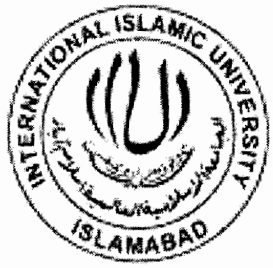
DEVELOPMENT OF INDICATORS FOR THE ASSESSMENT OF SOCIAL, ECONOMIC AND ENVIRONMENTAL IMPACTS OF CLEAN DEVELOPMENT MECHANISM (CDM) PROJECTS IN PAKISTAN



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DEVELOPMENT OF INDICATORS FOR THE ASSESSMENT OF SOCIAL, ECONOMIC AND ENVIRONMENTAL IMPACTS OF CLEAN DEVELOPMENT MECHANISM (CDM) PROJECTS IN PAKISTAN

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Submitted in partial fulfillment of the requirements for the MS degree in discipline Environmental Sciences at the Department of Environmental Sciences, Faculty of Basic and Applied Sciences, International Islamic University, Islamabad

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Month, Year
February, 2010

IN THE NAME OF ALLAH, THE MOST MERCIFUL AND BENEFICIENT

"Truly strong is the Grip (and Power) of thy Lord, It is He, who creates from the very beginning, And He can restore (Life), And He is the Oft-Forgiving, Full of loving kindness, Lord of the Throne of Glory, Doer (without let) of all that He intends."

Qur'an 85:12-15

THIS EFFORT IS DEDICATED WITH LOVE AND GRATITUDE:-

- **TO OUR MASTER GOD AND PROPHET MOHAMMAD (P.B.U.H)**
- **TO MY BELOVED PARENTS**
- **TO MY LATE GRANDPARENTS**

ACKNOWLEDGEMENT

All praise to Allah Most Gracious, Most forgiving, Who, Alone, brings light and new life to those who call upon Him; we praise Him, seek His help, and ask for His forgiveness. Peace and blessings of Allah be upon His Slave and His Messenger, Prophet Mohammad (PBUH). I present my humblest thanks from the core of my heart to Holy Prophet Mohammad (PBUH), the most ideal and outshine among others ever born on earth.

This research study is the ultimate end of my extensive voyage in attaining my degree of MS Environmental Sciences. I have not traveled in a vacuum in this journey. I would like to pay my special thanks and gratitude to some special persons who made this journey easier for me with their encouraging words throughout my degree program. Firstly, a very special thanks to Dr. Abdul Rauf Farooqi, Chairman Department of Environmental Sciences. I want to thank my teachers especially Dr. Rashid Karim, who not only served as my supervisor but has also, encouraged, helped and challenged me throughout my degree program. He is always available and ready to help his students with their research and problems which has resulted throughout in a smooth research period. I am thankful to him for his motivating ideas and support in my difficult times. I am thankful to all of my teachers who have educated me, during the degree period of MS.

I am deeply indebted to my External supervisor Mr. Matloob Khan, National Expert-CDM Programme UNIDO Pakistan for his immense encouragement, support and a friendly professional environment to work in. His expertise in scientific work in CDM area has improved my skills and prepared me for future challenges.

My sincere and humblest thanks to my family for their tenacious love and support throughout my life; I am grateful to my father, for his extensive care and love towards his children always. He worked industriously day and night to sustain his family and spare no attempts to provide me and my brothers & sisters the finest upbringing. I would like to thank my mother, although I have no suitable words to thank her for the hard work she did throughout the life to bring her kids up. Mama, I love you. I feel proud of my sisters and brothers, for their talents. All of them had been my best counselors. I want to give special credit and thanks to my husband for his everlasting care, friendship, encouragement, support, love and numerous fruitful suggestions. Lots of love for my lovely daughter Wania Khan.

Ayesha Aftab Butt

DECLARATION

I Ms. Ayesha Aftab Butt D/O Mr. Aftab Iqbal Butt, Registration No. 01/FBAS/MSES/07 student of MS Environmental Sciences at the Department of Environmental Sciences, International Islamic University, Islamabad (IIUI) do hereby solemnly declare that the thesis entitled, "Development of Indicators for the assessment of social, economic and environmental impacts of Clean Development Mechanism (CDM) projects in Pakistan" submitted by me in partial fulfillment of the requirements for the degree of MS is my original work and has not been submitted or published earlier and shall not in future be submitted by me for obtaining any degree from this or any other University or Institution.

Name: Ayesha Aftab Butt

Signature:

Date: 27 Jul '2011

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LIST OF ABBREVIATIONS

ALGAS- Asia Least-Cost Greenhouse Gas Abatement Strategy

CAN- Calcium Ammonium Nitrate

CDM- Clean Development Mechanism

CERs- Certified Emission Reductions

CNG- Compresses Natural Gas

CO_2- Carbon Dioxide

COP- Conference of Parties

DNA- Designated National Authority

ESD- Environmental and Social Development

ET- Emissions Trading

GDP- Gross Domestic Product

GHG- Green House Gases

HFCs- Hydro Fluorocarbons

INC- Intergovernmental Negotiation Committee

IPCC- Inter governmental Panel on Climate Change

JI- Joint Implementation

MoE- Ministry of Environment

MTPD- Metric Tons Per Day

NGO- Non Governmental Organization

N_2O- Nitrous Oxide

NP- Nitro Phosphate

NSDS - National Sustainable Development Strategy

PDD- Project Design Document

PFL- Pak Arab Fertilizer Limited

PFCs- Per Fluorocarbons

PP- Project Proponent

PPM- Parts Per Million

REP- Renewable Energy Policy

SD- Sustainable Development

SF_6- Sulfur Hexafluoride

UNCSD- United Nations Commission on Sustainable Development

UNEP- United Nations Environment Programme

UNFCCC- United Nations Framework Convention on Climate Change

UNIDO- United Nations Industrial Development Organization

WMO-World Meteorological Organization

WSSD- World Summit on Sustainable Development

ABSTRACT

This research is aimed to review and develop the indicators for assessing the social, environmental and economic impacts of the on-going Clean Development Mechanism (CDM) projects in Pakistan. The study examines missing links, identified through comparative analysis of the on-going projects. It identified the salient impacts of the on-going CDM projects in Pakistan i.e. the Certified Emission Reductions (CERs) and generation of carbon credits. In 2008 throughout the world about 4000 projects were registered which were together reduced 220 million tons of GHGs per year by CDM Executive Board. In the context of Pakistan three CDM projects were destined to reduce 1.3 million tons CER costing of US$ 1.4million per year. In Pakistan, the requirement of CDM Capacity enhancement has been recognized at two levels: Firstly awareness raising education and capacity building, Secondly, establishment of CDM Secretariat at the Ministry of Environment to manage new projects and investors engaged in CDM sector. Two CDM projects, Catalytic N_2O abatement at Pak Arab Fertilizer, Multan and the 84 MW New Bong Hydropower Project were registered whereas, seven projects were undergoing the validation process. It has also highlighted the benefits gained through such projects. In addition the Green House Gas inventory showed the energy, transport and agriculture sectors were greatest emitters in Pakistan. It was suggested that for sustainability of Pakistan any CDM project has to qualify, at least two of the four pillars, namely environmental, social, technological and economic sustainability, must show positive results. The study combines the findings of different studies and communicates well the new tools to understand the evolving environmental factors to evaluate the CDM project performance. Viewing through the limited literature available addressing CDM in Pakistan, the projects mostly focused on the methods, research and capacity building but this necessitated the need to converse the issues of sustainable

development. CDM being the new intervention needed focused attention, as great benefits are associated with it. The set of indicators derived from the study were in compliance with National Sustainable Development Strategy of Pakistan only addressing the environmental, social, technological and economic challenges associated with CDM projects in Pakistan. The study recommends that the Board of Investment should convince foreign investors to set up projects with in equity in the form of joint ventures through CDM arrangements. Finally the study postulated that there was a pressing need to conduct research in institutional and financial arrangements to further the scope of CDM in Pakistan.

CHAPTER 1

INTRODUCTION

Climate Change is the new emerging global environmental issue nowadays which has drawn the world's attention towards itself. Any changes occurring in the natural environment ultimately affects the human activities and hence effects the growth and development of a country. Global Warming is one the serious environmental problem which has aggravated other environmental problems like water and air pollution, soil erosion and loss of biodiversity as well. It is important to adopt some measures in order to reduce such impacts, improvements therefore is needed in energy efficiency, exploration of renewable energy sources and preservation of forests and agricultural lands prove to be great steps in solving various ecological dilemmas. (Olhoff *etal.* 2007)

Recognizing the consequences of climate change different intergovernmental conferences were being carried out in late 1980s and early 1990s particularly focusing on havoc impacts of climate change and its mitigation options. The Kyoto Protocol came into force in 1997, which is one of the great efforts for the protection of the environment and a step towards achieving the sustainable development. The Kyoto Protocol led to the formulation of 3 market based flexibility mechanisms to mitigate Green House Gas (GHGs) emissions, one of which is Clean Development Mechanism (CDM).

Clean Development Mechanism defined as, a tool which allows emission reduction projects that assist in creating sustainable development in developing countries to generate certified emission reductions (CERs) for use by the investor. (Rosales and Pronove 2002)

The Clean Development Mechanism (CDM) is an innovative mechanism which has twin aim of supporting industrialized countries in meeting their greenhouse gas (GHG) emission reduction commitments and assisting the developing countries in achieving sustainable development (SD).

CDM is newly emerging policy tools which aim to reduce the emissions all over the world and has a great potential to combat with climate change impacts thus benefit the entire globe. It is important to encourage the CDM projects in order to fulfill the national requirements and cope with problems like poverty, food insecurity and illiteracy. The only way CDM can contribute to sustainable development in developing world is, if the mechanism embraces simultaneously social, economic and environmental responsibility and avoids becoming yet another tool to make the economically richer to be more rich. (Pembina 2003)

The aspect of sustainable development for CDM is not just a condition; it is the prime driver for establishing a country's interest in the development of CDM projects. CDM projects generate number of impacts e.g. social, economic and environmental in the host countries besides the GHG emission reductions. The choice of the Sustainable Development criteria and the assessment of the Sustainable Development impacts are supreme matters of the host countries in the present operationalization of the Kyoto Protocol. Therefore, all national authorities needs to establish the sustainable development dimension in order to assess the connection between national development goals and CDM

projects, with intention of selection and designing of CDM projects to create synergy with the development goals of a nation. (Liguang 2006)

1.1. Aims and Objectives of the Study

The study is focused on the particular objective of the CDM, introduced under the Kyoto Protocol which aims to assist the developing nations in meeting the sustainable development objectives and countries are benefited through clean technologies, investment and sustainable development.

The main objective of the study is to develop a complete list of Sustainable Development indicators which proves to be helpful on national level for the assessment of the impacts of CDM projects in Pakistan for both the on-going and new project proposals. With respect to the developing countries like Pakistan, CDM is a new area and not much research has been done so far in exploring the concept of sustainable development within the perspective of CDM. This research can also facilitate the policy decisions in this area at national level.

1.2. Significance of the Study

The ultimate output of this research study is a contribution to the national development goals, as the host country is particularly responsible to ensure the sustainable development objectives of CDM projects.

Pakistan is actively contributing in the global climate change mitigation efforts since 1992 and acceded to the Kyoto Protocol in 2005. National Sustainable Development Strategy (NSDS) process has been carried out in Pakistan with the assistance of United Nations Environment Programme (UNEP). NSDS attempts to address the current challenges to sustainable development in Pakistan. This study therefore attempts to provide

a detailed list of sustainable development indicators for the assessment of CDM project impacts which will be in line with the national development goals and policies of Pakistan. (National Sustainable Development Strategy 2009)

CHAPTER 2

REVIEW OF LITERATURE

Thorne *et al.* (1999) conceded a study on criteria and indicators for appraising Clean Development Mechanism Projects. The study seeks towards the prospects and problems associated with the application of global criteria and sustainable energy development indicators. The eligibility criteria and indicators can be used both as a constraint as well as important instruments in determining the opportunities for the host countries overwhelmed with CDM project proposals. The criteria has provided with the approach for the appraisal of CDM projects as well as an input for a decision regarding their acceptance or rejection. The study has resulted in the list of certain social, economic and environmental indicators along with the percentage calculation formulas of assessment of the indicators. A generic overview of the study has helped in sorting out the indicators for this study focusing specifically on the perspective of CDM projects of Pakistan.

Schloze (2003) developed a paper on CDM and its sustainability in South. The study draws the attention towards the concept of sustainability and links between climate change and sustainability on international and local scale with regard to CDM. As several authors point out, the CDM risks undermining the actual international climate regime by offering loop holes for industrialized countries. It therefore potentially reduces efforts towards a more sustainable climate regime. On the other hand, local CDM projects may

have positive co benefits besides emission reductions. The results indicate that besides a range of benefits, there are also some potential negative impacts, like forced restrictions of resource use and social tensions. The major problems in the analyzed project originate from the conflict between the protection of carbon sinks and socio-economic rural development. It is fair to call the Clean Development Mechanism a pragmatic instrument for achieving some goals of sustainable development and nature conservation. But the operationalization of the CDM and other Kyoto instruments poses several threats to the Protocol's integrity. Therefore, the success of the CDM depends mainly on the further formation of an international climate regime. If the regime is too weak, the CDM will probably fail. The study gave an insight how the sustainable development goals could be achieved and has also discussed the main criteria in the study which has proved helpful and provided a path for a need in the determination of the sustainable development indicators for assessing the CDM project impacts which is the goal of this study.

Sutter (2003) carried out a study on sustainability checkup for CDM projects. The study focused on the approaches on how to assess the sustainability of CDM projects. The methodology Multi-Attributive Assessment of CDM which evaluates CDM projects by means of 12 clearly defined criteria is presented and discussed. It produces comprehensive and pragmatic sustainability profiles of CDM projects. The methodology has been tested in case studies in India and South Africa. As the study has provided the information regarding various approaches which could be used for the sustainability of CDM projects assessment, it has also provided a help in determination of the indicators of the sustainable development for this study also.

Brown *et al.* (2004) prepared a technical report under the Tyndall Research Project on how do CDM projects contribute to Sustainable Development. They focused the

development of the Trade-off analysis, and a closer look at the local development aspects of carbon projects. They concluded that one of the main challenges of present and future carbon projects is to find the appropriate means and resources to work closely with local organizations and to understand local social, environmental and political histories. Brown suggested that carbon projects require robust and flexible institutional frameworks, which allow project developers and participants to cooperate and fairly negotiate new rules governing resource use, in which rights and duties on all parts should be made clear and agreed. If funding to developing countries through the UNFCCC, Kyoto Protocol and other international channels is to bring meaningful benefits, then further research is necessarily on the politics, legitimacy and institutions which enable and disable different actors to reap benefits. The report has been reviewed as it has a close link to the objectives of the current research study and especially to the perspective of sustainable development indicators.

Tomilola (2005) focused on attracting CDM investment in the developing countries specifically keeping in view the sustainable development criteria. The study poses the requirements which were established by the legal regime and criteria identified by the investor countries and host countries and also barriers identified from the literature and empirical studies, both general and region/country-specific. This study has highlighted the CDM sustainable development criteria in developing countries like Jamaica, South Africa and Philippines. These reviews has helped greatly in identifying the sustainable development criteria for this study also because Pakistan is a new entrance in the CDM business and hence also require the investment from across the globe.

Amin (2005) primed a research study on technology transfer for sustainable development through CDM from the perspective of Bangladesh. The study argues that CDM is a practical tool to combat with Climate change. However, the majority of

developing countries will have to balance national necessities, such as poverty eradication, food security and education, with encouraging CDM projects. The study concluded the only way the CDM can contribute to sustainable development in these parts of the world (including Bangladesh) is if the mechanism embraces simultaneously social, economic and environmental responsibility. The study specifically dealt with the Bangladesh status and criteria for the CDM projects for the developing country like Bangladesh which resembles to the status of Pakistan in terms of CDM projects application and assessment in Pakistan. The review of the study thus provided great help in this study also in quoting the list of indicators prior for the social, economic and environmental criterion.

Martin (2005) presented a report on the clean development mechanism, sustainable development and its assessment. The study focused on different aspects; data regarding GHG intensities alongwith the details of baselines, promotion of renewable energy projects and contribution of Finland to the success of the Honduran CDM projects by forming a development partnership with local stakeholders whose outcome were a study pointing out opportunities for renewable CDM project activities. The study has focused the parameters for the sustainable development assessment of the CDM projects and has provided the solutions to improve the SD performance of CDM projects. It has contributed indirectly in determining the best possible set of indicators for sustainable development assessment.

Hueberger et al. (2005) proposed a methodology for Sustainability Assessment – Experiences from South Africa and Uruguay. MATA-CDM (Multi-Attributive Assessment of CDM Projects) is a quantitative evaluation of potential projects regarding their contribution to sustainable development. In South Africa, the application was done mainly for academic and demonstrative purposes, whereas in Uruguay it was implemented together with the responsible Designated National Authority (DNA). The work included

the selection of sustainability criteria and measurable indicators. This method was applied to three potential CDM projects in South Africa and one in Uruguay. Results show that under the conditions of this study, the MATA-CDM approach yet fails to yield a perfect quantitative overall sustainability assessment of CDM projects. The reason for reviewing the paper is, the MATA CDM Approach is new in terms of the assessment of CDM project impacts and this paper has identified the workable sustainability criteria and indicators which are important for concluding this study also.

Joris (2005) addressed the participation of developing countries in CDM project development. The study discussed the development path for developing countries that seek to become more active in the CDM and the concept of unilateral CDM is integrated in this path towards increasingly independent action. Unilateral CDM relates to the capacity to channel project ideas through the entire CDM project cycle as ever independently as possible. The motivation to engage in unilateral CDM project development is bound to vary. A distinction is made between 'deliberately' and 'necessarily' unilateral CDM. The former refers to the desire to exert more market power and the latter is meant to serve as a last-resort option, when more traditional, risk-sharing channels are not accessible. A review of this study has provided the information regarding the sustainability development in terms of CDM projects in the developing countries of which Pakistan is also the one, the study has provided a more clear path how to integrate well the concept of sustainability with the national goals of the country and has proved helpful in determining the successful list of indicators which is the ultimate outcome of this research study.

Dyer *et al.* (2006) carried out a study entitled, "From Clean Development to Strategic Sustainable Development: Strategic planning for the Clean Development Mechanism". The study concluded a lack of consent on definitions of sustainability and

sustainable development and a lack of capacity to address these concepts, there is a risk that CDM projects may fail to move the host country towards sustainability. The study suggested the use of a principle-based definition of sustainability to guide project participants in their decision-making process. The study has identified the important sustainability aspects and risks associated with them, the review has provided the information to consider those aspects while preparing list of indicators of this study.

Zang (2006) reviewed the CDM Policy and Implementation in China. The study focuses on the current CDM developments in China, attentions were given to the renewable energy, and energy efficiency and methane capture project opportunities in China. Secondly, it has introduced China's current policy on CDM implementation, and reviewed its permission requirements, institutional arrangements and project procedures. Based on the observations, it has analyzed the current problems and pointed out the shortfalls of the existing Chinese CDM policies and institutional settings. Options to remove these barriers were given as recommendations. Thirdly, based on the analysis made on energy efficiency and renewable CDM project development in China, case study was given on China's landfill gas to energy project. The study analyzed the perspective of GHG mitigation through landfill gas capture and utilization in China, its opportunities and challenges. Moreover, this study demonstrated how CDM can add value to landfill gas-to-energy projects in China. The review of the study gave an insight to the CDM implementation barriers which may also correlate with the issues regarding CDM project development in Pakistan and has proved helpful in this study also.

Liguang (2006) carried out a study focusing on the synergies for achieving the sustainable development in China by the CDM project. By reviewing the global carbon market and Chinese CDM activities the report has presented the dynamics of the CDM

scheme and evaluates China's performance in current CDM implementation. The study also examines the China's CDM potential and its impact on the economic development and also provide with the suggestions to achieve the sustainable development objective through CDM activities. This research study of Masters Programme, "Seeking Synergies to achieve sustainable development" has been reviewed as it depicts how the sustainable development aspects could be integrated well to the country's performance and the same could also prove helpful in assessing the impacts of CDM projects and development of successful list of indicators.

Miller (2005) discussed the definition of sustainability in "Introducing Sustainability" as "sustainability or durability is the ability of earth's various systems, including human cultural systems and economies, to survive and adapt to changing environmental conditions indefinitely". The Clean Development Mechanism (CDM) introduced under the Kyoto Protocol, deals with the financing of GHG mitigation projects in the developing countries financed by the industrialized nations. The Kyoto Protocol requires that CDM should assist the developing countries to achieve sustainable development. However, a clear definition of sustainability for CDM projects is still debatable. Definitions of sustainability reviewed, as the aspect of sustainability in terms of the assessment of CDM projects is important.

Cassia (2007) revealed a study on CDM and energy Efficiency Projects attempting to approve a CDM district heating methodology. This empirical analysis is backed by the theory of sustainability, applied to district heating and cooling technology. Ideas were considered to establish a minimum standard definition for sustainability (this is currently defined by each country) to avoid a 'race to the bottom' and reconsidering the concept of additionality for projects with high sustainable development components. The study

focused on energy efficiency project CDM approved methodology, with relevance to this study it is good to know generally the new approved technology like district heating methodology is new and advance.

National Sustainable Development strategy –NSDS (2009) prepared by the Ministry of Environment, Government of Pakistan highlights the NSDS process along with the challenges of sustainable development and challenges of policy integration. NSDS aims to formulate the pleasant society in the country which lead towards the promotion of impartial economic growth without the over exploitation of natural resources and equal distribution of development outcomes to all, including all deprived and susceptible of the society and future generation. The CDM Criteria by DNA/CDM Cell for host country approval (HCA) in Pakistan includes the NSDS recommendations by one way or the other to meet the Sustainable Development objectives in the country. The review of NSDS has provided a clear insight as how the CDM projects success linked with the Sustainable development aspects (social, environmental and economic).

Olhoff *et al.* (2007) under the UNEP, CD4CDM project prepared a guidebook on CDM Sustainable Development Impacts. The guidebook provides information to experts and policy makers regarding the CDM project development for the promotion of sustainable development criteria in the light of Kyoto Protocol. The study provides an outfitted approach to sustainable development in the perspective of CDM projects. The study focused on linkage between CDM projects and National sustainable development goals along with the application of evaluation indicators reflecting CDM project specific issues related with costs and emissions mitigation. The study has also presented the development criteria for economic, social and environmental pillars. Review of the study

has helped in concluding the list of indicators according to national sustainability goals of Pakistan.

Chapter 3

MATERIALS AND METHODS

The research methodology handled the data in two main steps;

a. Data Collection

b. Data Analysis

Data (qualitative / quantitative) was collected from different primary and secondary sources such as; surfing through net, literature reviews, series of interviews, meetings, field visits, focus group discussions, interviews, brain storming sessions with CDM experts, different events / conferences. It included the;

i. Meetings with relevant ministries (Ministry of Environment, Ministry of Industries, Ministry of Water and Power)

ii. International Organizations working on CDM projects implementation in Pakistan.

iii. Meetings with the CDM registered project proponents. (Visit of Pak Arab Fertilizer Limited, 1st CDM approved project of Pakistan by UNFCCC)

iv. Brain storming sessions during field/site visit.

Certain questions were also raised to reach towards the end objective of the study. The following sub questions were further developed:

a. What is the current status of CDM activities in Pakistan?
b. What Pakistan is been doing in promoting the CDM activities?
c. What are the potential sectors of CDM projects in Pakistan?
d. What are the barriers in the implementation of CDM projects in Pakistan faced by the industries?
e. What kind of recommendations should be made for effective implementation of CDM projects in Pakistan?

However, the overall research question which the study intended to answer is;

"**Development of Indicators for assessing the social, economic and environmental impacts of CDM projects in Pakistan.**" In recognition of the situation, five specific tasks were identified/ highlighted in the project study;

1. Integrative review and analysis of CDM in Pakistan.
2. Identification of the potential for CDM in Pakistan particularly in the potential sectors mentioned in the National CDM Strategy.
3. Evaluation of the CDM performance in Pakistan and the sustainable development assessment of CDM projects in Pakistan.
4. Development of the indicators for assessing the social, economic and environmental impacts of CDM projects in Pakistan.
5. Analysis of the sustainability criteria employed for the 1st CDM approved project, Pak Arab Fertilizer Multan in Pakistan.

The first step of Data Collection highlighted the Background of the CDM Approach in accordance with the Sustainable Development Objectives. Various methods were used for the entire study; integrative review of CDM in Pakistan's context was based on the latest appropriate information obtained through review of literature and sequential

progressive interviews conducted. Literature included the scientific journals, research project reports, publications, Project Design Documents (PDDs), conference papers and presentations as well as up-to-date information from Ministry of Environment, CDM Cell website. The statistical data came from authoritative publications (ministries, international organizations, private sector working on CDM projects), formal interviews were taken (personally or via email). Some of the interviewees gave well-timed response to the project findings. (Appendix A enlists the organizations met and interviews carried out throughout the period of research).

Information related to CDM and Climate Change was collected by attending seminars, conferences and workshops conducted by different private, international and government organizations working on CDM project development in Pakistan like Winrock International, CDM Cell-MoE, UNIDO, Carbon Services etc. The consequent interactions enhanced the sources of information and shaped further discussions.

Comparative approach was also used in the study as well. Assessment of the Pak Arab Fertilizer, Multan project (1st CDM registered project of Pakistan) was carried out against the set defined indicators in the Gold Standard Manual. Degree of success was assessed in terms of meeting up of the criteria of sustainable development (social, economic and environmental).

A close and open ended questionnaire was developed on the basis of standardized gold indicators and indicators extracted from the PDD for the assessment of social, economic and environmental impacts generated by the CDM project of Pak Arab Fertilizer Limited (PFL). The questionnaire highlighted the three criterions (social, environmental and economic) for the assessment of CDM project impacts. The questionnaire was discussed with the project officials and filled. Questions mentioned in the questionnaire

were related to the current status of the project, benefits gained by the community through the project, economic well being of the country and environmental well being of the particular area where the project was operational. The questionnaire has helped in determining the missing links which were addressed by the study. (Questionnaire given in Appendix B) The secondary data was also collected through different sources particularly from the internet and Ministry of Environment, DNA.

3.1. Research Design Table

PART	WORKING QUESTIONS	APPROACH	INFORMATION	EXPECTED RESULTS
BACKGROUND OF CDM APPROACH IN ACCORDANCE WITH THE SUSTAINABLE DEVELOPMENT.				
CDM in Pakistan's Context	- What is the policy context for CDM development? - How does CDM develop in Pakistan? - What is the progress of CDM scheme?	- Description of Pakistan's Environmental policies (Renewable Energy Policy, NSDS) - Description of Pakistan's CDM history and current situation	- Official websites of relevant ministries. - Research papers - Review of policies - Review of NSDS	- Understanding about Pakistan's policies related to climate change issue. - Understanding Pakistan's history and progress of CDM projects implementation. - Understanding the NSDS's overall process
Pakistan's CDM Potential and identification of potential sectors	- What is the potential of Pakistan's CDM implementation? - Identify the potential CDM sectors in Pakistan?	- Data obtained through Reports, Policy Plan, Different projects Inception reports, Algas Study	- Research Papers / articles / interviews / discussions (personal or email)/ websites / Attending of events and seminars	- List of particular sectors and their GHG abatement potential.
Sustainable Development Assessment of CDM projects in Pakistan	- What is the main criterion of sustainable development assessment of CDM projects?	- Determination of goals and priorities of Pakistan - Setting up of assessment scale	- Research papers, articles, websites, National operational strategy 2006 for Pakistan.	- Understanding sustainable development evaluation of CDM projects. - Identified proposed assessment scale of sustainable development benefits.
Development of indicators for assessing social, economic and environmental impacts of CDM projects in Pakistan	- Enlisting of possible sustainability themes. - Enlisting of indicators.	- Determination of possible indicators for the sustainability assessment of CDM projects.	- Reports, papers, websites, gold standards manual.	- Proposed list of indicators for assessing the social, economic and environmental impacts of CDM projects in Pakistan. - Indicators proposed for both ongoing CDM projects and new CDM project proposal (PDD)
Analysis of sustainability criteria of Pakistan's 1st CDM approved project, Pak Arab Fertilizer, Multan.	Assessment of sustainability criteria against the gold standard indicators	Medium: Questionnaire Visit of project site	Gold standard manual	- On site questionnaire filled by the project officials - Final analysis of sustainability criteria and barrier identification

3.2. Problem Formulation

Assessment of sustainable development aspect of CDM projects is a chance for the national authorities to identify potential CDM projects and exploitation of local development synergies. The Designated National Authorities (DNAs) play a significant role in securing the recognition of national development benefits of CDM projects, since they are anticipated to examine the obligation of the CDM to assist Sustainable Development to be fulfilled in host countries. (Olhoff *etal.* 2007)

Chapter 40 of Agenda 21[1] calls for the indicators of sustainable development. Agenda requires the countries, international, governmental and non-governmental organizations to develop the idea of sustainable development indicators to identify those in the perspective of CDM project performance. It is the choice of the host Party to verify whether a CDM project activity helps to achieve Sustainable Development goals or not.

Pakistan, being the beneficiary of CDM, has huge potential through the development of these projects in various sectors. For the successful implementation of CDM, Pakistan needs to set up its own sustainable development indicators which may prove to be helpful in the assessment of future CDM projects in the country. Although Pakistan has endorsed host country approval to certain CDM projects and also leading towards Certified Emissions Reductions (CERs) but still there is a need to meet the sustainable development criteria through the development of Sustainable Development Indicators (SDI) to meet the desired goals of effective implementation of future CDM

[1] **Agenda 21** is a programme run by the United Nations (UN) related to sustainable development. It is a comprehensive blueprint of action to be taken globally, nationally and locally by organizations of the UN, governments, and major groups in every area in which human's impact on the environment.

projects and their success in Pakistan as well as globally. This study will lead towards the development of sustainable development indicators which proves to be helpful in assessing the impacts of CDM projects and will also provide a path for the future studies in this line.

Chapter 4

RESULTS AND DISCUSSIONS

4.1. Background

Climate change was identified as a severe threat in the First World Climate Conference held in 1979. Afterwards several Intergovernmental conferences were being carried out. UN General Assembly accepted the state of treaty discussions in December 1990 and the Intergovernmental Negotiation Committee (INC) for a framework convention on climate change started its work within a goal to organize the Rio Earth Summit in June 1992. More than 165 countries signed the UNFCCC which came into force in March 1994. The aim of the convention is to stabilize the GHGs safe level and also the countries specified their intentions to take climate change into account in appropriate social, economic and environmental policies. UNFCCC (1992) was accomplished in Kyoto Protocol (Japan) five years later. The protocol set legal binding obligation for Annex I countries to reduce their GHG emissions by 5.2% below 1990 levels over the commitment period of 2008-2012.

The protocol has also introduced three market based and ground breaking flexibility mechanisms aiming to curb the GHG emissions. The mechanisms were

intended to assist industrialized countries (Annex I) to lessen the cost of meeting their emissions targets by achieving emission reductions at lower cost in other countries than they could domestically. The Three flexibility mechanisms are;

Emissions trading: - indicated in Article 17 of Kyoto Protocol entails the trading of GHG emission reductions within Annex I[2] countries termed as Assigned Amount Units (AAU).

Joint Implementation: - specified in Article 6 of Kyoto Protocol allows industrialized countries to invest in projects of emission reductions in other Annex I countries. The credits are received in the form of Emission Reduction Units (ERU). (Amin, Rabiul 2005)

Clean Development Mechanism (CDM): - The CDM, contained in Article 12 of the Kyoto Protocol, allows the implementation of Emission reduction projects in Non Annex I countries to receive the offset credits in the form of Certified Emission Reductions (CERs) which may be applied against their own emission reduction targets. The CDM endeavors to uphold sustainable development in developing countries to contribute towards the reduction of GHGs [3] globally.

CDM and Sustainable Development Linkage

Chapter 8 of Agenda 21 attempts the adoption of national development strategies for sustainable development which relates to the sectoral economic, social and environmental policies operating in the country. This means that no limitations are

[2] Annex I includes the developed countries or countries with economies in transition with emission reduction requirements.

[3] Green House Gases includes, CO_2, CH_4, HFCs, SF_6, CFCs, NOx.

imposed on the kind of (sustainable) development benefits that a CDM project generates in addition to the reduction of GHG emissions. (Olhoff *etal.* 2007)

Current status of CDM projects in the World

As of 21st July 2008, 1128 projects have been registered by the CDM Executive Board as CDM projects, estimating around 220million tons of CO_2 equivalent per year GHG emission reductions. There are about 4,000 projects yet to be certified which would reduce CO_2 emissions by over 2.5 billion tons until the end of 2012. The current status of CDM projects in different countries is indicated in Figure No.1.

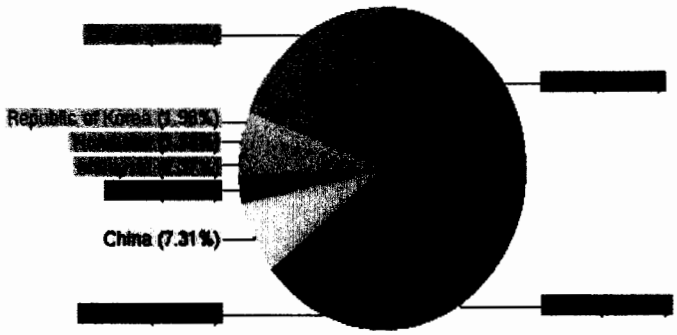


Figure No.1 Status of CDM Projects (UNFCCC 2008)

The number of CDM projects being added to the pipeline in December 2008 was 118. The CDM pipeline now contains 4364 CDM projects (excluding the 87 rejected and the 24 withdrawn projects). 1300 of the projects are now registered and 344 are in the registration process. The amount of CERs issued is 240 million CERs. The average issuance success is 98.1%. The annual number of new projects in the CDM Pipeline has increase from 840 in 2006, to 1429 in 2007 and to 1561 in 2008. (UNFCCC 2008) The

Average Annual CERs / Reductions and Number of CDM Projects by Top 16 of Non Annex-I Countries are given in Table No 1.

Table No. 1 Average Annual CERs & Number of CDM projects by Top 16 of Non Annex-I Countries (UNFCCC 2008)

Sr #	Country	CERs/Reductions	No of Projects
1	China	113,346,790	245
2	India	31,068,449	355
3	Brazil	19,282,867	143
4	Republic of Korea	14,599,555	19
5	Mexico	7,367,437	105
6	Chile	4,325,867	25
7	Argentina	4,121,351	14
8	South Africa	2,557,984	14
9	Indonesia	2,556,908	16
10	Qatar	2,499,649	1
11	Malaysia	2,479,529	29
12	Egypt	1,794,907	4
13	Nigeria	1,496,934	1
14	Israel	1,180,521	12
15	Peru	1,153,322	12
16	Pakistan	1,280,167	3

At the moment, there are a total of 4,252 CDM projects in the process of obtaining the UN's clearance. Of these, 1,568 projects are in China and another 1,138 in India. In Pakistan, there are about 21.

4.2. CDM in Pakistan

The part 1 of the project design CDM in Pakistan includes the Pakistan's performance regarding CDM project activities. It is divided in to 2 main sections:

a. Country profile followed by the description of Environmental policies of Pakistan.

b. CDM practices in Pakistan with a particular focus on Capacity building ongoing projects of Pakistan and status of current CDM projects in Pipeline.

4.2.1. Country Profile and Environmental Policies of Pakistan

Pakistan is spread over an area of 803,940 sq km comprising of 1624 million of population. The GDP is Rs 5926.0 billion with growth rate of 5.8%. (Economic Survey of Pakistan 2008)

The sustainable development criterion is in line with the environmental policies of Pakistan and has been greatly reflected in "National Environment Policy 2005" as well as in "Renewable Energy Policy 2006". The policies successfully depict the formulation of framework to achieve sustainable development targets through conservation, protection and restoration of Pakistan's natural environment. "Renewable Energy Policy" has been introduced to find out the new sources of energy. The policy focused towards the exploitation of the environment friendly unexplored sector by attracting the investors through offering the incentives. Renewable energy policy has 4 strategic policy objectives i.e. Energy security, economic benefits, social equity and environmental protection all accounted in the criteria of sustainable development.

The National Sustainable Development Strategy (NSDS) is in line with the commitments of various UN Conferences held globally during the last decade.

4.2.2. CDM Practices in Pakistan

The current situation with respect to the limited number of CDM projects registered or in the pipeline in Pakistan is an indicator that the CDM project development process is not currently being vigorously implemented in Pakistan. It has been recognized that there is a requirement of CDM capacity enhancement in the country at essentially two levels. Firstly, there is a need for creating awareness, education, and capacity building of project developers and investors in both the public and private sectors, to

understand the CDM process and to recognize the opportunities that the mechanism offers in various sectors. At present investors largely rely on information provided to them by consultants in this area. Investor capacity needs to be enhanced so that they can themselves identify CDM as a viable opportunity to improve the feasibility of low GHG projects, and incorporate this learning into their business decisions.

Secondly, there is a vital need to build the capacity of the CDM Secretariat and Ministry of Environment to manage the enhanced pipeline of new projects, and to support investors who are engaged in this sector. (Win rock 2009)

4.2.2.1. CDM Capacity Building Projects in Pakistan

Government of Pakistan is supporting the Institutional strengthening needs of CDM cell in the Ministry of Environment (MoE) on sustainable basis to facilitate the CDM process in the country. Assessing the need for support, two Institutional capacity building projects have been initiated through donor funding to be implemented by World Bank and UNIDO. Thus the CDM cell is being supported by three projects at present given in Table No.2

Table No.2 Ongoing CDM Capacity Building Projects in Pakistan (CDM Cell, Ministry of Environment 2008)

Name of Project	Cost	Source of Funding	Duration
Establishment of CDM Cell	Rs 38.93 Mln	Government of Pakistan PSDP	2006-2009
Capacity Building in CDM through World Bank	US$ 570,000	Japan fund under Climate change initiative Trust funds	2007-2009
Institutional capacity Enhancement for CDM through UNIDO	US$ 674,610 (1st Tranche US$ 507,584)	Government of Norway	2008-2010

4.2.2.2. Status of Current CDM Projects in Pipeline

Pakistan's first approved CDM project which got registered with UNFCCC in November 2006 entitled as, **"Catalytic Abatement of Nitrous Oxide at the Tail Gas End of the Nitric Acid Plant of the Pakarab Fertilizers Limited, Multan. (Investor: Mitsubishi, Japan)"** estimating 1,150,000 CERs annually. The other CDM project registered recently with UNFCCC on 31st January 2009 entitled as, "The 84 MW New Bong Escape Hydropower Project, Azad Jammu and Kashmir (AJK), Pakistan". Two Projects are at validation stage, "Landhi Cattle Project, Karachi" and "Lahore Compost Project (Saif Group of Industries)". Year 2009, declared as, "National Year of Environment" by the Ministry of Environment, Government of Pakistan which targets to register at least 40 projects in the year 2009. The list specifying the current status of CDM projects in Pakistan is given in Table No.3

Table No.3 Status of CDM Projects in Pakistan (CDM Cell, Ministry of Environment 2008)

CDM Projects Developed	Status
Catalytic N_2O Abatement Project in the Tail Gas of the Nitric Acid Plant of the Pakarab Fertilizer Ltd (PVT) in Multan.	Registered
Community Based Renewable Energy Development in Northern Areas of Pakistan.	Undergoing Validation
Fuel Switch to a less carbon intensive fuel at SFS Pvt. Ltd (SFSPL), Pakistan." Version 1.	Undergoing Validation
Almoiz Bagasse Cogeneration Project.	Undergoing Validation
Construction Of Additional Cooling Towers at AES Lalpir.	Undergoing Validation
Fuel Switch and Energy Efficiency Project at Prosperity Weaving Mills.	Undergoing Validation
Maple Leaf Generator Change Project.	Undergoing Validation
Pakarab Fertilizer Co-generation Power Project Version 02.	Undergoing Validation

84 MW New Bong Escape Hydropower Project.	Registered (January 2009)
Landhi Cattle Waste Management Project.	Undergoing Validation

A National CDM Operational Strategy has been approved by the Prime Minister of Pakistan in February 2006 for the execution of CDM projects in Pakistan in consultation with stakeholders. The strategy has illustrated policy rules and sets the criterion for evaluation and endorsement of CDM projects.

The identified potential sectors for CDM projects are in alternate/renewable energy production as well as hydro-electric power, wind energy, waste/bio-energy, Land use, Land use Change and Forestry (includes biodiversity protection, soil conservation, watershed maintenance, sustainable forest management, afforestation and reforestation), Agricultural and livestock practices, Waste Management (landfills, solid waste management, recycling), Transportation (alternative fuel vehicles, mass transit systems, cleaner engines, CNG) and in different Industrial processes. (Pakistan National Operational Strategy for CDM 2006)

4.3. Potential CDM Sectors in Pakistan

According to the requirement of the UNFCCC, signatories need to submit their detailed national progress reports concerning the execution of the convention. Pakistan has submitted its First National Communication presenting GHGs inventory along with the assessment of mitigation options after a long process of 3 years. The GHG inventory for Pakistan for the base year 1994 was prepared in accordance with the revised guidelines for preparation of national inventories issued by the Intergovernmental Panel on Climate Change (IPCC). The national greenhouse gas (GHG) inventory showed that

the energy, transport and agriculture sectors were the greatest emitters of GHGs in Pakistan. The mitigation options assessment conducted under the National Communication covers three main sectors: energy, forestry and land use change, and agriculture and livestock. The focused CDM potential industrial sectors of Pakistan are highlighted in the tables below along with their GHG abatement potential (Win rock International 2009). In the industrial energy efficiency sector, the following sectors given in Table No. 4 are found to have the highest GHG abatement potential.

Table No. 4 GHG Abatement Potential of Industrial Energy Efficiency Sectors (Win rock 2009)

Abatement Sectors	**Potential for CO_2 Abatement (Million Tons/ year)**
Brick Manufacturing	10.0
Transportation	8.8
Oil and Gas Sector	6.53
Textile Industry	5.62
Fertilizer Industry	5.03
Cement Industry	4.71
Iron and Steel Industry	1.78
Glass Industry	0.88
Inorganic Chemicals	0.3

In the power sector efficiency and renewable energy sectors, the following sub-sectors given in Table No. were found to have the largest GHG abatement potential.

Table No.5 GHG Abatement Potential of Power Sectors (Win rock 2009)

Abatement Sectors	Potential for CO_2 Abatement (Million Tons/ year)
Large Hydro (25,641MW)	56.15
Grid Connected Small Hydro (1,815 MW)	5.56
Reduction in transmission & distribution losses	4.0
Combined Cycle Power Plant	4.0
Domestic Energy Efficiency	3.6
Bagasse Cogeneration (760 MW)	1.66
Municipal Energy Efficiency	0.47
Small Hydro (Off-grid Micro/Mini Hydro) (45 MW)	0.276
Solar Home Systems	0.05
CNG Buses	0.024

In the waste management sector the following sub-sectors given in Table No.6 were found to have the largest GHG abatement potential.

Table No.6 GHG Abatement Potential of Waste Management Sectors (Win rock 2009)

Abatement Sectors	Potential for CO_2 Abatement (Million Tons/ year)
On farm biogas	15.0
Sanitary landfills – methane capture	2.04
Composting plants (urban solid waste)	1.70
Commercial and industrial wastewater	1.63
Ethanol production	0.23

4.4. Sustainable Development Assessment of CDM Projects in Pakistan

Generally there are no frequently identified tools and criteria for assessing the performance of CDM projects implementation in Pakistan. One of the options is to evaluate whether and to what point the CDM activities have recognized the dual targets

identified by the Kyoto Protocol supporting developed nations in achieving their quantified Kyoto objectives in a cost efficient way and ensuring the sustainable development benefits to the host country. (Win rock 2009) Pakistan being a developing nation and new in the emerging business of carbon market, has to comply or meet particularly with the sustainable development objectives of the country to build up the sustainability status of Pakistan globally.

The sustainable development in the CDM context is identified as a process for which social, economic, environmental and technological dimensions needs to be assessed.

Social: Sustainable development should contribute towards the alleviation of poverty, generation of employment, removal of social inequality and provision of essential facilities leading towards improving the quality of life.

Economic: Sustainable development should bring additional investment consistent with the needs of the people.

Environmental: The proposed activity should contribute towards bringing of resource sustainability, resource degradation, maintenance of biodiversity, impact on human health, and a general reduction of pollution levels.

Technological: It is important that the proposed activity must transfer the environmentally safe and sound technologies which assist particularly in improving the technological base of Pakistan. The new and improved technologies can come from within the country and the developed countries as well. (Amin Rabiul 2005)

The most crucial problems identified for assessing the sustainable development aspect of CDM projects in Pakistan are; provision of essential needs, population control,

food security, energy supply etc. For Pakistan specifically the overriding goals and priorities identified are; Poverty alleviation, Economic and social development, Safe drinking water, Primary health care, Universal primary education and Environmental protection.

Also the National Sustainable Development Strategy (NSDS) focuses on the challenge currently faced by Pakistan to put the country on a development path, the progress of which should not be measured merely through statistics of economic growth but by the quality of life of its people, who must be placed at the center of national development. This approach whether for economic or social development or for environmental enhancement demands enhanced participatory planning and management through involvement of stakeholders.

It is important to carry out the assessment of sustainable development benefits of CDM projects applicable to the future CDM projects also. The easiest way is the application of a uniform checklist which considers different parameters against the defined scale. Different identified indicators can be calculated using the standardized values given in Table No. 7 indicating the values from -1 to 3.

Table No. 7 Assessment scale for determination of the Sustainable Development benefits of CDM projects (PCF Plus Report 2002)

SCALE Value	SIGN	INDICATOR
-1	Negative	Project has negative sustainable development impacts. Negative impacts generated in terms of environmental and social development (ESD) policies and/or causing environmental/social impacts from the CDM project baseline.
0	Neutral	Sound CDM project having no difference from baseline in any of

		environmental/social or policy terms
1	Positive	One additional significant benefit e.g. one of social, local, environmental, health, poverty, community participation or economic/welfare gains.
2	Positive	Two or more additional benefits in two categories. i.e. social, environmental and economic
3	Positive	Significant benefits in three or more categories i.e. social, local, environmental, health, community participation and welfare/employment.

4.5. Themes and Indicators for the Assessment of Impacts on Sustainable Development

It has been found from the literature that the Agenda 21 calls for the development of indicators for sustainable development. It also stress on the need of development of concept of indicators of sustainable development at national and international level to recognize the impacts of CDM projects on sustainability of a country.

It is important to extend and identify the themes of sustainable development in social, economic and environmental context which will provide a basis for the development of specific indicators. The main themes identified for sustainable development through literature review, research studies and findings of this research study surrounds around 4 pillars; social, economic, environmental and institutional given in Table No. 8

Table No. 8 Themes of Sustainable Development (SDI Report, UNCSD 1995)

Sustainable Development Pillars	**Themes**
SOCIAL	Education
	Employment
	Health/ Water Supply/ Sanitation
	Housing/ Accommodation
	Welfare/Quality of life
	Poverty/ Income Distribution
	Population
	Social/ Ethical values
	Role of women
	Access to land and resources
	Community structure
	Equity/ social exclusion
ENVIRONMENTAL	Global climate change/ Sea level rise
	Sustainable use of natural resources
	Air pollution/ Ozone Depletion
	Freshwater/ Groundwater
	Agriculture/ Secure food supply
	Land use Change
	Sustainable Forest Management
	Restricted Carrying Capacity
	Coastal Zone
	Urban
	Waste Management
	Biodiversity
ECONOMIC	Trade
	Productivity

	Economic structure and development
	Energy
	Consumption and production patterns
	Transportation
	Economic dependency/ indebtedness
INSTITUTIONAL	Integrated decision making
	Capacity building
	Science and technology
	Public awareness and information
	International conventions / cooperation
	Governance/ role of civic society
	Institutional and legislative frameworks
	Disaster preparedness
	Public participation

4.5.1. Generalized Indicators identified against the Themes

Certain indicators have also been identified against the themes developed; these are the indicators identified on broadly basis not specific to the CDM projects, on the basis of these the indicators specific to the CDM projects will be developed along with some new interventions applicable to all CDM ongoing and proposed projects. The list of generalized indicators is given in Table No. 9

Table No. 9 Theme Indicator Framework (SDI Report, UNCSD 1997)

THEMES	INDICATORS
SOCIAL	
Equity Poverty and Gender Equality	Percentage of population living below poverty line Income Inequality Index Ratio of average female wage to male wage Unemployment rate
Health includes; Sanitation Drinking water Nutritional Status Health care Mortality rate	Population having access to safe drinking water Population with ample sewage disposal facility Nutritional status Life expectancy Immunization against infectious diseases Mortality rate (under 5 yrs) Population having easy access to primary health care facility
Education Level of education Literacy	Adult educational success level Children receiving primary education till 5 grade. Literacy rate of adults
Housing Living conditions and standard	Area available per person (floor area)
Population Change in population	Growth rate of population Population with urban formal and informal settlements
ENVIRONMENTAL	
Atmosphere Air quality	Concentration of air pollutants Green house gases emissions

Climate change Ozone layer depletion	Consumption of ozone depleting substances
Land Urbanization Agriculture Desertification Forest	Urban formal and informal settlements Arable crop land area Use of pesticides and fertilizers Desertified or affected area Forest area as percent of land area
Biodiversity Species Ecosystem	Presence of key species Protected area as percent of total area Area covered by ecosystems
Fresh water Quality of water Quantity	BOD/COD Extraction of annual ground and surface water as % of available water bodies
Oceans/ Seas and coasts Fisheries Coastal zone	Annual collection of key species Concentration of algae in coastal areas Percentage of population living in coastal areas
Waste Generation and management	Generation of industrial and municipal solid waste Generation of hazardous waste, recycled waste and reuse
ECONOMIC	
Economic structure Performance Trade and financial status	GDP per capita Trade of goods Investment share in GDP
Consumption & Production patterns Consumption of material Use of energy Transportation	Intensity of use of material Energy consumed annually Intensity of use of energy Mode of transport and distance covered per capita

Institutional framework International cooperation and success Strategic implementation	Execution of agreed global treaties and agreements Execution of national sustainable development strategies
Institutional Capacity Enhancement of access information Infrastructure and communication Science and technology Disaster risk preparedness and response	Telephone and internet facilities Expenditure on research and development Human and economic loss due to disasters

4.5.2. Proposed Set of Indicators for the assessment of Social, Environmental and Economic Impacts of CDM Projects in Pakistan

Pakistan being a developing country and a new entrant to the CDM business needs to develop the guidelines and the indicators for review and approval of CDM projects according to national sustainability goals (Pakistan National Operational Strategy for CDM 2006). According to a research study CDM projects must contribute to the sustainable development in host (Non-Annex I)[4] countries. Sustainable development including technical and institutional infrastructural are required to be raised to an increased stage in order to evaluate the projects qualifying for CDM. All CDM projects need to demonstrate progress in all three pillars of sustainable development (environmental, social, and economic) as well as sustainable technological indicators.

[4] Non-Annex I countries can host Clean Development Mechanism projects and supply carbon offsets to Annex I countries. They are the developing countries which have no emissions reduction requirements; however, they may still be intense emitters.

As an ultimate outcome of the study the list of indicators is therefore proposed for assessing the social, economic and environmental impacts of CDM projects in Pakistan given in Table # 10 which is applicable both to the new project proposal (PDD) and to the ongoing CDM projects in Pakistan. The proposed indicators are grouped below in Table No 10 according to the four pillars of sustainable development - namely environmental, social, economic and technological sustainability.

Table No. 10 Proposed Set of Indicators for assessing the CDM Project Impacts on Sustainable Development (Compiled by Ayesha Aftab Butt 2009)

CRITERIA	INDICATORS	NEW CDM PROJECT PROPOSAL (PDD)	ONGOING CDM PROJECT
		[redacted]	
1) Reduction of greenhouse gas emissions	Reduction of greenhouse gas emissions compared with baseline (CO2 equivalent)	0 Greenhouse gas emissions are equivalent to baseline +1 Greenhouse gas emissions are reduced	- 1 Increase in greenhouse gas Emissions 0 Greenhouse gas emissions are equivalent to baseline +1 Reduction of greenhouse gas emissions less than 10% by year +2 Reduction of greenhouse gas emissions by 10% and more by year
2) Reduction of air pollutant emissions in compliance with air quality standards Note: Standards concerning air pollutants should be in compliance with the laws of Ministry of Environment, EPAs, Pollution Control Departments etc.	Emission of air pollutants compared with baseline	-1 Increase in emissions of air Pollutants 0 Emission of air pollutants is equivalent to baseline +1 Reduction of air pollutant emissions	-1 Increase in emissions of air Pollutants 0 Emission of air pollutants is equivalent to baseline +1 Reduction of air pollutant emissions less than 20% by year +2 Reduction of air pollutant emissions by 20% and more by year

3) Noise pollution (in compliance with government standards announced by EPAs such as NEQs)	Sound level in the project site	0 Sound level meets standards +1 Sound level below standards	-1 Sound level exceeds standards 0 Sound level meets standards +1 Sound level below standards by 10 Decibel or less +2 Sound level below standards more than 10 decibels
4) Odor pollution (in compliance with government standards)	Odor pollution	0 Meets standards +1 Below standards	-1 Exceeds standards 0 Meets standards +1 Below standards +2 Odorless
5) Wastewater quality (According to set effluent standards)	Wastewater quality	0 Wastewater quality meets standards +1 Wastewater quality is below Standards +2 Wastewater quality is below standards and wastewater discharge decreases +3 Zero discharge of wastewater/treated wastewater	0 Wastewater quality meets standards +1 Wastewater quality is below Standards +2 Wastewater quality is below standards and wastewater discharge decreases +3 Zero discharge of wastewater/treated wastewater

6) Waste management	Waste output of the project per raw material input	-1 Increased waste output per raw material input 0 Waste output per raw material input remains intact +1 Reduction of waste output per raw material input +2 Zero discharge of waste	-1 Increased waste output per raw material input 0 Waste output per raw material input remains intact. +1 Reduction of waste output per raw material input +2 Zero discharge of waste
7) Soil pollution	Soil pollution in compliance with government standards	0 No soil pollution +1 Rehabilitation of soil quality	-1 Creating soil pollution 0 No soil pollution +1 Rehabilitation of soil quality
8) Groundwater contamination	Groundwater contamination	n/a Not applicable to the new proposals	-1 Groundwater contaminated 0 No groundwater contamination
9) Reduction of hazardous waste Note: Hazardous waste should be in compliance with laws announced by relevant ministries and authorities.	The amount of hazardous waste	-1 The amount of hazardous waste Increases 0 The amount of hazardous waste remains intact +1 The amount of hazardous waste decreases.	-1 The amount of hazardous waste increases 0 The amount of hazardous waste remains intact +1 The amount of hazardous waste decreases
10) Water demand and efficiency of water usage	The project's water demand and efficiency of water usage	-2 Water usage impacts water resources and creates other environmental impacts in the water	-2 Water usage impacts water resources and creates other environmental impacts in the water

		basin. -1 Water usage impacts water resources. Water usage per production unit increases. 0 Water usages does not impact water resources nor create environmental impacts in the water basin. +1 Self-contained water storage +2 Self-contained water storage and decrease of water usage per unit.	basin. -1 Water usage impacts water resources. Water usage per production unit increases. 0 Water usages does not impact water resources nor create environmental impacts in the water basin. +1 Self-contained water storage +2 Self-contained water storage and decrease of water usage per unit.
11) Soil, coastal and river bank erosion.	Soil, coastal and river bank erosion in the project site	n/a Not applicable	-1 Soil, coastal/river bank erosion caused by the project's activities 0 No soil, coastal and river bank erosion caused by the project activities.
12) Increase in green areas under the project's initiative.	Green areas	0 The project does not develop green areas. +1 The project develops green areas. +2 The project develops green areas above the average of provincial statistics. +3 The project develops green areas	0 The project does not develop green areas. +1 The project develops green areas. +2 The project develops green areas above the average of provincial statistics. +3 The project develops green areas

		above the average of provincial statistics and does not pollute landscape.	above the average of provincial statistics and does not pollute landscape.
13) Ecosystem diversity	The impact on ecosystem diversity and biodiversity	-1 Impact on ecosystem diversity and biodiversity. 0 No impact on ecosystem diversity and biodiversity. +1 Increase of biodiversity to the ecosystem.	-1 Declined biodiversity in the ecosystem. 0 The ecosystem remains intact. +1 Increase of biodiversity to the ecosystem.
14) Species diversity	Population size and species of flora and fauna	-1 Decline in population size and species of flora and fauna. 0 Flora and fauna species remain intact. +1 Increase in flora and fauna species.	-1 Decline in population size and species of flora and fauna. 0 Flora and fauna species remain intact. +1 Increase in flora and fauna species.

1) People's participation (assessed by the level of organized participation)	People's participation	-1 No participation taking place. 0 Participation taking place by notifying/informing. +1 Participation in a hearing process. +2 Participation through community representation in the	-1 No participation taking place. 0 Participation taking place by notifying/informing. +1 Participation in a hearing process. +2 Participation through community representation in the meetings

		committee meetings	
2) Activities promoting social development, culture, and sufficiency Economy philosophy Note: This is a measure to encourage the project to promote social development, culture, healthcare, public utilities, public assistance, sufficiency economy philosophy, and the environment of the community; hence, there is no negative score. These community relations activities can be conducted within or outside the project facilities, as long as they are the project's initiative.	Projects or activities based on sufficiency economy philosophy, Protection of natural and cultural heritage, Scholarship awards, Religious, arts and cultural activities, Healthcare support, Child nursery care, Supplying drinking water etc.	0 No service of social development and public activities. +1 The proportion of social development services and public activities amount to 1% - 5% of the project's net income. +2 The proportion of social development services and public activities amount to more than 5% of the project's net income. +3 The proportion of social development services and public activities amount to more than 5% of the project's net income.	0 No service of social development and public activities. +1 The proportion of social development services and public activities amounts to 1%-5% of the project's net income. +2 The proportion of service on social development services and public activities amounts to more than 5% of the project's net income. +3 The proportion of social development services and public activities amounts to more than 5% of the project's net income.
3) Workers' health and surrounding community health	Workers' health and community health plan	0 Compliance with Health and Safety rules. +1 A plan to address protection, prevention and organization of relief in industrial accidents. +2 Workers' health and	0 Compliance with Health and Safety rules. +1 A plan to address protection, prevention and organization of relief in industrial accidents. +2 Workers health and community

		community health plan.	health plan.
4) Generation of Employment opportunities.	Creation of jobs.	n/a in case of new project proposals.	-1 No job opportunities created. 0 equal job opportunities created. +1 Highly qualified job opportunities created. +2 Jobs are created at all levels. (Highly, poorly)

	[redacted]		
1) Technological development	Development/import of technology	-1 Use of inappropriate technology. (Technology is not adjusted to better suit local demand. OR Lack of participation from local entrepreneurs in the installation or maintenance process. Local entrepreneurs are not hired to produce equipment) 0 Use of standard technology in the country. +1 Most appropriate technology available in developed countries which is easy for use and maintenance by the locals, and	-1 Use of inappropriate technology. (Technology is not adjusted to better suit local demand. OR Lack of participation from local entrepreneurs in the installation or maintenance process. Local entrepreneurs are not hired to produce equipment) 0 Use of standard technology in the country. +1 Most appropriate technology available in developed countries which is easy for use and maintenance by the locals, and suitable for local

		suitable for local environment, society and economy. +2 Technology developed in the country which is easy for use and maintenance by the locals and suitable for the local economy and society.	environment, society and economy. +2 Technology developed in the country which is easy for use and maintenance by the locals and suitable for the local economy and society.
2) Capacity-building	Number of well skilled employees	1 Decline in number of well skilled employees. 0 The number of well skilled employees remains intact. +1 Increasing number of well skilled employees.	-1 Decline in number of well skilled employees. 0 The number of well skilled employees remains intact. +1 Increasing number of well skilled employees.
3) Plan of Post Crediting Period of the project	Post Crediting Period plan as outlined by the project	0 The project does not have a Post Crediting Period plan. +1 Presence of Post Crediting Period plan as outlined by the project.	0 The project does not have a Post Crediting Period plan. +1 Presence of Post Crediting Period plan as outlined by the project.

1) Increasing income of the workers	Workers' annual income	0 Workers' income remains the same. +1 Increasing workers' income	0 Workers' income remains the same. +1 Increasing workers' income
2) Energy	Use of alternative energy		

- **Use of alternative energy.**	or energy efficiency (percentage %) Use of alternative energy / domestic renewable energy (tons of oil equivalent)	0 The amount of alternative energy usage remains the same +1 Increasing alternative energy usage	0 The amount of alternative energy usage remains the same +1 Increasing alternative energy usage less than 50% +2 Increasing alternative energy usage equal to or exceeding 50%
- **Energy efficiency**	Percentage of energy usage efficiency	0 Energy efficiency remains the same +1 Energy efficiency increases	0 Energy efficiency remains the same +1 Energy efficiency increases **less than 5%** +2 Energy efficiency increases **by 5% and more**
3) Direct government investments.	Provision of infrastructure and procedural requirements.	0 No Provision of infrastructure. +1 Provision of infrastructure by the government.	0 No provision of infrastructure. +1 Provision of infrastructure by the government.

4.6. Analysis of sustainability criteria of Pakistan's 1st CDM approved project, Pak Arab Fertilizer, Multan.

A field visit has been carried out on 17th May 2009 to collect the relevant primary data. Plant site visit, Meetings and Interview session was conducted with the core management staff of PFL. An update was obtained by the project officials regarding the current status of credits earned by PFL.

4.6.1. General Introduction

The first CDM project in Pakistan was accepted by UNFCCC in November 2006. The project at the Pak Arab Fertilizer Limited, Multan involves catalytic breakdown of Nitrous Oxide gas with annual emission reduction of 1,329,653 Tons of CO_2 eq/yr. Pak Arab Fertilizers limited is pioneer in introduction of CDM technology in Pakistan. The project is placed at Khanewal Road, Multan. The site area comprises 302 (301.47) acres, which includes area for the factory and the housing colony. The company owns this land area. (PFL Yearbook 2004)

4.6.2. Plant Productions of PFL

PFL is the largest fertilizer complex in Pakistan and the only factory producing Calcium Ammonium Nitrate (CAN) and Nitro phosphate (NP) commonly known as compound fertilizer. Raw materials for manufacture of the fertilizers are natural gas (56-62 million cubic feet/day) supplied by Sui Northern Gas pipelines Limited through its transmission network and rock phosphate (700 metric tons per day) imported from Jordan/Morocco.

The company produces Nitro phosphate (NP), calcium ammonium nitrate (CAN) and Urea. The annual capacities of the products are given in Table No. 11

Table No. 11 Capacities of the Products produced by PFL Plants, Multan (PFL Field Study 2009)

Products		Installed Capacity MTPD	Design Capacity per Annum MT
Inter-mediate product	**Ammonia** raw material for NP,CAN & Urea	**960**	**316,800**
	Nitric Acid **New** **Old**	**1,380** **2 lines 600 each** **180**	**446,400** **396,000** **50,400**
Fertilizers	**Nitro Phosphate**	**1,015**	**304,500**
	Calcium Ammonium Nitrate	**1,500**	**450,000**
	Urea	**280**	**92,400**

4.6.3. Pak Arab Fertilizer Limited, Multan CDM Projects:-

Pak Arab Fertilizers limited is pioneer in introduction of CDM technology in Pakistan. PFL currently has the following CDM projects which are at different phases;

- Abatement of Nitrous Oxide gas from tail gas of Nitric Acid plants. (It is functional since 2007).
- Replacement of conventional power house with modern co-generation plant, thus reducing the CO_2 emission. (Project under Commissioning and PDD with UNO board for approval).

- Liquefaction of Carbon dioxide, off gas from ammonia plant, for industrial and beverage use.

4.6.3.1. Nitrous Oxide Abatement Project of PFL

At Pak Arab the purpose of CDM is to destroy nitrous oxide (N_2O) present in exhaust stream of Nitric Acid Plants. Pak Arab Fertilizers have 3 CDM plants installed at 3 Nitric Acid Lines A, B and C.

- Two lines are identical named Line-A & B bearing name plate capacity of 600 M. ton/ day on 100% basis.
- Third unit is Line-C, bearing name plate capacity of 180 M. ton/ day on 100% basis.

Line A is in operation since April 18, 2007, Line B is in operation since September 03, 2007 and Line C put in operation on March 01, 2008. (PFL Field Study 2009)

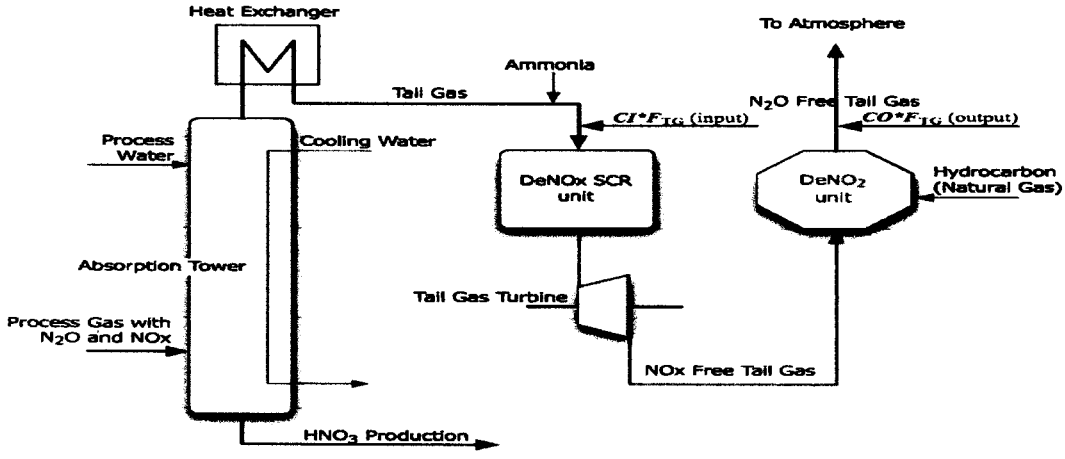


Figure No. 2 Nitrous Oxide Abatement Process (PFL, Project Design Document 2004)

The project proves really helpful in controlling the NOx emissions impact as the Global warming potential of Nitrous Oxide (N_2O) is 310; i.e. it is 310 times more hazardous to atmosphere than Carbon dioxide (CO_2). The daily average generation of CERs by the project accounted is approximately 3000. Up till 2009, 5 claims for the project CERs have been carried out. Claims indicated in the Table No. 12

Table No 12 Claims for Project Certified Emission Reductions by Pak Arab Fertilizer Limited, Multan (PFL Field Study 2009)

Claim #	**Amount of CO_2**
1	76499 tons of CO_2
2	218705 tons of CO_2
3	274412 tons of CO_2
4	392606 tons of CO_2
5	411934 tons of CO_2

CERs for the first four claims are received; however the fifth claim is in process and will be obtained by January, 2010. The total earning from the CDM Nitric Acid Project is 685 million Pkr (9.13 million Euros) and the total annual CER production is 825,000 tCO_2e. (PFL Field Study 2009)

4.6.4. Assessment of social, economic and environmental sustainability of the project against the Gold Standard Indicators

To assess the sustainability of the CDM Nitric Acid project of PFL, some of the indicators have been extracted from the "Gold Standard Manual for CDM project developers" (Gold Standard Manual 2006), which has specific relevance to the PFL

project. The sustainability of the project is assessed against the following indicators given in Table No. 13

Table No. 13 Standard Indicators for the Assessment of CDM projects (Gold Standard Manual 2006)

THEME	INDICATORS
SOCIAL	
	Contribution to Net Employment Generation
	Equal Employment Opportunities
	Social security of work force
	Capacity building of staff / learning
	Education
	Improved quality of life
ECONOMIC	
	Contribution to the sustainability of the balance of payments
	Cost effectiveness
	Contribution to macroeconomic sustainability
	Reduction of direct government investments
	Net foreign currency savings
ENVIRONMENTAL	
	Air Quality
	Avoided emissions of local pollutants
	Other pollutants
	Biodiversity

4.6.4.1. PFL Project Impacts on Social Sustainability

CDM project of Pak Arab Fertilizer Limited, Multan has created the following impacts on the social sustainability:

i. Contribution to Net Employment Generation

Through the installation of technology for friendly environment the first impact created for sustainable development is the increase in the net employment opportunities for male and female at different levels on equality bases. The CDM project has played a vital role in enhancement of net employment generation by hiring of staff to operate the technology. 10 permanent jobs have been created to operate the technology, among which 8 positions are of average level while 2 are unskilled labors. Moreover, about 50 positions were created on temporary basis for the time period of 3 months during the installation of CDM technology and 3 local engineering companies were involved in the engineering design, manufacturing of equipment and installation of technology.

Hence, the project has increased the employment opportunities for the community which has also led to improve their social status as well.

ii. Equal Employment Opportunities

For social sustainability it is required that employment opportunities for male and female should be equal as both are playing vital role in the development of society. At PFL, 12 female are working while the number of male employees is 300. At top management level 50 male are working. 2 females are also working at the managerial level while remaining 10 are hired as staff.

iii. Health & Social Security of Workplace

According to data collected the personal observations indicates that the PFL is providing social security including health insurance (OPD, hospitalization, dental care, maternity etc.) to all of workforce including their dependents. Life insurance is not yet provided to workforce but it is under process and soon will be offered. It shows that Pak Arab Fertilizer, Multan is earning financial benefits from CDM technology by saving the energy and utilizing the development of their workers which leads to social sustainability.

iv. Capacity Building of Staff

Pak Arab Fertilizer, Multan has skilled staff for the practical implementation of CDM project. According to data collected and discussions made during the site visit, showed that PFL has managed 3 training sessions for 25 CDM concerned workforce to enhance their professional skills. For the capacity building of workers PFL has conducted following trainings:

1. CDM plant operational Training
2. CDM monitoring training

The trainings dealt with the introduction of CDM technology and operation of CDM plant. Moreover, in future Pak Arab Fertilizer has a plan for the training course on CDM monitoring and equipment maintenance by a consulting firm OEM (ABB Japan).

v. Education

Pak Arab Fertilizer, Multan is playing a very positive and constructive role in providing quality education to the local community. In factory's vicinity there are separate secondary level schools for girls and boys funded by Pak Arab Fertilizer,

Multan. Moreover, another school is being constructed by the PFL outside the factory's compound for poor and labor community.

vi. Improved Quality Of Life/Welfare

Ultimate result of the provision of above mentioned facilities (capacity building of staff, health & social security of workplace, equal employment opportunities, net employment generation and education) has improved the quality of life of the community. Pak Arab Fertilizer, Multan has residential facility for the employees about 25 % of their workers are living in that colony which is safe and secure for them. This colony has all the basic requirements playing ground for children, mosque, school, community education center and own electric supply system as the generators are owned by the PFL. Moreover, workforce which is coming from nearby areas outside the factory compound is provided with the pick and drop service. From the information it is concluded that the CDM project of Pak Arab Fertilizer is promoting social sustainability for the community by providing them employment opportunities, health, education and better quality of life etc.

4.6.4.2. PFL Project Impacts on Economic Sustainability

CDM project of Pak Arab Fertilizer Limited, Multan has determined the following impacts on the Economic Sustainability:

i. Sustainability of the Balance Of Payments

CDM technology can play a vital role in the sustainability of the payments of the country as it will improve trade balance which will contribute to the sustainability of balance payment. By selling the CERs more foreign currency can be attained within the country as it is just like the revenues earned by the Pakistani manpower working abroad.

PFL through installation of its CDM project is getting income by selling the CERs is an additional earning of the factory and saving of energy due to CDM technology is a source of sustainability of payment. By the installation of CDM technology in the industrial area of the country trade income has become surplus. PFL, CDM project has attracted additional investment within the country and abroad by introducing new CDM projects.

ii. Cost Effectiveness

As CDM project at Pak Arab Fertilizer, Multan is like role model of the technology; their experience encourages the technology as it is more cost effective as expenses of the production means now cost of production is reduced after the installation of CDM technology. They reduced 20% to 40 % of fuel consumption and producing more fertilizer. So the rate of their production has been increased while the cost of production has been reduced with the technology. It means that 20% to 40% energy efficiency has increased through this technology.

Pak Arab Fertilizer, Multan is earning 3000 X 330 CERs per year which reduce their expense of production. Moreover, they factory has skilled labour working over the CDM technology who are experts of their field. It is the strength of the organization that it is getting more benefit from these 10 employees rather than having more unskilled workforce. This less skilled labour is cost effective for the economic sustainability of the organization.

iii. Contribution to Macroeconomic Sustainability

CDM technology is a broader concept if a country will have more CDM projects it will affect on macro level. Economic growth is directly affected by the balance of payments, cost effectiveness and foreign currency savings. CDM technology is playing

role in the economic growth of the country by reducing the cost of production, by selling CERs, by improving the energy efficiency etc. it clears that CDM technology is contributing in macroeconomic sustainability.

Pak Arab Fertilizer, Multan has created a positive impact through installation of a CDM project and they are going to install another CDM project in their industry. They have planned for more training sessions to build the capacity of their work force to reduce the cost of production and increase the effectiveness of staff. From their first experience of CDM project they believe that by the installation of more CDM technology will increase the rate of investment in the country and for the growth of economy CDM projects should be encouraged by the government and investor.

iv. Reduction of Direct Government Investments

As during the meeting sessions it has been found that the CDM projects are not encouraged by the government and government can play its role to encourage this technology by the provision of infrastructure and improving the procedural requirements. According to the stakeholders concern, government authorities are having lack of awareness about the CDM technology. So, government should conduct awareness trainings for the concerned officials to encourage the economic growth of the country. Moreover, government should motivate the industrial zone to install CDM technology in their industries. Stakeholders are not happy with the procedural requirements of the government for the host country approval of the project. According to them concerned officials of Ministry of Environment are not cooperative. Furthermore, according to stakeholders government can encourage the CDM technology by the provision of funding through easy loans or sharing cost of CDM projects and availability of infrastructure.

Government must have some clear monetary policy of tax reforms to encourage the CDM technology. According to the stakeholders the banks also can play a vital role to encourage the technology by developing special loan policies for the installation of CDM technology.

The major issue for the CDM technology is the support from government side. According to the stakeholders (Pak Arab Fertilizer, Multan) view the difficult procedural requirements and non contributing role of government stakeholders is main issue in the development of CDM technology.

v. Net Foreign Currency Savings

CDM technology should be encouraged for the sustainability of economic growth of the country as by selling of CERs country is saving the net foreign currency. Moreover, by encouraging CDM technology in the country demand for environment friendly products will be increased in the international market and our export will be enhanced. The technology introduced by PFL has encouraged the foreign investor to invest in Pakistan which has resulted in the net foreign currency saving and economy of the country became stronger.

4.6.4.3. PFL Project Impacts on Environmental Sustainability

CDM project of Pak Arab Fertilizer Limited, Multan has generated the following impacts on the Environmental Sustainability:

i. Air Quality (Emission other than GHGs)

Pak Arab Fertilizer, Multan CDM technology is environment friendly technology which has improved the quality of air as it reduced the emission of GHGs. Total quantity of green house gas emission by volume is carbon dioxide 85%, Methane is 8%, Nitrous

Oxide is 5% and Fluorinated Gases (HFCs, PFCs, and SF_6) is 2%. These gases are further converted into harmless, odorless and colorless gases before emitting them in the air.

ii. Avoid emission of local pollutant

Pak Arab Fertilizer, Multan CDM technology is safe and sound for the environment as the emission of N_2O is stopped to atmosphere up to 90%. Production of Nitric Acid before the installation of technology was 600 X 2 X 180 MTPD while current baseline N_2O concentration is 1200 ppm. Net emission reduction rate is 90 % and leakage of emission is only 10 % which shows that it is environment friendly technology.

iii. Other Pollutants

As CDM technology is not harmful for the environment and reducing the pollution in air, water and land in the same way hazardous / non hazardous waste generated after the installation of the technology is reduced. Moreover, Pak Arab Fertilizer has arrangements for the catalytic breakdown of N_2O for the treatment of hazardous / non hazardous waste.[5]

[5] Source: Compiled by Ayesha Butt, 09

Chapter 5

CONCLUSIONS AND RECOMMENDATIONS

5.1. CONCLUSIONS

The study is focused to the following objectives;

a. Development of sustainable development indicators.

b. Assessment of sustainability of an on-going CDM project in Pakistan.

c. Identification of missing gaps and possible recommendations.

5.1.1. Development of Sustainable Development Indicators

The ultimate outcome of the study is the list of sustainable development indicators addressing 3 main pillars i.e. social, environmental and economic particularly. A relative scale has also been provided for the assessment of the indicators. The list of indicators developed for the assessment of CDM projects in Pakistan clearly highlights the most important aspects which should be addressed properly for a developing country like Pakistan. The list of indicators defined under the criterion as highlighted in Table No. 14

Table No. 14 Proposed Set of Indicators for the Assessment of CDM projects sustainability of Pakistan

CRITERIA	INDICATORS
ENVIRONMENTAL	Reduction of greenhouse gas emissions compared with baseline (CO2 equivalent)
	Emission of air pollutants compared with baseline
	Sound level in the project site
	Odor Pollution
	Waste water quality
	Waste output of the project per raw material input
	Soil pollution in compliance with government standards
	Ground water contamination
	The amount of hazardous waste
	The project's water demand and efficiency of water usage
	Soil, coastal and river bank erosion in the project site
	Green Areas
	The impact on ecosystem diversity and biodiversity
	Population size and species of flora and fauna
SOCIAL	People's participation, sensitization, education
	Projects or activities based on sufficiency economy philosophy, Protection of natural and cultural heritage, Scholarship awards, Religious, arts and cultural activities, Healthcare support, Child nursery care, living standards, Supplying drinking water etc.
	Workers' health and surrounding community health
	Generation of Employment Opportunities
TECHNOLOGICAL	Development/import of technology
	Number of well skilled employees
	Post Crediting Period plan as outlined by the project
ECONOMIC	Workers' annual income
	Energy. Consumption, Production Use of alternative energy or energy efficiency (percentage %) Use of alternative energy / domestic renewable energy (tons of oil equivalent) Percentage of energy usage efficiency
	Provision of infrastructure and procedural requirements.

Keeping in view, the situation of a developing country like Pakistan, environment is the neglected area as compared to the social and economic criteria. In case of CDM projects (On-going and new project proposals) indicators provided prove to be useful as each criteria is addressed separately. In contrast to the existing literature of the sustainability assessment of CDM projects, this study has focused on a specific perspective of development of indicators for the assessment of sustainable CDM projects of Pakistan. The set of proposed indicators resulted from the study are totally in compliance with the National Sustainable Development Strategy (NSDS) of Pakistan and addresses separately the environmental, social and economic challenges associated with the CDM projects which may hinders the sustainable development of the country.

5.1.2. Assessment of Sustainability of an On-going CDM project of Pakistan

During the field visit of the PFL Project Multan, assessment has been made on the basis of the indicators extracted from the Gold Standard Manual typically being used for assessing the performance of the CDM projects. The scale values would be like;

- 0 -- Neutral (Sound CDM project with no significant benefits nor loss)
- +1-- Positive (One additional significant benefit e.g. one of social, local, environmental and economic).
- +2 – Positive (Two or more additional benefits in two categories. i.e. social, environmental and economic).
- +3 – Positive (Significant benefits in three or more categories i.e. social, local, environmental, health, community participation and welfare/employment).
- -1 – Negative (Negative impacts generated in terms of environmental and social development (ESD) policies and/or causing environmental/social impacts from the CDM project baseline).

The following table shows the rating against the defined scale for the assessment of CDM project impacts for the PFL project Multan.

Table No. 15 Rating of Pak Arab Fertilizer (PFL) Project Impacts (Compiled by Ayesha Aftab Butt 2009)

THEME	INDICATORS	SCALE	BENEFITS
SOCIAL	Contribution to net employment generation	+1 -- Positive	Social
	Equal employment opportunities	0 -- Neutral	-
	Social security of work force	+2 – Positive	Social (health) Economic
	Capacity building of staff and learning	0 -- Neutral	-
	Education	+1 -- Positive	Social
	Improved quality of life	+2 –Positive	Social Environmental
ECONOMIC	Contribution to sustainability of the balance of payments	+2 –Positive	Economic Environmental
	Cost effectiveness	+1 – Positive	Economic
	Contribution to macroeconomic sustainability	+1 -- Positive	Economic
	Reduction of direct government investments	0 – Neutral	-

	Net foreign currency savings	+1 -- Positive	Economic
ENVIRONMENTAL	Air quality	+1 --Positive	Environmental
	Avoided emissions of local pollutants	+1 --Positive	Environmental
	Other Pollutants	+1 --Positive	Environmental
	Biodiversity	Not applied	-

5.2. RECOMMENDATIONS

Pakistan is a developing nation with problems like diminutive geographic area and burdened with population, political insecurity, resource constraints, unemployment, poverty and environmental problems. In this regard, implementation and development of CDM projects is vital. Environmental well being can be achieved through execution of maximum number of CDM projects which helps in overcoming the problems like energy crisis, health hazard and economic instability. CDM projects development in Pakistan has faced several restrictions since its initiation. The major gaps identified in the CDM projects implementation in Pakistan are as follows;

- There is a lack of baseline data. A well defined baseline should be established taking into consideration the opinions of country's experts and all concerned government, non-government and international organizations.
- There is a Low level of awareness amongst the public, private and financial sectors about CDM procedures and opportunities are the underlying obstacles to CDM's thrive in Pakistan. Awareness raising and dissemination of information should be carried out properly through seminars, workshops, trainings and advertisement.
- Pakistan lacks optimum funds in the CDM operation, in this regard government should mobilize the entrepreneurs through motivation and the banking sector should be called for raising fund for the CDM projects development. There is a need that the Board of Investment should convince foreign investors to set up projects with 100 per cent equity or in the form of joint ventures on the basis of CDM arrangements.

- There is low Capacity level of public and private institutions. It is important to build the capacities of the officials of these institutions particularly the staff of DNA through information dissemination and also to draw the attention of donor agencies and other foreign investor through participation in trade fairs, exhibitions, international workshops and websites of other national institutions. CDM project approval process is quite complex in Pakistan. Industrial stakeholders are not satisfied with the procedure of host country approval and they are of the view that the concerned government officials are not properly providing guidelines to complete the required procedure. In order to overcome this problem country like Pakistan should apply to the CDM Executive Board to relax and simplify the process for the sake of smooth growth of CDM in the whole developing world. Proper guidelines for the preparation of PDD and all other related stuff must be made readily available on net for preparation of reports and studies otherwise stakeholder is bound to hire consultant services which may prove to be expensive.
- There is a gap in the understanding of the involvement of academic institutions in the CDM project development. In this regard, the academic institutions and consulting firms should be taken on board for their technical skills enhancement in order to provide technical resources in Pakistan for CDM project development and to address the projects' sustainability issues in a best way.
- The government alone however, cannot alleviate the seriousness of threat to sustainable development in Pakistan. It demands urgent action by all segments of society including the Government, private sector, NGOs and civil society at large. The government should take the lead in initiating the action through promoting

participation for ownership of policies, programmes and projects and enforceability of laws and regulations.

- For carrying out the sound sustainable development activities/projects in Pakistan and to make NSDS effective it is important to devise an appropriate institutional mechanism for its implementation and monitoring. NSDS is multisectoral in nature, in this matter Government should constitute a multisectoral body which should not only plan, monitor or supervise the implementation of NSDS but also motivate the key stakeholders with a stake in a prosperous future of Pakistan, in its implementation and may also serve the purpose provided its mandate and membership is broadened in line with all three aspects of sustainable development i.e. economic, social and environmental dimensions.

This research study has led towards the formulation of the list of sustainable development indicators for the assessment of CDM projects of Pakistan applicable to both the on-going projects and to the new project proposals. The developed indicators are in line with the objectives of the environmental policies of Pakistan specifically the NSDS, Renewable Energy Policy and the National Operational Strategy for CDM of Pakistan.

A Way Forward

This study has provided a ground for the further research on how these indicators could be refined more in order to be used for the assessment of CDM projects according to the national priorities and project specific indicators could also be proposed. The future studies may also focus on the Development of a success criteria including Sustainable

Development Indicators by assessing the projects through the DNA with the help of UNFCCC. To make this effective a Sustainable Development Unit could be established under the DNA to work on this special perspective of Sustainable Development. Further research to be carried should also need to focus on the following;

- **Research into the need of Institutional Arrangements: -** For the Developing nations say Pakistan like to host CDM projects need to put in place the necessary institutional mechanisms for approving CDM projects and ensuring their compatibility with national sustainable development goals and strategies.
- **Need for financial arrangements: -** There is a need for sufficient financial arrangements into the CDM sector in order to promote the associated sustainable (social, economic and environmental) benefits arising from these projects.
- It is needed to know how much sustainable development could be possible through CDM projects for the developing countries.

  Sustainable development is not actually a requirement but should be considered as an important aspect in CDM scheme. For the developing countries like Pakistan CDM should be examined both at policy and implementation levels and the success stories of the advanced civilizations prove to be effective in this regard.

REFERENCES

Austin D. and P. Faeth (1999) How much sustainable development can we expect from the Clean Development Mechanism? World Resource Institute, Washington, D.C.

Austin D. and P. Faeth (2000) Financing Sustainable Development with the Clean Development Mechanism. World Resource Institute, Washington, D.C.

Baumert, K., N. Kete, and C. Figueres (2000) Designing the Clean Development Mechanism to Meet the Needs of a Broad Range of Interests. Climate Notes, WRI http://pdf.wri.org/cdm_design_note.phf

Bernstein, P., Montgomery, W., and Rutherford, T., (1999) Global Impacts of the Kyoto Agreement. Resource and Energy Economics. 21: 375-413.

Black *et al.* (2000) Contributions from the National Strategy Studies Program to COP 6 negotiations regarding CDM & JI. World Bank, Washington, D.C. / Lyon

Brown et al. (2004) How do CDM projects contribute to Sustainable Development? Technical Report, Tyndall Center for Climate Change Research

Burian M. (2006) The Clean Development Mechanism, Sustainable Development and its Assessment. HWWA Report 264, Programme International Policy of Hamburg Institute of International Economics

Cassia Simons Januario (2007) The CDM and energy efficiency projects, how to approve a CHP district heating methodology? Environmental Policy and global challenge, International, regional and local perspectives, Roskilde University Denmark

CDM Cell, Ministry of Environment, Pakistan (Website): http://www.cdmpakistan.gov.pk/ (Dated: April 2009)

CD4CDM (web site) http://www.cd4cdm.org/publications/CDMpipeline.xls

Dyer *et al.* (2006) Strategic Planning for the Clean Development Mechanism. Development to strategic sustainable development Master's Thesis

Fenhann, Jorgen (2005) The Efficiency of the CDM Project Cycle is improving Energy, Climate and Sustainable Development. Special Issue, November 2005

Government of Pakistan (2006) Pakistan National Operational Strategy for CDM in Pakistan. CDM Cell, Ministry of Environment, Pakistan, http://cdmpakistan.gov.pk/cdm_stat.html

Government of Pakistan (2009) National Sustainable Development Strategy for Pakistan. Salient Features, UNEP and Ministry of Environment, Government of Pakistan, www.pakistan.gov.pk/.../BRIEF_ON_THE_**NSDS**_PROCESS_IN_PAKISTAN.pdf

Haripriya, G. (2004) How much Sustainable is the Sustainable Development objective of CDM in developing countries like India. Forest Policy and Economics 6:329-343

Hart, Stuart L. (1997) Beyond greening: Strategies for a sustainable world. Harvard Business Review, January-February, pp.66-76

Hussain, S. (2005) Presentation on CDM Status in Pakistan. Government of Pakistan, Ministry of Environment

Kolshus *et al* (2001) Can the Clean Development Mechanism Attain Both Cost-effectiveness and Sustainable Development Objectives. CICERO Working Paper, August 2001

Laseur, J. (2005) Addressing the participation of developing countries in CDM project development. Unilateral CDM, Master's Thesis

Liguang, L. (2006) Seeking synergies to achieve sustainable development. Clean Development Mechanism in China. Master Thesis, Masters of Science Programme, Jinan University, China

Olhoff et al. (2007) CDM Sustainable Development Impacts Guide, CD4CDM UNEP Project

Pak Arab Fertilizers Limited (2006) Project Design Document. Multan www.cdmpakistan.gov.pk/.../CDM_PDD_CoGen_Pakarab_ver02.pdf

Pembina Institute for Appropriate Development (2003) A User's Guide to the Clean Development Mechanism (CDM) – Second Edition

Ren, X., Zeng, L., Zhou, Dadi (2005) Sustainable Energy Development and Climate Change in China. *Climate Policy*, 5:183–196

Rosales, J. and G. Pronove (2002) A Layperson's Guide to the Clean Development Mechanism. UNCTAD-Earth Council

Scholze (2003) Sustainability in South- Kyoto's Clean Development Mechanism. 17:pp.89-90

Sustainable Development Networking Program (2001) Global Climate Change Bangladesh Episode. http:// www.sdnbd.org/

Christoph Sutter (2003) Sustainability Check up for CDM projects. Swiss Federal Institute of Technology Zurich, Energy and Climate, Switzerland, Published by SDC (Swiss Agency for Development and Cooperation)

Thorne, L.A., Rovere (1999) Criteria & Indicators for appraising CDM projects. Federal university of Rio de Janeiro, Brazil

Tomilola A. (2005) Promoting Renewable Energy and Energy Efficiency. School of Law, University of Dundee, Nether gate, Dundee, UK

UNDP (2003) The Clean Development Mechanism. A User's Guide, UNDP

UNEP (2004) CDM Information and Guidebook. Second edition, UNEP Riso Center

UNEP (2005) Status and Analysis of the Current CDM Project Portfolio. Carbon Market Update, Issue No. 1, UNEP, IETA, URC

UNEP (2005b) Status and Analysis of the CDM Project Portfolio. Carbon Market Update, Issue No. 2, UNEP, IETA, URC

UNEP (2006) CDM and Sustainable Development Impacts. UNEP Risø Centre on Energy, Climate and Sustainable Development", Risø National Laboratory

UNFCCC Website http://www.unfccc.int

UNIDO (2007) Vienna Energy Efficiency & Climate Meetings. UNIDO (Website): http://www.unido.org/en/doc/61189

UNIDO (2009) Institutional Capacity Enhancement for CDM in Pakistan. Project Inception Report by UNIDO (unpublished), Ministry of Environment, Government of Pakistan

William. R. Blackburn (2007) The Sustainability Handbook

World Bank (2004) Clean Development Mechanism in China – Taking Proactive and Sustainable Approach. World Bank

World Bank (2009) Capacity building of CDM Project Inception Report by Win rock International. Ministry of Environment, Government of Pakistan

Zhang, Zhongxiang. (2005) Towards an Effective Implementation of CDM Projects in China. Nanyhang Technological University

Zang, Lei. (2006) Clean Development Mechanism Policy & Implementation in China. P.hD Thesis, Wageningen University

APPENDICES

Appendix A Contact List of Interviews and Meetings

[redacted]	[redacted]	[redacted]	[redacted]
Mr. Saleem Zafar	Pak Arab Fertilizer, Multan	Meeting & Emails	CDM Project implementation at PFL, Multan
Mr. Rauf Ahmad	Pak Arab Fertilizer, Multan	Meeting & Emails	Status of generation of CERs by PFL, Pakistan's Host country Approval procedural flaws
Ms. Sehrish Khawaja	Pak Arab Fertilizer, Multan	Meeting & Emails	Thesis Discussion, questions about Pakistan's current position, CDM development and upcoming projects of CDM by PFL.
Ms. Samina Iftikhar	Ex UNIDO National Consultant, Islamabad	Meetings, Emails & Telephonic Conversations	Progressive thesis discussions, questionnaire developed based on defined SD indicators, barriers in the implementation of CDM in Pakistan, PFL Visit.
Ms Nadia Aftab	National Consultant, UNIDO, Islamabad	Meetings	Barriers in the implementation of CDM projects in the country, current progress
Mr. Matloob Khan	National Expert CDM-UNIDO	Discussions, Emails	CDM updated information and rules, Status of CDM projects in the world.
	CDM Cell	Group Discussions / Meetings	Implementation of CDM projects in Pakistan, Workshops conducted on CDM.
	UNIDO	Group Discussions / Meetings	Current status of CDM Capacity building projects, their funding and implementation phase

Appendix B Questionnaire for the Assessment of CDM Project Impacts

QUESTIONNAIRE FOR THE ASSESSMENT OF A CDM PROJECT IMPACTS

1. What is the size of your company?
   - Less than 50 employees
   - 51-250 employees
   - 251-500 employees
   - More than 500 employees

2 At what position you are working in the company?
   a. worker b. Management c. Any other _____

3. Do you know about the CDM project?
   a. Yes b. No

Can you shortly describe the project and technology?

SOCIAL SUSTAINABILITY

Indicator 1: Contribution to Net Employment Generation.

1. How many skilled labors are hired to operate the technology?
   No of hired labor: ___

2. Whether the resultant jobs are highly skilled or unskilled?
   a. Highly skilled b. unskilled c. Both

3. How many highly skilled jobs have been created for CDM project?
   No. of Jobs: ___

4. How many permanent jobs have been created?
   No. of Jobs: ___

5. How many opportunities are created on temporary bases?
   No. of Jobs: ___

6. How many local engineering companies get involved in the engineering design, manufacturing of equipment and installation of technology?
   No. of Jobs: ___

Indicator 2: Equal Employment Opportunities

1. Are the principles of equal opportunities reflected in the employment structure of middle and upper management?
   Yes *No* *don't know*

Indicator 3: Social security of workforce

1 Staff working here has health insurance from company?
   a. Yes b. No

2. Health insurance covers whole family of employee?

a. Yes b. No

3. Does Company is providing life insurance to employees?
   a. Yes b. No
4. Does Company is providing accident insurance to employees?
   a. Yes b. No
5. Above mentioned security services are for all staff?
   a. Yes b. No
6. What kind of health services are covered in insurance?

a.	OPD	Yes	No
b.	Hospitalization	Yes	No
c.	Dental care	yes	No
d.	Maternity	Yes	No
e.	Any Other _____		

9. Is there any Hospital facility near the plant to meet the emergency?
   a. Yes b. No

7. If no then is there ambulance facility available?
   a. Yes b. No

8. Pension facility is provided to employees?
   a. Yes b. No

Indicator 4: Capacity Building of Staff/Learning

1. Training courses are conducted for the employees to operate the CDM system?
   a. Yes b. No

2. How many training courses have been conducted for the operation of equipment?
   Number of training courses: _____.

3. Training courses have been conducted for the monitoring of reduction of emission?
   a. Yes b. No

4. What training have you received related to CDM?
   Name of training: _____

5. What is future capacity building plan?
   Describe here: _____

6. This section should also include a description of how environmentally safe and sound technology and know-how to be used is transferred to the Host Party, if any.
   .....

7. What kind of project specific training is planned?

Indicator 5: Education

I. Is there school provided by the company for the quality education of the children of factory employees?
   a. Yes b. No

2. Schools are at what level?
   a. Primary b. Middle
   c. Secondary d. higher secondary

Indicator 6: Improved quality of life

1. Is there any residential facility for the hired employees?
   a. Yes b. No

2. Is there any shortage of electricity because of CDM system installation?
   a. Shortage b. Increased c. Indifferent

3. Describe how quality of life of the area has been improved?
   .....

ECONOMIC SUSTAINABILITY

Indicator 1: Contribution to the Sustainability of the Balance of Payments

1. Do you think CDM technology is helpful in improving the balance of payment in country?
   a. Yes b. No

2. How CDM technology can contribute in favourable balance of payment for the country?
   .....

3. How CDM technology can help Pakistan in reducing its import bill?
   .....

4. Do you think CDM technology can attract additional investment within the country and abroad?
   a. Yes b. No

Indicator 2 - Cost Effectiveness

1. How much was the fuel/energy consumption before the installation of CDM equipment?
   _____

2. How much fuel consumption has been reduced?
   a. 5-20% b. 20-40% more than 40%

3. How much is the fuel/energy consumption after the installation of system? _____

4. How much energy efficiency has been improved through this technology?
   a. 5-20% b. 20-40% more than 40%

5. How many CERs your company is earning/ year? _____

Indicator 3: Contribution to macroeconomic sustainability

1. Do you think Investment rate will be increased with installation of CDM equipment?
   a. Yes b. No c. Doesn't effect

2. Do you think Economic growth can be effected by encouraging the CDM projects in the country?
   a. Yes b. No c. Doesn't effect

Indicator 4: reduction of direct government investments

1. Do you think government should play its role to encourage the CDM technology?

2. If yes, how government can help?
   a. Procedural requirement
   c. setback
   c. financial assistance
   d. provision of infrastructure.

3. How government can provide improved procedural support to encourage the CDM Projects in the country?

.....

4. How government can provide setback to encourage the CDM projects in the country?

.....

5. How government can provide financial assistance to encourage the CDM projects in the country?

.....

6. How government can help to improve the infrastructure to encourage the CDM projects in the country?

.....

7. What kind of role banks can play to encourage the CDM technology within the country?

.....

Indicator 5: Net Foreign Currency Savings

1. Do you think CDM projects can play an important role in increasing net foreign currency savings?
   a. Yes b. No c. Doesn't effect

2. Do you feel that import of goods will be increased / decreased after the installation of CDM technology?
   a. Yes b. No c. Doesn't effect

3. Do you feel that foreign investment will be enhanced by encouraging the CDM technology in the country?
   a. Yes b. No c. Doesn't effect

ENVIRONMENTAL SUSTAINABILITY

Indicator 1: Biodiversity (species and habitat conservation)

1. After the installation of CDM project do you think sustainability of natural resources has improved?
   a. Yes b. No

Indicator 2: Air Quality (emission other than GHGs)

1. How air pollution is reduced after the installation of CDM equipment?
   a. quantity of emissions, b. composition of emissions

Indicator 3: avoided emissions of local pollutant

1. How this technology is safe & sound for the environment?

.....

2. How much was the production of nitric acid before installation of this technology?

.....

3. How much is the current baseline N2O concentration?

.....

4. What is alternative use of N2O?

.....

5. Do you think that Project is harmful for local environment?
   a. Yes b. No
6. If yes, how?
   ---
7. Do you think environmental pollution is decreased?
   a. Yes b. No
8. Is there any negative impact on the air quality?
   a. Yes b. No
9. What is the net emission reduction rate?
   ---
10. What is the current production of nitric acid?
    ---
11. How much is the leakage of emission?

Indicator 4: Other Pollutants:

1. Is there any reduction in the total amount of waste generated after the installation of CDM equipment?
   a. Yes b. No

2. Is there any reduction in the total amount of hazardous waste generated after the Installation of CDM equipment?
   a. Yes b. No
3. Do you have some arrangements for the treatment of hazardous / non-hazardous waste?
   a. Yes b. No

4. How PFL is managing the waste disposal?

List five major benefits that Pakistan may derive by participating in CDM projects.

.....

.....

List five major risks/drawbacks that Pakistan attracts if it participates in CDM projects.

.....

.....

OTHERS

1. Are you satisfied with procedures to apply for approval of CDM project?
   a. Yes b. No

2. Do you know about the host country approval procedure for CDM project?

a. Yes b. No

3. What is the responsibility of Designated National Authority, are you satisfied with its performance?

.....

4. Are you satisfied with the coordination of host country authorities?
   a. Yes b. No

5. Risks in approval procedure of CDM

.....

Appendix C Location of Pak Arab Fertilizer Project, Multan

Source: Pak Arab Fertilizer Limited (2004), Multan, Project Design Document

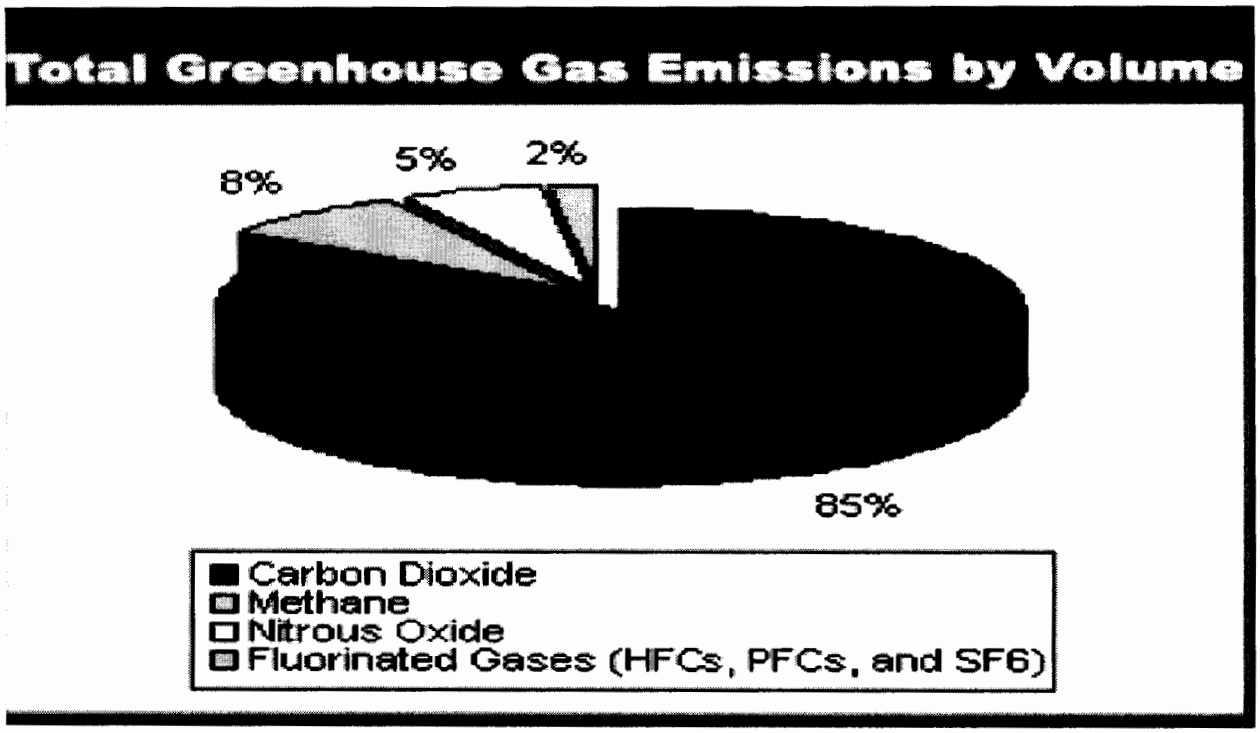
Appendix D Global Warming Potential of GHGs

The table below shows the heat trapping ability of the important greenhouse gases after 20 years and 100 years as compared to Carbon dioxide (CO2).

Global Warming Potentials of Greenhouse Gases
(when compared to CO_2)

Greenhouse Gas	GWP After 20 Years	GWP After 100 Years
Carbon Dioxide	1	1
Methane	72	25
Nitrous Oxide	310	298
HFC-23	12000	14800
HFC-125	6350	3500
HFC-134a	3830	1430
HFC-143a	5890	4470
CF_4	5210	7390
C_2F_6	8630	12200
SF_6	16300	22800

Source: http://steadystaterevolution.org/addressing-global-climate-change/



Source: http://steadystaterevolution.org/addressing-global-climate-change/