction in the late 1960s. Carbon neutrality is the

baseline criterion for the movement. It can be achieved in five general steps (Clean Air Cool Planet, 2006). The first step is to assess a carbon footprint—that is, the amount and breakdown of different greenhouse gases an individual or organization produces. Tools for estimating footprints, such as Web-based calculators, are widely available for use by individuals and corporations. Once a person or company determines its approximate amount of carbon emissions, the next step is to formulate a strategy to reduce emissions through changes in energy conservation and efficiency activities. The third step is to estimate remaining carbon emissions—those that are not eradicated in the previous step. The fourth step is to purchase carbon offsets for that remainder. The fifth step is to communicate carbon neutrality status. This final step is more applicable to larger organizations than it is to individuals or smaller firms.

3.5 Carbon Trading

Bosello (1999) demonstrated that development of carbon emissions trading market, everyone needs to test presence of externality and internality. If these are internalized prior to the introduction of the market, there is always difference in the market. Due to existence imbalance between internality and externality, till today there is some market which was missed out by countries. The internalization of externalities (e.g. through taxation) amounts to reconstruction of the missing markets, so that the theorems of welfare can continue to hold. For developing this market the key important concern is that how the final distribution of wealth has been done for property rights on the environment resources which were allocated.

James et al. (2002) emphasised on development of the standardization process of the carbon contract that helps to facilitate trades and emissions projects by contractual process so it helps to reduce the transaction cost. The paper covers the clauses related to parties, recitals, sale and purchase, deliver, evidence the validity, risk associated with the contract, price and terms of payments, warranties, representation, defaults, confidentiality, arbitration, taxes and third parties related clauses. There is no regulated scheme for transactions involving project based emission reductions and the market for such emission reductions is not yet liquid. Borger et al. (2007) focused on managing the financial risks induced by power plants is one of the key components of the risk management of utility companies. These financial risks may be

represented by certain financial futures positions, e.g. a coal-powered power plant can be thought of as a long position in electricity, a short position of coal and, due to recent efforts to regulate emissions, a short position in CO_2 emission certificates. The research paper considered the interaction of all of these positions including emission certificates. In order to evaluate the risk of these portfolios, need to analyze the dependence structure across different commodities.

E. Christian (2007) emphasised the carbon emissions trading schemes. Carbon emissions trading is likely to be a crucial pillar of future climate change policy. Since 2005 the European Union (EU) has implemented a CO_2 emissions trading scheme, the first major global scheme of its kind, and potentially an important precursor for other such schemes. Launched in 2005, the EU ETS is the first cross-border tradable permit or emissions trading scheme to address GHGs emissions, covering almost 11,500 installations or about 45% of total CO_2 emissions in the EU, including process emissions. It provides for a mechanism by which emitters – factory operators, oil refineries, power plants etc. – can identify the most cost-effective ways to reduce their emissions. By factoring carbon-reduction strategies into day to- day business decisions, emissions trading would go beyond conventional environmental policy, mainly seen as an inescapable overhead. Another potential advantage is that the resulting (forward) carbon price would improve long-term predictability, a crucial factor for business to make efficient investment decisions. Third, a cap-and-trade system such as the EU ETS provides environmental certainty by capping the overall emission level from the covered sources. Such a system lends itself well to the implementation of the Kyoto Protocol targets which are expressed in absolute terms. Fourth, emissions trading can be expected to minimise the distortions to competition in the EU market as it imposes an EU-wide carbon price for all industries alike. Doran (2007) states that cap-and-trade program (Pricing theory of Carbon) is one of the most effective and efficient mechanisms for reducing GHGs emissions currently known to policy makers. They also focused on the EU ETS countries applied Cap and Trade.

Ladaniwskyj (2008) examined that the futures market contract constellation for Kyoto Phase II carbon financial instruments (CFI's) as traded on the European Climate Exchange; the most sophisticated and liquid carbon exchange in the EU. Among the leaders of the world's nations, a growing accord has come about whereby it has been conceded that the observed

changes in the earth's climate constitute an alarming trend, and are, in all likelihood largely a product of human activity. The research paper also emphasis on the theory "behind a cap and trade mechanism is based upon a Pigovian tax type structure that minimizes deadweight losses in the economy by ensuring that the ability to continue to emit GHGs remains with agents that attach to it the highest value and in tandem, ensure that the cost of abatement is minimized as it will naturally flow to areas where the value attached to the right to emit is lowest. Carbon Reduction Institute (2009) produced the purchasing guidelines for the carbon credit. Carbon credit projects are tested against standards so that the buyer can be sure that they are funding a reduction of greenhouse gas from the atmosphere that would not otherwise have occurred. Any carbon credit used by an organization to meet emission reduction requirements under the CO_2 certification program must meet the following standards.

1. Financially additional

For a carbon credit to be financially additional, the money from the credits must have been required to make the project happen beyond business as usual. Their energy savings pays back in time frames that make it a 'business as usual' proposition.

2. Environmentally additional

The project must be additional to the environment. Carbon Credits cannot be claimed on projects that would have occurred anyway. Furthermore, carbon savings from a carbon offset must be additional to a country's mandatory Kyoto target. For countries/states with a binding target, such as Australia, NZ and the EU, (from 2008-2012), this can be achieved through the Joint Implementation mechanism, or through sourcing carbon credits that pre-date the Kyoto commitment period.

3. Permanent

Permanence is a very important requirement for a voluntary credit. Carbon savings that have been forward claimed or carbon emissions that have been stored can present a liability risk for any party using them to make a claim. If the emissions fail to happen, or are released into the atmosphere, and the project proponent does not make good this reduction, then the liability may fall back on the purchaser who made a claim, to rectify the issue.

4. Leakage

Leakage is where a project results in an increase of emissions elsewhere. This is a major risk in avoided deforestation projects where the removal of one section of forest product from the market encourages the destruction of forest in another due to inelastic demand.

5. Validated and Verified Savings

The project must use a methodology that conservatively quantifies its emissions reductions through a scientifically valid approach. The project must be audited by an independent third party to quantify the number of tonnes of greenhouse gas that it has saved. This can occur through ISO 14064.3 and 14065; through a GHGs program, or through using an approved methodology from a GHG Program. Any credit from projects that satisfy the 5 criteria above can be used within the CO_2 certification program.

Chaklader (2010) states that increasing pollution level; the economic activity is focusing on Emission Trading (ET) industry actively. As per Multi-Commodity Exchange of India, with the increasing ratification of Kyoto Protocol (KP) by countries and rising social accountability of polluting industries in the developed nations, the carbon emissions trading is likely to emerge as a multibillion-dollar market in global emissions trading. Carbon Credit is tradable permits as well as it gives monetary values.

Hamilton et al. (2010) covered the international market trend regarding carbon trading. In 2009, voluntary markets (excluding the now defunct Chicago Climate Exchange) were estimated to account for about 1 per cent of total volume of emissions rights traded, representing about 0.3 per cent of total value of trade, mostly from carbon forest sinks or renewable. In 2009, transactions in voluntary carbon markets (including the Chicago Climate Exchange) amounted to 93.7 million tonnes of CO_2-e valued at US$387 million, and 51 million tonnes CO_2-e estimated at US$338 million without the Chicago Climate Exchange.

Perdan et al. (2011) emphasis on the greenhouse gas emissions trading schemes and examine the prospects of carbon trading. Companies that keep their emissions below the level low their allowances can sell their excess allowances at a price determined by supply and demand at that time. For the carbon emissions there is three phases: Phase I covered the European

Commission has cut the volume of emission allowances to 6.5% below the 2005level. Phase II began on 1 January 2008 and will run until 31 December 2012 which coincides with the ‘‘first commitment period’’ of the Kyoto Protocol— the 5-year period during which the EU and its member states must comply with their emission targets under the Protocol. Phase3 will run for 8years, from1 January 2013 to 31 December 2020. Perdan et al. (2011) discussed about the carbon trading operations and the future aspects about the carbon credit in Phase III which starts from 2013. There are several emissions schemes for carbon trading some of the schemes are linked with the Kyoto commitments (UNFCC, 1998), while others are operating in countries which have not ratified the Kyoto Protocol (e.g. the USA).The research paper analysed the five carbon trading systems such as EU ETS, RGGI, GGAS, NZ ETS and Tokyo-ETS. P. Bond (2012) stipulates emission trading and eco-social environmental factors. The political-economic branch of the geography discipline offers insights into the last decade’s policy reactions to climate change, particularly because of its unique critique of mainstream economic approaches to greenhouse gas emissions mitigation. Systematically cutting emissions is vital to avoiding climate chaos, thereby maintaining the world’s average temperature rise at 1◦C this century, a level deemed necessary to avoid submersion of small islands and heavily inhabited coastland, and destruction of most African agriculture (that figure was formerly estimated to be 2◦C but has since been lowered in demands made by the climate justice movement and tabled in the United Nations. Even after a price recovery, by 2007 it was apparent that Europe’s carbon trading pilot was not working. As Peter Atherton (2007) of Citigroup conceded, “ETS has done nothing to curb emissions is a highly regressive tax falling mostly on poor people”. Already a half-decade earlier, a first generation of carbon trade critics—affected communities (from Indonesia, Thailand, India, South Africa, Brazil and Ecuador), academics and researchers, and radical environmentalists—took the name Durban Group for Climate Justice and issued the “Durban Declaration” in October 2004 to sound the alarm about ethical and economic shortcomings.

Torres et al. (2011) demonstrates the new schemes through Local Emissions Trading Scheme. Local authorities are important actors to mitigate climate change. They can implement policies which can reduce emissions of greenhouse gases in sectors like transport, waste, agriculture and land use, land use change and forestry (LULUCF). The Portuguese mainland provides a test bed for the implementation of such a scheme beyond the Kyoto Protocol’s

commitment period (2013–2020). Under this scheme, the Central Government starts by allocating allowances to the different local authorities and, at the end of each year (in our case study between 2013 and 2020), local authorities return a number of allowances corresponding to the level of emissions observed in their municipality during that year. If, in a particular case, that level is lower than the level allocated for, that local authority can bank those surplus allowances for the following year or sell them to other local authorities. If there are higher emissions in one municipality than the quantity allowed for in the previous allocation, that authority must buy the necessary allocations in the market.

3.6 Indian Market for Carbon Emissions

To study the Indian Market, the timeframe started from the year 1998 to 2012 had been studied. Schumacher et al. (1998) emphasis that the productivity growth of Indian iron and steel sector. The variance may be traced to the time period of study, source of data for analysis, and type of indices and econometric specifications used for reporting productivity growth. The research paper derived both growths accounting and econometric estimates of productivity growth for this sector. The results show that over the observed period from 1973-74 to 1993-94 productivity declined by 1.71% as indicated by the Trans log index. Using a Tran's log specification the econometric analysis reveals that technical progress in India's iron and steel sector has been biased towards the use of energy and material, while it has been capital and labor saving.

S. Katja and S. Jayant (1999) focusing on Indian Cement Industry and the opportunity for Carbon Emission market. The cement industry presents one of the most energy-intensive sectors within the Indian Economy. Increases in productivity through the adoption of more efficient and cleaner technologies in the manufacturing sector will be effective in merging economic, environmental, and social development objectives. Energy use and carbon emissions depend mainly on the level of production and the technologies employed. Even the structure and policies also affects the productivity. The author pointed out cost effective low cost potentials for reducing energy consumption as well as carbon emissions. In comparing Indian energy consumption to best practice energy consumption showed that energy savings of up to 38% could be achieved.

Deodhar (2003) covered the financial structure for CDM projects in India. To meet the emission reduction requirement through purchase of carbon credit from projects in developing countries, the Clean Development Mechanism (CDM) under the Kyoto Protocol to the UN Framework Conversion on Climate Change developed the legal framework. Initially, banks and financial institutions have not developed procedure for efficient financing of CDM projects. To encourage private sector for project development capacity, there should be transparent and effective rules at central and state level. CDM funds and CDM bonds become attractive to reduce the credit risks and political risk.

S. Inderjeet and M. Axel Michaelowa (2004) covered the urban building sector in India. Indian economic growth is likely to lead to a huge increase of energy use in buildings but so far, policies to address this issue are lacking. Standard building energy use concerning glazing, air conditioning and lighting in different climatic zones across India leads to energy use per m2 which is 3-4 times of the German average. The research paper focusing on the potential to improve building energy efficiency and measures in the building sector could be framed as projects under the Clean Development Mechanism. The research paper taken case based analysis for large buildings in the Indian public and private sector are presented. Khuranana et al. (2004) examined the Indian urban sector potential for CDM through energy efficient. Indian economic growth is likely to lead to a huge increase of energy use in buildings but so far, policies to address this issue are lacking. Standard building energy use concerning glazing, air conditioning and lighting in different climatic zones across India leads to energy use per m2 which is 3-4 times of the German average. We assess the potential to improve building energy efficiency and how measures in the building sector could be framed as projects under the Clean Development Mechanism. CDM case studies for large buildings in the Indian public and private sector are presented. They achieve annual greenhouse gas reductions of 500 to 10,000 ton, which may not be sufficient to overcome the CDM transaction cost barrier. Michaelowa et al. (2006) stipulates to assess additionality and sustainable development issues of energy efficiency CDM projects with an emphasis on the situation in India. In the second half of 2005, almost 100 energy efficiency projects has been submitted for validation and 54 of those projects were analysed with regards to additionality and sustainable development benefits based on Activity Scale (Large Scale & Small Scale), Sector (WHR, DSM, Cement Blending, Service), project start date. 60% are large scale projects and 90% had started before 2005. Besides resource conservation, energy efficiency projects do not create much qualitative

sustainable development benefits on the whole. Technology transfer occurred rarely and indigenous technology development happened only in 2 projects.

IL&FS (2007) focused on the CDM befits to the waste management in India. 42 Million tons MSW generated per annum as well as open Dumping a common practice that is applied negligible compliance to MSW 2000 Rules. But there are limitations of lack of financial resources, institutional weakness and improper choice of technology main cause of non compliance. Municipal Solid Waste Management focused on collection and transportation with minimal focus on treatment and disposal. The assessment provides information on India's emissions of Greenhouse gases (Carbon Dioxide [CO_2], Methane [CH_4] and Nitrous Oxide [N_2O]) emitted from anthropogenic activities at national level from Energy; Industry; Agriculture; Waste; and Land Use Land Use Change & Forestry (LULUCF) sectors. They analysed the different sectors CO_2 emissions with 1994 to 2007.The total GHG emissions without LULUCF have grown from 1251.95 million tons in 1994 to 1904.73 million tons in 2007 at a compounded annual growth rate (CAGR) of 3.3% and with LULUCF the CAGR is 2.9%. Between 1994 and 2007, some of the sectors indicate significant growth in GHG emissions such as cement production (6.0%), electricity generation (5.6%) and transport (4.5%). The robustness of the GHG inventory making process is dependent on the Tier of methodology used. Higher the Tier, more representatives is the emission estimated of the actual emissions. Of the total 1727.71 million tons of CO_2 equivalent emissions from India in 2007, 21% of the emissions have been estimated using Tier I methodology, 67% by Tier II and 12% by Tier III (INCCA 2007)

Two years after the Kyoto Protocol entered into force in 2005, India has emerged as the most active seller of carbon credits worldwide, with many of the country's firms implementing eco-friendly systems of production and going 'green.' According to Environment Secretary Meena Gupta, India accounts for 289 CDM projects out of the 844 registered - or 34 per cent - making it a global market leader. China and Brazil follow with 16 and 13 per cent respectively. Projects are mostly in the areas of renewable energy, followed by energy efficiency, industrial processes and municipal solid-waste. Substantial carbon credits are also coming from the infrastructure and power sectors which are thriving in India's fast-growing economy. Take India's cement industry. It generates 5 per cent of India's total carbon dioxide

emission of about 150 million tons every year, but is now eyeing carbon credits in a big way. A study carried out by ACC, India's leading cement maker, says India accounts for 44 out of 76 total CDM cement projects worldwide and would deliver roughly 40 per cent of emission reductions in the sector. However, in terms of volumes, projections say that by 2012, China will lead the Asian market with 45 per cent of the supply market and India will drop to 16 per cent. Chinese projects are on a much larger scale than India's programs (India Features, 2007).

Shukla (2007) covered the CO_2 Emissions in Energy sector in India. In energy sector, taking time series data for energy consumption and supply applying I-O model, while I-O show the flow of goods and services, in one economy. In I-O model, for the energy sector it was modified and taking five independent variables and CO_2 Emission as a dependent variable and find out the effect taking 1998 as a base year. Each and every study I-O model can be changed based on the assumptions used by the author.

Pathak et al. (2009) focusing on Biogas technology, using local resources such as cattle dung and organic wastes, provides an alternate source of energy for cooking and lighting in rural areas and manure in the form of biogas spent slurry. When organic waste is stored in the absence of air, a microbial degradation process starts producing biogas, which is a mixture of 55% to 70% methane (CH_4), which is the combustible component, 30% to 45% carbon dioxide (CO_2) and a small amount of hydrogen (H_2). Urban (2009) covered the implementation part for the two developing county such as China and India. The research paper analyzed case studies of two countries. Three modeling case studies are presented: for the Chinese power sector, the economy of Beijing and rural Indian households without access to electricity. The paper demonstrates a significant reduction in greenhouse gas emissions and energy use, while costs are likely to increase. Lastly on the basis of analysis the researcher gave suggestion for financial assistance and technology transfer to support their efforts towards a climate-friendly low-carbon economy.

Humbad et al. (2009) reveals that Rural India has a potential to earn carbon credit. To reduce green house gas emissions, the authors applied efficient mechanism by setting up household based energy substitution such as biogas plant projects. The design variables are rank ordered using statistical analysis. The basis of this model is the research study conducted in 10

villages of Jhunjhunu district of Rajasthan, India spanning a population of around 31,000 people. Under the International emission trading (IET) mechanism, the countries can trade their surplus credits in the international carbon credits market to those countries with quantified emission limitation and reduction commitments under the Kyoto Protocol. Amongst the developing nations, India is considered as one of the largest beneficiary of the carbon trade through the Clean Development Mechanism (CDM). Prabhakant et al. (2009) covered the energy security in India going for carbon credits. The analysis was based on the carbon credit earned by each district for supplying minimum substance electricity to each family in India. Indian economy growth rate is 8-10% per annum. For sustaining that growth rate, it depends on coal as well as electricity majorly. Energy consumption of a country is one of the indicators of socio-economic development. For the research the author first go for covers average electricity required in one home assuming that there is one fan and one light. SAPV panels are one of system to earn carbon credit. For the calculation of the cost the author applies return of capital cost model and indentifies the amount of carbon credit earned. Agarwal (2010) reveals the energy price regulation is an important policy issue in the context of any developing nation, including India. It is believed that the existing pricing policy for Natural Gas in India has constrained the growth of natural gas market in India, leading to a large unmet demand, primarily from the heavily subsidized power and fertilizer sector. This paper is an attempt to analyze the policy issue of natural gas pricing in India, using Kingdon's Multiple Policy Stream Model. According to this multiple streams approach, the developments in the policy making process can be explained by the efforts of policy entrepreneurs to successful capitalize on the occasional "policy windows" by coupling elements in three different "streams": problems, policies, and politics. The paper focuses on the developments in gas pricing policy in India, identifying the problem, policy, and political streams, and the ways in which key political entrepreneurs have coupled the streams at critical times is past, thereby illustrating the possibility of a current opportunity for taking a regulatory initiative on natural gas pricing.

Chaklader (2010) stated that Global economy concern about increasing pollution level, and for that the global economic focusing on Emission Trading (ET) industry actively. As per Multi-Commodity Exchange of India, with the increasing ratification of Kyoto Protocol (KP) by countries and rising social accountability of polluting industries in the developed nations,

the carbon emissions trading is likely to emerge as a multibillion-dollar market in global emissions trading. Carbon Credit is tradable permits besides giving monetary values. Carbon Emission Reduction (CER) is traded in the derivative trading market as a commodity. In India the trading in National Commodity and Derivatives Exchange Ltd (NCDEX), India started from the month of April, 2008.

Palmetto (2010) offered carbon financing for the carbon credit projects in India. Palmetto's CDM Project team has successfully completed over €100 million worth of transactions in the global carbon markets. Within the Clean Development Mechanism (CDM), they are able to execute Certified Emission Reduction (CER) transactions with sophisticated, innovative structures to benefit CDM Project Developers. This includes recent CDM transactions, the impact of policy changes and the growth of localized environmental market opportunities. In this way, the aim is improve market transparency and increase market access. They are charging the commission is based on a success-fee, which is directly linked to the value of the CER transaction. This ensures that their clients do not pay until there is a successfully completed sale.

Poudyal et al. (2011) emphasis on motivation and support for green projects varies by their organizational objectives and characteristics. There are the certain factors which motivate to participate in Green Projects like credibility and reputation, relationship with stakeholders, cost reduction, operational effectiveness, and compliance with business and legal agreements. It has been also focused on that environmental performance indirectly generates higher revenue for businesses through reduction of production costs, product differentiation ability, and market access. The author emphasis on consumer perceptions towards factors that is considered for emission management decision and for that the companies which were registered under CCX were taken as base. The development of market based incentives could be beneficial for the businesses to be innovative in environmental management.

Mukharjee (2011) covered the unique path to lower the carbon emissions taken by India. With four times the population of the United States, an economy growing 8-9 percent a year and surging energy demand, India's race to become an economic power has propelled it to Number 3 in the list of top carbon polluters. India's greenhouse gas emissions will keep rising

as it tries to lift millions out of poverty and connect nearly half a billion people to electricity grids. But it is also trying to curb emissions growth in a unique way, fearing the impacts of climate change and spiraling energy costs. In the world's first such national market-based mechanism, called Perform, Achieve and Trade (PAT), India is starting a mandatory scheme that sets benchmark efficiency levels for 563 big polluting from power plants to steel mills and cement plants, that account for 54 percent of the country's energy consumption.

N.E. Hultman et al. (2012) emphasis on the firms' perceptions of CDM decisions in Brazil and India. It reveals challenges to market development that should be addressed in order to make the roll out of a post-2012 CDM more effective. They conducted firm-level interviews covering 82 CDM plants in the sugar and cement sectors in Brazil and India, focusing on how individual managers understood the potential benefits and risks of undertaking clean development mechanism (CDM) investments. The results indicate that the CDM operates in a far more complex way in practice than that of simply add in marginal incremental a project's internal rate of return.

3.7 Carbon Credit Market in Gujarat

The research focused on the potential of Gujarat market. One of the researches covered the initiate taken by the Municipal Corporation to earn carbon credit and the opportunity for the new carbon projects. Nadene Ghouri (2009) covered the facts that affect environment and human rights in Gujarat taking florochemical companies. GFL had spoiled the land and water area nearest to plant and that affect the human. GFL is part of a worldwide carbon-trading scheme, centered in London, which is supposed to be helping to save the planet from global warming. Under the Kyoto agreement and supervised by the UN, looks like an efficient way to cut global carbon emissions. However, a live investigation has exposed a series of major failings and loopholes in the scheme. Four years ago, GFL installed technology to reduce the greenhouse gases it produces and was given a vast financial reward by the UN; a UK company was also given considerable sums for investing in the projects. However, far from being a flagship green factory, GFL stands accused of poisoning the local environment. S. Shwetal (2011) covered the possibility of exclusive use of renewable energy for electricity required by the Municipality for Pumping, Lighting and Municipality Buildings etc. This can

be one of the many first initiatives of the State for climate change mitigation, Gujarat can be the first State in the World to have carbon neutral municipalities by adopting this practice. Gujarat Government is supporting establishment of renewable energy power plants through Power Purchase Agreement (PPA) based on policies for solar, wind, biomass etc. By development of Carbon Neutral Towns, Government will further establish an example of Convenient Action for curbing challenges of Climate Change. Proposed 10 Carbon Neutral towns will require a 1 time expense of about Rs. 75 to 100 Cr., in return will get assured supply of electricity for coming 25 years. Pearson (2011) covered the Gujarat carbon credit award with reference to Gujarat Flourochemicals Ltd. Gujarat Flourochemicals Ltd., an Indian maker of refrigerant gases, rose to a three-year high after winning carbon credits for the first time since the United Nations ended a probe into projects claiming emission reductions of industrial gases. The shares gained 4.5 percent to 263.95 rupees in Mumbai trading, its highest close since February 2008. The benchmark Sensitive Index advanced 1.1 percent. Such credits are bought by companies and nations to comply with limits on emissions of greenhouse gases. While HFC-23 projects represent less than 1 percent of all registered CDM projects, their credits account for more than half the tradable offsets issued so far by the UN. The 19 projects cutting the gas under the CDM program are mainly in China and India. United Nations Environment Program (2011) covered Gujarat earned carbon credits. The 24-year-old wants Gujarat to be the world's highest carbon-credits earner and emerge as the number one player in green initiatives. Shwetal Shah's aspiration and zeal have earned him an invitation from the United Nations Environment Program (UNEP) to participate in the 5th International Marine Debris Conference (IMDC) in Honolulu in March 2011. The conference focuses on waste management in marine ecosystems, a crucial necessity for the long-term environmental sustainability of coastal states. Gujarat is the first state in India to sign such MoU with the World Bank. Under this agreement, Gujarat is planning to launch a campaign to reduce carbon emissions from the state. Emissions from industries and steps like safe handling of solid wastes will also be taken under this campaign. In return, the World Bank will provide financial incentives to the state. The recent agreement with the World Bank will go a long way in ensuring that the new industries, which will open shops in the state, abide by the global pollution standards. According to the Environment and Forestry Ministry in India, companies in the country have already earned $7.9 million through carbon credit trading. The

CDM under the Kyoto Protocol lets wealthier nations trade their emission reduction commitments with developing countries by buying carbon credits earned by the latter for projects reducing greenhouse gas emission. Since the CDM began in 2005, India has registered more than 450 projects for carbon trading.

3.8 Future Aspects about Carbon Emissions

In the year 2012, the Kyoto Protocol Phase I was over and all the countries need to decide about the adoption of Phase II that started from the year 2013 to 2018. The future is uncertain because there technical and non technical parameters affects the carbon market. The research also focused on the future aspects about the carbon trading schemes.

As the climate change issue reaches fever pitch, interest in the use of forests as a means of removing carbon dioxide (CO_2) from the atmosphere has accelerated. Carbon storage in new forests can provide a cost-effective form of net greenhouse gas abatement and a valuable source of transitional emissions reductions until new energy technologies are developed. Forest establishment can also contribute to other social and environmental outcomes. New plantations and replanting will only occur if a positive investment environment exists. The potential of Australian forests to store more carbon depends on the rate of new plantings or forest regeneration, harvesting and growth rates, and tree deaths by fire, pests and disease.

Anonymous (2010) covered the future aspects of carbon credit. Under the United Nations' clean development mechanism, or CDM, developed countries buy carbon credits—generic units to measure carbon emission reduction—from projects and companies in developing countries. India has been second only to China in sale of carbon credits (19.24% of the global total) and the number of projects that have sold credits (23.07%). This scheme depends on developed countries' commitment to reduce carbon dioxide emission and other so-called greenhouse gases, which scientists say are responsible for climate change worldwide. But developed nations have made these commitments only until 2012. As climate talks remain stalled, the future of trading in carbon emission reductions is uncertain.

Perdan et al. (2011) focused on the future aspects about carbon trading schemes. In 2009 the carbon market endured its most challenging year to date, and in the midst of a global

economic crisis, emissions trading looked ‘‘clouded by uncertainty.’’ At the same time, there are notable intentions within the current schemes to expand geographically and temporary and include more sectors and greenhouse gases. Furthermore, new schemes are being planned around the world too and there are indications that some of them would be linked or merged with the current emission trading mechanisms. This raises a possibility of the emergence of a global carbon market. However, there are significant technical and non-technical (policy and political) obstacles to a possible expansion. The paper has also argued that an expansion of current emissions trading schemes and their possible linking depends not only on technical fixes and harmonization of different trading systems, but also on clear policy signals, continuing political support and a more stable economic environment.

3.9 Summary of Literature Review

In these literatures, the research had covered the timeframe from year 1998 to 2014. In 2003, the study was focused on the development and implementation of GHG emission mechanism developed under Kyoto Protocol. Kyoto Protocol is an agreement which was signed by all the member countries and shows their commitment towards the burning issue “Global Warming”. Kyoto Protocol came into force in 2005. In 2005, the research covered the different industries that come under the head of CO_2 emission and how much CO_2 had been released by those industries. Further, the research has done the trading part of Carbon Credit which was initiated by EUETS and how the developing countries take an advantage of this opportunity by developing carbon finance industry.

One of the research focused area was to implement Clean Development Mechanism (CDM) for the developing countries. Gradually the research covered the conceptual framework for clean development mechanism and Norms developed by UNFCCC in the year of 2007 and 2008. The studies done in the year of 2008 was focused on the implementation of the first attempt done by Kyoto Protocol for the developing countries that is Clean Development Mechanism (CDM). In 2009, the new model came into existence that is life cycle energy metrics. The researcher focused on the implementation of life cycle energy metrics in different economy and industries. In addition to this model, other research was focused on descriptive study on phase II of Kyoto Protocol which started from 2008 to 2012.

Legal aspects of carbon emissions play an important role from company as well as economy point of view. The research studies covered the GATT and WTO rules and disciplines with standing of UNFCCC and the Kyoto protocol. In 2010, the studies more focused on the carbon trading and cap and trade system. In addition to these, one of the studies covered the accounting treatment for the carbon credit by the companies. The recent studies focused on the carbon tax which will come into existence in near future. In 2011, the studies more focused on the implementation done in different industries such as Energy, Steel, and Cement etc. in developing countries like India and China. Carbon trading emerged as the new financial industry for the global market. The timeframe covered for the study is year 1999 to 2012. In 1999 study focused on internal and external carbon trading market and find out the inequality between these two parameters. In the year of 2012, the research more focused on the development of standardized process for carbon trading market. After the development of standardized format, in the year 2007 the studies focused on the risk involvement in carbon trading market and expansion of carbon trading market by introducing new schemes under EUETS. From the year 2008 to 2012, the Kyoto Protocol Phase II started. Majority of the research emphasised on the carbon trading market and economy indicators. From the year 2011, the researcher focused on the future trends and aspects about Carbon trading market.

From Indian Perceptive there were very less research done on industry specific. Initial phase of research, it focused the productivity and growth rate of different industries in India which affect the carbon credit market. From 2002, the study covered the clean development mechanism process and applicability. From year 2004 to 2007, the research was done on industry basis. Each research focused on the individual industry and urbanization in Indian economy. This was helped to identify the potential industries for carbon emission. In the year 2009, the area covered by the researcher was technology adoption issues and potential in rural India. Carbon trading market study started from the year 2010 covered the MCX data. It also emphasised on the comparison of carbon emission market with other developing countries more with China. The recent research focused on the political and economic parameter affects the carbon market and motivate the green projects by emerged venture capitalist and involvement by the government. Gujarat is the first state to sign MOU for the carbon credit market and started the new department that is “Climate Change” under the Gujarat Urban Development Corporation (GUDC).

3.10 Research Gap

From the literature, it has been identified that there were very less research done on Indian Organisations. There were no researches done on primary data from organisations in Gujarat state. This leads to study different parameters of energy organisations. The study will become pioneer for the further research.

3.11 Conceptual Framework of Carbon Credit

One of the environmental threats our planet faces today is the potential for long-term changes in the earth climate and temperature known as Global Climate Change. Although Climate Change may result in some benefit to some extend but overall effects are likely to be harmful. GHG emissions from humans have increased by 70% between 1970 and 2004.With current climate change policies, GHG emissions are projected to continue to increase this century. In 1992 at the Rio Earth Summit nations from around the world met and agreed to voluntarily reduce greenhouse gas (GHG) emissions benchmarking 1990 levels but it was not legally binding so they would not get great success. Again in 1997, the entire representatives around the world meet again in Kyoto at Japan to sign an agreement that is legally bounded and named as Kyoto Agreement. The agreement gives internationally enforceable limits on the emission of greenhouse gases as a key tenet of the treaty. By 2012 the industrialized countries would be obliged to cut their GHG emissions by an average of 5.2% relative to their base-year emissions in 1990. The focus of Kyoto Protocol, however is the reduction in the level of six gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydroflourocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). The Kyoto Protocol has bought out three mechanisms for GHG emission abatement that is (i) Joint Implementations; (ii) Clean Development Mechanism; (iii) International Emission Trading. All these mechanisms are market-based. The first two are project based, where as the third one allows the developed countries to sell surplus emission of one country to another developed country. To develop a common base of the global warming for all the countries potential of six gases covered under the Kyoto Protocol agreement, it is decided that 1 tonne of carbon equivalent to 1 credit as a baseline indicator under any one of the mechanism. For the implementation of the three mechanisms, under Kyoto Agreement, they categorized countries under two heads:

(i) Annexure I for Developed Countries and (ii) Non-Annexure I for Developing and Under Developed countries.

India is developing country. From the three mechanisms, In India Clean Development Mechanism is applied. The Clean Development Mechanism (CDM) will serve as a symbiotic association between the Annexure I and Non Annexure I country parties where both will be mutually benefited from the association. India would be benefited by receiving new sustainable technologies and funding aids helping them achieve their sustainable development objectives. The other benefits to the developing country parties would be in terms of increased income, employment generation, alleviation of the poor and improvement of ambient air quality and standards of living. The National CDM Authority (NCDMA) is a single window clearance for CDM projects in the country. India is the leading country in the world with the second rank in Carbon Emission Reduction earning after China. China accounted for more than 55% of total CER issued under UNFCCC, where as 15% of total CER issued are of India. Gujarat is the first state in the country accounted Rs.127, 021,481 CER issued till 2012 that 18% of the total CER in India.

Although the world leaders struggle to achieve target in Kyoto Protocol first commitment period is ending on 31 December 2012, but still they initiated for the second commitment period will start right after it. The commitment period started in 2013 and extended until 2017 or 2020. At the UN's annual climate change conference just concluded in Doha, 194 countries agreed to an extension of the Kyoto Protocol through 2020. But the second phase still omits the world's two biggest greenhouse gas emitters – China and the United States. Governments agreed to work toward a universal climate change agreement covering all countries from 2020, to be adopted by 2015, and to find ways to scale up efforts before 2020 beyond the existing pledges to curb emissions. Still the Global market have an opportunity to delay the Global warming effects by adopting Kyoto Protocol Phase II and put their efforts to save the world.

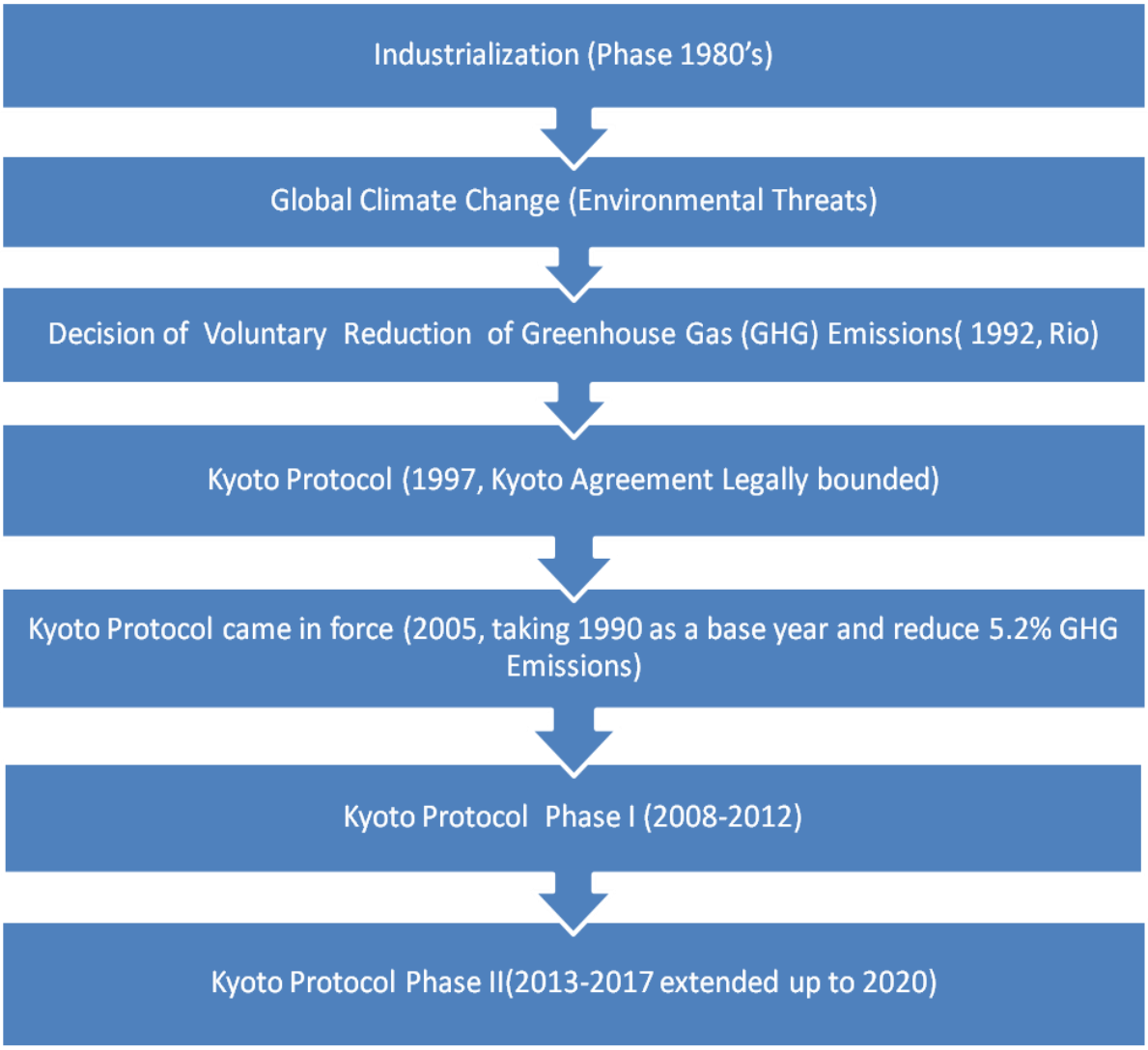

Figure 3.1: Conceptual Framework of Carbon Credit

CHAPTER- 4

Research Methodology

4.1 Introduction

The purposes of this section are to (1) define the research question for this research effort and (2) present a set of specific hypotheses that address the research question.

4.2 Overview of the Study

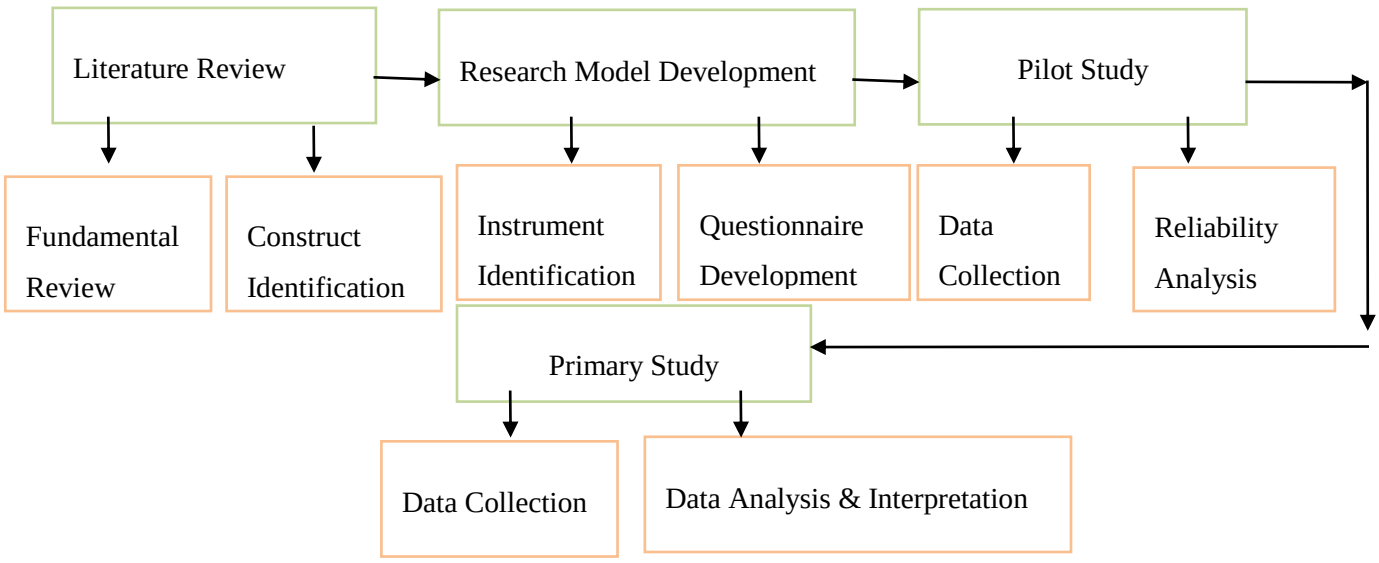

Figure 4.1: Overview of the Study

The first phase is to conduct a literature review to study the concept in detail and identify the scenario in India as well as Gujarat. A summary of the literature review is presented in chapter III of this document. A thorough literature review produced no previous studies that

investigated the projects which already registered by the energy sector organizations. This observation emphasizes the need to address the research question in this study.

The second phase is to incorporate to identify and development of instrument. This step involves developing a questionnaire depicting the hypothesized relationships between aspects considered, factors and barriers and risk association with the CDM project, selecting a measurement tool for each construct (based on the content, and lineage of the available tools), and finally developing a general model that is questionnaire includes all the aspects identify from the literature review. The structural model is presented in this document, while the general model and a summary of the construct selection process are presented in this chapter.

The third phase is to conduct a pilot study. The primary objective of this research phase is to collect responses and conduct a pilot study designed to confirm the reliability and validity of the measurement instruments. Pilot data is collected via structured interview as well as through mail. The objective of the pilot study is to conduct an initial analysis of the general model in order to gain introductory insight into relationships between model constructs. Although the sample size for the pilot study is not large enough to conduct reliable analysis, analysis of the general model can provide an indication of possible relationships which will be reinforced by the primary study.

The fourth and final phase is the primary research study. The primary research study involves collecting data, conducting analysis for each of the instruments utilized to collect data, and the study the relationships between model variables.

4.3 Variables Defined

The next phase of the research effort is to construct a structural model (Questionnaire) which depicts the relationship between expertise and the constructs identified during literature review. In the literature review, a set of constructs consisting of different aspects considered by the organization, list of factors and barriers need to be considered for CDM projects and the risk level association are identified as traits which potentially influence the development of CDM Projects. The concept of exogenous and endogenous variables is similar to the concept of independent and dependent variables that is common in many statistical

applications. Exogenous variables affect or influence the model without being affected by it. That is, an exogenous variable only has paths coming from it and none leading to it. Endogenous variables are affected or influenced by other variables in the model, and therefore have at least one path leading to it (Blunch 2008).

Table 4.1: Variables Defined

Sr. No.	Variables	Extracted from
1.	Aspects considered for CDM projects	CDM website, 'CDM Project Cycle': http://cdm.unfccc.int/Projects/diagram.html accessed Sept.,2013
2.	Factors affecting CDM projects	www.paryavaranmitra.org.in
3.	Barriers faced by organisation for CDM projects	www.paryavaranmitra.org.in
4.	Risk associated with CDM projects	Clean Development Mechanism and Carbon Credits, ICAI, April,2009
5.	Impact of CDM projects	www.cdmindia.gov.in
6.	Carbon Financing	Clean Development Mechanism and Carbon Credits, ICAI, April,2009
7.	Carbon Trading	www.unfccc.int

4.4 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 of energy sector organisations in Gujarat.

3. To examine the barriers faced by selected organisations for CDM projects and the impact of CDM projects on functions of organisations.

4. To explore the future potential of carbon credit market in Gujarat and India.

4.5 Research Hypotheses

H1: There is a significant difference between factors affecting the CDM projects and time span of the project/ public & private sector organisations/ technology adopted for CDM projects.

H2: There is a significant difference between barriers affecting CDM projects and time span of the CDM project/ classification of organisations based on investment/number of employees/public & private sector organisations/technology adopted for CDM projects.

H3: There is a significant difference between aspects considered for the CDM projects and number of years serves in the industry/ classification of organisation based on investment/public & private organisation/technology adopted for CDM projects.

H4: There is a significant difference for carbon trading among different type of organisation based on no of years serves in industry/ classification of organisation based on investment/public & private organisation/ technology adopted for CDM projects.

H5: There is a significant difference between impact of CDM projects on organisation and number of registered project/number of employees/number of years serves in industry/public & private organisation/ technology adopted for CDM projects.

H6: There is a significant association between risk associated with the CDM projects and time span of the CDM projects/ public & private energy sector organisations / technology adopted for CDM projects.

H7: There is a significant association between deployment of corporate social responsibility and number of years serves in industry/public & private organisations/ technology adopted for CDM projects.

H8: There is a significant difference between number of registered CDM projects among public & private organisations/ technology adopted for CDM projects.

H9: There is a significant difference between estimated CER p.a. among public & private organisations/ technology adopted for CDM projects /carbon trading.

4.6 Scope of the Study

The scope of the study refers to the parameters under which the study examines Registered CDM projects in the state of Gujarat. The study focuses on carbon credit market in India and Gujarat state including Kyoto protocol and its mechanism, The Indian nodal agency for carbon credit is NCDMA and CDM cell in Gujarat. 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 Gujarat which have registered their large scale CDM projects for carbon emission reduction (CER) up to 2012 under NCDMA (Kyoto protocol phase I).

4.7 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 formularise 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 judgement 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 organisers 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 2012) in Gujarat state.

- **Target group:** In Gujarat, the companies from energy sector (Renewable/Non-renewable) 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 Gujarat.

- **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 Gujarat 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.

Table 4.2: CDM projects and CER up to 2012

Name of Sector	No of projects	CER up to 2012(in tonnes)
Afforestation and Reforestation	18	10,874,541
Agriculture	3	74,393
Chemical Industries	18	11,793,853
Energy Demand	221	27,109,485
Energy Distribution	9	657,149
Energy industries(Renewable/Non-renewable sources)	2219	487,417,048
Fugitive emissions from fuel(Solid, Oil and gas)	3	165,438
Fugitive emissions from production and consumption of halocarbons and Sulphur	6	82,095,771
Manufacturing Industries	237	64,405,361
Metal Production	5	5,425,126
Mining/Mineral Production	4	19,053,935
Solvent use	1	103,579
Transport	13	1,238,906
Waste handling and disposal	69	12,498,337
Total (Number of Projects)	**2826**	**722,912,923**

(Source: CDM Projects and CER up to 2012 retrieved from http://www.cdmindia.gov.in/reports_new.php assessed on Feb. 28, 2013)

4.9 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 pre-tested 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.

4.10 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 categorised 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 non-parametric 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 analyse your data using a chi-square test for independence, need to make sure that the data you want to analyse "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.

4.11 Synopsis of the organisation studied

There are total 33 energy sector organisations who had registered their large scale CDM projects under NCDMA till 2012 in Gujarat. Finally the study is able to covered 22 organisations out of 33 organisations (approx. 66.67% of the population). From 22 organisations, 18 organisations were from private sector and 4 organisations from public sector.

The studied organisations were majorly from the large scale organisations based on investments and three organisations from small and medium scale organisations. In terms of no of years serves in the industry, there are nine organisations who has served less than five years, six organisations served five to ten years, three organisations served ten to fifteen years and four organisations served more than fifteen years in the industry. There are eleven organisations that had registered only single CDM projects in Kyoto protocol phase I. out of 22 organisations, 17 organisations had registered CDM projects for less than 14 years' time period and 5 organisations had registered for more than 14 years' time period.

CHAPTER – 5

Data Analysis and Interpretation

5.1 Introduction

This chapter gives insight of data collected from energy sector organisations which had registered large scale CDM projects up to 2012. The time frame covered by the data set is based on the availability of the data. After applying reliability test on the data collection instrument, the final data had been collected. Based on the normality of the data set, the non-parametric test has been used for the data analysis. The chapter also covers the individual findings of the data set.

5.2 CDM Projects Profile and Company Profile

- Time span of the CDM projects

Table 5.1: 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 organisations 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 5.2: Technology adopted for CDM Projects

Particulars	Solar	Wind
Technology adopted for CDM Projects	11	11

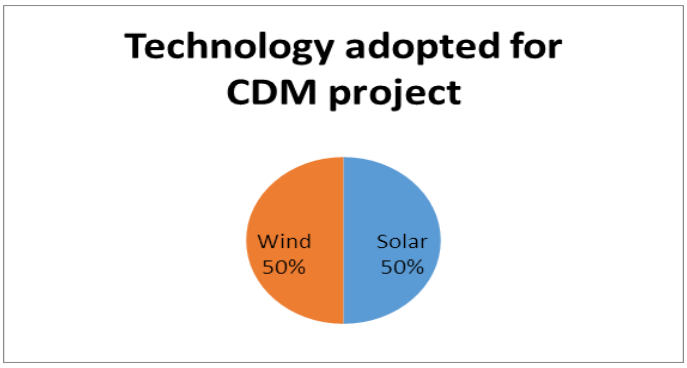

Figure 5.1: Technology adopted for CDM Projects

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 5.3: Deployment of corporate social responsibility

Particular	No	Yes
Deployment of CSR	4	18

- If Yes, than degree of deployment of Corporate Social Responsibility

Table 5.4: 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

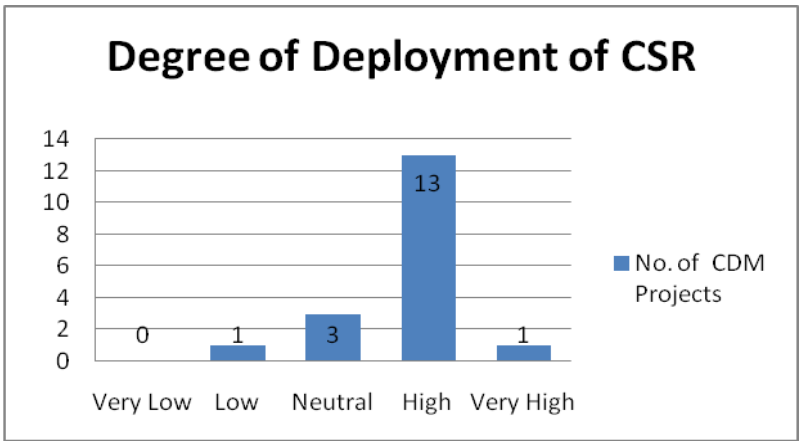

Figure 5.2: Degree of deployment of corporate social responsibility

Interpretation:

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

- Aspects considered for CDM Projects by energy sector organisations

Table 5.5: 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	16	5	0	1	0	
	1	10	0	4	0	3

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
Upgradation 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 add. 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
Transparent Projects Need	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 5.6: 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

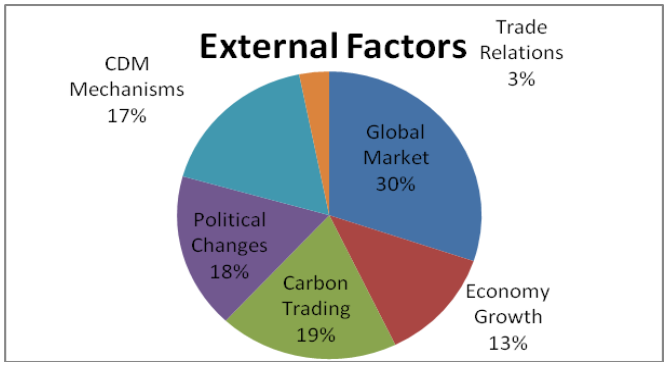

Figure 5.3: External factors affecting CDM Projects

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 5.7: Internal factors affecting CDM Projects

Internal Factors	No. of Organisations
Monitoring Cost	13
Adopting Technology	8

HR Practices	1
Management	10
Others	1

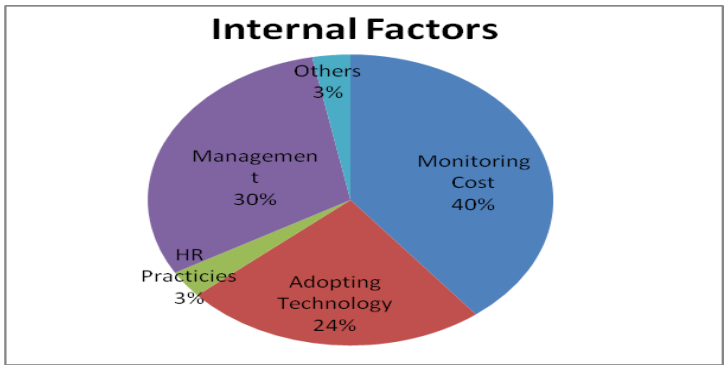

Figure 5.4: Internal factors affecting CDM Projects

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 organisation for the CDM Projects

Table 5.8: Barriers faced by the organisation for the CDM Projects

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

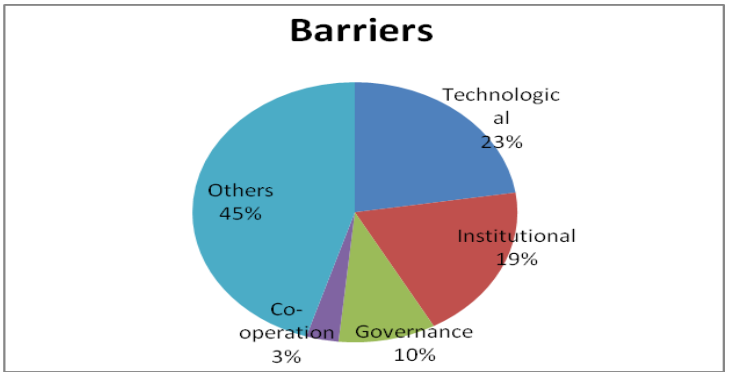

Figure 5.5: Barriers faced by the energy sector organisations

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 organisations.

Table 5.9: Impact of CDM Projects on energy sector organisations

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 organisation.

- Risk involved in CDM Projects

Table 5.10: 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 organisations.

- Mode of finance used for CDM Projects

Table 5.11: Mode of finance

Mode of Finance	No
Internal	19
External	15

Table 5.12: Sources of Finance

Sources of Finance	No
Grants	1
Loans	16
Equity	17
Other	4

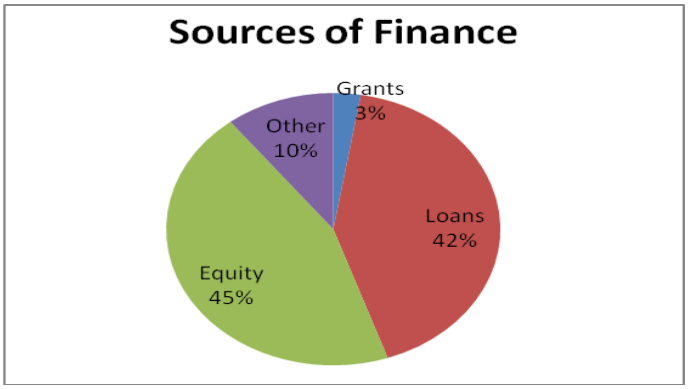

Figure 5.6: Sources of Finance

Interpretation:

From the above table, it can be interpreted that the organisations can deploy both the mode of finance that is internal as well as external. Out of all the financial sources, most of the organisations raise funds through equity and loans.

- Carbon Trading for the CDM Projects

Table 5.13: Carbon trading

Particular	Yes	No	Total
Carbon Trading	6	16	22

- If Yes, than which modes used for carbon trading

Table 5.14: Modes used for carbon trading

Particular	No. of Organisations
Spot	1
Future Contract	1
OTC	0
Forward Contract	4
Total	6

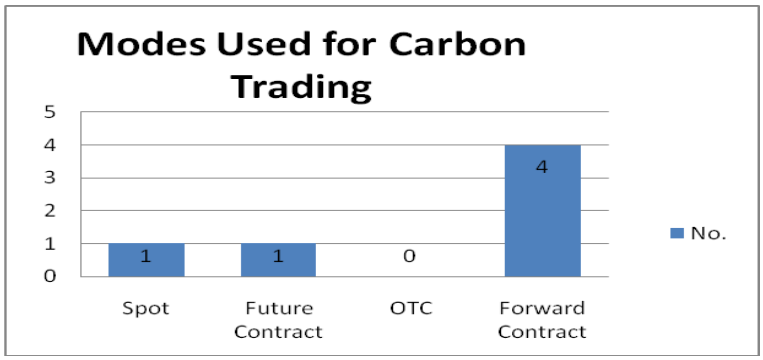

Figure 5.7: Modes used for carbon trading

Interpretation:

From the above table, it can be interpreted that out of 22 organisations; only 6 organisations had gone for carbon trading. Most of the organisations used forward contract as carbon trading instrument.

- **Company profile**

Table 5.15: Ownership structure of energy organisations

Particulars	No. of Organisations
Public	4
Private	18
Total	22

Interpretation:

From the above table, it can be interpreted that out of 22 organisations; only 4 organisations are from public sector and 18 organisations are from private sector.

Table 5.16: Age of the energy sector organisations

Particular	Less than 5 years	5 to 10 years	10 to 15 years	More than 15 years	Total
No of Years serve in Industry	9	6	3	4	22

Interpretation:

The above table shows that 15 organisations (more than 50% of samples) has less than 10 years of the life serves in the industry.

Table 5.17: Type of organisation based on investment

Particular	Micro	Small	Medium	Large	Total
Type of org. based on Investment	0	2	1	19	22

Interpretation:

The above table reveals that majority of the samples are belong to large scale organisation based on investment.

Table 5.18: Number of registered CDM Projects

Number of registered Projects	1	2	3	5	7	8	Total
Number of organisations	11	2	4	3	1	1	22

Interpretation:

The energy sector organisations have registered CDM Projects. From the samples, 11 organisations (50% of the samples) had registered single CDM Projects.

5.3 Cross-Tabulation

- Technology and Ownership of energy organisations

Table 5.19: Technology and ownership of energy organisations

Particulars	Public	Private
Solar	0	11
Wind	4	7

Interpretation:

The result shows that out of the whole sample there are 11 private sector organisations which have registered their CDM Projects for solar technology and there is no single public sector organisation registered their Projects for solar technology. On the other hand, 7 private sector organisations had registered their CDM Projects for wind technology and 4 public sector organisations had also registered their CDM Projects for wind technology.

- Ownership of energy sector organisations and life of CDM Projects

Table 5.20: Ownership of energy sector organisations and life of CDM Projects

Particulars	Phase I (1to 7years)	Phase II (8to 14 years)	Phase III (15to 21 years)
Public	2	1	1
Private	6	8	4

Interpretation:

Out of 22 energy organizations, 17 organizations has registered the CDM Projects for less than 14 years. Only 5 energy organisations has registered CDM Projects for more than 14 years.

- Ownership of energy organisations and type of energy organisations based on investment

Table 5.21: Ownership of organisations and type of organisations based on investment

Particulars	Micro	Small	Medium	Large
Public	0	0	0	4
Private	0	2	1	15

Interpretation:

Out of 22 organisations, 19 organisations are large scale based on investment (4 public and 15 private).

- Ownership of energy organisations and age of energy organisations

Table 5.22: Ownership of energy organisations and age of energy organisations

Particulars	Less than 5 years	5 to 10 years	10 to 15 years	More than 15 years
Public	0	0	2	2
Private	9	6	1	2

Interpretation:

All the public sector organisations have more than 10 years of age in the industry. From the private sector, majority have less than 5years of age in the industry.

- Technology and estimated carbon emission reduction p.a.

Table 5.23: Technology and estimated CER p.a.

Particulars	Estimated Carbon Emission Reduction p.a.		
	Less than 50000	50001 to 100000	More than 100000
Solar	8	1	2
Wind	4	6	1

Interpretation:

In solar technology, majority of the energy organisations estimate less than 50000 CER p.a... On the other hand, in wind technology organisations have registered less than 100000 CER p.a. that shows that in wind organisations have better opportunity to generate more CER p.a.

5.4 Descriptive Analysis

- Different aspects considered for CDM Projects by energy organisations

Table 5.24: Aspects considered for CDM Projects

	N	Minimum	Maximum	Mean	Std. Deviation
Reduce pollution	22	2.00	5.00	4.0455	.99892
Eco friendly	22	2.00	5.00	4.7273	.76730
Positive impact on Human wellbeing	22	2.00	5.00	4.5455	.85786
Does not make environment safe	22	1.00	4.00	1.3636	.72673
Sound Technology	22	2.00	5.00	4.3636	1.00216
Technology affect positive on Company	22	3.00	5.00	4.4091	.73414

Technology help development of Economy	22	2.00	5.00	3.8636	.88884
Upgradation of Technology	22	1.00	5.00	3.4545	1.01076
PDD is Real	22	1.00	5.00	4.2727	1.03196
Proper Methodology for measurement	22	2.00	5.00	4.5455	.85786
Create Employability	22	1.00	5.00	4.1818	1.13961
Reduce Poverty	22	1.00	5.00	3.5455	1.14340
Improve Quality of Life	22	2.00	5.00	3.7727	1.10978
Attract additional Investment	22	2.00	5.00	4.0000	.87287
Clear Timespan	22	3.00	5.00	4.4545	.67098
Clear Baseline	22	3.00	5.00	4.4545	.59580
Impact on resource Sustainability	22	2.00	5.00	3.7727	.97257
Precise Baseline	22	2.00	5.00	4.1818	1.00647
Transparent Projects	22	2.00	5.00	4.3636	.90214
Comparable Projects	22	3.00	5.00	3.8636	.88884
Feasibility of the Projects	22	3.00	5.00	4.5455	.67098
Avoid Overestimation	22	1.00	5.00	4.2727	.98473
Homogeneous Baseline	22	2.00	5.00	4.0455	.99892
Reliable Baseline	22	3.00	5.00	4.3636	.65795
Potential Error	22	2.00	5.00	4.4091	.73414
Updated Baseline	22	3.00	5.00	4.2273	.81251
Valid N (list wise)	22				

Interpretation:

From the above table, all the aspects considered by the organisation for the CDM Projects has mean score higher than 2.5. From all the aspects, the Projects feasibility, the Projects should be eco-friendly, proper methodology as well as reliable baseline have mean score of 4.54,

4.72, 4.54 and 4.36 respectively. Out of that all four aspects, the minimum deviation is 0.65 and 0.67 for feasibility of the Projects and reliable baseline.

- Risk level associated with the CDM Projects

Table 5.25: Risk level associated with the CDM Projects

	N	Minimum	Maximum	Mean	Std. Deviation
Feasibility Risk	22	1.00	4.00	2.2727	.93513
License Risk	22	1.00	4.00	2.3636	1.09307
Time Over run Risk	22	1.00	4.00	3.0455	.99892
Capital Cost Overrun Risk	22	1.00	4.00	2.7727	.75162
Technology Risk	22	1.00	4.00	2.3182	1.08612
Market Risk	22	1.00	4.00	2.6818	1.24924
Supply Risk	22	1.00	4.00	2.3182	1.21052
Operation Risk	22	1.00	4.00	2.4091	1.25960
Legal Risk	22	1.00	4.00	2.5455	1.18431
Financial Risk	22	1.00	4.00	2.9545	1.17422
Counterparty Risk	22	1.00	4.00	2.6818	1.12911
Valid N (list wise)	22				

Interpretation:

From the above table, the risk associated with the CDM Projects are playing vital role. Time over run risk has highest mean score that is 3.045, second highest mean score is 2.95 for financial Risk, and the third highest mean score is 2.77 for capital cost over-run risk. Out of the all the three Risk, capital cost over-run risk has lowest standard deviation that 0.75. So it can be interpreted that capital cost over-run risk and time over-run risk has highest impact on CDM Projects.

- Impact of CDM Projects on energy organisations

Table 5.26: Impact of CDM Projects

Particulars	N	Minimum	Maximum	Mean	Std. Deviation
Administration	22	1.00	5.00	2.7273	1.03196
Operations	22	1.00	5.00	3.3636	.95346
Finance	22	3.00	5.00	4.0000	.61721
Human Resource	22	1.00	4.00	3.0909	.81118
Technology	22	1.00	5.00	3.5000	1.05785
Marketing	22	1.00	5.00	2.9545	1.04550
Management	22	2.00	5.00	3.5455	.67098
Stakeholders	22	3.00	5.00	3.8636	.56023
Competitors	22	1.00	4.00	2.8636	1.03719
Economy	22	2.00	5.00	3.7727	.97257
Valid N (list wise)	22				

Interpretation:

From the above table, the impact of CDM Projects on the different aspects of organisation as well as economy of country is considered for the study. The mean score for the finance, stakeholder and economy is 4.00, 3.86 and 3.77 respectively. So it can be said that finance, stakeholder and economy has higher impact compare to other aspects. Out of these three aspects, stakeholder has lowest standard deviation that is 0.56 followed by finance that is 0.617.

5.5 Reliability Test

Cronbach alpha reliability test was conducted to check fitness of questionnaire.

Table 5.27: Reliability Test

Cronbach's Alpha	Cronbach's alpha based on standardized items
.869	.857

Interpretation:

Value of Cronbach alpha value as exhibited by table is 0.857 which is more than 0.75. Therefore the reliability of the data can be said to be good.

5.6 Hypothesis Testing

5.6.1 Kruskal-Wallis Test

H1 0: There is no significant difference in factors affecting the CDM Projects for different time span of the Projects.

H1 A: There is a significant difference in factors affecting the CDM Projects for different time span of the Projects.

Table 5.28: Mean rank of external factors and time span

Particular	Time span	N	Mean Rank
External factors	1.0000	8	6.50
	2.0000	9	13.72
	3.0000	5	15.50
	Total	22	

Table 5.29: Mean rank of internal factors and time span

Particular	Time span	N	Mean Rank
Internal Factors	1.0000	8	11.25
	2.0000	9	12.83
	3.0000	5	9.50
	Total	22	

Table 5.30: Kruskal-Wallis Test- Factors affecting the CDM Projects and time span of the Projects

Sr. No.	Factors affecting the CDM Projects	Sig. value
1	External Factors	0.018
2	Internal Factors	0.550

Interpretation:

Above table shows the significant value for the external factors and internal factors such as 0.018 and 0.550 respectively. In the case of external factors, the significant value is less than 0.05 so null hypothesis is rejected. For the internal factors, the significant value is higher than 0.05 so null hypothesis is not rejected. Therefore it can be interpreted that there is a difference for external factors (global market, political changes and trade relations) among different time span of the CDM Projects and rest of the factors does not have difference in terms of time span of the Projects.

H2 0: There is no significant difference in barriers affecting the CDM Projects for different time span of the Projects.

H2 A: There is a significant difference in barriers affecting the CDM Projects for different time span of the Projects.

Table 5.31: Mean rank of barriers affecting the CDM Projects and time span

	Time Span	N	Mean Rank
Barriers affecting the CDM Projects	1.0000	8	10.94
	2.0000	9	13.94
	3.0000	5	8.00
	Total	22	

Table 5.32: Kruskal-Wallis Test- Barriers affecting the CDM Projects and time span of the Projects

	Barriers affecting the CDM Projects
Chi-Square	4.149
df	2
Asymp. Sig.	.126

a. Kruskal Wallis Test

b. Grouping Variable: Time Span

Interpretation:

The above referred table shows the significant value for the barriers faced by the organisation which are higher than 0.05. It means that Null Hypothesis is not rejected. It can be interpreted that there is no difference for the barriers faced by the organization among different time span of the CDM Projects.

H3 0: There is no significant difference in aspects considered for the CDM Projects among Age of the Energy Organisations.

H3 A: There is a significant difference in aspects considered for the CDM Projects among Age of the Energy Organisations.

Table 5.33: Kruskal-Wallis Test- Aspects considered for the CDM Projects among age of the energy sector organisations

Sr. No.	Statements	Sig. value
1	I believe that pollution level of the environment get reduced because of the CDM Projects.	0.844
2	The Projects is ecofriendly according to me.	0.827
3	The Projects has positive impact on human wellbeing.	0.149
4	I believe that the CDM Projects does not make the environment a safer place.	0.510
5	I believe that the company has adopted/used sound technology.	0.426
6	The technology adopted for the CDM Projects has affected the company positively.	0.787
7	The technology adopted for CDM Projects shall help in the development of the Economy.	0.978
8	According to me, the technology adopted for the CDM Projects has affected in the upgradation of the technology base.	0.454
9	I believe that the emission level mention in the PDD is real.	0.399
10	The measurement of the CER followed by the proper methodology.	0.084
11	According to me, the Projects will able to create employability.	0.766
12	I believe that the Projects helps in reduces poverty.	0.180
13	The Projects helps in the improvement of the quality of life.	0.105
14	I believe that the Projects attract the addition investment in the economy.	0.752
15	According to me, the time span of the Projects needs to be clear.	0.682
16	The baseline of the Projects has been cleared.	0.510
17	I believe that the Projects has an impact on the resource sustainability.	0.628
18	The baseline of the Projects is precise according to me.	0.435
19	According to me, the Projects needs to be transparent.	0.392
20	The Projects needs to be comparable.	0.091
21	I believe that the feasibility of the Projects needs to be workable.	0.293
22	The Projects has avoided overestimation.	0.033
23	According to me, the methodology to decide baseline is homogeneous.	0.347

24	I believe that the baseline needs to reliable for the Projects feasibility.	0.210
25	The Projects has well defined the potential errors.	0.025
26	I believe that the updated baseline needs to be clear.	0.105
	Overall result of aspects considered by organisations	0.263

Interpretation:

From the above table, it can be understood that the significant value for the aspects considered by the organization is higher than 0.05 except overestimation and potential error such as 0.033 and 0.025 respectively. So in case of the majority of the aspects considered by the organisation, null hypothesis is not rejected. It can be interpreted that there is no difference for aspects considered by the organization for the CDM Projects among life of the organisation except overestimation and the potential error.

H4 0: There is no significant difference in aspects considered for the CDM Projects for different classification of organisation based on Investment.

H4 A: There is significant difference in aspects considered for the CDM Projects for different classification of organisation based on Investment.

Table 5.34: Kruskal-Wallis Test- aspects considered for the CDM Projects for different classification of organisation based on investment

Sr. No.	Statements	Sig. value
1	I believe that pollution level of the environment get reduced because of the CDM Projects.	0.815
2	The Projects is ecofriendly according to me.	0.771
3	The Projects has positive impact on human wellbeing.	0.546
4	I believe that the CDM Projects does not make the environment a safer place.	0.235
5	I believe that the company has adopted/used sound technology.	0.761
6	The technology adopted for the CDM Projects has affected the company positively.	0.731

7	The technology adopted for CDM Projects shall help in the development of the Economy.	0.335
8	According to me, the technology adopted for the CDM Projects has affected in the upgradation of the technology base.	0.237
9	I believe that the emission level mention in the PDD is real.	0.672
10	The measurement of the CER followed by the proper methodology.	0.746
11	According to me, the Projects will able to create employability.	0.256
12	I believe that the Projects helps in reduces poverty.	0.696
13	The Projects helps in the improvement of the quality of life.	0.989
14	I believe that the Projects attract the addition investment in the economy.	0.672
15	According to me, the time span of the Projects needs to be clear.	0.272
16	The baseline of the Projects has been cleared.	0.203
17	I believe that the Projects has an impact on the resource sustainability.	0.500
18	The baseline of the Projects is precise according to me.	0.600
19	According to me, the Projects needs to be transparent.	0.272
20	The Projects needs to be comparable.	0.218
21	I believe that the feasibility of the Projects needs to be workable.	0.742
22	The Projects has avoided overestimation.	0.615
23	According to me, the methodology to decide baseline is homogeneous.	0.385
24	I believe that the baseline needs to reliable for the Projects feasibility.	0.547
25	The Projects has well defined the potential errors.	0.613
26	I believe that the updated baseline needs to be clear.	0.526
	Overall result of aspects considered by organisations	0.623

Interpretation:

From the above table, it can be interpreted that the significant value for the aspects considered by the organization for CDM Projects are higher than 0.05. It means that null hypothesis is

not rejected for all the aspects. It can be interpreted that there is no difference among aspects considered by the organisation with the classification of organisation based on investment.

H5 0: There is no significant difference in barriers faced by the organisation among different classification of organisations based on investment.

H5 A: There is a significant difference in barriers faced by the organisation among different classification of organisations based on investment.

Table 5.35: Mean rank of barriers faced by the organisation among different classification of organisations based on investment

	Classification of organisation based on investment	N	Mean Rank
Barriers faced by the organisation	2.0000	2	8.00
	3.0000	1	8.00
	4.0000	19	12.05
	Total	22	

Table 5.36: Kruskal-Wallis Test- barriers faced by the organisation among different classification of organisations based on investment

	Barriers faced by the Organisations
Chi-Square	1.502
df	2
Asymp. Sig.	.472

a. Kruskal Wallis Test

b. Grouping Variable: Type of Organisation based on Investment

Interpretation:

From the above table, it can be interpreted that the significant value for the barriers faced by the organisation for CDM Projects (0.472) which is higher than 0.05. It means that null hypothesis is not rejected for the barriers faced by the organisation. So it can be interpreted

that there is no difference for the barriers faced by the organisation among different type of organisation based on investment.

H6 0: There is no significant difference in barriers faced by the organisation among number of employees of energy sector organisations.

H6 A: There is a significant difference in barriers faced by the organisation among number of employees of energy sector organisations.

Table 5.37: Mean rank of barriers faced by the organisation and number of employees

	No of Employees	N	Mean Rank
Barriers faced by the organisation	1.0000	8	12.19
	2.0000	5	12.70
	3.0000	4	8.00
	4.0000	5	12.00
	Total	22	

Table 5.38: Kruskal-Wallis Test- Barriers faced by the organisation and number of employees

	Barriers faced by the organisations
Chi-Square	2.161
Df	3
Asymp. Sig.	.540

a. Kruskal Wallis Test

b. Grouping Variable: No of Employees

Interpretation:

From the above table, it can be interpreted that the significant value for the barriers faced by the organization for CDM Projects is 0.540 which is higher than 0.05. It means that null hypothesis is not rejected. It can be interpreted that there is no difference for the barriers faced by the organisation with respect to number of employees of organisations.

H7 0: There is no significant difference in carbon trading among different age of energy sector organisations.

H7 A: There is a significant difference in carbon trading among different age of energy sector organisations.

Table 5.39: Mean Rank of carbon trading among different age group of energy organisations

	No of years serves in industry	N	Mean Rank
Carbon trading	1.00000	9	9.72
	2.00000	6	10.33
	3.00000	3	12.17
	4.00000	4	16.75
	Total	22	

Table 5.40: Kruskal-Wallis Test- Carbon trading and age group of energy organisations

	Carbon trading
Chi-Square	5.894
df	3
Asymp. Sig.	.117

a. Kruskal Wallis Test

b. Grouping Variable: No of years serves in Industry

Interpretation:

From the above result, it can be understood that the significant value for the carbon trading for CDM Projects is 0.117 which is higher than 0.05. So null hypothesis is not rejected. Therefore it can be said that there is no difference for the carbon trading among age of energy sector organisation.

H8 0: There is no significant difference in carbon trading among different classification of organisation based on investment.

H8 A: There is a significant difference for carbon trading among different classification of organisation based on investment.

Table 5.41: Mean rank of carbon trading among type of organisation based on investment

	Type of Organisation based on Investment	N	Mean Rank
Carbon trading	2.0000	2	8.50
	3.0000	1	19.50
	4.0000	19	11.39
	Total	22	

Table 5.42: Kruskal-Wallis Test- Carbon trading among type of organisation based on investment

	Carbon trading
Chi-Square	3.270
Df	2
Asymp. Sig.	.195

a. Kruskal Wallis Test

b. Grouping Variable: Type of Organisation based on Investment

Interpretation:

From the above table, it can be interpreted that the significant value for the carbon trading for CDM Projects is 0.195 which is higher than 0.05. It means that null hypothesis is not rejected. It can be interpreted that there is no difference for the carbon trading among different type of organisation based on investment.

H9 0: Impact of CDM Projects does not differ significantly with number of registered CDM Projects by energy sector organisation.

H9 A: Impact of CDM Projects does differ significantly with number of registered CDM Projects by energy sector organisation.

Table 5.43: Kruskal-Wallis Test- Impact of CDM Projects and number of CDM Projects

Sr. No.	Impact of CDM Projects	Sig value
1	Administration	0.837
2	Operations	0.198
3	Finance	0.494
4	Human Resource	0.667
5	Technology	0.182
6	Marketing	0.112
7	Management	0.522
8	Stakeholder	0.376
9	Competitors	0.382
10	Economy	0.192
	Overall result of impact of CDM Projects	0.192

Interpretation:

From the above table, it can be referred that the significant value for the impact of CDM Projects on organisation is higher than 0.05. It means that null hypothesis is not rejected. So it can be interpreted that impact of CDM Projects does not differ on various parameters of energy organisation with respect to total number of registered CDM Projects.

H10 0: Impact of CDM Projects does not differ significantly on various parameters of energy sector organization with respect to number of employees.

H10 A: Impact of CDM Projects does differ significantly on various parameters of Energy Organization with respect to number of employees.

Table 5.44: Kruskal-Wallis Test- Impact of CDM Projects and number of employees

Sr. No.	Impact of CDM Projects	Sig value
1	Administration	0.039
2	Operations	0.199
3	Finance	0.758
4	Human Resource	0.733
5	Technology	0.970
6	Marketing	0.554
7	Management	0.384
8	Stakeholder	0.201
9	Competitors	0.905
10	Economy	0.381
	Overall result of impact of CDM Projects	0.396

Interpretation:

From the above table, it can be interpreted that the significant value for the impact of CDM Projects on organisation administrative part is 0.039 which is less than 0.05. It means that null hypothesis is rejected. The result revealed that there is significant difference between impact of CDM Projects on organisation and number of employees but only administrative part, other parameters does not have any difference with size of organisation based on employees.

H11 0: Impact of CDM Projects does not differ significantly of energy sector organization with respect to age of them.

H11 A: Impact of CDM Projects does differ significantly of energy sector organization with respect to age of them.

Table 5.45: Kruskal-Wallis Test- Impact of CDM Projects and age of energy organisations

Sr. No.	Impact of CDM Projects	Sig. value
1	Administration	0.207
2	Operations	0.386
3	Finance	0.814
4	Human Resource	0.422
5	Technology	0.708
6	Marketing	0.875
7	Management	0.685
8	Stakeholder	0.689
9	Competitors	0.441
10	Economy	0.216
	Overall result of impact of CDM Projects	0.568

Interpretation:

From the above table, it can be identified that the significant value for the impact of CDM Projects on organisation is higher than 0.05. It means that null hypothesis is not rejected. It can be interpreted that impact of CDM Projects does not differ on various parameters of energy organization with respect to age of energy organisations.

5.6.2 Chi-Square Tests

H12 0: Time span of the Projects and risk associated with the registered CDM Projects is independent.

H12 A: Time span of the Projects and risk associated with the registered CDM Projects is dependent.

Table 5.46: Chi-square Test- Time span of the Projects and risk associated with the registered CDM Projects

Sr. No.	Risk associated with registered CDM Projects	Sig. value
1	Feasibility Risk	0.755
2	License Risk	0.200
3	Time Over-run Risk	0.089
4	Capital Cost Over-run Risk	0.045
5	Technology Risk	0.063
6	Market Risk	0.850
7	Supply Risk	0.682
8	Operation Risk	0.107
9	Legal Risk	0.261
10	Financial Risk	0.155
11	Counter Party Risk	0.427
	Overall result of risk associated with CDM Projects	0.048

Interpretation:

The above referred table shows the significant value for the risk associated with registered CDM Projects is 0.048 which are less than 0.05. It means that null hypothesis is rejected. It can be interpreted that time span of the Projects and risk associated with the registered CDM Projects are dependent. From the above table, all the risk associated with the registered CDM Projects does not have individual difference except capital cost over-run risk.

H13 0: Deployment of CSR and age of the energy sector organisations are independent.

H13 A: Deployment of CSR and age of the energy sector organisations are dependent.

Table 5.47: Chi-square Test- Deployment of CSR and age of the energy organisations

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.821	3	.185
Likelihood Ratio	5.782	3	.123
Linear-by-Linear Association	.618	1	.432
N of Valid Cases	22		

Interpretation:

From the above table, it can be interpreted from the significant value is 0.185 which is higher than 0.05 therefore null hypothesis is not rejected. Deployment of corporate social responsibility (CSR) through registered CDM Projects and age of the energy sector organisations are independent.

H14 0: Energy sector organisations gone for carbon trading and number of registered CDM Projects are independent.

H14 A: Energy sector organisations gone for carbon trading and number of registered CDM Projects are dependent.

Table 5.48: Chi-square Test- Carbon trading and number of registered CDM Projects

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.858	5	.570
Likelihood Ratio	4.573	5	.470
Linear-by-Linear Association	.304	1	.581
N of Valid Cases	22		

Interpretation:

The significant value of result is 0.570 which is higher than 0.05 therefore null hypothesis is not rejected. So energy sector organisation gone for carbon trading and number of registered CDM Projects are independent to each other. It has been identified that the organisations which had registered CDM Projects does not necessary to go for carbon trading.

H15 0: Energy sector organisations gone for carbon trading and estimated carbon emission reduction p.a. are independent.

H15 A: Energy sector organisations gone for carbon trading and estimated carbon emission reduction p.a. are dependent.

Table 5.49: Chi-square Test- Carbon trading and estimated CER p.a.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.034	2	.219
Likelihood Ratio	2.774	2	.250
Linear-by-Linear Association	2.562	1	.109
N of Valid Cases	22		

Interpretation:

The significant value is 0.219 which is higher than 0.05. So Null Hypothesis is not rejected. The result of the test shows that energy sector organisations gone for carbon trading and estimated carbon emission reduction p.a. are independent to each other. It means that estimated carbon emission reduction p.a. and the organisation gone for carbon trading do not have dependency to each other.

H16 0: Energy sector organisations gone for carbon trading and ownership structure of organisations are independent.

H16 A: Energy sector organisations gone for carbon trading and ownership structure of organisations are dependent.

Table 5.50: Chi-square Test- Carbon trading and ownership structure of energy sector organisations

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.013	1	.910		
Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	.013	1	.910		
Fisher's Exact Test				1.000	.708
Linear-by-Linear Association	.012	1	.912		
N of Valid Cases	22				

Interpretation:

From the above table, it can be interpreted that the significant value of energy sector organisations gone for carbon trading is 0.910 which is higher than 0.05. It means that null hypothesis is not rejected. The result stipulates that organisations gone for carbon trading and ownership structure of organisations are independent.

H17 0: Estimated CER p.a. by energy sector organisation and technology adopted for CDM Projects are independent.

H17 A: Estimated CER p.a. by energy sector organisation and technology adopted for CDM Projects are dependent.

Table 5.51: Chi-square Test- Estimated CER p.a. by energy sector organisation and technology adopted for CDM Projects

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.238	2	.043
Likelihood Ratio	5.661	2	.059
Linear-by-Linear Association	.759	1	.384
N of Valid Cases	22		

Interpretation:

The result of the test shows that the significant value is 0.043 which is less than 0.05. Null hypothesis is rejected. From the above table, it can be interpreted that estimated CER p.a. by energy sector organisation and technology adopted for CDM Projects are dependent. It can be understood that estimated CER p.a. by energy sector organisation and technology adopted for CDM Projects are inter-related.

5.6.3 Mann-Whitney U Test

H18 0: Impact of CDM Projects does not differ significantly with respect to ownership structure of energy sector organisations.

H18 A: Impact of CDM Projects does differ significantly with respect to ownership structure of energy sector organisations.

Table 5.52: Mann-Whitney U Test- Impact of CDM Projects and ownership structure of energy organisations

	Public and Private	N	Mean Rank	Sum of Ranks	Sig.
Administration	1.00	4	8.50	34.00	0.279
	2.00	18	12.17	219.00	
	Total	22			
Operations	1.00	4	13.50	54.00	0.469
	2.00	18	11.06	199.00	
	Total	22			
Finance	1.00	4	11.50	46.00	1.000
	2.00	18	11.50	207.00	
	Total	22			
Human Resource	1.00	4	14.50	58.00	0.266

	2.00	18	10.83	195.00	
	Total	22			
Technology	1.00	4	8.25	33.00	0.247
	2.00	18	12.22	220.00	
	Total	22			
Marketing	1.00	4	11.75	47.00	0.929
	2.00	18	11.44	206.00	
	Total	22			
Management	1.00	4	11.00	44.00	0.850
	2.00	18	11.61	209.00	
	Total	22			
Stakeholders	1.00	4	10.13	40.50	0.568
	2.00	18	11.81	212.50	
	Total	22			
Competitors	1.00	4	10.38	41.50	0.688
	2.00	18	11.75	211.50	
	Total	22			
Economy	1.00	4	11.75	47.00	0.929
	2.00	18	11.44	206.00	
	Total	22			
Overall impact of CDM Projects					0.902

Interpretation:

From the above table, it can be interpreted that the significant value for the impact of CDM Projects on various parameters of energy sector organisations is higher than 0.05. It means that null hypothesis is not rejected. So Impact of CDM Projects does not differ with respect to ownership structure of organisations.

H19 0: Aspects considered for CDM Projects does not differ significantly with respect to ownership structure of energy sector organisation.

H19 A: Aspects considered for CDM Projects does differ significantly with respect to ownership structure of energy sector organisation.

Table 5.53: Mann-Whitney U Test- Aspects considered for CDM Projects and ownership structure of energy organisation

Sr. No.	Statements	Sig. value
1	I believe that pollution level of the environment get reduced because of the CDM Projects.	0.685
2	The Projects is eco friendly according to me.	0.476
3	The Projects has positive impact on human wellbeing.	0.786
4	I believe that the CDM Projects does not make the environment a safer place.	0.870
5	I believe that the company has adopted/used sound technology.	0.692
6	The technology adopted for the CDM Projects has affected the company positively.	0.602
7	The technology adopted for CDM Projects shall help in the development of the Economy.	0.720
8	According to me, the technology adopted for the CDM Projects has affected in the upgradation of the technology base.	0.199
9	I believe that the emission level mention in the PDD is real.	0.851
10	The measurement of the CER followed by the proper methodology.	0.192
11	According to me, the Projects will able to create employability.	0.925
12	I believe that the Projects helps in reduces poverty.	0.428
13	The Projects helps in the improvement of the quality of life.	0.232
14	I believe that the Projects attract the addition investment in the economy.	0.638
15	According to me, the time span of the Projects needs to be clear.	0.338
16	The baseline of the Projects has been cleared.	0.268
17	I believe that the Projects has an impact on the resource sustainability.	0.086

18	The baseline of the Projects is precise according to me.	0.645
19	According to me, the Projects needs to be transparent.	1.000
20	The Projects needs to be comparable.	0.336
21	I believe that the feasibility of the Projects needs to be workable.	0.109
22	The Projects has avoided overestimation.	0.575
23	According to me, the methodology to decide baseline is homogeneous.	0.358
24	I believe that the baseline needs to reliable for the Projects feasibility.	0.186
25	The Projects has well defined the potential errors.	0.268
26	I believe that the updated baseline needs to be clear.	0.521
	Overall aspects considered for CDM Projects	0.538

Interpretation:

The result of the data reveals that the significant value for the various aspects considered by the organisations is higher than 0.05 that means null hypothesis is not rejected. It can be interpreted that aspects considered for the CDM Projects does not differ significantly with the ownership structure of energy sector organisations.

H20 0: Barriers faced by the organisations does not differ significantly with the ownership structure of energy sector organisations.

H20 A: Barriers faced by the organisations does differ significantly with the ownership structure of energy sector organisations.

Table 5.54: Mann-Whitney U Test-Barriers faced by the energy organisations and ownership structure of organisations

	Technological	Institutional	Governance	Cooperation	Other
Mann-Whitney U	33.000	35.000	30.000	34.000	31.000
Wilcoxon W	43.000	45.000	40.000	44.000	202.000
Z	-.316	-.110	-.858	-.471	-.510

Asymp. Sig. (2-tailed)	.752	.912	.391	.637	.610
Exact Sig. [2*(1-tailed Sig.)]	.837[a]	.967[a]	.652[a]	.902[a]	.712[a]

a. Not corrected for ties.

Interpretation:

From the above table, it can be interpreted that the significant value for the barriers faced by the organisations for CDM Projects are higher than 0.05. It means that null hypothesis is not rejected. So it can be identifies that barriers faced by the organisations does not differ with the ownership structure of energy sector organisations and all the barriers faced by the energy organisations and ownership structure of the organisation are negatively correlated.

H21 0: Factors affecting registered CDM Projects does not differ significantly with the ownership structure of energy sector organisations.

H21 A: Factors affecting registered CDM Projects does differ significantly with the ownership structure of energy sector organisations.

Table 5.55: Mann-Whitney U Test-Factors affecting CDM Projects and ownership structure of organisations

	Public and Private	N	Mean Rank	Sum of Ranks	Sig.
External Factors	1.00	4	13.00	52.00	0.391
	2.00	18	11.17	201.00	
	Total	22			
External Factors	1.00	4	7.50	30.00	0.102
	2.00	18	12.39	223.00	
	Total	22			
External Factors	1.00	4	8.25	33.00	0.200
	2.00	18	12.22	220.00	
	Total	22			
External	1.00	4	11.50	46.00	

Factors	2.00	18	11.50	207.00	1.000
	Total	22			
	1.00	4	8.75	35.00	
External Factors	2.00	18	12.11	218.00	0.280
	Total	22			
	1.00	4	10.50	42.00	
External Factors	2.00	18	11.72	211.00	0.495
	Total	22			
	1.00	4	16.00	64.00	
Internal Factors	2.00	18	10.50	189.00	0.072
	Total	22			
	1.00	4	10.25	41.00	
Internal Factors	2.00	18	11.78	212.00	0.610
	Total	22			
	1.00	4	11.00	44.00	
Internal Factors	2.00	18	11.61	209.00	0.637
	Total	22			
	1.00	4	12.00	48.00	
Internal Factors	2.00	18	11.39	205.00	0.844
	Total	22			
	1.00	4	13.75	55.00	0.034
Internal Factors	2.00	18	11.00	198.00	
	Total	22			
Overall result of External/ Internal factors affecting CDM Projects					0.195/0.042

Interpretation:

From the above table, it can be interpreted that the overall significant value for internal and external factors affecting the CDM Projects are 0.195/0.042. It means that null hypothesis is not rejected except internal factors. In the individual factors results not all the internal factors only finance as internal factor has difference with ownership structure of organisations. So it can be identified that various factors affecting registered CDM Projects does not differ with the ownership structure of energy sector organisations who had registered and implement the Projects in Gujarat.

H22 0: Risk associated with registered CDM Projects does not differ significantly with the ownership structure of energy sector organisations.

H22 A: Risk associated with registered CDM Projects does differ significantly with the ownership structure of energy sector organisations.

Table 5.56: Mann-Whitney U Test- Risk level associated with registered CDM Projects and ownership structure of energy organisations

	Public and Private			Sum of Ranks	Sig.
	1.00	4	6.25	25.00	
Feasibility Risk	2.00	18	12.67	228.00	0.061
	Total	22			
	1.00	4	9.25	37.00	
License Risk	2.00	18	12.00	216.00	0.428
	Total	22			
	1.00	4	14.00	56.00	
Time Overrun Risk	2.00	18	10.94	197.00	0.368
	Total	22			
	1.00	4	11.25	45.00	
Capital Cost Overrun Risk	2.00	18	11.56	208.00	0.925
	Total	22			

	1.00	4	6.75	27.00	
Technology Risk	2.00	18	12.56	226.00	0.091
	Total	22			
	1.00	4	11.00	44.00	
Market Risk	2.00	18	11.61	209.00	0.859
	Total	22			
	1.00	4	4.50	18.00	
Supply Risk	2.00	18	13.06	235.00	0.013
	Total	22			
	1.00	4	5.88	23.50	
Operation Risk	2.00	18	12.75	229.50	0.046
	Total	22			
	1.00	4	11.25	45.00	
Legal Risk	2.00	18	11.56	208.00	0.930
	Total	22			
	1.00	4	10.88	43.50	
Financial Risk	2.00	18	11.64	209.50	0.821
	Total	22			
	1.00	4	7.75	31.00	
Counterparty Risk	2.00	18	12.33	222.00	0.183
	Total	22			
Overall result of risk associated with CDM Projects					0.118

Interpretation:

From the above table, it can be interpreted that the significant value of the risk level associated with different phase of CDM Projects is higher than 0.05 except supply risk and operation risk. It means that null hypothesis is not rejected for the rest of the risk level. It can

be identified that risk level associated with registered CDM Projects does not differ with the ownership structure of energy sector organisations except supply risk and operation risk.

H23 0: Deployment of corporate social responsibility through CDM Projects does not differ significantly with the ownership structure of energy sector organisations.

H23 A: Deployment of corporate social responsibility through CDM Projects does differ significantly with the ownership structure of energy sector organisations.

Table 5.57: Mann-Whitney U Test- Deployment of CSR and ownership structure of organisations

	Deployment of CSR
Mann-Whitney U	28.000
Wilcoxon W	199.000
Z	-1.018
Asymp. Sig. (2-tailed)	.309
Exact Sig. [2*(1-tailed Sig.)]	.538[b]

a. Grouping Variable: Public and Private

Interpretation:

The test of the result shows that the significant value for the deployment of CSR through CDM Projects is higher than 0.05. It means that null hypothesis is not rejected. It can be interpreted that deployment of corporate social responsibility through CDM Projects does not differ with the ownership structure of energy sector organisations as well as both the parameters are negatively correlated.

H24 0: There is no significant difference in number of registered CDM Projects among public/private organisations.

H24 A: There is a significant difference in number of registered CDM Projects among public/private organisations.

Table 5.58: Mann-Whitney U Test- number of registered CDM Projects and ownership structure of organisations

	No of Register Projects
Mann-Whitney U	30.000
Wilcoxon W	40.000
Z	-.548
Asymp. Sig. (2-tailed)	.583
Exact Sig. [2*(1-tailed Sig.)]	.652[a]

Interpretation:

From the above table, it can be interpreted that the significant value for number of registered CDM Projects is higher than 0.05. From the result, it can be interpreted that there is no difference for number of registered CDM Projects among public/private organisations.

H25 0: Impact of CDM Projects on energy sector organisations does not differ significantly with the technology adopted for the CDM Projects.

H25 A: Impact of CDM Projects on energy sector organisations does differ significantly with the technology adopted for the CDM Projects.

Table 5.59: Mann-Whitney U Test- Impact of CDM Projects and technology

	Technology	N	Mean Rank	Sum of Ranks	Sig.
Administration	2.00	11	13.73	151.00	0.088
	3.00	11	9.27	102.00	
	Total	22			
Operations	2.00	11	9.45	104.00	0.116
	3.00	11	13.55	149.00	
	Total	22			

	Technology	N	Mean Rank	Sum of Ranks	Sig.
Finance	2.00	11	9.05	99.50	0.038
	3.00	11	13.95	153.50	
	Total	22			
Human Resource	2.00	11	10.18	112.00	0.299
	3.00	11	12.82	141.00	
	Total	22			
Technology	2.00	11	10.82	119.00	0.607
	3.00	11	12.18	134.00	
	Total	22			
Marketing	2.00	11	10.36	114.00	0.392
	3.00	11	12.64	139.00	
	Total	22			
Management	2.00	11	10.64	117.00	0.488
	3.00	11	12.36	136.00	
	Total	22			
Stakeholders	2.00	11	11.95	131.50	0.689
	3.00	11	11.05	121.50	
	Total	22			
Competitors	2.00	11	10.59	116.50	0.492
	3.00	11	12.41	136.50	
	Total	22			
Economy	2.00	11	12.18	134.00	0.607
	3.00	11	10.82	119.00	
	Total	22			
Overall impact of CDM Projects					0.243

Interpretation:

The result reveals that impact of CDM Projects on various parameters of energy sector organisations does not have difference with the technology adopted for the CDM Projects. The significant value for all the parameters is higher than 0.05 except finance parameter. So null hypothesis is not rejected for various parameters except finance. Registered CDM Projects has impact on the finance part of the energy sector organisations.

H26 0: Aspects considered for the CDM Projects by organisations does not differ significantly with the technology adopted for the CDM Projects.

H26 A: Aspects considered for the CDM Projects by organisations does differ significantly with the technology adopted for the CDM Projects.

Table 5.60: Mann-Whitney U Test- Aspects considered for the CDM Projects and technology

Sr. No.	Statements	Sig. value
1	I believe that pollution level of the environment get reduced because of the CDM Projects.	0.155
2	The Projects is eco friendly according to me.	0.621
3	The Projects has positive impact on human wellbeing.	0.240
4	I believe that the CDM Projects does not make the environment a safer place.	0.899
5	I believe that the company has adopted/used sound technology.	0.168
6	The technology adopted for the CDM Projects has affected the company positively.	0.380
7	The technology adopted for CDM Projects shall help in the development of the Economy.	0.254
8	According to me, the technology adopted for the CDM Projects has affected in the upgradation of the technology base.	0.040
9	I believe that the emission level mention in the PDD is real.	0.167
10	The measurement of the CER followed by the proper methodology.	0.049
11	According to me, the Projects will able to create employability.	0.857

12	I believe that the Projects helps in reduces poverty.	0.359
13	The Projects helps in the improvement of the quality of life.	0.207
14	I believe that the Projects attract the addition investment in the economy.	0.014
15	According to me, the time span of the Projects needs to be clear.	0.712
16	The baseline of the Projects has been cleared.	0.170
17	I believe that the Projects has an impact on the resource sustainability.	0.254
18	The baseline of the Projects is precise according to me.	0.337
19	According to me, the Projects needs to be transparent.	0.712
20	The Projects needs to be comparable.	0.832
21	I believe that the feasibility of the Projects needs to be workable.	0.280
22	The Projects has avoided overestimation.	0.248
23	According to me, the methodology to decide baseline is homogeneous.	0.547
24	I believe that the baseline needs to reliable for the Projects feasibility.	0.058
25	The Projects has well defined the potential errors.	0.031
26	I believe that the updated baseline needs to be clear.	0.417
	Overall aspects considered for CDM Projects	0.076

Interpretation:

From the above table, it can be identify that the significance value of the aspects considered for the CDM Projects is higher than 0.05 except potential error, resource sustainability, additional investment, and proper methodology and updated technology. It means that null hypothesis is not rejected for rest of the aspects. It can be interpreted that there is no difference for the aspects considered for the CDM Projects by energy organisations with the technology adopted for the CDM Projects. Only few aspects that are updated technology, proper methodology, additional investment, resource sustainability and potential error.

H27 0: Barriers faced by the energy sector organisations does not differ significantly with the technology adopted for the CDM Projects.

H27 A: Barriers faced by the energy sector organisations does differ significantly with the technology adopted for the CDM Projects.

Table 5.61: Mann-Whitney U Test- Barriers faced by the energy organisations and technology

	Technological	Institutional	Governance	Cooperation	Other
Mann-Whitney U	55.000	38.500	55.000	55.000	38.500
Wilcoxon W	121.000	104.500	121.000	121.000	104.500
Z	-.447	-1.871	-.607	-1.000	-1.732
Asymp. Sig. (2-tailed)	.655	.061	.544	.317	.083
Exact Sig. [2*(1-tailed Sig.)]	.748[a]	.151[a]	.748[a]	.748[a]	.151[a]

Interpretation:

From the above table, it can be interpreted that the significance value for barriers faced by the energy sector organisations is higher than 0.05. It means that null hypothesis is not rejected. It can be interpreted that barriers faced by the organisations does not differ with the technology adopted for the CDM Projects.

H28 0: Factors affecting registered CDM Projects does not differ significantly with the technology adopted for the CDM Projects by organisations.

H28 A: Factors affecting registered CDM Projects does differ significantly with the technology adopted for the CDM Projects by organisations.

Table 5.62: Mann-Whitney U Test- Factors affecting CDM Projects and technology

	Methodology Used	N	Mean Rank	Sum of Ranks	Sig.
	2.00	11	11.00	121.00	
External Factors	3.00	11	12.00	132.00	0.544
	Total	22			
	2.00	11	11.50	126.50	
External Factors	3.00	11	11.50	126.50	1.000
	Total	22			
	2.00	11	11.50	126.50	
External Factors	3.00	11	11.50	126.50	1.000
	Total	22			
	2.00	11	11.00	121.00	
External Factors	3.00	11	12.00	132.00	0.677
	Total	22			
	2.00	11	10.00	110.00	
External Factors	3.00	11	13.00	143.00	0.211
	Total	22			
	2.00	11	10.50	115.50	
External Factors	3.00	11	12.50	137.50	0.147
	Total	22			
	2.00	11	11.00	121.00	
Internal Factors	3.00	11	12.00	132.00	0.672
	Total	22			
	2.00	11	10.50	115.50	
Internal Factors	3.00	11	12.50	137.50	0.386
	Total	22			
	2.00	11	12.00	132.00	
Internal Factors	3.00	11	11.00	121.00	0.317

	Total	22			
	2.00	11	11.50	126.50	
Internal Factors	3.00	11	11.50	126.50	1.000
	Total	22			
	2.00	11	11.00	121.00	
Internal Factors	3.00	11	12.00	132.00	0.317
	Total	22			
Overall External/ Internal factors affecting CDM Projects					0.438/ 0.217

Interpretation:

From the above table, it can be interpreted that the significance value of various factors affecting CDM Projects is higher than 0.05. It means that null hypothesis is not rejected. It can be identified that factors affecting the registered CDM Projects does not differ with the technology adopted for the CDM Projects.

H29 0: Risk associated with registered CDM Projects does not differ significantly with the technology adopted by organisations.

H29 A: Risk associated with registered CDM Projects does differ significantly with the technology adopted by energy sector organisations.

Table 5.63: Mann-Whitney U Test- Risk associated with CDM Projects and technology

	Methodology Used	N	Mean Rank	Sum of Ranks	Sig.
	2.00	11	12.64	139.00	
Feasibility Risk	3.00	11	10.36	114.00	0.389
	Total	22			
	2.00	11	10.59	116.50	
License Risk	3.00	11	12.41	136.50	0.497

	Total	22			
	2.00	11	10.36	114.00	
Time Overrun Risk	3.00	11	12.64	139.00	0.385
	Total	22			
	2.00	11	12.09	133.00	
Capital Cost Overrun Risk	3.00	11	10.91	120.00	0.637
	Total	22			
	2.00	11	11.27	124.00	
Technology Risk	3.00	11	11.73	129.00	0.864
	Total	22			
	2.00	11	10.14	111.50	
Market Risk	3.00	11	12.86	141.50	0.304
	Total	22			
	2.00	11	11.36	125.00	
Supply Risk	3.00	11	11.64	128.00	0.918
	Total	22			
	2.00	11	11.68	128.50	
Operation Risk	3.00	11	11.32	124.50	0.891
	Total	22			
	2.00	11	10.50	115.50	
Legal Risk	3.00	11	12.50	137.50	0.455
	Total	22			
	2.00	11	10.68	117.50	
Financial Risk	3.00	11	12.32	135.50	0.530
	Total	22			
	2.00	11	10.68	117.50	
Counterparty Risk	3.00	11	12.32	135.50	0.538

Total	22			
Overall risk associated with CDM Projects				0.847

Interpretation:

The test of the result shows that all the category of risk associated with CDM Projects does not differ with the technology adopted by organisations. Because the significant value of all the risk associated with the CDM Projects is higher than 0.05 which indicates that null hypothesis is not rejected.

H30 0: Deployment of CSR through CDM Projects does not differ significantly with the technology adopted by the energy sector organisations.

H30 A: Deployment of CSR through CDM Projects does differ significantly with the technology adopted by the energy sector organisations.

Table 5.64: Mann-Whitney U Test- Deployment of CSR and technology

	Deployment of CSR
Mann-Whitney U	49.500
Wilcoxon W	115.500
Z	-1.080
Asymp. Sig. (2-tailed)	.280
Exact Sig. [2*(1-tailed Sig.)]	.478[b]

a. Grouping Variable: Methodology

b. Not corrected for ties.

Interpretation:

From the above table, it can be interpreted that the significance value of the result is higher than 0.05. It means that null hypothesis is not rejected. It can be interpreted that deployment of CSR through CDM Projects does not differ with technology adopted by the energy sector organisations.

H31 0: There is no significant difference in number of registered CDM Projects for different technology adopted by energy sector organisations.

H31 A: There is a significant difference in number of registered CDM Projects for different technology adopted by energy sector organisations.

Table 5.65: Mann-Whitney U Test- Number of registered CDM Projects and technology

	No. of registered. CDM Projects
Mann-Whitney U	55.000
Wilcoxon W	121.000
Z	-.388
Asymp. Sig. (2-tailed)	.698
Exact Sig. [2*(1-tailed Sig.)]	.748[b]

a. Grouping Variable: Methodology

b. Not corrected for ties.

Interpretation:

From the above table, it can be interpreted that the significance value of number of registered CDM Projects is higher than 0.05. It means that null hypothesis is not rejected. It can be interpreted that there is no difference in number of registered CDM Projects for different technology adopted for the CDM Projects by energy sector organisations.

H32 0: Carbon Trading does not differ significantly with the technology adopted by the energy sector organisations.

H32 A: Carbon Trading does differ significantly with the technology adopted by the energy sector organisations.

Table 5.66: Mann-Whitney U Test- Carbon trading and technology

	Carbon Trading
Mann-Whitney U	49.500
Wilcoxon W	115.500
Z	-.935
Asymp. Sig. (2-tailed)	.350
Exact Sig. [2*(1-tailed Sig.)]	.478[a]

a. Not corrected for ties.

b. Grouping Variable: Methodology

Interpretation:

From the above table, it can be interpreted that the significance value for the organisation gone for Carbon Trading is higher than 0.05. It means that Null Hypothesis is not rejected. It can be interpreted that Carbon Trading does not differ with the technology adopted by the energy sector organisations.

H33 0: Estimated carbon emission reduction p.a. does not differ significantly with the ownership structure of energy sector organisations.

H33 A: Estimated carbon emission reduction p.a. does differ significantly with the ownership structure of energy sector organisations.

Table 5.67: Mann-Whitney U Test- Estimated CER p.a. and ownership structure of energy sector organisations

	CER p.a.
Mann-Whitney U	35.000
Wilcoxon W	45.000
Z	-.095
Asymp. Sig. (2-tailed)	.924
Exact Sig. [2*(1-tailed Sig.)]	.967[a]

Interpretation:

The test of the result reveals that estimated carbon emission reduction p.a. does not differ significantly with the ownership structure of energy sector organisations. The significant value of the test result is higher than 0.05 which means null hypothesis is not rejected.

H34 0: There is no significant difference for estimated CER p.a. and organisation gone for carbon trading.

H34 A: There is a significant difference for estimated CER p.a. and organisation gone for carbon trading.

Table 5.68: Mann-Whitney U Test- Estimated CER p.a. and carbon trading

	CER p.a.
Mann-Whitney U	30.000
Wilcoxon W	166.000
Z	-1.479
Asymp. Sig. (2-tailed)	.139
Exact Sig. [2*(1-tailed Sig.)]	.203[a]

a. Not corrected for ties.

b. Grouping Variable: Carbon Trading

Interpretation:

From the above table, it can be interpreted that the significance value of estimated CER p.a. and organisation gone for carbon trading is higher than 0.05. It means that null hypothesis is not rejected. It can be interpreted that there is no difference for CER p.a. and organisation gone for carbon trading.

5.7 Kyoto Protocol Phase II

CFR (2013) reported that climate change is one of the most significant threats facing the world today. According to the American Meteorological Society, there is a 90 percent probability that global temperatures will rise by 3.5 to 7.4 degrees Celsius (6.3 to 13.3 degrees Fahrenheit) in less than one hundred years, with even greater increases over land and the poles. These seemingly minor shifts in temperature could trigger widespread disasters in the form of rising sea levels, violent and volatile weather patterns, desertification, famine, water shortages, and other secondary effects including conflict. In November 2011, the International Energy Agency warned that the world may be fast approaching a tipping point concerning climate change, and suggested that the next five years will be crucial for greenhouse gas reduction efforts. One way to reduce emissions would be to switch from fossil-fuel-based power to alternative sources of energy, such as nuclear, solar, and wind.

At the launch of the United Nations Framework Convention on Climate Change seventeenth Conference of Parties (COP-17) in Durban, South Africa, many climate change experts were concerned that the Kyoto Protocol could expire in 2012 with no secondary legally binding accord on limiting global emissions in place. This fear, however, was somewhat assuaged as the nearly two hundred countries present at the COP-17 approved an extension of the protocol through 2017 and potentially 2020.The limitations of the Durban Platform, as well as the increasingly tenuous status of the Kyoto Protocol, have created a fresh imperative for global action on climate change. The tension between developing and developed countries is fueled by ongoing disagreements over how to interpret a fundamental underpinning of the UNFCCC and Kyoto framework--namely, the principle of common but differentiated responsibilities among industrialized (Annex I) and developing (non-Annex I) countries, particularly when it comes to establishing and achieving meaningful mitigation targets. The international climate regime is at its strongest when it comes to understanding the threats posed by climate change. Such efforts, which are centered on the Intergovernmental Panel on Climate Change (IPCC), predate any other dedicated element of the regime. Yet, the infiltration of politics into the climate change debate has hampered the legitimacy and pervasiveness of new findings.

There was no urgent action to ensure that the global mean temperature does not rise beyond the critical 2 degree Celsius above pre-industrial levels. There was little progress on green

climate fund, technology transfer and capacity building issues. On the other hand, there was considerable heated rhetoric indicative of new battle lines for future negotiations. The world heaved a sign of relief that the Kyoto Protocol did not collapse and was extended for another five years up to 2017. The stark reality is that CO_2 emission reduction obligations for the first commitment period of the Kyoto Protocol, which ends in 2012, have been breached by Annexure I countries with impunity. Their emissions have increased and not reduced by five per cent from the 1990 level as was agreed to in the Kyoto Protocol. It is doubtful whether meaningful emissions reductions will emerge during the second commitment period of the Kyoto Protocol (2012-2017).

- The Doha Conference

At the UN's annual climate change conference just concluded in Doha, 194 countries agreed to an extension of the Kyoto Protocol through 2020. But the second phase still omits the world's two biggest greenhouse gas emitters – China and the United States. Governments agreed to work toward a universal climate change agreement covering all countries from 2020, to be adopted by 2015, and to find ways to scale up efforts before 2020 beyond the existing pledges to curb emissions. The extension of Kyoto will have various implications on the future of carbon markets. EU, Australia and New Zealand had proposed varying level of commitments at Cancun COP 16. The local carbon trading schemes of these countries allow varying percentage of international offsets that will come through CDM. This provides a hope for the ongoing CDM Projects to sell out the astronomical CERs produced to be sold out in the market at competitive prices. There will be huge demand of international offsets under Kyoto phase II periods whether it extends for 5 year up to 2017 or 8 years up to 2020.

Recognizing that developed countries are principally responsible for the current high levels of GHG emissions in the atmosphere as a result of more than 150 years of industrial activity, the Protocol places a heavier burden on developed nations under the principle of "common but differentiated responsibilities."

During the first commitment period, 37 industrialized countries and the European Community committed to reduce GHG emissions to an average of five percent against 1990 levels. During the second commitment period, Parties committed to reduce GHG emissions by at least 18

percent below 1990 levels in the eight-year period from 2013 to 2020; however, the composition of Parties in the second commitment period is different from the first.

- Monitoring emission targets

Under the Protocol, countries' actual emissions have to be monitored and precise records have to be kept of the trades carried out registry systems track and record transactions by Parties under the mechanisms. The UN Climate Change Secretariat, based in Bonn, Germany, keeps an international transaction log to verify that transactions are consistent with the rules of the Protocol.

Adaptation

The Kyoto Protocol, like the Convention, is also designed to assist countries in adapting to the adverse effects of climate change. It facilitates the development and deployment of technologies that can help increase resilience to the impacts of climate change. The Adaptation Fund was established to finance adaptation Projects and programs in developing countries that are Parties to the Kyoto Protocol. In the first commitment period, the Fund was financed mainly with a share of proceeds from CDM Projects activities. In Doha, in 2012, it was decided that for the second commitment period, international emissions trading and joint implementation would also provide the Adaptation Fund with a 2 percent share of proceeds.

- Factors that affect the Kyoto Protocol

  - Carbon Emission Targets: Carbon footprint of each nation (including imports and excluding exports), the progress made under Kyoto looks extremely poor, with Europe's savings reduced to just 1% from 1990 to 2008 and the developed world as a whole seeing its emissions rise by 7% in the same period. It shows that the concept has not taken seriously.

  - Registrations Process: For the registration of CDM Projects, the organisation need to go through with process and that process required more paper work and time consuming.

- Classification of Nations: Kyoto Protocol has classified the nations into two broad categories Annexure I and Annexure II. Some of the countries argued that the classification of the nations is not proper, that will be the reason for discontinue of the some countries in Kyoto Protocol Phase II.

- Carbon Pricing: There was initial rush for registration CDM Projects and get carbon credit, but it was only when number of applications from India were turned down and facing problem. The mindset of Indian companies has changed dramatically. Earlier, they were not even prepared to sell their carbon credit at 15 euros, and now they have given open mandates to sell whenever the price comes to 4 euros.

- Economic Downturn: The global financial crisis and the resulting economic slowdown may be assumed to have at least the benefit of also reducing environmental degradation in the individual countries. There are some short-term benefits to the global environment from the economic slowdown. Such benefits include reduction in the rate of air and water pollution from reduced energy use - which has direct implications for the urban poor's health. Government action to support investment in green growth measures, promoting direct investment or fiscal incentives for energy efficiency and clean environment low-carbon technologies (Anbumozhi et al. 2010).

- Technology Transfer: Developed world started to limit emission of Greenhouse Gases, but the question can be whether the current structure of CDM provides sufficient incentives for technology transfer (Popp 2010).

- India and Kyoto Protocol Phase II

India has taken a number of initiatives to reduce its GHG emissions; for instance, it has announced that per-capita emission levels will not exceed the developed countries' emission levels. It also aims to reduce emission intensity of its Gross Domestic Production by 20-25 per cent of the 2005 level by 2020. India has also adopted the National Action Plan on Climate Change, which includes both mitigation and adaptation measures. Several initiatives have been taken to promote clean energy and energy efficiency in order to reduce the CO_2

emissions. The National Solar Mission intends to promote solar energy and the National Mission on Energy Efficiency aims to enhance energy efficiency (ICWA, 2013).

The Doha outcomes have offered mixed success and failure for India. New Delhi had argued for a meaningful and comprehensive outcome in the Kyoto Protocol and implementation of Long-term Cooperative Action (LCA) tracks. However, several key concerns of India have been implicitly and explicitly incorporated in the discussions at Doha meetings. India successfully brought the Intellectual Property Rights matter into the climate change discourse. The second commitment for emissions reduction under the Kyoto Protocol is elusive, but developing countries including India have no binding obligation to reduce emissions by 2020. India is of the view that clean technology should be declared as 'global public goods', available to developing countries for free or affordable cost. The Doha Climate Platform launched at the Doha conference neither offers hope for adequate sources of climate finance nor technology transfer. India also advocated that the principle of equity is the mainstay of global climate change regime, and categorically stated that any tinkering with the term 'equity' would not be acceptable to it.

To conclude, despite there being no significant changes or major breakthrough in international negotiations on climate change to address the environmental and development challenges, people's awareness of the environmental challenges has been rising slowly across the world and countries are taking initiatives to address these challenges. There is a need for comprehensive and coordinated efforts at the global level for an effective and meaningful transition towards a low-carbon economy. The international community should adopt clean technologies, improve energy efficiency, and turn to more sustainable sources of energy and modes of production and consumption without the economic growth. Unchecked climate change could radically alter the prospects for growth and development in some of the poorest countries. Millennium Development Goals for 2015 are unlikely to be achieved in many regions of the world. Climate change can pose serious implications for the long-term 'sustainability of development progress in the developing countries. This underlines the urgency of strong and early action to reduce GHG emissions. The fact that the developing countries are so far behind the advanced industrialized countries in energy consumption per capita suggests that more widespread adoption of energy-saving techniques would be needed

to prevent a significant increase in world-wide energy consumption and CO_2 emissions (ICWA, 2013). With around 17 percent of world population, one of fastest growing economies of the world and the world's fourth largest emitter of greenhouse gases, India has become a crucial player in the climate change negotiations. Climate change issue underpins almost all aspects of economy and society and has been intrinsically connected with global trade, security, technology transfer, energy etc. India should enhance its diplomatic activities with countries who share common concerns. Successful adaptation finely tuned with mitigation holds the key for inclusive development and economic progress in the country. The country's expenditure on the adaptation programs has increased to 2.84 per cent during 2009-10. Climate concerns and its related issues should be explicitly mainstreamed in India's energy and foreign policy (ICWA, 2013).

India and US signed a deal to enhance cooperation on cutting emissions and investing in low carbon energy sources. India's economy is currently heavily reliant on coal, and that's unlikely to change any time soon. Last year, almost 60 per cent of India's installed power plants were coal-based. Wind power currently accounts for about 70 per cent of India's renewable energy capacity, and the government wants to add 10,000 megawatts more each year. Modi also wants to try and scale-up the solar power-driven economic revival he instigated as Gujarat governor, adding 100 gigawatts nationwide by 2022. Over 800 million Indians use cook stoves that burn dung, wood, or other solid fuels to generate heat, many of them in rural communities. As India's population increases, demand for these fuels is set to rise. The fuels used in the cook stoves release lots of particulate matter and greenhouse gases, such as methane, contributing to air pollution, climate change and hundreds of thousands of deaths each year. India's government is trying to rollout a biogas cookstove program to reduce the emissions from these stoves.(India's Energy and Climate Change Challenge)

- Conference of Parties (COP- 21)

  As International Energy Agency had focused on COP 21 in world energy outlook 2016. The major focus of Paris agreement is renewable energy sources. The broad policy framework laydown by the National Environment Policy (2006) which was

promotes sustainable development along with respect for ecological constraints and the social justice.

UNFCCC has described about the steps taken for determined contribution. India declared a voluntary goal of reducing the emission intensity of its GDP by 20-25% , over 2005 levels, by 2020. India has a definite plan of action for clean energy, energy efficiency in various sectors of industries, steps to achieve lower emission intensity in the automobile and transport sector, a major thrust to non-fossil based electricity generation and a building sector based on energy conservation. The Indian Economy has adopted strategies for carbon mitigation like clean and efficient energy system, enhancing energy efficiency in industries, developing climate resilient urban centers, promoting waste to wealth conversion and planned afforestation etc.

Chapter – 6

Findings and Suggestions

The alarm for global warming affect crop production, and cause sea levels to rise significantly and this would adversely affect mankind as well as inhabitants on earth. Burning of fossil fuels is a major source of industrial GHG emissions, especially from power, cement, steel, textile, fertilizer industries. The major greenhouse gases emitted by these industries increases the atmosphere's ability to trap infrared energy and thus affect the Climate. The United Nations Framework Convention on Climate Change (UNFCCC) is an international environmental treaty framed at United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro in 1992. The treaty is aimed at reducing emissions of greenhouse gases in order to combat Global Warming. It covers emission of the six main greenhouse gases, namely: Carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and Sulphur hexafluoride (SF_6). India being a developing or "Non-Annex country" has no restrictions that needs to be followed with regards to carbon emission i.e. there is no cap prescribed on how much carbon it can emit. Various companies have already made a mark in this field by entering into carbon trade and clean development mechanism Projects. They are deriving benefits in terms of better technological knowledge and carbon trade profits.

The study has been carried out to study CDM Projects and different parameters of CDM Projects. Although there are several articles that appear to express parameters considered for CDM Projects. The research highlights the research gap identified from comprehensive review of literature which shows that there is significant gap in the understanding of the

concept from the organisations point of view. An empirical study utilising structured questionnaire was employed to survey energy sector organisations which had registered and implement the CDM Projects in Gujarat. Furthermore the research attempted to provide unique insights into the question raised in relation to barriers analysis of CDM Projects, factors affecting CDM Projects, risk involved in CDM Projects, aspects considered for CDM Projects, impact of CDM Projects, carbon trading and corporate social responsibility by using non-parametric test with an understanding of the data normality and small sampling unit. In this chapter, the findings of the empirical study discussed. The discussion focuses on the result presented and analysed in the previous chapter.

6.1 Company Profile and CDM Projects

From the inferential statistics, the data has been classified as per technology adopted for CDM Projects, ownership of energy sector organisations, classification of organisation based on investment and number of years serves in industry. Out of all the technology, solar and wind are the major used technologies by the energy sector organisation for CDM Projects in Gujarat. From the data analysis, it shows that the whole sample distributed equally among solar and wind technology (11-solar, 11-wind). The energy sector organisations categorised into public and private. Out of 22 organisations, 18 organisations are private and 4 organisations belong to public sector. The life of the organisations in the industry varies from less than 5 years to more than 15 years. 9 organisations have less than 5 years of life in the industry. The organisations has categorised based on investment. Out of all, 19 organisations belong to large scale organisations.

6.2 Barriers Analysis of CDM Projects

There is vast literature on the barriers which impede the transfer of climate technologies to developing countries. As UNFCCC has described the guidelines to evaluate the additionality of CDM Projects, there are different approaches for additionality assessment. The first step is to apply barrier analysis. Barriers analysis addresses the barriers faced by the CDM Projects. As part of the barrier analysis, Projects have to show that at least one alternative plan. The literature emphasised that every Projects has different barriers such as technological barrier for adopting and implementing technology, geographical barriers for the organisations outside Gujarat and implement in Gujarat, financial barrier for Projects financing for more than 10

years, institutional barrier from management acceptance, governance barrier as guidelines and government support for CDM Projects, alliance between countries and trade policies that act as barrier relating to technology transfer as well as return of the CDM Projects. Out of all the barriers, financial barriers, and technological barriers are highly faced by the energy sector organisations as per the study. To check the significant differences for barriers faced by the energy sector organisations, they have been categorised as organisation based on investment, number of employees, ownership structure of energy sector organisations (public/private) and technology adopted for CDM Projects. The result shows that there is no difference among all the independent variables listed above. So it can be interpreted that barriers faced by energy sector organisations are independent.

6.3 Factors Affecting CDM Projects

The factors categorised into two that internal as well as external factors. Out of all the external factors, global market condition is highly affecting the CDM Projects. Monitoring cost of the CDM Projects can be fluctuating so it affects the CDM Projects as internal factors. By applying statistical tool to check difference for factors affecting CDM Projects with independent variables such as time span of the Projects, ownership structure of organisations (public/private) and technology adopted for CDM Projects. The result shows that there is significant difference for external factors (global market, political changes and trade relations) among different time span of the CDM Projects. Rest of the factors does not have difference in terms of time span of the Projects. Various factors affecting registered CDM Projects does not differ with the ownership structure of energy sector organisations except internal factor that is financial factor. The technology adopted for CDM Projects does not affect the factors considered for CDM Projects.

6.4 Risk Involved in CDM Projects

There are different types of risk involved in CDM Projects. The risk associated with CDM Projects are categorized into major five heads such as: registration risk, performance risk, counter party risk, market risk and country risk (ICAI, 2009). Projects sponsors will be particularly concerned with the assessment of all the risk associated with CDM Projects. Conventional Projects risks can be divided in terms of three phases in which they occur;

planning, construction and operation risks. The sponsors of the Projects will undertake their own risk assessment early in the Projects planning process. The lenders will undertake their risk assessment at a later stage, focusing on construction and operation phase risk. The risk associated with CDM Projects can be measure on nominal scale or monetary terms. The literature defined financial risk is highly involved with CDM Projects from the view point of sponsors of the Projects. From the study, it can be identified that other than financial risk, time over-run risk and operation risk are also associated with CDM Projects. The study also reveals that capital cost over-run risk and financial risk involve in the CDM Projects as per the respondent studied because of the estimated cost of the Projects gets increased. The statistical analysis shows that time span of the Projects and risk associated with the registered CDM Projects are dependent. Out of all risk, capital cost over-run risk and time over-run risk has difference with the time span of the registered energy sector CDM Projects. To check the significant differences for risk involved in CDM Projects, the statistical tool applied with ownership structure of energy sector organisations (public/private) and technology adopted for CDM Projects. The result of the data shows that the significant value of the risk level associated with different phases of CDM Projects is higher than 0.05 except supply risk and operation risk. It means that supply risk and operational risk have difference with the ownership structure of energy sector organisations. Risk involved with CDM Projects does not differ significantly with the technology adopted for CDM Projects.

6.5 Aspects Considered for CDM Projects

The validation serves as Projects design verification and is a requirement of all Projects. The validation is an independent third party assessment of the Projects design. In particular, the Projects's baseline, the monitoring plan (MP), and the Projects’s compliance with relevant UNFCCC and host country criteria are validated in order to confirm that the Projects design, as documented, is sound and reasonable, and meet the stated requirements and identified criteria. Validation is a requirement for all CDM Projects and is necessary to provide assurance to stakeholders of the quality of the Projects and its intended generation of certified emission reductions (CERs). The CDM Projects should meet prescribed criteria for registration as per NCDMA broadly named as: additionality, sustainable development indicators and baselines. By taking the base of all the criteria’s, the questions have been drafted for study. The study has covered all the criteria to analyse and identify most preferred

criteria by the energy sector organisations. There are various aspects considered for the CDM Projects. From all the aspects, the CDM Projects needs to be eco friendly this criterion has the highest mean score of 4.72. The study has also analysed difference of all the criteria with age of energy sector organisations, classification of energy sector organisations based on investment and ownership structure of energy sector organisations (public/private). From the result, it can be interpreted that there is no difference for aspects considered by the energy sector organisations for the CDM Projects among all the independent variables listed above except certain criteria that are financial additionality(additionality), environmental well-being and technological well-being (Sustainable development indicators), and overestimation and the potential error (baselines). The research also found that out of all, these aspects play a vital role that social well being, economic well being and environmental well being.

6.6 Impact of CDM Projects

When the organisations registered CDM Projects/s, there are certain areas where organisations find changes. Out of all the parameters, one of the points is impact of CDM Projects on organisations and other parameters. The organisations certain functions such as finance, stakeholder and management functions affected by the Projects. The study has analysed the difference for impact of CDM Projects on energy sector organisations with respect to total number of registered Projects, number of employees, age of energy sector organisations, ownership structure of organisation and technology adopted for the CDM Projects. The output of the data reveals that impact of CDM Projects does not differ with total number of registered Projects, the age of energy sector organizations, ownership structure of energy sector organisations, and the technology adopted for the CDM Projects except finance part. But there is difference for the impact of CDM Projects on organisations with number of employees but only administrative part. Energy sector organisation adopts technology that requires additional investment and for the implementation of technology, the organisation required manpower. That why CDM Projects is affecting finance and administrative part. Finally at the end management has impact of CDM Projects.

6.7 Carbon Trading

Carbon trading refers to the trading of emissions of six major greenhouse gases. It is a market-based instrument. There are currently several national emissions trading systems being planned or beginning to be implemented. These can be split up into those that are: (a) based upon a 'cap and trade' model or (b) those operating as a 'baseline and credit' system. In a cap and trade system, such as international emissions trading under the Kyoto Protocol or the US CO_2 emissions trading system, an overall limit or 'cap' is established for emission by participants, and allowances equal to the overall cap are distributed. Participants may trade any allowances above the amount they must hold for their particular emissions level. The energy sector organisations registered their Projects but majority of the organisations does not prefer to go for carbon trading because they had contract with the foreign party. Out of all the samples studied, six organisations had gone for carbon trading and most of the organisations prefer forward contract. The sampling organisations have different life span in the industry, but it does not make any difference for the organisations gone for carbon trading. From the data, it has been identified that organisations gone for carbon trading is independent form the organisations category, type of organisation based on investment, estimated carbon emission reduction p.a., ownership structure of energy organisations, number of registered CDM Projects and technology adopted for CDM Projects. It has been identified that organisations which had registered CDM Projects does not necessary to go for carbon trading.

6.8 Corporate Social Responsibility

Corporate social responsibility credit scheme: Given the subjective nature of industry, the scheme should clearly identify what qualifies for credits. As in carbon credits, this can be based on a barrier analysis. The barrier analysis should explain the activities that qualify for the second category, as explained above. Also important is the methodology for quantifying the credits, which may not be a simple calculation like in carbon credits. Quantifying CSR credits is not going to be easy. It definitely needs to be based on the impact of the activity, with clearly-identified indicators for success and there are methodologies available to evaluate this. CDM Projects used as a tool for the corporate social responsibility. In data set, the result also found the same relation and the degree for the deployment of corporate social

responsibility is high. The analysis has identified that majority of the organisation used carbon credit as a tool for CSR. Deployment of corporate social responsibility (CSR) through registered CDM Projects and age of the energy sector organisations are independent. Deployment of corporate social responsibility through CDM Projects does not differ with the ownership structure of energy sector organisations as well as both the parameters are negatively correlated. The data revealed that deployment of CSR through CDM Projects does not differ with the technology adopted by the energy sector organisations.

6.9 Suggestions

- **Suggestions to the governing body**

India has potential to generate more carbon credit. Government body of India (NCDMA) has increasingly being creating awareness in the market for the concept. Global market conditions and trade relationship affects the CDM market so economy has to draft such a policy to overcome from the factors. Government has to generate more source of carbon financing that will help the organisation for better implementation of the CDM Projects.

- **Suggestions to the organisations**

Various parameters affecting CDM Projects were studied. Analysis revealed that majority organisation used two renewable sources: wind and solar. So still there is opportunity to explore other renewable sources. CDM Projects has impact on administrative functions due to availability of specialized manpower so companies can have manpower that help them for better performance. Time over-run risk and capital risk are associated with CDM Projects that shows that companies has to put their efforts to complete the CDM Projects within time limit.

Chapter – 7

Conclusion and Scope for Future Research

7.1 Conclusion

The current study deals with the energy sector organisations that had registered large scale CDM Projects and implemented in Gujarat 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 Gujarat. 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 analysed 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 organisation, 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.

7.2 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.

7.3 Limitations and Direction for the Future Research

This section is not a long-period plan for future research; instead, it outlines some relevant topics that will be investigated in the next few years, which are natural extensions of my

current research. The current study has some of the limitations that are beyond the scope of the current study which may affect the strength of findings. The study has focused primarily on energy sector only in Gujarat with large scale Projects. The research can be extended by covering all the CDM Projects of Gujarat and makes inter industry comparison. At the same time, the study has covered only conceptual framework of India. The future research will be done on cross-national comparison with the selected economic indicators. Kyoto protocol phase II started after 2012 and it is not that much analysed so researcher can go for detailed analysis of Kyoto protocol phase II. Carbon credit is treating as one of the commodity in the market. Carbon credit pricing is always unpredictable so by analysed the pricing of carbon credit, the research can be extended.

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List of Publications

Sr. No.	Title of the research paper	Name of Journal	Author's Name
1	Study of Carbon Credit Management at Ahmedabad Municipal Corporation	ICEI-2012	Tejal Bhatt, Hetal Jani and Avani Shah
2	Carbon Credit: Indian Economy Perspective	Asian Journal of Research in Business Economics and Management	Avani Shah and Dr. Narayan Baser
3	Impact of Clean Development Mechanism (CDM) Projects on Energy Industry Organisations of Gujarat	Guvesana Journal of Management	Avani Shah and Dr. Narayan Baser
4	Carbon Market: A road map ahead	'Sankalpa': Journal of Management & Research	Avani Shah and Dr. Narayan Baser

Appendix A

Questionnaire

Dear Sir/Madam,

The questionnaire is prepared for the research study leading to PhD in Management registered with Gujarat Technological University. I heartily request you to provide impartial and realistic answers to all these questions on the basis of your experience and expertise to make this research fruitful and applicable. Questionnaire attempts to study the carbon credit scenario in Indian market. Besides this study is also an attempt to study the impact of carbon credit on economic indicators. Questionnaire is divided into three sections - Section A deals covered the registered Projects related information: Section B covers the general information regarding Projects and section C covers the organisation details. I assure you that the information/opinion/data given by you will be used exclusively for academic purpose. Thanking you in anticipation of your support.

-Avani Shah

Section A – CDM Registered Projects

1. Are you aware about the Global Warming? (Please put √ sign wherever applicable.)

☐ YES ☐ NO

2. Are you aware about the Carbon Emission Reduction (CER)? (Please put √ sign wherever applicable.)

☐ YES ☐ NO

3. Have you registered your Projects for Carbon Emission Reduction? (Please put √ sign wherever applicable.)

☐ YES ☐ NO

4. Under which legal body your organization has registered the Projects/s? (Please put √ sign wherever applicable.)

Central Govt. ☐ State Govt. ☐ Multi state Govt. ☐

5. Mention applied mandatory laws and regulation

Central Government: _____

State Government: _____

Industry Laws: _____

6. How much time span of the Projects you consider before registration? (Please put √ sign wherever applicable.)

Phase I (1to 7years) ☐ Phase II (8to 14 years) ☐ Phase III (15to 21 years) ☐

7. Geographical boundaries: (Please put √ sign wherever applicable.)

Local/Regional ☐ National ☐ International ☐

8. Which methodology has been used for CDM Projects?

Biomass ☐ Solar ☐ Wind ☐ Natural Gas ☐ Thermal ☐ Other ☐

_____

9. Do you feel that Carbon Credit can be deployment for Corporate Social Responsibility? (Please put √ sign wherever applicable.)

YES ☐ NO ☐

9.1 If YES, than what level… (Please put √ sign wherever applicable.)

Very Low ☐ Low ☐ Neutral ☐ High ☐ Very High ☐

10. Aspects considered for the CDM Projects in India (Please put √ sign wherever applicable.) (1- Strongly Disagree, 2- Disagree, 3-Neither agree not disagree, 4- Agree, 5- Strongly Agree)

Sr. No.	Statements	1	2	3	4	5
1	I believe that pollution level of the environment get reduced because of the CDM Projects.					
2	The Projects is eco friendly according to me.					
3	The Projects has positive impact on human wellbeing.					
4	I believe that the CDM Projects does not make the environment a safer place.					
5	I believe that the company has adopted/used sound technology.					

6	The technology adopted for the CDM Projects has affected the company positively.					
7	The technology adopted for CDM Projects shall help in the development of the Economy.					
8	According to me, the technology adopted for the CDM Projects has affected in the upgradation of the technology base.					
9	I believe that the emission level mention in the PDD is real.					
10	The measurement of the CER followed by the proper methodology.					
11	According to me, the Projects will able to create employability.					
12	I believe that the Projects helps in reduces poverty.					
13	The Projects helps in the improvement of the quality of life.					
14	I believe that the Projects attract the addition investment in the economy.					
15	According to me, the time span of the Projects needs to be clear.					
16	The baseline of the Projects has been cleared.					
17	I believe that the Projects has an impact on the resource sustainability.					
18	The baseline of the Projects is precise according to me.					
19	According to me, the Projects needs to be transparent.					
20	The Projects needs to be comparable.					

21	I believe that the physibility of the Projects needs to be workable.					
22	The Projects has avoided overestimation.					
23	According to me, the methodology to decide baseline is homogeneous.					
24	I believe that the baseline needs to reliable for the Projects physibility.					
25	The Projects has well defined the potential errors.					
26	I believe that the updated baseline needs to be clear.					

11. What are the factors affecting the carbon credit Projects? (Please put √ sign wherever applicable.)

External factors

☐ Recession in Global Market ☐ Country's Economic growth

☐ Carbon Trading Mechanism ☐ Political Changes

☐ CDM Mechanism ☐ Trade Relations ☐ Others _____

Internal factors

☐ Monitoring cost of the Projects ☐ Adopting and Implementing Technology

☐ HR Practices ☐ Management ☐ Others _____

12. What are the barriers that would prevent the implementation of proposed Projects activity? (Please put √ sign wherever applicable.)

☐ Technological Barriers ☐ Institutional Barriers ☐ Governance level

Cooperation between Host and Investors Country ☐ Others _____

13. What according to you is the impact of CDM on the following factors? Please tick on the appropriate impact level.

Particulars	**Very Low**	**Low**	**Neutral**	**High**	**Very High**
Administration					
Operations					
Finance					
Human Resource					
Technology					
Marketing					
Management					
Stakeholders					
Competitors					
Economy					

14. The funds to start a CDM Projects can be raised from… (Please put √ sign wherever applicable.)

Internal Sources of Financing ☐ External Sources of Financing ☐

15. The sources of financing (Please put √ sign wherever applicable.)

Grants ☐ Loans (Debt) ☐ Equity ☐ Others ☐

Please Specify the Source_____

16. The degree of risk involve in different level of Projects

(Please put √ sign wherever applicable.)

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				
Permit/License Risk				
Construction Phase				
Time Over-run Risk				
Capital Cost over-run Risk				
Operation Phase				
Technology Risk				
Market Risk				
Supply Risk				
Operation Risk				
Political/Legal Risk				
Financial Risk				
Counterparty Risk				

17. Investment Analysis (Please put √ sign wherever applicable.)

17.1 Selected Appropriate Analysis Methods

Simple Cost Analysis ☐ Investment Comparison Analysis ☐

Benchmark Analysis ☐ Others please specify ☐

_____

17.2 Models Apply for the calculation

Net Present Value ☐ Internal Rate of Return ☐ Sensitivity Analysis ☐

Scenario Analysis ☐ Return on Investment ☐ Others

_____

18. Have your organisation gone for Carbon Trading? (Please put √ sign wherever applicable.)

☐ YES ☐ NO

18.1 If yes, than which instruments…. (Please put √ sign wherever applicable.)

Spot ☐ Futures ☐ OTC ☐ Others ☐ _____

<u>Section B – Projects Details</u>

Please fill the following information related to Registered Projects

Projects Design Documents	
Title of the Projects	
Projects Size	
Sectorial Scope	
Projects Participant(s)	
Host Party(ies)	
Selected Methodology	
Purpose of Projects	

Technology Employed	
Estimated GHG Emissions p.a.	

Section C – Organisation Details

1. Your Organization (Optional) is _____

2. No of years serve in Industry:

   Less than 5 Years ☐ 5to 10 Years ☐ 10to 15 Years ☐ More than 15 years ☐

3. Type of Organisation Based on Investment:

   Micro(Less than 25 lakhs) ☐ Small (25 Lakhs to 5 Crore) ☐

   Medium (5Crore to 10 Crore) ☐ Large (More than 10 Crore) ☐

4. No of Employees:

   Less than 100 ☐ 101to 500 ☐ 501to 1000 ☐ More than 1000 ☐

5. Main Manufacturing Activity_____

6. No of Registered Projects_____ No of Projects planning for registration_____

7. Name of the Respondents: _____

8. Email ID:_____ Contact No:_____

   (**Note:** Your personal and corporate details will remain confidential. It use for only research purpose.)

Appendix B

List of Energy Sector Organisations

Sr. No.	Name of Organisation
1	Sunborne Energy Gujarat One Pvt Ltd
2	CLP Wind Farms India Private Limited
3	Bharat Forge Limited
4	Green Infra Wind Power Limited
5	Gujrat Flurochemicals Limited
6	Cargo Solar Power (Gujarat) Private Limited
7	Vaayu Group of Companies
8	Hiraco Renewable Energy Private Limited
9	Ganges Green Energy Private Limited
10	Sand Land Real Estates Private Limited
11	Tata Power Renewable Energy Limited
12	Adani Enterprises Limited
13	Gujarat State Fertilizer Limited
14	Abellon Clean Energy Pvt. Ltd.
15	AES Saurashtra Windfarms Private Limited
16	Precious Energy Services Private Limited and Solitaire Energies Private Limited
17	Surajbari Windfarm Development Private Limited
18	Visual Percept Solar Projects Private Limited
19	Gujarat Narmada Valley Fertilizers Company Limited(GNFC)
20	Rddhi Siddhi GlucoBiols Limted(RSGBL)
21	Gujarat State Energy Generation Limited
22	Enking International