Abstract

Lo scopo della mia tesi è esaminare quale impatto potrebbero avere i meccanismi del protocollo di Kyoto sulla riduzione delle emissioni di gas serra nel settore petrolifero: in particolare esaminerò come l'industria petrolifera sta utilizzando i meccanismi di sviluppo pulito (Clean Development Mechanism); a partire da questa analisi andrò a esaminare, in vari casi di studio, come i meccanismi del protocollo di Kyoto sono stati applicati in alcuni paesi in via di sviluppo e produttori di petrolio.

Per quanto riguarda i casi di studio ho scelto:

- Repubblica Islamica dell'Iran,
- Repubblica Federale di Nigeria,
- Repubblica di Indonesia,

Tre paesi produttori di petrolio che, pur essendo accomunati da questa caratteristica, si trovano in tre aree geografiche diverse, hanno realtà economica e politica diverse che li spingono ad assumere diversi atteggiamenti nella loro politica interna e soprattutto in politica estera e nei rapporti internazionali a livello globale e in modo particolare nel settore energetico.

Perturbazioni del clima globale, causate dalle attività umane, sono emerse negli ultimi decenni, destando sempre maggiore preoccupazione: appare chiaro quindi che il fenomeno dei cambiamenti climatici sarà, in futuro, sempre più importante e diffuso. Nello stesso tempo, affrontare il problema dell'aumento di livello di concentrazione di gas serra nell'atmosfera sarà un enorme sfida. Dato che le emissioni di anidride carbonica derivata dal consumo di combustibili fossili contribuisce altamente ai problemi climatici, un intervento umano per la riduzione di gas serra per aiutare la stabilizzazione climatica sarà indispensabile. Il cambiamento climatico è un problema globale e la sua soluzione necessita di un intervento globale. Negli ultimi anni, la questione su come affrontare il cambiamento climatico ha occupato i primi posti dell'agenda politica internazionale.

Il consumo energetico mondiale ha cominciato a crescere rapidamente con la rivoluzione industriale e, successivamente, con l'introduzione del metodo della produzione meccanizzata e a causa del crescente consumo dei combustibili fossili come carbone ed, in seguito, il petrolio.

Il capitolo primo descrive i principali contenuti della mia tesi, cioè la Convenzione quadro delle Nazioni Unite sui cambiamenti climatici (United Nations Framework Convention on Climate Change, da cui l'acronimo UNFCCC), il primo strumento internazionale giuridicamente vincolante che tratta direttamente i problemi legati ai cambiamenti climatici e la riduzione delle emissioni dei gas serra sulla base dell'ipotesi di riscaldamento globale. Il Protocollo di Kyoto, cioè il protocollo internazionale più importante legato alla UNFCCC, è diventato molo più noto della stessa Convenzione. La Global Gas Flaring Reduction Partnership (GGFR) è un associazione internazionale nata in seno alla Banca Mondiale che ha lo scopo di sostenere i governi nazionali, le agenzie di sviluppo e le industrie petrolifere nei loro sforzi per ridurre la combustione e lo scarico di gas associati ("Flaring and Venting of Associated Gas"), prodotti nelle piattaforme petrolifere durante l'estrazione del petrolio e dannosi per l'ambiente. Questo capitolo si chiude con una riflessione sulle Relazioni Internazionali: il cambiamento climatico per la sua natura è un problema globale in cui è difficile definire le responsabilità relative ad un unico paese, perché le attività di un paese potrebbero coinvolgere anche regioni molto lontane: pertanto gli studi in materia di relazioni internazionali possono avere un effetto diretto e considerevole sulle problematiche climatiche: i loro diversi approcci concettuali, teorici e metodologici potrebbero contribuire ad un migliore raggiungimento di risultati favorevoli alla risoluzione dei problemi climatici.

Il capitolo secondo si concentra sul settore petrolifero e le emissioni causate da tale settore, sul processo della produzione del petrolio e sulle potenziali emissioni di gas che possono fuoriuscire da ciascun segmento. Probabilmente il settore petrolifero, per le sue emissioni causate dalle attività di esplorazione, è il settore più complesso che deve pertanto essere affrontato con cura nel dibattito in materia di riduzione di gas serra. Ci sono tre barriere principali che causano le emissioni di gas associati: mancanza di supervisione regolamentare, accesso limitato al mercato finale, mancanza di finanziamenti. Gas naturale ed infrastrutture di petrolio causano oltre il 20 per cento delle emissioni di metano rilasciate dalle attività umane. Queste emissioni si verificano in tutti i settori riguardanti industria petrolifera, dalla

perforazione e produzione, attraverso l'elaborazione e trasmissione alla distribuzione e all'uso finale come combustione.

Il terzo capitolo si tratta di negoziati internazionali, brevemente descritti dal punto di vista storico, a partire dal Mandato di Berlino (1995), per giungere all'Accordo di Durban (Sudafrica, 2011). Le discussioni politiche sono realmente iniziate con la firma dell'UNFCCC da parte dei paesi aderenti: questa convenzione stabilisce la linea-guida per valutare come i paesi possono lavorare insieme per indirizzare il cambiamento climatico e il suo impatto. Per continuare a parlare dei problemi e valutare i progressi in materia dei cambiamenti climatici le parti della convenzione dovrebbero incontrarsi ogni anno dal 1995 nelle Conferenze delle parti (COP), supremo organo decisionale previsto dalla convenzione.

Il capitolo quarto descrive approfonditamente uno dei meccanismi del Protocollo di Kyoto cioè il meccanismo dello sviluppo pulito (Clean Development Mechanism, o CDM) e come esso può contribuire allo sviluppo sostenibile nei paesi che hanno ratificato il Protocollo di Kyoto. Il CDM è stato creato per promuovere nei paesi ospitanti (paesi in via di sviluppo partecipanti al Protocollo di Kyoto) dei progetti per la riduzione di gas serra, usando i finanziamenti previsti dai paesi sviluppati che fanno parte del Protocollo di Kyoto allo scopo di renderli possibili.

Il capitolo quinto illustra e verifica il livello con cui gli argomenti trattati nella parte teorica possono essere applicati nella pratica, a tale scopo porto l'esperienza di 3 paesi in via di sviluppo e produttori di petrolio che si trovano in diverse aree geografiche e con una realtà economica e politica diversa, tutti aderenti al Protocollo di Kyoto.

Per esaminare i casi di studio comincio con una visione panoramica e generale di ciascun paese, nel secondo passo analizzo la situazione politica e relazionale di ognuno di loro, continuo questo studio con una piccola parentesi riguardo al settore petrolifero, nel passo successivo analizzo l'emissione di gas associati (quantità e cause), in seguito esamino l'esempio del progetto tramite i meccanismi dello sviluppo sostenibile.

La **Repubblica Islamica dell'Iran** ha firmato la UNFCCC nel 1992 e in seguito l'ha ratificata nel luglio 1996, inoltre ha ratificato il Protocollo di Kyoto nel 2005. L'Iran sempre è stato attivamente partecipe alle Conferenze delle parti come "Non-Annex I party".

In Iran esistono undici progetti CDM, di cui solo uno nel settore petrolifero: questo numero è relativamente molto più basso rispetto ai potenziali progetti applicabili nelle industrie Iraniane.

L'applicazione del progetto Soroosh & Norooz per la riduzione delle emissioni di gas serra nel settore petrolifero Iraniano (detto Iranian National Oil Company, INOC) mostra l'applicabilità dei progetti tramite meccanismi di sviluppo pulito.

Esiste una duplice barriera alle applicazioni dei progetti CDM nel settore petrolifero in Iran:

- Una delle questioni principali riguarda le sanzioni contro l'Iran. Il paese è storicamente soggetto a sanzioni internazionali da ormai trent'anni, ma le sanzioni applicate negli ultimi anni hanno colpito di più l'economia Iraniana e di conseguenza il settore petrolifero. Uno degli scopi principali del CDM è il trasferimento delle tecnologie dai paesi sviluppati ai paesi in via di sviluppo; le sanzioni riducono direttamente questo beneficio: per esempio, il grande progetto di Kharg Sour Gas, di cui il progetto Soroosh Norooz costituisce una piccola parte, non è stato realizzato perché il gas acido necessita delle tecnologie più complesse e le sanzioni di fatto impediscono l'accesso a queste tecnologie. Ricordo in breve le sanzioni per quanto riguarda il divieto di commercio delle tecnologie di duplice uso, che potrebbero essere utilizzate anche nel settore militare;
- Il secondo aspetto riguarda le sanzioni che colpiscono il settore finanziario e bancario del paese, il congelamento di conti appartenenti alle banche e alle società iraniane coinvolte nello sviluppo del programma nucleare: il settore energetico iraniano è nazionalizzato ed automaticamente rientra sotto il controllo finanziario delle stesse banche, pertanto le sanzioni contro le banche automaticamente bloccano i finanziamenti a tutti i progetti dello stato. I crediti di emissione (CERs) sono i crediti che spettano ai paesi ospitanti dei progetti CDM: questo tipo di sanzioni crea delle barriere per il settore petrolifero Iraniano e senza i crediti di emissione diventa impossibile l'implementazione dei progetti CDM.

La **Repubblica Federale di Nigeria** ha firmato la UNFCCC nel 1992 e in seguito l'ha ratificata nel luglio del 1994; inoltre ha ratificato il Protocollo di Kyoto nel 2004 e ha partecipato alle Conferenze delle parti come "Non-Annex I party".

In Nigeria esistono cinque progetti CDM, di cui tre nel settore petrolifero.

Il vantaggio principale delle implementazioni dei progetti CDM nel settore petrolifero Nigeriano è l'uso produttivo del gas recuperato dalle pozze di petrolio, che in certe piattaforme di petrolio vengono ancora bruciate, per aiutare lo sviluppo delle regioni del Golfo di Niger.

Ci sono tre progetti CDM già attivi: questo conferma l'applicabilità dei progetti CDM in questo paese.

Una delle barriere all'implementazione dei progetti CDM nel settore petrolifero nel Golfo del Niger è l'onerosità dei progetti: le piattaforme petrolifere in Nigeria si trovano infatti in zone molto remote, sottosviluppate e prive di infrastrutture per il trasporto dell'energia alle industrie e ai consumatori finali, superare questa barriera rende i progetti molto costosi ed economicamente non giustificabili. Inoltre, l'investimento nel delta del Niger è proibitivo data la condizione di estrema insicurezza della zona.

L'aumento delle violenze da parte delle minoranze etniche per protestare contro il governo Nigeriano e le sue estrazioni di petrolio negli ultimi cinque decenni sono le cause principali di insicurezza nel Golfo del Niger. Debolezza delle istruzioni, sottosviluppo e povertà nella zona del delta, dovute all'alto livello di corruzione del Governo Nigeriano e all'ingiusta distribuzione delle risorse e al mancato rispetto dei diritti umani, favoriscono l'insicurezza nel paese.

La **Repubblica di Indonesia** ha firmato la UNFCCC nel 1992 e in seguito l'ha ratificata nel luglio del 1994, inoltre ha ratificato il Protocollo di Kyoto nel 2004 e ha partecipato alle Conferenze delle parti come "Non-Annex I party".

L'Indonesia è un paese in via di sviluppo con un tasso di crescita molto alto e con un crescente fabbisogno di energie fossili: l'applicazione dei progetti CDM è pertanto una grande opportunità per questo paese.

L'applicazione di un solo progetto CDM nel settore petrolifero in Indonesia è relativamente insufficiente. L'Indonesia è meno favorevole agli investimenti sui progetti per la riduzione di

gas serra e ha una politica indirizzata al raggiungimento della sicurezza e all'approvvigionamento energetico; fattori quali un limitato accesso ai finanziamenti, mancanza del budget statale, limitata conoscenza e capacità, mancanza delle politiche per la regolamentazione nel settore energetico portano come conseguenza un minore investimento in progetti CDM. Inoltre, un altro fattore che influenza la difficoltà e onerosità dei progetti in Indonesia è la situazione geografica: essendo uno stato arcipelagico ha bisogno di più investimenti per trasportare l'energia dalle piattaforme energetiche alle centrali di produzione e da queste ultime ai centri di urbani per il consumo finale.

Introduction

Disruption of the global climate, driven by human activities, has emerged over the past few decades as a major issue of concern. It is now increasingly apparent that the impacts of a changing climate will be significant and widespread. At the same time, it is also clear that tackling the problem of rising greenhouse gas concentrations in the atmosphere will be an enormous undertaking. Given that carbon dioxide emissions from fossil-fuel combustion contribute significantly to the climate problem. Climate change is a global problem and requires a global solution. In recent years, addressing climate change has been high on the international policy agenda.

The exploitation of oil and gas reserves has not always been without some ecological side effects. Oil spills, damaged land, accidents and fires, and incidents of air and water pollution have all been recorded at various times and places. In recent times the social impact of operations, especially in remote communities, has also attracted attention. The oil and gas industry has worked for a long time to meet the challenge of providing environmental protection.

The principal emissions in Oil and Gas sector in Oil and Gas producing countries are flaring and venting gas during the production and distribution segments. Flaring and venting system are widely used in the oil and natural gas industry. This system commonly occur at oil production facilities where the associated gas is economically unsupportable. The uneconomical conservation could success when there are:

1- Lack of economic inventive to invest in projects that reduce GHG (market failure).

2- Lack of infrastructure for the transport and marketing of gas – especially associated gas produced with oil that is located in remote locations (so-called “stranded gas”).

This paper’s objective is:

1- Look at the extent to which CDM has been used to offset these two principal barriers,

2- Examine which CDM methodologies have been developed for these two barriers,

3- Look at different case studies of energy exporting countries to see how CDM has been used in the energy sector.

It will also look at the overall international political situation in which these issues have been debated and will look at country case studies in how will the mechanism under the Kyoto Protocol have impact emissions in Oil and Gas producing countries.

In first chapter of this paper I go to describe the international most important environmental organizations that have a significant rule in emission reduction, the objective and aim of the organizations that support national governments, development agencies and industries in their efforts to reducing the environmentally damaging emissions.

In second chapter I talk about flaring and venting of associated gas comes from oil and gas sectors, I begin this chapter with a general and brief description of an Oil and gas facility and describe in which sector of a facility could exist a potential green house gas emission. I continuing this chapter with describing what are flaring and venting of associated gas and why natural gas is flared or vented, what is emitted from flaring and venting, afterwards I go to talk about flaring issue in oil and gas producing countries, I dedicate the end of this chapter to flaring of associated gas reduction policy and the rule of Global Gas Flaring Reduction Public Private Partnership.

I dedicate the third chapter of this paper to international negotiations, first of all I talk about how international organization gave address to climate negotiations, I continuing with decision making bodies that give address to the international negotiations with an historical view of international negotiation under United Nations Conventions on Climate Change, afterwards, I continue this chapter with principle of common but differentiated responsibility and the principal differences in responsibilities that exist in developing and developed countries in climate change issue.

The forth chapter I have a specific and detailed view on mechanisms under Kyoto Protocol especially Clean Development Mechanism, first of all I describe article 12 of Kyoto Protocol that establish CDM and defines its purpose, I continuing this chapter talking about objective, importance, participants and project cycle of CDM, I finish this chapter talking briefly about other mechanism under Kyoto Protocol which is Joint Implementation.

The last chapter is about case study, in this chapter first of all I begin with a brief and general overview on each country, in second step I describe the political situation relative to climate issues, afterward I talk about oil and gas sector, the production, consumption and exportation of oil and gas and the impact of this industry in internal economic development, I

continue each case study talking about flaring and venting of associated gas in the oil and gas sector with the aim of describe the level of green house gas emissions released by oil and gas industry in these countries and the main reasons that cause/give address the practice of this phenomenon, I finish each case study with description of a project activity under clean development mechanism and showing in practice how mechanism under Kyoto Protocol especially Clean Development Mechanism could give address to the reduction of flaring or venting of associate gas in oil and gas producing countries and in same time how could help to the local and national economic development in developing oil and gas producing countries.

Purpose

The goal of this paper will be to examine how will the mechanism under the Kyoto Protocol have impact emissions in the Oil & Gas sector, specifically I will examine how the oil and gas industry has utilized the CDM mechanism and then look at this on a case study basis in certain developing, energy-exporting countries particularly in Middle East & North Africa.

For this aim in my paper, first of all, I go to study briefly the Upstream & Downstream in Oil & Gas sector, specifically the exploration, treatment, transmission, refineries, distribution and the GHG emission in atmosphere by Oil & Gas industries in this stages, specifically the inefficiency of technology that cause the gas flaring and venting that harms the environment through GHG and other emissions, afterwards, I will study the Kyoto Protocol Mechanisms such as Clean Development Mechanism (CDM) and Joint Implementation (JI) for examine how the mechanisms help stimulate the investment for GHG emission reduction in the Oil & Gas sector and help countries meet their emission targets in a cost-effective way, finally I will view different case study by the type of mechanism from different countries, economic reality and geographical area, particularly in Middle East & North Africa, for verify how the mechanisms under the Kyoto Protocol could affect the improvement of technology development for electricity production in Oil & Gas producing countries and consequently the emission reduction in thus countries.

Intrinsic to any discussion is a clear understanding of what is meant by climate change of the global climate, driven by human activities, has emerged over the past few decades as a major issue of concern. It is now increasingly apparent that the impacts of a changing climate will be significant and widespread. At the same time, it is also clear that tackling the problem of rising greenhouse gas concentrations in the atmosphere will be an enormous undertaking. Given that carbon dioxide emissions from fossil-fuel combustion contribute significantly to the climate problem.

Climate change is a global problem and requires a global solution. In recent years, addressing climate change has been high on the international policy agenda.

CHAPTER 1

Structure of the Study

1.1 Principal components

In this paragraph I describe the principal international organizations and agreements that operate in international framework and could have the principal and crucial influence on global context of emission reduction.

1.1.1 The United Nations Framework Convention on Climate Change

The United Nations Framework Convention on Climate Change (UNFCCC) is the first legally binding international instrument that deals directly with climate change. Presented for signature at the United Nations Conference on Environment and Development in Rio de Janeiro (Earth Summit) in 1992, the Convention immediately drew the signatures of 155 Heads of State and other senior representatives, and after its 50th ratification, took effect on March 21 1994. As of February 17 2003, 194 nations have ratified or acceded the Convention, thus binding themselves to its terms (Boardley, 2003).

UNFCCC was established with the aim to alleviate GHG concentration in the atmosphere at safe levels. Its ultimate objective is stated in Article 2:

> *'... stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.'*

In working to achieve the objective of the Convention, governments agreed on guiding principles set out in Article 3. These are summarized below:

Equity: Parties should protect the climate system '… on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities' (Article 3.1). This principle has been used to justify the requirement that industrialized countries should act first to mitigate emissions. Historically developed countries have emitted most of the GHGs which are contributing to the heightened atmospheric concentrations. Developed countries also have greater resources to tackle the issue. Developing countries on the other hand appear to be more vulnerable to the impacts of climate change and have a lower capacity to respond (Article 3.2). However, as a result of rapid economic growth, developing country GHG emissions have increased dramatically. They currently are about equal to developed country GHG emissions, and are projected to significantly exceed developed country emissions in the near future (IPIECA, 2008).

Precaution: This principle recognizes that although there are many uncertainties associated with climate change, waiting for certainty before taking action could make it impossible to avoid serious climate change impacts. The Precautionary Principle states that "Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing such measures…" (Article 3.3).

Sustainable development: The principles of sustainable development and economic growth are highlighted in Article 3.4 and 3.5. Here we find recognition that development and climate change are intrinsically interlinked. Economic growth and development are essential ingredients of successful policies to tackle this issue. Policies and measures dealing with climate change should be cost-effective, delivering global benefits at the lowest possible cost.

Parties to the UNFCCC are those countries that have ratified, accepted, approved, or acceded to, the treaty. The Convention divides countries into three main groupings: Annex I, Annex II and non-Annex I. Each of these groupings has differing commitments. We cover the commitments of UNFCCC Parties in more detail on pages 19 and 18 of this Guide (IPIECA, 2008).

Annex I Parties include the developed countries that were members of the Organization for Economic Cooperation and Development (OECD) in 1992 plus countries with economies in transition (EITs).[1] Annex I parties accepted a voluntary commitment to return their emissions of GHGs to 1990 levels by year 2000. Subsequently, the Kyoto Protocol established legally binding GHG emissions targets for the 2008–12 period for Annex I Parties that are recorded in Annex B of the Protocol.[2] The difference between these two lists is that Belarus and Turkey are Annex I countries, but not Annex B countries.

Annex II Parties consist of the OECD members of Annex I. They accepted a commitment to provide financial aid to non-Annex I Parties to meet their agreed incremental costs under the UNFCCC. Annex II Parties also agreed to transfer environmentally-sound technologies to other Parties, particularly non-Annex I Parties, to enable them to reduce their GHG emissions.

Non-Annex I counties which are developing or least developed nations, on the other hand do not oblige with emission reduction rules unless Annex I nations supply enough funding and technology (UNEP Riso Center on Energy, 2004).

Under UNFCCC, Annex I Nations (Industrialized Countries and the countries undergoing progression of transition to market economy committed to reduce their GHG emissions to year 1990 levels by the year 2000 according Aricle 4.2 (a) and (b) (UNEP Riso Center on Energy, Climate and Sustainable Development 2004)) has agreed to reduce their emission levels to the year 1990 levels by the year 2000 and mitigation of reduced emission are observed by Conference Of Parties (COPs) (IPIECA, 2008).

Funding: Every two years, the Executive Secretary proposes a programme budget, setting out the main tasks to be performed by the Secretariat in the coming biennium and funding

[1] For a list of Annex I Parties to the UNFCCC see: http://unfccc.int/parties_and_observers/parties/items/2352.php.

[2] To see the list of Annex B Parties to the Kyoto Protocol see: http://unfccc.int/essential_background/kyoto_protocol/items/3145.php

needed to carry out this work. This proposal is considered by the SBI, which then recommends a programme budget for approval by the COP. The programme budget is funded by the Parties, whose contributions are based on the UN scale of assessment. The Secretariat also administers two trust funds supported by voluntary contributions from Annex II Parties. The first pays for attendance of one or two non-Annex I Party delegates to each formal UNFCCC or subsidiary body meeting. The other pays for special projects such as workshops between formal meetings. Financial assistance provided by Annex II Parties to non-Annex I Parties is channeled primarily through the Convention's financial mechanism, operated by the Global Environment Facility (GEF), which also serves as the financial mechanism for other UN environmental treaties. Over the 1991–2005 period, approximately US$ 2 billion was provided in grants from the GEF Trust Fund for climate change activities. GEF grants typically attract three times as much money in co-financing from bilateral agencies, recipient countries and the private sector (IPIECA, 2008).

1.1.2 Kyoto Protocol

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change (UNFCCC). The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialized countries and the European community for reducing greenhouse gas (GHG) emissions .These amount to an average of 5% against 1990 levels over the five-year period 2008-2012.

The major distinction between the Protocol and the Convention is that while the Convention encouraged industrialized countries to stabilize GHG emissions, the Protocol commits them to do so.

Recognizing that developed countries are principally responsible for the current high levels of GHG emissions in the atmosphere as a result of more than 150 years of industrial activity, the Protocol places a heavier burden on developed nations under the principle of "common but differentiated responsibilities."(unfccc.int, 2011).

The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005. The detailed rules for the implementation of the Protocol were adopted at COP 7 in Marrakesh in 2001, and are called the "Marrakesh Accords."

Under the Treaty, countries must meet their targets primarily through national measures. However, the Kyoto Protocol offers them an additional means of meeting their targets by way of three market-based mechanisms.

The three mechanisms are:

- International Emissions Trading (IET)
- Joint Implementation (JI)
- Clean Development Mechanism (CDM)

The mechanisms help stimulate green investment and help Parties meet their emission targets in a cost-effective way.

Parties with commitments under the Kyoto Protocol (Annex B Parties) have accepted targets for limiting or reducing emissions. These targets are expressed as levels of allowed emissions, or assigned amounts, over the 2008-2012 commitment period. The allowed emissions are divided into Assigned Amount Units(AAUs).

Emissions trading, as set out in Article 17 of the Kyoto Protocol, allows countries that have emission units to spare - emissions permitted them but not "used" - to trade this excess capacity to countries that are over their targets (unfccc.int, 2011).

Figure 1.1 The Kyoto Flexibility Mechanism (Kamel, 2007).

Clean Development Mechanism (CDM) is one of the "flexibility" mechanisms defined in the Kyoto Protocol (IPCC, 2007), The CDM, defined in Article 12 of the Protocol, allows a country with an emission-reduction or emission-limitation commitment under the Kyoto

Protocol (Annex 1 Party) to implement an emission-reduction project in developing (Non-Annex 1) countries. Such projects can earn saleable Certified Emission Reduction (CER) credits, each equivalent to one tone of CO2, which can be counted towards meeting Kyoto targets (Figure 1.1).

The mechanism known as "joint implementation," defined in Article 6 of the Kyoto Protocol, allows a country with an emission reduction or limitation commitment under the Kyoto Protocol (Annex 1 Party) to earn emission reduction units (ERUs) from an emission-reduction or emission removal project in another Annex 1Party, each equivalent to one tonne of CO2, which can be counted towards meeting its Kyoto target (unfccc.int, 2011).

Joint implementation offers Parties a flexible and cost-efficient means of fulfilling a part of their Kyoto commitments, while the host Party benefits from foreign investment and technology transfer.

Table 1.1 Countries included in Annex B and their emissions targets (unfccc.int, 2011).

The maximum amount of emissions (measured as the equivalent in carbon dioxide) that a Party may emit over the commitment period in order to comply with its emissions target is known as a Party's assigned amount. The individual targets for Annex I Parties are listed in the Kyoto Protocol's Annex B (Table 1.1).

The Protocol mirrors the Convention in recognizing the specific needs and concerns of developing countries, especially the most vulnerable among them. Annex I Parties must thus provide information on how they are striving to meet their emissions targets while minimizing adverse impacts on developing countries.

An Adaptation Fund was established to finance concrete adaptation projects and programs in developing countries that are Parties to the Kyoto Protocol. The Fund is to be financed with a share of proceeds from clean development mechanism (CDM) project activities and receive funds from other sources.

The Kyoto Protocol is generally seen as an important first step towards a truly global emission reduction regime that will stabilize GHG emissions, and provides the essential architecture for any future international agreement on climate change.

By the end of the first commitment period of the Kyoto Protocol in 2012, a new international framework needs to have been negotiated and ratified that can deliver the stringent emission reductions the Intergovernmental Panel on Climate Change (IPCC) has clearly indicated are needed (unfccc.int, 2011).

The targets cover emissions of the six main greenhouse gases, namely:

- Carbon dioxide (CO2);
- Methane (CH4);
- Nitrous Oxide (N2O);
- Hydro Fluorocarbons (HFCs);
- Per Fluorocarbons (PFCs);
- Sulphur Hexafluoride (SF6)

1.1.3 Clean Development Mechanism (CDM)

Clean Development Mechanism (CDM) is the only market based mechanism developed in the Kyoto Protocol, with the joint collaboration between the developed as well as the developing nations existing.

CDM has primarily two objectives:

1- Providing public or private entities from Annex I countries with flexibility in realizing their quantified emission reduction commitments.

2- Assisting non-Annex I countries who host CDM projects in achieving GHG reductions and sustainable development.

CDM projects are done on the voluntary basis with aim to show long-term benefits via climate change mitigation measures. The projects under CDM should be attaining the emission reductions even after the completion of the project (Pasupuleti, 2010).

Each CDM project activity is intended to result in real, measurable and long term GHG emission reduction benefits that are additional to those that would occur in the absent of project.

The CDM is thus conceived as a project-based mechanism that can provide increased flexibility (temporal, geographical, sectoral) to investor countries or companies, which can reduce their overall compliance cost, while providing host countries and local partners with additional funds and environmentally friendly technology for archiving sustainable development (Liguang, 2006).

The mechanism is seen by many as a trailblazer. It is the first global, environmental investment and credit scheme of its kind, providing a standardized emissions offset instrument, CERs.

A CDM project activity might involve, for example, a rural electrification project using solar panels or the installation of more energy-efficient boilers.

*Data as of close business 31 March, 2012

Table 1.2 Number of CDM validation project (unfccc.int, 2012).

The mechanism stimulates sustainable development and emission reductions, while giving industrialized countries some flexibility in how they meet their emission reduction or limitation targets. A CDM project must provide emission reductions that are additional to what would otherwise have occurred. The projects must qualify through a rigorous and public

registration and issuance process. Approval is given by the Designated National Authorities. Public funding for CDM project activities must not result in the diversion of official development assistance.

Operational since the beginning of 2006, the mechanism has already registered more than 4576 projects and is anticipated to produce CERs amounting to more than 2.9 billion tones of CO2 equivalent in the first commitment period of the Kyoto Protocol, 2008–2012.

Figure 1.2 Number of projects entering validation (unfccc.int, 2012),

1.1.4 Baseline and monitoring methodologies

The Clean Development Mechanism (CDM) requires application of a baseline and monitoring methodology in order to determine the amount of Certified Emission Reductions (CERs) generated by a mitigation project in a project host country. Methodology are classified into four categories (unfccc.int, 2010):

- Methodologies for large scale CDM project activities;
- Methodology for small scale CDM project activities;
- Methodology for large scale afforestation and reforestation (A/R) CDM project activities;
- Methodology for small scale A/R project activities.

Each methodology summary sheet provides the following information:

- Typical project(s) to which the methodology is applicable;
- Type(s) of greenhouse gas emission mitigation action;
- Important conditions for application of the methodology;
- Key parameters that need to be determined or monitored;
- Visual description of baseline and project scenarios.

There are two ways for finding a suitable methodology:

- Categorization by mitigation activity type;
- Categorization by applied technology type/measure.

The first way of looking up methodologies is according to the relevant sectoral[3] scopes and type of mitigation activities such as renewable energy, low carbon electricity generation, energy efficiency measures, fuel and feedstock switch, GHG destruction, GHG emission avoidance, displacement of a more-GHG-intensive output and GHG removal by sinks. Project developers knowing the type of mitigation activity to be implemented in their projects can thus easily identify potentially suitable methodology (unfccc.int, 2010).

Sectoral scopes (energy sectors – generation, supply and consumption) are first distinguished according to:

- Electricity generation and supply;
- Energy for industries;
- Energy (fuel) for transport;
- Energy for households and buildings.

And then categorized in terms of type of mitigation activity:

- Displacement of a more-GHG-intensive output:
    i. Renewable energy;
    ii. Law carbon electricity
- Energy efficiency;
- Fuel and feedstock switch.

[3]The methodology categorization table allocates the methodology to the sectoral scope(s) that have been formally defined for it, which are primarily used as the basis of DOE accreditation. However, if there are additional sectoral scopes that are also applicable to the methodology, then the methodology is also shown in these sector in the table. This is to make it potentially easier to look up the methodology.

Other sectors are categorized according to these mitigation activities:

- Displacement of a more-GHG-intensive output;
- Renewable energy;
- Energy efficiency;
- GHG distraction;
- GHG emission avoidance;
- Fuel switch;
- GHG removal by sinks.

The second way of looking up methodology focuses on the technology applied in the project. The categorization by technology type enables project developer to identify a set of comparable methodologies applicable to the technology that is going to be implemented in their projects.

There has been distinct development phases of methodology over time, leading to "families" when one methodology catalyzed the development of other methodologies[4] (unfccc.int, 2010):

- Methodology for renewable electricity,
- Methodology for renewable energy (thermal or mechanical energy),
- Methodology for efficient or less-carbon-intensive fossil-fuel-fired power plants,
- Methodology for fuel switch,
- Methodology for biofuel,
- Methodology for industrial energy efficiency,
- Methodology for household & building energy efficiency,
- Methodology for feedstock switch,
- Methodology for industrial gases,
- Methodology for waste management and wastewater,
- Methodology for transport,
- Other methodologies,

[4]The concept of methodology families and family trees was initially adopted in the following guidebook: Understanding CDM Methodologies: A guidebook to CDM Rules and Procedures, written by Axel Michaelowa, Frédéric Gagnon-Lebrun, Daisuke Hayashi, Luis Salgado Flores, PhlippeCrête and Mathias Krey, commissioned by the UK Department for Environment Food and Rural Affairs (© Crown Copyright 2007).

There are more than 149 methodologies in CDM projects activity that are classified into four categories as mentioned above, few of these mechanism could be use in the Oil & Gas industry.

The Oil & Gas industry is usually divided into three major components:

- Upstream,
- Midstream,
- Downstream,

The upstream oil sector is a term commonly used to refer to the searching for and the recovery and production of crude oil and natural gas. The upstream oil sector is also known as the Exploration and Production (E&P) sector. The upstream sector include the searching for potential underground or underwater oil and gas fields, drilling of exploratory wells, and subsequently drilling and operating the wells that recover and bring the crude oil and/or raw natural gas to the surface.

The midstream processes, stores markets and transports commodities such as crude oil, natural gas, natural gas liquids, liquefied Natural Gas and sulphur. Midstream operations are usually include in the downstream category.

The downstream is the term commonly used to refer to the refining of crude oil and the selling and distribution of natural gas and products derived from crude oil. Such products include Liquefied Petroleum Gas (LPG), gasoline or petrol, jet fuel, diesel oil, other fuel oils, asphalt and other petroleum coke. The downstream sector include oil refineries, petrochemical plants, petroleum product distribution, retail outlets and natural gas distribution companies.

In the Oil & Gas sector there are 7 CDM methodologies that we can classified them into the three categories mentioned above:

Approved methodologies in the Oil & Gas sectors are (CDM methodology, 2010):

- Upstream;
    - AM0009: Recovery and utilization of gas from oil wells that would otherwise be flared or vented, 11 projects registered,
    - AM0077: Recovery of gas from wells that would otherwise be vented or flared and its delivery to specific end-users,
- Midstream;

- AM0043: Leak reduction from a natural gas distribution grid by replacing old cast iron pipes or steel pipes without catholic protection with polyethylene pipes,
- AM0023: Leak reduction from natural gas pipeline compressor or gate stations, 8 projects registered,

- Downstream;
  - AM0055: Baseline and monitoring methodology for the recovery and utilization of waste gas in refinery facilities, 4 projects registered,
  - AM0037: Flare (or vent) reduction and utilization of gas from oil wells as a feedstock, 3 projects registered,

Usually these projects are in developing (oil & gas producing) countries, adaptation to climate change in developing countries is vital and has highlighted by them as having a high or urgent priority.

Developing countries have limitation in capacity making adaptation. Limitations include both human capacity and financial resources.

This projects could be realized with a joint collaboration between developed nations who are the investors of CDM projects and developing nations who host the CDM projects.

For analyzing the CDM methodologies in oil & gas sector, I am going to use the different case studies that all of them are the developing countries specially the oil & gas producing nations.

For analysis I will have a review on:

- General description of project activity and the aim of the project,
- Application of a baseline and monitoring methodology,
- Duration of the project activity,
- Environmental impact,

1.2 Global Gas Flaring Reduction (GGFR)

Flare and vent systems are widely used in the oil and natural gas industry, to dispose of waste volumes of hydrocarbon gases and vapors. For more than a decade, flaring and venting of associated gas (AG) has remained stable at a level representing global emissions of

greenhouse gases (GHG), the World Bank estimates that over 134 Billion cubic meters of natural gas are flared or vented annually.

The Global Flaring Reduction Public-Private Partnership was launched at the World Summit on Sustainable Development (WSSD). The aim of the Partnership is to support national governments, development agencies and the petroleum industry in their efforts to reduce the environmentally damaging flaring and venting of gas associated with extraction of crude oil.

Gas flaring reduction activities capture the gas produced at the oil extraction source and channel it to more useful outlets, including the power generation industry and for use in households. The Partnership enables private investment in pipelines and other infrastructure that makes this capturing possible.

Launched at the world summit on Sustainable Development in August 2002, the Global Gas Flaring Reduction public-private partnership (GGFR) brings around the table representatives of governments of oil-producing countries, state-owned companies and major international oil companies so that together they can overcome the barriers to reducing gas flaring by sharing global best practices and implementing country specific programs.

The GGFR partnership, a World Bank-led initiative, facilitates and supports national efforts to use currently flared gas by promoting effective regulatory frameworks and tackling the constraints on gas utilization, such as insufficient infrastructure and poor access to local and international energy markets, particularly in developing countries (worldbank.org, 2012)

Poverty reduction is also an integral part of the GGFR program, which is developing concepts for how local communities close to the flaring sites can use natural gas and liquefied petroleum gas (LPG) that may otherwise be flared and wasted. The program has already evaluated opportunities for small-scale gas utilization in several countries (worldbank.org, 2012).

The GGFR considers the CDM an important means to achieve flaring reductions and also sees such projects to be central to the objectives of the Kyoto Protocol. With the entry into force of the Kyoto Protocol on 16 February 2005 the importance of the CDM in the GGFR's work program has taken on new significance.

1.2.1 The facts

Over 134 billion cubic meters (or 5,3 trillion cubic feet) or natural gas are being flared and vented annually. The gas flared annually is equivalent to 25 percent of the United States gas consumption, 30 percent of the European Union's gas consumption, or 75 percent of Russia's gas exports. The gas flared yearly also represents more than the combined gas consumption of Central and South America. The annual 35 bcm (or 1,2 trillion cubic feet) of gas flared in Africa alone is equivalent to half of that continent's power consumption.

*Coverage limited to Gulf of Mexico, Alaska, and partial continental USA

Table 1.3 Estimated flared volume from satellite data 2006-2010 (worldbank.org, 2012).

Flaring gas has a global impact on climate change by adding about 400 million tones of CO2 in annual emissions. Fewer than 20 countries account for more than 70 percent of gas

flaring and venting. And just four countries together flare about 70 billion cubic meters of associated gas.The following figure (Figure .3) demonstrates the top 20 flaring countries and their emission from 2006 to 2010 (worldbank.org, 2012).

The majority of GGFR partners have now agreed to endorse a voluntary standard to eliminate venting and reduce flaring significantly within five to ten years by finding commercial users for the associated gas through increased collaboration between countries.

The Standard also implies that countries that have endorsed it will avoid flaring in new oil developments, if economically feasible.

The voluntary Standard, which was developed by operators and governments, also encourages an integrated approach to the utilization of associated gas and provides a framework for governments, companies and other key stakeholders to consult with one another, take complementary action and publish figures flaring and venting volumes in a unique web-based data tool developed GGFR partners.

Since the Steering Committee on June 30, 2003, the GGFR Partnership has again expanded significantly. As a result overall funding has improved and around 90% of the work program for the global deliverables and initial GGFR Partner countries is now funded. The extended work program including additional target countries would be covered for 75%. The work program is being implemented, with global activities maturing and work in several countries starting based on previously agreed country work programs.

Considerable progress was made on a common global standard for gas flaring and venting. The standard is focusing on gas market development, optimal hydrocarbon production, and sustainable development. The direction of the standard is no continuous flaring and venting unless alternatives are demonstrated to be unfeasible. Criteria for unfeasible and instruments to assess such a situation include integrated economics rather than incremental gas economics, with safeguards to protect against unreasonable requirements. Continuous improvement toward an end goal of "no continuous or non continuous venting or flaring of associated gas," measuring, public reporting, and independent verification on emissions and reduction performance are among the standard's attributes (worldbank.org, 2012).

1.2.2 Commercialization

Commercialization discussions with Partners continued with the objective to facilitate utilization of otherwise flared gas in GGFR focus countries through identification of projects and reduction of barriers. This has resulted in several items in the country work programs, such as work on market development and access, regulatory/legal/fiscal/incentives frameworks, and removal of associated gas utilization barriers (worldbank.org, 2012).

1.2.3 Additional target countries

Indonesia has decided to join the GGFR Partnership, and the proposed work program includes a countrywide review of associated gas utilization and carbon credit capacity building. A study on the flaring situation in Russia and possible benefits to the country of gas flaring reduction in terms of revenue, balance of payment impact etc. has started with results expected before the next steering committee. Venezuela was visited and a notional work program has been discussed. Discussions with Equatorial Guinea are planned during a conference focusing on the country in Houston in November. In the Middle East, Iran is the most significant flaring country and has invited Bank Operations to discuss flaring reduction assistance. GGFR joined the Bank mission scheduled in December 2003. Mexico and Brazil were visited previously (worldbank.org, 2012).

1.2.4 Measures of Success

The GGFR team is developing success measures for the entire Partnership as well as some underlying measures for the team itself.

Some 70-80% of global flaring is occurring in 10-15 countries, and participation of all those governments and their national oil companies in GGFR, in combination with participation of the major international oil companies active in those countries, would significantly facilitate global flaring reduction (worldbank.org, 2012).

1.3 International Relations

The risks posed by climate change are real and its impacts are already taking place. In 2007 the UN Security Council held its first debate on climate change and its implications for international security. The European Council has drawn attention to the impact of climate

change on international security and in June 2007 invited the High Representative and the European Commission to present a joint report to the European Council in Spring 2008.

The science of climate change is now better understood. The findings of the Intergovernmental Panel on Climate Change demonstrate that even if by 2050 emissions would be reduced to below half of 1990 levels, a temperature rise of up to 2ºC above pre-industrial levels will be difficult to avoid. Such a temperature increase will pose serious security risks that would increase if warming continues. Unmitigated climate change beyond 2ºC will lead to unprecedented security scenarios as it is likely to trigger a number of tipping points that would lead to further accelerated, irreversible and largely unpredictable climate changes. Investment in mitigation to avoid such scenarios, as well as ways to adapt to the unavoidable should go hand in hand with addressing the international security threats created by climate change; both should be viewed as part of preventive security policy.

Climate change is best viewed as a threat multiplier which exacerbates existing trends, tensions and instability. The core challenge is that climate change threatens to overburden states and regions which are already fragile and conflict prone. It is important to recognize that the risks are not just of a humanitarian nature; they also include political and security risks. Moreover, in line with the concept of human security, it is clear that many issues related to the impact of climate change on international security are interlinked requiring comprehensive policy responses (Climate Change and International Security, 2008).

The Middle East and North Africa (MENA) region is particularly vulnerable to climate change. It is one of the world's most water-scarce and dry regions; with a high dependency on climate-sensitive agriculture and a large share of its population and economic activity in flood-prone urban coastal zones. On the other hand, societies of this region have been under pressure to adapt to water scarcity and heat for thousands of years, and have developed various technical solutions and institutional mechanisms to deal with these environmental constraints.

An increasing level of awareness is building among all stakeholders in the MENA region on the significance of climate change, reflecting both the global increase in awareness of the phenomenon, as well as mounting concerns in the region about increasingly frequent droughts and a looming water supply shortage. While ultimately, effective adaptation to climate change will depend on countries' commitment, the Bank has a key role to play in mainstreaming adaptation measures in MENA's development agenda (worldbank.org, 2010).

According to the latest IPCC assessment, the climate is predicted to become even hotter and drier in most of the MENA region. Higher temperatures and reduced precipitation will increase the occurrence of droughts, an effect that is already materializing in the Maghreb. It is further estimated that an additional 80–100 million people will be exposed by 2025 to water stress, which is likely to result in increased pressure on groundwater resources, which are currently being extracted in most areas beyond the aquifers' recharge potential. In addition, agriculture yields, especially in rainfed areas, are expected to fluctuate more widely, ultimately falling to a significantly lower long-term average. In urban areas in North Africa, a temperature increase of 1-3 degrees could expose 6–25 million people to coastal flooding. In addition, heat waves, an increased "heat island effect," water scarcity, decreasing water quality, worsening air quality, and ground ozone formation are likely to affect public health, and more generally lead to challenging living conditions.

Global models predict sea levels rising from about 0.1 to 0.3 meters by the year 2050, and from about 0.1 to 0.9 meters by 2100. For MENA, the social, economic, and ecological impacts are expected to be relatively higher compared to the rest of the world. Low-lying coastal areas in Tunisia, Qatar, Libya, UAE, Kuwait, and particularly Egypt are at particular risk (worldbank.org, 2010).

1.4 Impacts of Climate Change on Regional Development

Much of the progress so far achieved by countries in the region to tackle challenges of high unemployment and integration with the global economy can be jeopardized by climate change. Income and employment may be lost as a result of more frequent droughts in rural areas, and to floods and sea surges in urban and coastal areas. Changes in temperature and precipitation patterns may result in damage to strategic economic sectors such as tourism or others with growth potential such as high-value-added agriculture. The combination of such impacts is likely to slow down the reform process and ultimately offset the growth benefits generated by high oil prices.

Climate change also poses many challenges to the region's cities, which represent hubs for economic, social, cultural and political activities. Rising sea level could affect 43 port cities—24 in the Middle East and 19 in North Africa. In case of Alexandria, Egypt, a 0.5 meter rise would leave more than 2 million people displaced, with $35 billion in losses in land, property,

and infrastructure, as well as incalculable losses of historic and cultural assets (World Bank, 2010).

Security of Oil & Gas sector is always high on the agenda of governments in importing countries as well as for the governments of producing countries. Today 10 countries possess over 100 trillion cubic feet of gas (tcf) of proven reserves – The USA, Venezuela, Russia, Iran, Iraq, Qatar, Saudi Arabia, the UAE, Algeria and Nigeria. All of these will be significant over the next decade.

Lengthening supply chains and growing inter-dependence underlie the growing geo-political tensions to oil and gas. Geo-politics will play a large part of course, a mutual trust between the oil &gas producing and producer countries could certainly enhance the security in energy sector and increasing an effective improvement in international relations especially in the critical areas.

1.5 Conclusion

It is now increasingly apparent that the impacts of a changing climate will be significant and widespread. At the same time, it is also clear that tackling the problem of rising greenhouse gas concentrations in the atmosphere will be an enormous undertaking.

Climate change is best viewed as a threat multiplier which exacerbates existing trends, tensions and instability. The core challenge is that climate change threatens to overburden states and regions which are already fragile and conflict prone. It is important to recognize that the risks are not just of a humanitarian nature; they also include political and security risks.

The international most important environmental organizations have a significant and important rule in emission reduction issue in the world, the objective and aim of the organizations is supporting national governments, development agencies and industries and help them in their efforts to reducing the environmentally damaging emissions.

CHAPTER 2

Flaring of Associated Gas Issue in the Oil and Gas Sector

Associated gas flaring is one of the most challenging energy and environmental problems facing the world today. Approximately 150 billion cubic meters of natural gas are flared in the world each year, representing an enormous waste of natural resources and contributing 400 million metric tons of CO2 equivalent global greenhouse gas emissions. Environmental degradation associated with gas flaring has a significant impact on local populations, often resulting in loss of livelihood and health issues.

Gas flaring has been part of the oil industry from its inception. Associated gas, or solution gas, separates from the oil as a result of the pressure change between the oil producing formation and the surface (Farina, 2010).

As a byproduct of oil production, it is secondary to the value of the oil, and often in developing countries or areas for from gas markets, the least cost method of disposing of the gas is by flaring.

2.1 Nature, magnitude, and distribution of source

The oil and gas sector is perhaps the most complex source category. It could be divided into three broad categories:

- Oil and gas production;
- Crude oil transportation and refining;
- Natural gas processing, transportation and distribution;

There is much greater diversity in the industry than what is implied in these simple groupings; particularly in the area of oil and gas production. A more detailed breakdown of the industry is provided in Table 2.1.

Typically, the emissions potential and speciation profile varies dramatically between each of the industry segments and subcategories shown. The key factors that affect the amount of fugitive emissions from a given operation, are the amount and type of infrastructure employed, the integrity of the system, the amount of waste gas created and the incentives or requirements to control waste-gas volumes and reduce fugitive emissions. Since fugitive emissions are primarlly methane with a Global Warming Potential of 21 century, the impact on the atmosphere is far greater than their absolute level (Picard, 1999).

Regulations and pricing/economic incentives are usually the most significant factors affecting the amount of fugitive emissions from venting and flaring. Emissions from fugitive equipment leaks are proportional to the amount of process infrastructure and are a general reflection of the quality of the equipment components, and inspection and maintenance programs. Typically, the amount of emissions from fugitive equipment leaks is lowest where the process fluid is highly toxic (e.g., contains H2S) or has been odourised (Picard 1999).

Most of the fugitive greenhouse gas emissions from the oil and gas systems are methane losses from production activities, natural gas processing, transportation and distribution. The amount of fugitive emissions per unit of throughput tends to decrease downstream through both types of systems, for example, specific fugitive emissions of greenhouse gases are usually much greater from gas production than gas distribution.

Oil systems and gas systems are also significant sources of these gases. SO2 emissions are attributed to the flaring or incineration of sour waste gas and acid gas streams, and to inefficiencies in sulphur recovery units at sour gas processing plants, upgraders and refineries. CO2 emissions are a product of all flaring and incineration activities (Picard, 1999).

Table 2.1 Major Categories and Subcategories in the Oil & Gas Industry (Picard, 1999),

2.2 General description of oil and gas industry

Natural gas and oil infrastructure account for over 20 percent of global anthropogenic methane emissions. Methane gas emissions occur in all sectors of the natural gas and oil

industries, from drilling and production, through processing and transmission, to distribution and even end-use as a fuel.

This section provides a brief and general overview of most oil and gas field processing operations (Figure 2.1) common in this industry. The points A and B show the potential emission in an oil and gas industry.

Figure 2.1 Typical crude Oil processing and potential emissions (Visser & De Lardeler, 1997).

2.2.1 Process description

The petroleum industry is organized into the following four broad segments:

- Exploration and production;
- Transportation to Refineries;
- Marketing or distribution;

The oil and gas field production and processing operations begin with exploration to locate new sources of crude oil and natural gas. When potential sources are located, wells are drilled to confirm the presence of oil or gas and to determine whether the reserves are economically sufficient to support production. During production, crude oil and/or natural gas is recovered from wells and prepared for transportation from the field. Trucks, rail cars, barges and tankers

are used to transport domestic crude oil to refineries. Domestic crude oil can also be transported from the field to refineries by a complex network of pipelines. Natural gas, which may be produced alone or in combination with crude oil, often must be processed at a gas plant to make it suitable for consumer use (Rucker and Strieter, 1992).

2.2.2 Emission sources in an oil and gas facility

Emissions from oil and gas field processing operations (Table 2.2) result from both controlled and uncontrolled sources. In addition to emissions from the sources described below, emissions result from process upsets such as pressure relief device releases due to over-pressure (Eastern Research Group, Inc., 1999).

Table 2.2 Summery of potential emission in an oil and gas facility (Eastern Research Group, Inc., 1999)

2.3 General description of Flaring Venting and reinjection

In recent years, the exploration and production industry has significantly improved gas liquefaction technologies - technologies which until recently could only be applied to the largest gas reserves. In the situation where the associated gas cannot be commercialized, only three options remain:

- Flaring;
- Venting;
- Reinjection and store it in the underground formations from which the oil is being recovered.

2.3.1 Flaring of associated gas

Flaring is the controlled burning of natural gas in the course of routine oil and gas production operations. This burning occurs at the end of a flare stack or boom.

A complete flare system consists of the flare stack or boom and pipes which collect the gases to be flared. The flare tip at the end of the stack or boom is designed to assist entrainment of air into the flare to improve burn efficiency. Seals installed in the stack prevent flashback of the flame, and a vessel at the base of the stack removes and conserves any liquids from the gas passing to the flare. Depending on the design, one or more flares may be required at a production location. A flare is normally visible and generates both noise and heat. (Kearns, John; Armstrong, Kit; Shirvill, Les; Garland, Emmanuel; Simon, Carlos; Monopolis, Jennifer, 2000).

The gas-flaring problem is a classic case of failing to account for the real costs of energy production on local populations coupled with failures in government policy that have allowed the issue to continue. Governments with non-transparent policies and weak environmental regulations are particularly likely to flare large amounts of gas. The problem is exacerbated through policy distortions related to subsidized hydrocarbon and electricity pricing, as well as ineffective oversight and enforcement measures (Farina, 2010).

Gas is flared in oil operations for obvious safety reasons. Flaring systems are designed to protect personnel and equipment during emergencies or processing disruptions. However, in

some cases, the lack of immediate and economic options for the associated gas, coupled with the desire to accelerate and maximize oil production, drives significant amounts of gas flaring. Some of the largest wasted gas streams occur in remote areas where the lack of outlets and small volumes of gas often do not justify the expense of gathering.

Lack of monitoring equipment and limited oversight make it difficult to quantify the scale of gas flaring around the world. For example, in Russia, only half of the flares in the Khanty-anski region have flow monitors (Farina, 2010).

In addition, many countries do not publicly report gas flaring volumes, leading to significant uncertainty regarding the magnitude of the problem. In fact, to avoid scrutiny, it may be in the producer's or government's interest to limit access to data on gas flaring levels. Much of the official information on the amount of gas flaring comes from environmental ministries or statistical agencies within various governments. However, during the last decade, increased use of military satellites and sophisticated computer programs has been used to measure gas flaring. These efforts seek to correlate light observations with intensity measures and flare volumes to produce credible estimates of global gas flaring levels.

The cost of gas flaring can be measured in terms of greenhouse gas emissions, and the value of avoiding those emissions in evolving carbon markets. There is also a significant and measurable economic cost in terms of lost revenue that otherwise could be generated if flared natural gas was captured and sold into whatever end-use outlets exist in that region. Calculating costs in terms of health impact on local populations or lost output from degraded agricultural output and fisheries are somewhat more difficult. Environmental groups make the case that the unrecognized costs of development often far exceed the value of the oil. Still, others focus on sustainable development approaches that can unlock the value of the resources while reducing costs on communities. In most cases, change starts with a fuller accounting of environmental impacts, sound regulation, and more transparency on oil production revenues and costs (Farina, 2010).

The World Bank estimates that over 150 billion cubic meters (or 5,3 trillion cubic feet) of natural gas are being flared and vented annually. That is equivalent to 25 per cent of the United States' gas consumption or 30 per cent of the European Union's gas consumption. And the annual 40 bcm (or 1,4 trillion cubic feet) of gas flared in Africa alone is equivalent to half of that continent's power consumption. Flaring gas also has a global impact on climate change

by adding about 400 million tons of CO2 in annual emissions. This is more than the potential yearly emission reductions from projects currently submitted under the Kyoto mechanisms (Figure 2.2) (GGFR, 2008).

Figure 2.2 Gas consumption vs. Global flaring 2007

2.3.2 Venting

Venting is the controlled release of gases into the atmosphere in the course of oil and gas production operations. These gases might be natural gas or other hydrocarbon vapors, water vapor, and other gases, such as carbon dioxide, separated in the processing of oil or natural gas.

In venting, the natural gases associated with the oil production are released directly to the atmosphere and not burned. Safe venting is assured when the gas is released at high pressure and is lighter than air. Because of the strong mixing potential of high-pressure jets, the hydrocarbon gases discharged mix well with the air down to safe concentrations at which there is no risk of explosion. Venting is normally not a visible process. However, it can generate some noise, depending on the pressure and flow rate of the vented gases. In some cases, venting is the best option for disposal of the associated gas. For example, in some cases, a high concentration of inert gas is present in the associated gas. Without a sufficiently high

hydrocarbon content, the gas will not burn and flaring is not a viable option. Sometimes the source of inert gas may come from the process systems. The purging of process systems with inert gas may, in itself, justify venting as the safest means of disposal (Kearns, John; Armstrong, Kit; Shirvill, Les; Garland, Emmanuel; Simon, Carlos; Monopolis, Jennifer, 2000).

However associated gas is explosive and for safety reasons it cannot be vented in large volumes, so the common practice in the industry is the flaring not venting of gas.

2.3.3 Reinjection

Is a practicable option for some oilfields, but not in all cases. In some situations, the geological nature of the underground formations is such that the injected gas would migrate back to the oil production wells too easily, leading to inefficient and energy intensive gas recycling. Even for formations where reinjection is geologically practicable, the oilfield itself may be too small in economic terms to support the additional reinjection infrastructure. Although the current viability of underground gas storage is limited by geology and economics, some companies are investigating ways of making underground storage more attractive (Kearns, John; Armstrong, Kit; Shirvill, Les; Garland, Emmanuel; Simon, Carlos; Monopolis, Jennifer, 2000).

As reinjection requires expensive infrastructure for the drilling on injection wells and for the compression of the gas, this costs more than flaring.

2.4 Flaring issue in oil and gas producing countries

The gas flaring issue is not restricted to the key oil-producing regions. In fact, 45 Bcm per year or about 30 percent of the global total occurs in places outside of the key oil producing countries.

Flaring issues in the Middle East are as varied as the countries in the region. The largest volumes of gas flaring occur in Iran and Iraq. However, Saudi Arabia, Kuwait, Qatar, and other parts of the region have flaring issues. The essence of the flaring issue in the Middle East is not a lack of expertise on oil and gas, or in many cases infrastructure, but how governments either directly or indirectly set the price of gas at very low levels. In most countries in the region, the delivered price of gas is below $1.00 per MMBtu. The low value placed on natural

gas stems from several factors. Associated gas gathering was no practiced for decades at the supergiant oil fields of Saudi Arabia, Iran, Iraq, Kuwait, and other parts of the GCC. In many cases, the large concentration of associated gas reserves could be developed at low cost as a co-product of oil production. In the last decades governments some of these countries have encouraged gas use for industrial petrochemicals and power generation (Farina, 2010).

The variation in types of gas supply available and limited interregional trade drive each country to approach the flaring issue differently. In addition to the vast associated gas reserves in the region, some countries, like Qatar and Iran, have enormous concentrated supplies of non-associated gas that can also be produced at relatively low cost. The issue for flare gas reduction is prices, are typically administered at an average level based on the average costs of the giant concentrated gas resources. However, at sites where gas is sour, or at isolated smaller sites, gas gathering and processing costs are higher than average. As a result, often it has been more economical to flare hard-to-handle gas than to develop it into gas systems. In Iran, the mandated low price of gas, under investment in gas infrastructure, and international sanctions are driving gas flaring. The country is in the process of expanding pipeline infrastructure to better connect isolated locations. In addition, Iran will likely need to increase its use of re-injection and power in the oil field to drive pumps and compression to offset natural decline in its larger oil fields. However, until the issues around Iran's nuclear program are resolved, access to advanced gas technology will likely be limited (Farina, 2010).

Iraq has the same pricing issues of other regions, but the security situation and devastation accompanying the war have hurt the situation. Even before the U.S. invasion, data indicated Iraqi gas flaring was at high levels. Both satellite and reported data sources indicated seven to 10 Bcm per year of gas flaring. After the war, damage to gas processing sites in the south was extensive and remains unaddressed. Iraqi oil production is concentrated in the Kurdish provinces to the north and in the southeast portion of the country near Basra. Gas processing capacity is limited at key sites where oil production exists and is expected to grow rapidly.

Flaring has been rising in Latin America in particular. Mexico has shown a large increase in flaring over the last few years despite falling crude production. The problem largely stems from insufficient gas processing capacity to handle nitrogen rich associated gas from the Cantarell reinjection program. This problem is expected to be resolved over the next few years as new processing plants are brought into service highlights the need to anticipate and

synchronize oil and gas investments. Further south, as crude oil production has increased in Brazil, offshore flaring has increased. The Brazilian regulator ANP has been imposing rules on producers, primarily Petrobras, to address the problem and a number of associated gas concepts, including floating LNG and GTL, are being tested to handle growing output from their prolific sub-salt fields (Farina, 2010).

Even in the United States and Canada where regulatory focus on emissions is high, gas flaring remains a problem at times. In remote oil fields in the western United States, like the Bakkan fractured oil shale play, and in parts of Wyoming, gas flaring has increased sharply. Gas processing and gathering pipeline capacity has not been able to keep up with booming drilling activities.

In Nigeria, a multi-decade legacy of gas flaring has been a flashpoint for conflict in the Niger Delta region. While much still needs to be done, the Nigerian government and international producers have succeeded in cutting flaring by 28 percent from 2000 levels. A number of factors have driven investment to reduce flaring, including: higher oil prices, increased government stability, additional regulatory oversight, pressure from NGOs, and international focus on sustainability practices of the regions oil companies. However, the path toward reductions has been painfully slow (Farina, 2010).

The challenge in Nigeria is to enact effective policies that simultaneously build a dynamic energy sector, foster local economic development, improve security, and enhance government commitment to regulation and enforcement. In addition, there is a strong need to develop new gas infrastructure across the entire value chain, including the power sector.

Clearly, the situation in Nigeria is complex, the keys to Nigeria's success will be good governance, better security, operational best practices, new partnerships, and commitment to investment (Farina 2010).

Gas flaring is also a problem in Asia, especially at offshore sites and in remote onshore locations. Indonesia has been a clear success story as reform of the petroleum sector at the beginning of the decade has fostered development of a competent regulator in the form of BP Migas, and an increasingly savvy national oil company, Pertamina. In Indonesia, local and federal partnerships coupled with effective gas value chain investments and external financing have reduced flaring. Challenges will continue as new oil projects in Indonesia will be in the

more remote Kalimantan, Sulawesi, and Irian Jaya (Papu) regions further from existing gas and power networks being expanded on Java and Sumatra.

China has some offshore gas flaring, but the bulk of flaring is likely the result of a lack of gas infrastructure in the western and northern regions of the country. In general, more gas infrastructure is a key enabler of reduced flaring across the region. However, there is typically a need for government support to underwrite development of these new gas grids (Farina, 2010).

2.5 Local and global environmental impact of flaring gas

Gas flaring is associated with the release of a large number of pollutants. Improper combustion, as indicated by smoke from the flare stack, contributes to increasing the hazardous chemicals released into the environment including volatile organic compounds (GGFR, 2004).

Most gas flaring reduction is in essence a question of changing the purpose of the combustion at the oil field from gas elimination (flaring) to gas use, (for example, power production), or of moving the combustion away from the field—normally to a load center where it will be combusted for industrial or power production purposes. The local environmental effects of flaring therefore depend on the efficiency and location of the combustion process and which type of fuel is replaced by gas use. In conclusion, the local effects are project specific and must be analyzed on a case-by-case basis (GGFR, 2004).

Beside constituting a waste of economically valuable resources, flaring and venting are also significant contributors to global warming. Reduced flaring implies reduced carbon dioxide (CO_2) emissions, the amount of which depends on whether the gas is reinjected or replaces other fossil fuels such as diesel or coal. This reduction in CO_2 not only benefits the country that achieves the emission reductions, but constitutes a contribution to global efforts to limit CO_2 emissions with the objective of preventing climate change. CO_2 emission reductions constitute a service to the global community by reducing the risk of damage to human health, water systems, agriculture, and fishing resulting from climate change. At the same time, Emissions Trading, Joint Implementation, and the Clean Development Mechanism under the Kyoto Protocol represent opportunities for the countries which restrict gas flaring to capture part of the global public benefits of emission reductions (GGFR, 2004).

2.6 Flaring of associated gas reduction

Countries that have deliberately focused on development of their gas industry have usually been able to dramatically reduce gas flaring. As industry structures, infrastructure, and regulatory processes mature, previously flared gas tends to be used. However, this is not always the case. Gas flaring is most serious in places where investment is difficult (Nigeria, Iraq, Iran), especially where oil projects are extremely remote (West Siberia, Deep Offshore, and so on). A wide range of technology options exists to eliminate flaring, but each country or region has slightly different issues (Farina, 2010).

2.6.1 The additionality criterion

A flaring reduction project, as with any other CDM project activity, must demonstrate that the emission reductions are additional to those that would have occurred in the absence of the CDM project. In other words, project developers will need to show that the project goes beyond BAU in the area the project will be located. As there is currently very little experience testing the additionality of gas flaring reduction, standardized methodologies have not been developed and the additionality of projects will have to be assessed on a case-by-case basis. For flaring reduction projects, it is particularly important to examine regulatory issues, market barriers and financial viability (GGFR, 2003):

- Regulatory—This criterion examines whether the project is required under existing or contemplated legal/regulatory frameworks;
- Market barrier removal—This criterion examines whether the project faces market barriers that prevent its implementation;
- Financial viability—This criterion examines the commercial viability of the project, though without necessarily excluding project activities with a high internal rate of return (IRR).

2.6.2 Energy security

Flare reductions have been driven by a combination of concerns at the beginning of the decade over the reliability of the gas supply in Europe and North America and over relatively

high North American gas prices. These forces, for example, were a key factor in sanctioning of the associated gas liquefied natural gas (LNG) projects in West Africa for the Atlantic basin (Farina, 2010).

There are three main barriers to flare gas utilization:

1- Lack of regulatory oversight;
2- Limited access to domestic and external gas outlets; and
3- Financing challenges.

As with many energy issues, flare reduction requires a difficult balance between public and private interests. Private industry is very effective in allocating resources, deploying technology, and in most cases assessing risk.

However, government must set a level playing field, develop effective legal frameworks, and offer a generally stable environment for business. Governments can also help by setting up a regulatory structure that encourages companies to internalize the environmental externalities and limit unnecessary waste from flaring. They can build capacity and engage in international bodies to enhance access to external financing and clean development funding. Governments can shape investment with tax policy and fuel price reforms, but these may be difficult to implement. The most successful countries seem to use a combination of penalties and incentives along with targeted infrastructure investments that drive up the opportunity cost of flaring associated gas, while simultaneously expanding endues options (Farina, 2010).

2.6.3 Explore local solutions

Local governments are likely to see many of the benefits of reduced pollution or increased energy access, so engaging local officials in addition to the central government can be critical to secure buy-in for projects. Engagement of local utilities is especially critical in power projects.

As new oil projects emerge, governments must explicitly require that oil companies include provisions for utilization of associated gas as they submit plans for development. The governments should be aware of various technology options and, as possible, drive integrated gas and oil investments to avoid new flaring problems. Strengthening central and local government coordination is not enough. Governments must also undertake additional

guarantees such as preferred access to transmission for associated gas projects in order to ease investor risk and attract external sources of capital. Joint venture arrangements can allow parties to pool resources so that one company does not face the full burden of overcoming economic challenges that surround flare gas reduction projects. This can have particular benefit in regions where local economic development is a priority and regional tensions make access by external contractors problematic (Farina, 2010).

Local contractors can also play a vital role in reducing gas flaring. With proper training and guidance, local companies can be equipped to set up, operate, and service distributed generation or small gathering systems for liquids. However, care must be taken not to solely focus on driving local content at the expense of using the right technology and more cost effective solutions. The need for education and training also is critical. This can have particular benefit in regions where local economic development and capacity building is a priority.

2.7 GGFR four key areas of action

The GGFR action plan for reducing gas flaring and venting focuses on four key areas:

1) Commercialization of associated gas;

To reduce gas flaring, the GGFR provides assistance in developing domestic markets for associated gas, and in gaining access to international markets. The GGFR team facilitates demonstration projects for associated gas utilization by establishing partnerships between the relevant stakeholders. It also provides advice to governments (on fiscal legislation), to oil companies (on best practices and carbon credits trading), and to potential gas customers (on market development and gas agreements) (GGFR, 2008).

2) Regulations for associated gas;

International experience shows that effective enforcement of regulations and the provision of the right incentives are crucial to reducing flaring. A recent study on the role of regulation in gas flaring and venting in 44 oil-producing countries found, however, that most developing countries lack efficient, effective regulations on flaring and venting. In many of these countries institutions have inadequate capabilities and overlapping responsibilities. The GGFR Partnership's work on regulations also has focused on enabling the use of associated gas by helping governments create the right incentives such as proper regulatory structures governing

pricing, distribution, shared transport, export facilities, etc. Other important regulatory procedures also include those for approving flaring and venting permits, monitoring flaring and venting volumes, and enforcing operational standards (GGFR, 2008).

3) Implementation of the global flaring and venting reduction standard;

The majority of GGFR partners have now agreed to endorse a voluntary Standard to eliminate venting and reduce flaring significantly within five to ten years, by finding commercial uses for the associated gas through increased collaboration between countries. The Standard also implies that countries and companies that have endorsed it will avoid flaring in new oil developments, if economically feasible.

The voluntary Standard, which was developed by operators and governments, also encourages an integrated approach to the utilization of associated gas and provides a framework for governments, companies, and other key stakeholders to consult with one another, take complementary actions, and publish figures about flaring and venting volumes in a unique web-based data tool developed for GGFR partners (GGFR, 2008).

4) Capacity building to obtain carbon credits for flaring/venting reduction projects;

In 2002, the GGFR released a report on Kyoto Mechanisms for Flaring Reductions which attempts to overcome financial constraints on projects to reduce gas flaring by designing innovative financing mechanisms, including carbon credit trading. GGFR has facilitated flare reduction demonstration projects in Angola, Algeria, Indonesia, Nigeria, and Russia to evaluate their potential to earn greenhouse gas credits through the CDM/JI structure, and to show how carbon credit trading can improve the economic viability of gas flaring reduction projects (GGFR, 2008).

2.8 Expand access for flare and venting reduction financing

Critical investments and pipeline, processing, and storage are required to make it economic to gather the supply and foster gas use. Various forms of credit enhancement including partial risk guarantees are one way to support investment while policy reforms are underway. Other options such as targeted technology funds and carbon partnerships or funds show promise as a way to facilitate projects. The Clean Development Mechanism (CDM) established under the Kyoto Protocol, while a step forward, has proved less than effective to date in driving rapid deployment of gas flaring reductions. Reasons for the ineffectiveness are manifold, but often

the lack of monitoring or ambiguous regulations in producer countries makes it impossible to establish baseline scenarios or to prove investments would not happen. Furthermore, the regulatory burden and transaction costs associated with smaller projects can discourage developers from pursuing outside financing (Farina, 2010).

However, new efforts are emerging that promise to boost threshold economics for CDM investments. These include:

- Efforts by the World Bank's Global Gas Flaring Reduction Initiative (GGFR) and others to streamline and enhance existing CDM methodologies;
- Efforts to recognize gas flare reduction in emerging U.S. carbon emission offset programs; and
- Efforts to clarify that the World Bank's Clean Technology Fund can be used to support pipes and wires projects associated with flare reduction.

These efforts should be encouraged and expanded. The GGFR is already exploring ways to better align the CDM program, or future efforts of similar intent, with the unique flaring characteristics of different regions. U.S. policy makers should examine the potential benefits of extending offsets to gas flaring projects under any future carbon mandate (Farina, 2010).

Finding the right balance between public and private involvement will be a key part of the process. Governments have shown little inclination to be proactive in moving the CDM forward. For example, many African governments did not create a Designated National Authorities (the official national body for the Kyoto Protocol), or created them late, and often staffed them with people who did not understand the CDM at all. Russia, for its part, took until late 2009 to develop legislation relating to joint initiative approval and green investment schemes under Kyoto Protocol and only now are the first projects emerging. Even in cases where the government has done a good job on capacity building, there are issues of perverse incentives (Farina, 2010).

Further examination and deeper international cooperation is required to address the challenges that are limiting the number of gas flaring reduction projects in the CDM pipeline. To date, a host of issues have limited the acceptability of the many flare reduction projects. As discussed earlier, the core of the flaring problem often stems from ambiguous or poorly enforced flaring regulations that provide exceptions that allow flaring. The policies that attach low values to flare gas, making payment of fines preferable to gas system investments,

perpetuate the waste. In the international community flare projects face the stigma of being a considered hydrocarbon industry subsidy. In addition, limited monitoring often makes verifying progress impossible. Within the existing CDM structure, there are individual submissions for each project. As a result, it has been difficult to achieve large-scale reductions. Emerging public-private sector partnerships between oil companies, power generators, carbon finance, and regional bodies are encouraging and will likely create flare gas solutions. The slow progress on project-based approaches has brought focus on various programmatic solutions that might allow for packaging of a number of projects within an overall emissions reduction program (Farina, 2010).

2.9 Conclusion

Flaring and venting are avoidable processes in the production of oil and gas. For reasons that are often a combination of geography and availability of customers for gas, as well as local political factors, some or all of the associated gas produced with the oil is flared.

The gas flaring problem is complex and nuanced. Progress has been made where regulations have been tightened, policies have been modified, or viable outlets could be established. However, additional investments and increased government commitment needs to occur.

Gas flaring reduction has the potential to be one of the great energy and environmental success stories. For the oil and gas industry, the challenge represents a chance to take a leadership role on sustainable resource development and energy efficiency. For producer governments, it is an opportunity to create value from a wasted resource, enable wider access to energy, and mitigate social and political challenges that often accompany the issue.

CHAPTER 3

International Negotiations

Policy discussions truly began with the signing of the UN Framework Convention on Climate Change (UNFCCC) . This convention sets the framework for how countries can work together to address climate change and its impacts. Those that are signed up to the convention meet annually at the Conference of Parties (COP) to assess and discuss the progress towards meeting the targets set out in the convention. The convention was strengthened with the first amendment, the Kyoto Protocol in, which was ratified at COP 3 in Kyoto Japan in 1997, which has more powerful and legally binding targets.

The challenges to policy makers raised by climate change are wide-ranging and the threats posed to society are substantial. It is now widely recognized that reducing greenhouse gas emissions and deforestation are of the greatest urgency and there is, at last, a clear mandate for effective political, technological and financial action on a global scale, although the process for achieving this remains frustratingly elusive. The current actions pledged are still a long way from what is necessary, individual Governments need to take more action to curb emissions.

3.1 Conference of the parties

For stabilization of greenhouse gas concentrations in the atmosphere, at the level that would prevent dangerous anthropogenic interference and at the level where ecosystem can adapt naturally to climate change, during the United Nations Conference on Environmental and Development (UNCED), was produced an international environmental treaty known United Nations Framework Convention On climate Change (UNFCCC) that informally known as the Earth Summit.

For continuing to talk about the concerns and to assess progress in dealing with climate change the parties to the convention have met annually from 1995 in Conferences of the Parties (COP).

3.1.1 What is Conference of the Parties

The conference of the parties (COP) is the supreme decision making body of the Convention. All governments that are party to the Convention are represented at the COP where they review and promote the implementation of the Convention and any other legal instruments that the COP adopts, including institutional and administrative arrangements (unfccc.int 2011).

A key task for the COP is to review the national communications and emission inventories submitted by Parties. Based on this information, the COP assesses the effects of the measures taken by Parties and the progress made in achieving the ultimate objective of the Convention.

The COP meets every year, unless the Parties decide otherwise. The first COP meeting was held in Berlin, Germany in March, 1995. The COP meets in Bonn, the seat of the secretariat, unless a Party offers to host the session. Just as the COP Presidency rotates among the five recognized UN regions - that is, Africa, Asia, Latin America and the Caribbean, Central and Eastern Europe and Western Europe and Others – there is a tendency for the venue of the COP to also shift among these groups (unfccc.int 2011).

3.1.2 Bureau of the Conference of the Parties

The Bureau supports the COP through the provision of advice and decisions related to the ongoing work under the Convention, its conferences and the secretariat, especially at times

when the COP is not in session. The Bureau of is comprised of elected government representatives from each regional group.

The Bureau is mainly responsible for questions of process management. It assists the President in the performance of his or her duties by providing advice and by helping with various tasks (e.g. members undertake consultations on behalf of the President). The Bureau is responsible for examining the credentials of Parties, reviewing the list of IGOs and NGOs, seeking accreditation and submitting a report thereon to the Conference (unfccc.int, 2011).

Traditionally, the Bureau is responsible for advising the President and taking decisions with regard to the overall management of the intergovernmental process. The Bureau has overall responsibility for questions of process. Bureau members often consult with their regional groups on issues. The Bureau is not a forum for political negotiations.

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The secretariat often seeks advice and guidance from the Bureau on relevant matters

3.1.3 Presidency and membership of the Bureau of the Conference of the Parties

- The Bureau of the COP consists of 11 members comprising: the President, Vice Presidents, the Chairs of the subsidiary bodies and the Rapporteur.
- Each of the five regional groups is represented by two Bureau members, with one member from the Alliance of Small Island Developing States (AOSIS).
- Members are elected for an initial term of one year and may serve for not more than two consecutive terms of one year. They remain in office until their successors are elected.
- It is customary to invite a representative of the host country of the next COP to attend meetings of the Bureau if that Party is not already represented on the Bureau (unfccc.int, 2011).

3.1.4 Presidency and Rapporteur

- The post President and Rapporteur are subject to rotation among the five regional groups. When a COP is held at the invitation of a host country, it is customary to elect as President a Minister from that country, taking into account the principles of rotation.
- In the absence of an offer by a Party to host a COP, the session is held at the seat of the secretariat, and the region next in the line of rotation nominates a Minister for the Presidency.
- The President exercises such powers as are conferred by the rules of procedure. The president's main duties are to provide political leadership, to consult on issues and to chair meetings of the Bureau and the COP Plenary (unfccc.int, 2011).

3.1.5 Meeting of the Parties

The COP serves as the Meeting of the Parties to the Kyoto Protocol (CMP). All governments that are party to the Kyoto Protocol are represented, while governments that are not party are observers. The CMP reviews the implementation of the Kyoto Protocol and takes decision to promote its effective implementation.

The CMP meets annually during the same period as the COP. Parties to the Convention that are not Parties to the Protocol are able to participate in the CMP as observers, but without the right to take decisions. The functions of the CMP relating to the Protocol are similar to those carried out by the COP for the Convention.

The first meeting of the parties to the Kyoto Protocol was held in Montreal, Canada in December 2005, in conjunction with the eleventh session of the Conference of the Parties (unfccc.int, 2011).

3.2 Historical view of the conference of the parties

3.2.1 The Berlin Mandate

The first UNFCCC conference of the parties took place in Berlin, Germany from 28 March to 7 April of 1995. In the Berlin Mandate, the COP 1 agreed to begin a process to enable it to take appropriate action for the period beyond 2000, including the strengthening of commitments of Annex I Parties in Article 4.2 (a) and (b) of the Convention, through the adoption of a protocol or another legal instrument. The priority aim (www.iisd.ca)of the Berlin

Mandate is the strengthening of commitments in Article 4.2 (a) and (b) of the Convention for Annex I Parties, both to elaborate policies and measures, and to set quantified limitation and reduction objectives within specified time frames such as 2005, 2010 and 2020 for anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol (Earth Negotiation Bulletin 1995).

3.2.2 The Geneva Mandate

Cop 2 took place from 8 to 19 July 1996 in Geneva, Switzerland and represented the midpoint in a negotiating process begun with the adoption of the "Berlin Mandate" at the first Conference of the Parties in Berlin in March 1995.

The key issues considered at COP2 were:

- the treatment to be accorded the conclusions of the Second Assessment Report of the Intergovernmental Panel on Climate Change (IPCC);
- giving impetus to the Berlin Mandate negotiations.

COP2 analyzed progress being made by developed countries in implementing their existing commitments under the Convention. The COP concluded that Annex I Parties are fulfilling their commitments to "implement national policies and take corresponding measures on the mitigation of climate change". This assessment of Annex I Party performance was balanced by the finding that, according to available information, many Annex I Parties will need to take further action to return greenhouse emissions to their 1990 levels by 2000. Similar language was included in the Ministerial Declaration.

COP2 also concluded that challenges facing Annex I Parties in meeting the aim of returning emissions to 1990 levels by 2000, and efforts being made to address these challenges, will be relevant for the AGBM negotiations on commitments for the post-2000 period (Earth Negotiation Bulletin 1996).

However, Cop 2 with all his debates did not produce any appreciable progress.

3.2.3 The Kyoto Protocol on Climate Change

The Third Conference of the Parties (COP-3) to the United Nations Framework Convention on Climate Change (UFCCC) was held from 1 - 11 December 1997 in Kyoto, Japan. Over

10,000 participants, including representatives from governments, intergovernmental organizations, NGOs and the press, attended the Conference, which included a high-level segment featuring statements from over 125 ministers.

In the Kyoto Protocol, Parties in Annex I of the UFCCC agreed to commitments with a view to reducing their overall emissions of six greenhouse gases (GHGs) by at least 5% below 1990 levels between 2008 and 2012. The protocol also establishes emissions trading, joint implementation between developed countries, and a "clean development mechanism" to encourage joint emissions reduction projects between developed and developing countries (Earth Negotiation Bulletin, 1997).

3.1 Emission commitments for Annex I countries established in Kyoto Protocol (Climate Brief, 1998).

There are 5 Key provisions in Kyoto Protocol (Climate Brief, 1998):

- Commitments by Annex I Countries: The Kyoto Protocol aims to reduce aggregate greenhouse gas emissions from Annex I countries “by at least 5 percent” in the period 2008 to 2012. The gases include carbon dioxide (CO2), nitrous oxide (N2O), methane (CH4), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF6). For accounting purposes, the gases are converted to “carbon dioxide equivalent emissions” based on their 100-year global warming potentials.

The base year for determining reductions is 1990 for the first three gases listed above, and 1995 for the latter three gases. The Protocol contains differentiated targets for the Annex I countries. Compliance will be determined on a 'gross/net' basis, in which commitments are set based on gross emissions, but compliance is measured by the net quantity of emissions from sources plus removals by enhancement of CO2 sinks.

- Commitments by all Parties: General language is included about all Parties to the Convention advancing their commitments. Non-Annex I countries may set voluntary reduction targets rather than voluntarily agreeing to binding limits, as was suggested by the United States.
- Entry into force: The Kyoto Protocol will be open for signature between March 1998 and March 1999. It will enter into force when ratified by 55 Parties to the Convention, including parties that account for at least 55 percent of Annex I CO2 emissions in 1990.
- Enforcement: a later meeting of the treaty parties will decide on "appropriate and effective" way to deal with non compliance.
- Flexibility: The Kyoto Protocol provides for several types of flexibility in achieving reductions, but most of the details about scope, principles and implementation have not been defined.

3.2.4 The conference of the parties, Buenos Aires

The Fourth Conference of the Parties to the UN Framework Convention on Climate Change (UFCCC) was held from 2-13 November 1998 in Buenos Aires, Argentina, and was attended by over 5,000 participants. During the two-week meeting, delegates deliberated decisions for the COP during the ninth sessions of the Subsidiary Body for Implementation (SBI-9) and the Subsidiary Body for Scientific and Technological Advice (SBSTA-9). Issues related to the Kyoto Protocol were considered in joint SBI/SBSTA sessions.

Under the Plan of Action, the Parties declared their determination to strengthen the implementation of the Convention and prepare for the future entry into force of the Kyoto Protocol (Earth Negotiation Bulletin 1998).

The Buenos Aires Plan of Action includes deadlines on a number of important issues:

- Financial mechanisms - which will assist the developing world to respond to the challenges related to climate change.
- Further work on policies and measures - an issue introduced by the EU at a late stage in the Conference.
- Development and transfer of technologies.
- Rules governing the Kyoto Mechanisms with priority given to the Clean Development Mechanism.
- An undertaking to discuss supplementarity, ceilings, long term convergence and equity.

On technology transfer Parties broke a 4-year deadlock in the debate. The Conference decision outlines a process on how to overcome the barriers to the transfer of environmentally sound technology. On compliance Parties reached a common understanding that a strong and comprehensive regime is needed to ensure an effective implementation of the Kyoto Protocol. Countries vulnerable to the impacts of climate change will receive further support from the Global Environment Facility to plan concrete measures for adaptation.

3.2.5 The conference of the parties Bonn

The Fifth Meeting of the Conference of the Parties (COP-5) to the United Nations Framework Convention on Climate Change (UFCCC) met in Bonn, Germany, from 25 October - 5 November 1999. With over 3000 participants in attendance and 165 Parties represented, delegates continued their work toward fulfilling the Buenos Aires Plan of Action (BAPA) adopted at the Fourth Conference of the Parties (COP-4) in November 1998. Under the BAPA, Parties set a two-year deadline for strengthening UFCCC implementation and preparing for the future entry into force of the Kyoto Protocol.

During the course of COP-5, the Subsidiary Body for Implementation (SBI) and the Subsidiary Body for Scientific and Technological Advice (SBSTA) were assisted in their work by eight contact groups, a joint SBI/SBSTA working group and numerous informal consultations. During its last two days, COP-5 adopted 32 draft decisions and conclusions. on, inter alia, the review of the implementation of commitments and other UFCCC provisions and preparations for the first session of the COP serving as the Meeting of Parties to the Kyoto Protocol (COP/MOP-1). Ninety-three ministers and other heads of delegation addressed COP-

5 during a high-level segment held from 2 - 3 November. Delegates completed their work ahead of schedule and generated an "unexpected mood of optimism" in the lead-up to COP-6. After a faltering COP in Buenos Aires, the process recovered vital momentum and began to gather determination and support for a self imposed deadline for entry into force of the Protocol by 2002 (Earth Negotiation Bulletin 1999).

3.2.6 Conference of the parties, Hague, Netherland

The Sixth Conference of the Parties (COP-6) to the United Nations Framework Convention on Climate Change (UNFCCC) and the resumed thirteenth sessions of the UNFCCC's subsidiary bodies were held in The Hague, the Netherlands, from 13-25 November 2000. Over 7,000 participants from 182 governments, 323 intergovernmental and non-governmental organizations, and 443 media outlets were in attendance. The meeting aimed to set the operational details for commitments on reducing emissions of greenhouse gases under the 1997 Kyoto Protocol, and to reach agreement on actions to strengthen implementation of the UNFCCC itself. In attempting to achieve these goals, the meeting was intended to bring to a close more than two years of preparations and negotiations set out in the UNFCCC's 1998 Buenos Aires Plan of Action.

During the first week, delegates met in informal contact groups and other negotiating groups mandated by the UNFCCC subsidiary bodies. These meetings aimed to reduce differences on text for decisions on a range of issues related to the Protocol and the UNFCCC, including: the transfer of technology and capacity building to assist developing countries and countries with economies in transition; the adverse effects of climate change and the impact of implementation of response measures; best practices in domestic policies and measures to address greenhouse gas emissions; the mechanisms outlined under the Protocol; a compliance system for the Protocol; and issues relating to the land use, land-use change and forestry (LULUCF) sector (Earth Negotiation Bulletin 2000).

During the second week, COP-6 President Jan Pronk (the Netherlands) attempted to facilitate progress on the many disputed political and technical issues by convening high-level informal Plenary sessions to address the key political issues, which he grouped into four "clusters" or "boxes," as follows: (a) capacity building, technology transfer, adverse effects and guidance to the Global Environment Facility (GEF); (b) mechanisms; (c) LULUCF; and,

(d) compliance, policies and measures, and accounting, reporting and review under Articles 5 (methodological issues), 7 (communication of information) and 8 (review of information). Ministerial negotiations took place throughout Friday and into Saturday. However, after almost 36 hours of intense talks on the President's proposals, negotiators did not achieve a breakthrough, with supplementary, compliance and LULUCF proving to be particular sticking points. On Saturday afternoon, 25 November, President Pronk convened a final high-level informal Plenary in which he announced that delegates had failed to reach agreement. Delegates agreed to suspend COP-6, and expressed a willingness to resume their work in 2001 (Earth Negotiation Bulletin 2000).

3.2.7 Conference of the parties, Bonn Germany

The resumed sixth session of the Conference of the Parties (COP-6 Part II) to the United Nations Framework Convention on Climate Change (UNFCCC) and the fourteenth sessions of the UNFCCC's subsidiary bodies were held in Bonn, Germany, from 16-27 July. Over 4,600 participants from 181 governments, 254 intergovernmental, non-governmental and other observer organizations, and 332 media outlets were in attendance. The meeting sought to successfully complete negotiations aimed at setting the operational details for commitments on reducing emissions of greenhouse gases under the 1997 Kyoto Protocol. It also sought agreement on actions to strengthen implementation of the UNFCCC itself. In attempting to achieve these goals, which were set out in the 1998 Buenos Aires Plan of Action (BAPA), the resumed COP-6 was intended to bring to a close more than two and a half years of preparations and negotiations, and to complete the tasks that had been left unfinished at COP-6 in The Hague in November 2000.

From 16-18 July, delegates met in closed negotiating groups to reduce differences on texts for decisions on a range of issues related to the Protocol and the UNFCCC, including: financial issues; the mechanisms; compliance; and land use, land-use change and forestry (Earth Negotiation Bulletin 2001).

On Thursday, 19 July, the high-level segment of the resumed COP-6 began, with participants striving to make a breakthrough by achieving agreement on a "political" decision on key outstanding issues. On Saturday night, after protracted consultations, President Pronk presented his proposal for a draft political decision outlining agreements on core elements of

the BAPA. However, in spite of several Parties announcing Sunday that they could support the political decision, disagreements surfaced over the section on compliance.

The political decision – or "Bonn Agreement" – was approved by the ministers in Plenary late Monday morning, and formally adopted by the COP on Wednesday evening, 25 July. High level discussions over the weekend also resulted in a Political Declaration by a number of developed countries, in which they pledged additional funding for climate change activities for developing countries (Earth Negotiation Bulletin 2001).

During the remainder of the second week, delegates attempted to clear all remaining brackets in the outstanding texts held over from COP-6 Part I, based on the political guidance set out under the Bonn Agreement. Although decisions were adopted on several key issues, delegates were unable to complete all their work on the mechanisms, compliance and LULUCF. Since not all texts in the entire "package" of decisions were completed, all decisions were forwarded to COP-7, where delegates will attempt to conclude their negotiations.

The fourteenth sessions of the COP's subsidiary bodies met at the same time as the resumed COP-6. After a number of informal consultations, the subsidiary bodies adopted draft conclusions on a range of issues, including reports on inter-sessional activities, policies and measures, cooperation with relevant international organizations, and administrative and financial matters (Earth Negotiation Bulletin 2001).

3.2.8 Marrakesh accord, Morocco

The Seventh Conference of the Parties (COP-7) to the United Nations Framework Convention on Climate Change (UNFCCC) was held in Marrakesh, Morocco, from 29 October - 10 November 2001. Over 4400 participants from 172 governments, 234 intergovernmental, non-governmental and other observer organizations, and 166 media outlets were in attendance. The meeting sought to finalize agreement on the operational details for commitments on reducing emissions of greenhouse gases under the 1997 Kyoto Protocol. It also sought agreement on actions to strengthen implementation of the UNFCCC. In attempting to achieve these goals, which were set out in the 1998 Buenos Aires Plan of Action (BAPA), COP-7 intended to bring to a close three years of negotiations, and complete tasks left unfinished at COP-6 Parts I and II held in The Hague and Bonn, respectively. The Bonn

Agreements – a political declaration on outstanding issues that was adopted at COP-6 Part II in July 2001 – served as the basis for delegates striving to finish their work (Earth Negotiation Bulletin 2001).

From 30 October to 6 November delegates met in negotiating groups, closed drafting groups and informal consultations in their attempt to resolve outstanding issues. These included the mechanisms under the Protocol, a compliance system, accounting, reporting and review under Protocol Articles 5 (methodological issues), 7 (communication of information) and 8 (review of information), and land use, land-use change and forestry (LULUCF).

The fifteenth sessions of the COP's subsidiary bodies met during COP-7 from 29 October to 8 November. The subsidiary bodies adopted draft conclusions on a number of issues, including national communications, administrative and financial matters, and methodological issues (Earth Negotiation Bulletin 2001).

On Wednesday, 7 November, COP-7's High-Level Segment began, with ministers and senior officials seeking to bring negotiations to a successful conclusion. After protracted bilateral and multilateral talks, a package deal on LULUCF, mechanisms, Protocol Articles 5, 7 and 8, and the input to the WSSD was proposed on Thursday evening, 8 November. Although the deal was accepted by most regional groups, including the G-77/China and the EU, the Umbrella Group (a loose alliance of Annex I Parties that includes Canada, Australia, Japan, the Russian Federation, and New Zealand) did not join the consensus, with key issues of dispute including eligibility requirements and bankability under the mechanisms. However, after further extensive negotiations throughout Friday and into Saturday morning, a package deal was agreed, with key features including a compliance eligibility requirement, consideration of LULUCF Principles in reporting of such data and limited banking of units generated by sinks under the Clean Development Mechanism (Earth Negotiation Bulletin 2001).

3.2.9 Conference of the parties, New Delhi, India

The eighth Conference of the Parties (COP-8) to the United Nations Framework Convention on Climate Change (UNFCCC) and the seventeenth sessions of the COP's Subsidiary Body for Implementation (SBI) and Subsidiary Body for Scientific and Technological Advice (SBSTA) were held at the Vigyan Bhawan Conference Centre in New

Delhi, India, from 23 October to 1 November 2002. Over 4300 participants from 167 Parties, 3 observer States, 213 intergovernmental, non-governmental and other observer organizations, and 222 media outlets were in attendance. This was the first COP since November 2001, when delegates completed three years of negotiations on the operational details of the Kyoto Protocol and adopted the Marrakesh Accords to the Bonn Agreements. The meeting marked a new phase of negotiations focused on implementation of the Marrakesh Accords and UNFCCC issues (Earth Negotiation Bulletin 2002).

Throughout the meeting, Parties convened in negotiating groups, informal consultations, and plenary sessions of the SBI, SBSTA and COP in an attempt to adopt decisions and conclusions on a number of issues previously left off the agenda due to the pressing negotiations under the Buenos Aires Plan of Action. Among other things, Parties took up and adopted decisions and conclusions on: the improved guidelines for non-Annex I national communications; several issues under the financial mechanism; "good practices" in policies and measures; research and systematic observation; cooperation with relevant international organizations; and methodological issues. Three ministerial high-level round table discussions were held on Wednesday and Thursday, 30-31 October, to discuss "Taking Stock," "Climate Change and Sustainable Development," and "Wrap Up." On the final day, Parties adopted the Delhi Declaration on Climate Change and Sustainable Development (Earth Negotiation Bulletin 2002).

The usual division between developed and developing country positions on many issues was in evidence at COP-8. Many countries had hoped that the developed/developing country dichotomy would break down, exposing the variety of interests within non- Annex I countries. This would have facilitated the adoption of a Delhi Declaration initiating a dialogue on broadening commitments, in accordance with the stated positions of Annex I countries. Instead, the voice of non-Annex I countries in favor of such a declaration was drowned by calls from more powerful developing countries in favor of a declaration focusing on adaptation. The Delhi Declaration reaffirms development and poverty eradication as overriding priorities in developing countries and implementation of UNFCCC commitments according to Parties' common but differentiated responsibilities, development priorities and circumstances. It does not call for a dialogue on broadening commitments (Earth Negotiation Bulletin 2002).

3.2.10 Conference of the parties, Milan, Italy

The ninth Conference of the Parties (COP-9) to the United Nations Framework Convention on Climate Change (UNFCCC) and the nineteenth sessions of the COP's Subsidiary Body for Scientific and Technological Advice (SBSTA) and Subsidiary Body for Implementation (SBI) were held at the Fiera Milan Congress Center in Milan, Italy, from 1-12 December 2003. Over 5000 participants from 166 governments, four observer States, 312 intergovernmental, non-governmental and other observer organizations, and 191 media outlets were in attendance. Parties adopted numerous decisions and conclusions on various issues, including: definitions and modalities for including afforestation and reforestation activities under the Clean Development Mechanism; good practice guidance on land use, land-use change and forestry (LULUCF); the Special Climate Change Fund (SCCF); and the Least Developed Countries (LDC) Fund (Earth Negotiation Bulletin 2003).

The two faces of the UNFCCC, the negotiators and the constituency faces, were clearly visible at COP-9. The official negotiations, while remaining deadlocked on several issues, reached consensus on some decisions, particularly concerning sinks in the CDM for which the COP will be remembered as the "forest COP." Running parallel to the contact groups and informal consultations, where fine details were being discussed, COP-9 proved that climate change issues remain high on the political agendas of many NGOs, business groups, and the academic community (Earth Negotiation Bulletin 2003).

3.2.11 Conference of the parties, Buenos Aires, Argentina

The tenth Conference of the Parties (COP-10) to the United Nations Framework Convention on Climate Change (UNFCCC) and the twenty-first sessions of the COP's Subsidiary Body for Scientific and Technological Advice (SBSTA) and Subsidiary Body for Implementation (SBI) were held at La Rural Exhibition Center in Buenos Aires, Argentina, from 6-18 December 2004. Over 6100 participants from 167 governments, two observer States, 272 intergovernmental, non-governmental and other observer organizations, and 240 media outlets were in attendance. During the meeting, Parties addressed and adopted numerous decisions and conclusions on various issues, including: technology transfer; issues relating to land use, land use change and forestry; the UNFCCC's financial mechanism; Annex I national communications; capacity building; adverse effects and adaptation; and

UNFCCC Article 6 (education, training and public awareness) (Earth Negotiation Bulletin 2004).

On Saturday, 18 December, Parties agreed on a proposal to hold a Seminar by Government Experts prior to SB-22, and adopted a Buenos Aires Programme of Work on Adaptation and Response Measures. The purpose of the Seminar is to promote an informal exchange of information on actions relating to mitigation and adaptation to assist Parties to continue to develop effective and appropriate responses to climate change, and on policies and measures adopted by governments that support implementation of Parties' existing commitments under the UNFCCC and Protocol (Earth Negotiation Bulletin 2004).

Negotiations relating to a number of issues, including: the Least Developed Countries Fund; the Special Climate Change Fund; submission of second, or where appropriate, third national communications from non-Annex I Parties; policies and measures; and Protocol Article 2.3 (adverse effects of policies and measures) were not completed, and these issues were forwarded to SB-22 for further consideration.

Four high-level panel discussions were held on Wednesday and Thursday, 15-16 December on: "The UNFCCC after 10 Years: accomplishments and future challenges," "Impacts of climate change, adaptation measures and sustainable development," "Technology and climate change," and "Mitigation of climate change: policies and their impacts." Three in-session workshops were also held, on adaptation, mitigation and the organization of the intergovernmental process, respectively. Over 90 side events were held on issues ranging from emissions trading and the Clean Development Mechanism to reviews of accomplishments of the UNFCCC process (Earth Negotiation Bulletin 2004).

The year 2004 marks the tenth anniversary of the entry into force of the UNFCCC and, as such, many have been looking back with a sense of accomplishment at the progress achieved over the past decade. In addition, much of the world celebrated when the Russian Federation ratified the Kyoto Protocol, ensuring the continuity of mitigation efforts into the next decade as the Protocol enters into force in early 2005. To make sure that the "house" is in order for the Protocol's imminent entry into force, Parties gathered at COP-10 to complete the unfinished business from the Marrakesh Accords, and reassess the building blocks of the process and discuss the framing of a new dialogue on the future of climate change policy (Earth Negotiation Bulletin 2004).

3.2.12 Conference of the parties, Montreal, Canada

The eleventh Conference of the Parties (COP-11) to the UN Framework Convention on Climate Change (UNFCCC) and the first Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (COP/MOP1) took place in Montreal, Canada, from 28 November to 10 December 2005. The event drew 9500 participants, including 2800 government officials, over 5800 representatives of UN bodies and agencies, intergovernmental organizations and non-governmental organizations, and 817 accredited members of the media.

At COP/MOP 1, parties discussed and adopted decisions on the outstanding operational details of the Kyoto Protocol, including a package of decisions known as the "Marrakesh Accords." These decisions contain guidelines for how the Protocol will function, such as those relating to the "flexible mechanisms" intended to help parties reach their emissions targets in a cost-effective way, and a compliance mechanism. COP/MOP1 also took decisions on a process for considering further commitments for post-2012, when the Protocol's first commitment period ends. Various methodological, administrative, financial and institutional matters were also considered (Earth Negotiation Bulletin 2005).

COP-11 addressed issues such as capacity building, technology development and transfer, the adverse effects of climate change on developing and least developed countries, and several financial and budget-related issues, including guidelines to the Global Environment Facility (GEF), which serves as the Convention's financial mechanism. After lengthy negotiations, the COP also agreed on a process for considering future action beyond 2012 under the UNFCCC.

In the morning on 10 December, COP President Stéphane Dion declared the meetings a success, expressing satisfaction that they had avoided so many potential pitfalls and achieved a consensus outcome. With the Kyoto Protocol now operational and a post-2012 path now envisaged, most participants agreed that COP-11 and COP/MOP 1 was an important milestone in moving the process forward (Earth Negotiation Bulletin 2005).

3.2.13 The conference of the parties, Nairobi, Kenya

From 6-17 November 2006, a series of climate change meetings took place at the UN Office at Nairobi, Kenya. The "UN Climate Change Conference – Nairobi 2006" included the twelfth Conference of the Parties (COP-12) to the UN Framework Convention on Climate

Change (UNFCCC) and second Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (COP/MOP 2). These events drew over 5,900 participants, including 2,300 government officials, over 2,800 representatives of UN bodies and agencies, intergovernmental organizations and non-governmental organizations, and 516 accredited members of the media (Earth Negotiation Bulletin 2006).

At COP/MOP2, parties took up issues relating to the Protocol's flexible mechanisms, particularly the Clean Development Mechanism and Joint Implementation. Delegates also discussed parties' compliance with the Protocol, a proposed amendment to the Protocol, as well as capacity building and a number of financial, administrative and other matters. In addition, the first amendment to the Protocol was adopted, allowing Belarus to take on emissions reduction commitments under Annex B to the Protocol.

COP-12 reviewed the implementation of commitments and various other provisions of the Convention relating to such matters as the financial mechanism, national communications, technology transfer, capacity building, and the adverse effects of climate change on developing and least developed countries (LDCs) and of response measures and the special needs of LDCs (Article 4.8 and 4.9) (Earth Negotiation Bulletin 2001).

A major focus of both COP/MOP 2 and COP-12 was on long term action on climate change and on developing a framework for action once the Kyoto Protocol's "first commitment period" finishes in 2012. A "multi-track" approach to these issues, agreed at COP-11 and COP/MOP1, continued in Nairobi. Under the COP, a second workshop under the recently convened "Dialogue on long-term cooperative action to address climate change by enhancing implementation of the Convention" was held from 15-16 November. The workshop focused on "advancing development goals in a sustainable way" and "realizing the full potential of market-based opportunities." The Dialogue also considered the newly published Stern Review on the Economics of Climate Change (Earth Negotiation Bulletin 2006).

The COP/MOP considered long-term issues under agenda items on a "review of the treaty," which was mandated for COP/MOP2 under Article 9 of the Protocol. In addition, discussions were held on a proposal by the Russian Federation on procedures to approve voluntary commitments under the Protocol.

The COP and COP/MOP were assisted in their work by the Subsidiary Body for Scientific and Technological Advice (SBSTA) and the Subsidiary Body for Implementation (SBI). In

addition, numerous contact groups and informal discussions were arranged to help negotiations move forward. These meetings resulted in the adoption of 10 COP decisions and 11 COP/MOP decisions and in the approval of a number of conclusions by the subsidiary bodies. Unlike the first COP/MOP in Montreal in 2005, the Nairobi conference may not be remembered as one of those critical milestones when a major breakthrough occurred (Earth Negotiation Bulletin 2006).

3.2.14 Conference of the parties, Bali, Indonesia

The "United Nations Climate Change Conference in Bali" was held from 3-15 December 2007. The conference involved a series of events, including the thirteenth Conference of the Parties (COP-13) to the UN Framework Convention on Climate Change (UNFCCC) and third Conference of the Parties serving as the Meeting of Parties to the Kyoto Protocol (COP/MOP3). These events drew over 10,800 participants, including more than 3500 government officials, 5800 representatives of UN bodies and agencies, intergovernmental organizations and non-governmental organizations (Earth Negotiation Bulletin 2007).

The COP and COP/MOP were assisted in their work by the Subsidiary Body for Scientific and Technological Advice (SBSTA) and the Subsidiary Body for Implementation (SBI), which convened for their 27th sessions from 3-12 December. In addition, the *Ad Hoc* Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol met for its resumed fourth session (AWG 4) from 3-15 December. Numerous contact groups and informal discussions were also arranged to help negotiations move forward (Earth Negotiation Bulletin 2007).

These meetings resulted in the adoption of 15 COP decisions and 13 COP/MOP decisions and the approval of a number of conclusions by the subsidiary bodies. These outcomes covered a wide range of topics, including finalizing the Adaptation Fund under the Protocol, a decision on reducing emissions from deforestation in developing countries, and outcomes on technology transfer, capacity building, the Kyoto Protocol's flexible mechanisms, the adverse effects of combating climate change, national communications, financial and administrative matters, and various methodological issues (Earth Negotiation Bulletin 2007).

The main focus in Bali, however, was on long-term cooperation and the post-2012 period, when the Kyoto Protocol's first commitment period expires. Negotiators spent much of their

time seeking to agree on a two-year process – or "Bali roadmap" – to finalize a post-2012 regime by December 2009. Negotiations were conducted in a number of groups under the aegis of both the Convention and the Protocol. Under the Convention, the discussions focused on how to follow up on the "Dialogue on long-term cooperative action to address climate change by enhancing implementation of the Convention." Under the Protocol, the AWG considered a timetable for determining Annex I commitments for the post-2012 period. Delegates also outlined a preparatory process for the second review of the Protocol under Article 9, and held discussions on the "Russian proposal" on voluntary commitments.

The Bali Conference launched far reaching negotiations with a clear deadline for the conclusion of an agreement on the post-2012 period. Bali was successful in delivering the expected mandate and building blocks for the post-2012 period – the Bali roadmap.

Numerous relevant social events and activities, as well as some protests and demonstrations, were organized outside the conference venue (Earth Negotiation Bulletin 2007).

3.2.15 Conference of the parties, Poznań, Poland

The United Nations Climate Change Conference in Poznań, Poland, was held from 1-12 December 2008. The conference involved a series of events, including the fourteenth Conference of the Parties (COP-14) to the UN Framework Convention on Climate Change (UNFCCC) and fourth Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (COP/MOP 4) (Earth Negotiation Bulletin 2008).

In support of these two main bodies, four subsidiary bodies convened: the fourth session of the *Ad Hoc* Working Group on Long-term Cooperative Action under the Convention (AWGLCA 4); the resumed sixth session of the *Ad Hoc* Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol (AWG-KP 6); and the twenty-ninth sessions of the Subsidiary Body for Implementation (SBI 29) and Subsidiary Body for Scientific and Technological Advice (SBSTA 29) (Earth Negotiation Bulletin 2008).

These meetings resulted in the adoption of COP decisions, COP/MOP decisions and a number of conclusions by the subsidiary bodies. These outcomes covered a wide range of topics, including the Adaptation Fund under the Kyoto Protocol, the 2009 work programmers of the AWG-LCA and AWG-KP, and outcomes on technology transfer, the Clean

Development Mechanism (CDM), capacity building, national communications, financial and administrative matters, and various methodological issues.

The main focus in Poznań, however, was on long-term cooperation and the post-2012 period, when the Kyoto Protocol's first commitment period expires. In December 2007, negotiators meeting in Bali had approved the Bali Action Plan and Roadmap setting COP 15 in December 2009 as the deadline for agreeing on a framework for action after 2012. Poznań therefore marked the halfway mark towards the December 2009 deadline. While the Poznań negotiations did result in some progress, there were no significant breakthroughs, and negotiators face a hectic 12 months of talks leading up to the critical deadline of December 2009 in Copenhagen, Denmark (Earth Negotiation Bulletin 2008).

3.2.16 Conference of the parties, Copenhagen, Denmark

The United Nations Climate Change Conference in Copenhagen, Denmark took place from 7-19 December 2009. It included the fifteenth Conference of the Parties (COP-15) to the United Nations Framework Convention on Climate Change (UNFCCC) and the fifth Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (COP/MOP 5). COP-15 and COP/MOP 5 were held in conjunction with the thirty-first sessions of the Subsidiary Body for Scientific and Technological Advice (SBSTA 31) and the Subsidiary Body for Implementation (SBI 31), the tenth session of the Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol (AWG-KP 10) and the eighth session of the Ad Hoc Working Group on Long-term Cooperative Action under the UNFCCC (AWG-LCA 8) (Earth Negotiation Bulletin 2009).

The Copenhagen Conference marked the culmination of a two-year negotiating process to enhance international climate change cooperation under the Bali Roadmap, launched by COP-13 in December 2007. Close to 115 world leaders attended the joint COP and COP/MOP high-level segment from 16-18 December, marking one of the largest gatherings of world leaders outside of New York. The conference was subject to unprecedented public and media attention, and more than 40,000 people, representing governments, nongovernmental organizations, intergovernmental organizations, faith-based organizations, media and UN agencies applied for accreditation at the conference (Earth Negotiation Bulletin 2009).

Many hoped that the Copenhagen Climate Conference would be able to "seal the deal" and result in a fair, ambitious and equitable agreement, setting the world towards a path to avoid dangerous climate change. To this end, what many characterized as "intense negotiations" took place over the two weeks at the level of experts, Ministers and Heads of State. But it was not without controversy. Questions concerning transparency and process played out during the meeting. Differences emerged, inter alia, on whether work should be carried out in a smaller "friends of the chair" format as well as on a proposal by the Danish COP Presidency to table two texts reflecting the work done by the AWGs. Many parties rejected this idea, urging that only texts developed in the AWGs by parties should be used (Earth Negotiation Bulletin 2009).

During the high-level segment, informal negotiations took place in a group consisting of major economies and representatives of regional groups. Late on Friday evening, these talks resulted in political agreement entitled the "Copenhagen Accord," which was not based on the texts developed by either of the AWGs. Details of the agreement were widely reported by the media before the COP closing plenary. While most reports highlighted that Heads of State had been able to "seal the deal," almost everyone participating in the negotiations openly admitted that it was "far from a perfect agreement."

During the closing COP plenary, which lasted nearly 13 hours, long and what many characterized as "acrimonious" discussions ensued on the transparency of the process that had led to the conclusion of the Copenhagen Accord and on whether the COP should adopt it. Most negotiating groups supported its adoption as a COP decision in order to operationalize it as a step towards "a better" future agreement. Some developing countries, however, opposed the Accord reached during what they characterized as an "untransparent" and undemocratic" negotiating process. During informal negotiations facilitated by UN Secretary-General Ban Ki-Moon, parties agreed to adopt a COP decision whereby the COP "takes note" of the Copenhagen Accord, which was attached to the decision as an unofficial document. Parties also agreed to establish a procedure whereby countries supporting the Copenhagen Accord can accede to it (Earth Negotiation Bulletin 2009).

Many recognized the historical significance of the Copenhagen Conference, highlighting its unprecedented success in bringing together the majority of the world's leaders to consider climate change and listing mitigation actions pledged by developed and developing countries,

as well as provisions on finance and technology. Most delegates, however, left Copenhagen disappointed at what they saw as a "weak agreement," and questioning its practical implications given that the Copenhagen Accord had not been formally adopted as the outcome of the negotiations (Earth Negotiation Bulletin 2009).

The key points of the Accord are as follows (The Climate Group, 2010):

- On the politics: acknowledgement of the seriousness of the problem and need for urgent, collective action in line with existing principles (e.g. CBDR1).
- On the science: endorsement of the IPCC's recommendation that global temperature increase be kept below 2 oC.
- On adaptation: agreement that developed countries will provide adequate and predictable financial, technical and capacity-building support to developing countries.
- On developed country mitigation: agreement that Annex I parties will commit to quantified economy wide emission reductions by 2020 (although with no individual or aggregate targets given), with targets submitted to the UNFCCC by 31 January 2010. These targets, as well as financing to support developing country climate action, are to be monitored, reported and verified.
- On developing country mitigation: agreement that non-Annex I parties will implement mitigation actions that are monitored, reported and verified. These actions are to be submitted to the UNFCCC by 31 January 2010. Action by the poorest and most vulnerable countries is voluntary.
- On Monitoring, Reporting, Verification (MRV): agreement that unilateral developing country mitigation action will be subject to domestic MRV'ing with "international consultation and analysis" that respects "national sovereignty"; agreement that mitigation action supported by developed countries will be subject to international MRV'ing. Both developed and developing country MRV'ing will be subject to existing and to-be-agreed UNFCCC guidelines.
- On finance levels: commitment by developed countries to provide US$30 billion in short-term financing between 2010 and 2012 and to mobilize US$100 billion per annum by 2020. This will be from public, private, multilateral and alternative

sources. Funding will be used for mitigation, adaptation, technology transfer and capacity-building in developing countries.

- On financial architecture: agreement to establish a 'Copenhagen Green Climate Fund' which will receive a significant proportion of the above finance flows. Also the establishment of a 'High Level Panel' to study the contribution of potential sources of revenue.
- On 'REDD plus': agreement that a mechanism to mobilize funds to reduce emissions from deforestation and degradation (REDD) and support conservation is needed.
- On technology: agreement to establish a 'technology mechanism' to accelerate the transfer and development of mitigation and adaptation technologies.
- On markets: acknowledgement that markets enhance the cost-effectiveness of and promote mitigation actions. Implicit reference to benefits of emissions crediting or trading mechanisms to support low-carbon development in developing countries.
- On review of the Accord: a "call" to assess implementation of the Accord by 2015, with consideration of a 1.5oC temperature target.

In Copenhagen accord there are both good and not-so-good (or missing) aspects (The Climate Group, 2010):

The good bits:

- Having the US, China, India and other major developing countries sign up to a joint climate agreement for the first time.
- All of these countries also making unconditional national pledges to either cut or slow the growth of their emissions and/or implement specific measures to achieve this.
- Securing agreement on limiting average global temperature increase to 2oC or less.
- Resolution of the monitoring, reporting and verification issue relating to developing country mitigation action (a previous deadlock issue).
- Developed countries' commitment to provide US$30 billion of short-term funding through to 2012, and US$100 billion per annum of long-term funding by 2020, close to the level many had been demanding.

The not-so-good (or missing) bits:

- Lack of a long-term global emission reduction goal (e.g. 50% reduction of emissions by 2050).
- Lack of both individual and aggregate absolute emission targets for developed countries for 2020.
- Lack of relative emission reduction targets for developing countries for 2020 (i.e. deviation from BAU trajectories).
- Absence of any reference to a global emissions peaking date, or even a developed country peaking date, meaning that, together with the above, no clear pathway for emissions has been agreed.
- No mention of a timetable for concluding a legally binding agreement.
- Little or no reference to the need for, and role of, expanded carbon markets and no clarity over the future of the CDM and other market-based instruments.
- The uncertainty created over the future of the UNFCCC process, and particularly the Kyoto Protocol.
- Lack of any obvious mechanism for regularly ratcheting up levels of ambition (apart from the 2015 review).

3.2.17 Conference of the parties, Cancun, Mexico

The 16th Conference of the Parties (COP 16) to the United Nations Framework Convention on Climate Change (UNFCCC) took place in Cancun, Mexico from Nov. 29- Dec. 11, 2010. Nearly 12,000 government, NGO, indigenous, academic and private sector representatives participated in the meeting. The result, not only of 2 weeks, but five years of intense negotiations, was agreement on a package of decisions called the "Cancun Agreements." This was a historic step forward for international cooperation addressing one of the greatest challenges of our time—climate change. While the Cancun Agreements leave many important details open for further work, they do provide a framework for addressing all of the essential elements needed for comprehensive international action on climate change. In additional to the overarching framework, some of the most important accomplishments of the Cancun Agreements are the establishment of (Conservation International, 2011):

- A REDD+ mechanism;

- The Cancun Adaptation Framework;
- The Green Climate Fund;
- The Technology Mechanism;

The most important accomplishment in Cancun, however, may be the rebuilding of trust, a renewed willingness to work together, and a signal that the multilateral process is still alive. All but one of the UNFCCC's 194 parties supported the Cancun Agreements. The multiple standing ovations on the final Friday night and early Saturday morning of the conference demonstrated the enthusiasm negotiators and high-level attendees felt to work together and move forward. This was in stark contrast to the disappointing outcome at last year's COP in Copenhagen. Indeed, many arrived in Cancun feeling that all hung in the balance. The successful outcome was a major relief to those who feared that the UNFCCC would not rebound from another failure (Conservation International, 2011).

The two main outcomes of COP 16 are:

- The Cancun Agreement on Long-term Cooperative Action;
- The Cancun Agreement on Annex I Parties' Further Commitments under the Kyoto Protocol;

The Cancun Agreement on Long-term Cooperative Action includes all of the elements of the Bali Action Plan, including shared vision, adaptation, mitigation, finance, technology, capacity building, review and other matters. It also extends the ad hoc working group for Long-term Cooperative Action (AWGLCA), which aims to establish a new, comprehensive agreement that would include action by ALL parties on all the various aspects of the Bali Action Plan. While the Cancun Agreement still requires more detail on many aspects, particularly the mitigation commitments and actions, it does provide a timeline for finalizing what would be a truly landmark agreement (Conservation International, 2011).

The Cancun Agreement on Annex I Parties' Further Commitments decides that the ad hoc working group on the Kyoto Protocol (AWG-KP) should aim to complete its work as soon as possible in order to avoid a gap before the 2nd commitment period under the Kyoto Protocol is able to begin. The 2nd commitment period would specify quantified economy-wide emission reduction targets for Annex I (developed) countries that are party to the Kyoto Protocol.

Future commitment periods under the Kyoto Protocol are very important to some countries because Kyoto is a relatively strong, legally-binding agreement. However, a new agreement under the AWG-LCA would include all countries (including major economies such as the United States and China, which do not have obligations under Kyoto to reduce emissions) as well as a wider range of actions including both adaptation and mitigation. For this reason work, under the LCA and KP has been progressing in parallel (Conservation International, 2011).

One of the major accomplishments in Cancun was the establishment of the Green Climate Fund. The Green Climate Fund will be under the "guidance" (not "authority") of and accountable to the COP. The 24 members of its board will be equally divided between developed and developing countries. It will have an independent secretariat, the World Bank will act as the interim trustee and it will be subject to review in 3 years. Funding will be dispersed through thematic windows. Several issues remain to be resolved (Conservation International, 2011):

- Financial resources for the fund have not been identified;
- The relationship between the Green Climate Fund and existing bilateral and multilateral financing mechanisms is unclear;
- There is no specific date or work program for designing the Fund;

That said, the creation of the Green Climate Fund is an important first step in establishing more predictable, adequate and sustainable climate financing.

In addition, the Cancun Agreements formalize the developed countries' commitment to mobilize $100 billion per year by 2020. However, this commitment does not differentiate between public and private sources of finance. While $100 billion/year is a significant commitment, it is still far short of what is needed to support mitigation and adaptation action in developing countries. The agreement does not provide an assessment of the level of financing needed. Failure to agree on innovative resources is a major disappointment as innovative sources will be necessary to attain the scale of financing necessary for climate. On Fast-Start Finance, the UNFCCC agreed to increased transparency of the delivery of fast-start finance by establishing annual reporting by developed country in 2011, 2012 and 2013 (Conservation International, 2011).

The agreement takes note of the quantified economy-wide emission reduction targets to be implemented by Annex I parties and the nationally appropriate mitigation actions (NAMAs) of non-Annex I parties. It, thus, reaffirms the commitments by countries to implement their specific actions to reduce emissions and "anchors" these pledges in a UN agreement. The INF documents detailing commitments and actions are still being developed and further work is needed here in order to avoid dangerous levels of climate change.

The Cancun Agreement also contains important decisions that can begin to increase the transparency and accountability of countries' emissions and actions. The decision requires developed countries to improve their measuring, reporting and verification (MRV) of emissions, actions to reduce emissions and financial support to developing countries. It requires developing countries to domestically MRV their mitigation actions. Internationally supported mitigation actions would be subject to international MRV. These mechanisms enable recognition of countries that are meeting their commitments and the transparency to determine which countries are not (Conservation International, 2011).

3.2.18 Conference of the parties, Durban, South Africa

The United Nations Climate Change Conference in Durban, South Africa, was held from 28 November - 11 December 2011. The conference involved a series of events, including the seventeenth session of the Conference of the Parties (COP-17) to the UN Framework Convention on Climate Change (UNFCCC) and the seventh meeting of the Conference of the Parties serving as the Meeting of Parties to the Kyoto Protocol (CMP-7).

The Conference drew over 12,480 participants, including over 5400 government officials, 5800 representatives of UN bodies and agencies, intergovernmental organizations and civil society organizations, and more than 1200 members of the media.

The meetings resulted in the adoption of 19 COP decisions and 17 CMP decisions and the approval of a number of conclusions by the subsidiary bodies. These outcomes cover a wide range of topics, notably the establishment of a second commitment period under the Kyoto Protocol, a decision on long-term cooperative action under the Convention, the launch of a new process towards an agreed outcome with legal force applicable to all parties to the Convention, and the operationalization of the Green Climate Fund (Earth Negotiation Bulletin 2011).

The success of the Durban Conference hinged on resolution of three mutually dependent issues (Carpenter, 2012):

- Agreement on the continuation of the Kyoto Protocol;
- Agreement on a long-term cooperative plan and shared vision to address climate change;
- Agreement on finance—both through the provision of long-term finance to address climate change and through the establishment of the "Green Climate Fund", a fund intended to become "the main global fund for climate change finance".

The Durban Platform in particular had seemed unlikely, since China and India had refused to negotiate a new agreement to limit their emissions. Without this, the US would not agree to a new round of negotiations. Without all of these, the EU would not agree to a second commitment period under the Kyoto Protocol. What facilitated the Durban outcome was a compromise that gave some countries a 2020 start date for the new agreement and some flexibility on its legal character, and gave others an early start and end dates for the negotiations and language that the outcome of the new negotiations will have "legal force." Durban delivered the new negotiating process and with it, a new discussion on differentiation of responsibilities and commitments between developed and developing countries (Carpenter, 2012).

The decision to establish the Durban Platform marks the beginning of an important new chapter of Parties' collective effort to strengthen the multilateral, rules-based regime under the Convention. From 2012, Parties will embark upon the development of a new protocol, another legal instrument or an agreed outcome with legal force under the Convention that will be applicable to all Parties. The new agreement is to be ready by 2015, and will come into effect from 2020. It is expected to raise the level of ambition, and will be informed by the latest science and the outcomes of a 2013-2015 Review, which was agreed in Cancun at COP 16. A new subsidiary body, known as the Ad Hoc Working Group on the Durban Platform for Enhanced Action (ADP), will undertake the work. It was also agreed as part of the Durban Platform decision that the AWG-LCA will conclude its work at the end of 2012 (Carpenter, 2012).

The COP also launched a work plan on enhancing mitigation ambition that will explore options to close the mitigation gap between now and 2020 and ensure the highest possible mitigation efforts by all Parties. According to UNEP's Emissions Gap Report, an additional 6 GtCO2e of global emission reduction effort is required by 2020 to maintain a reasonable chance to meet the global goal of staying below 2 degrees Celsius in average global temperature rise, or of meeting a possible 1.5 degree Celsius goal in the future.

Governments have struggled since the Bali conference to address the question of how mitigation actions should be shared among countries, with developing countries strongly resisting legal obligations. Through a combination of the second commitment period of the Kyoto Protocol and the Durban Platform, a large part of this question may have been resolved. From 2013, the Kyoto Protocol, for those that undertake obligations within it, will provide new emissions targets; alongside this is the "pledge and review" process launched for all countries in Cancun in 2010 that will give transparency on all national actions. Many observers hope that, from 2020 onward, a new, single legal instrument covering mitigation—in one form or another—in all countries will come into force. This represents a significant shift in position since Copenhagen (Carpenter, 2012).

The Durban conference also produced many technical decisions that make the Cancun Agreements possible to implement, including the operationalisation of the Green Climate Fund, the establishment of the Adaptation Committee, and the selection process for Climate

Technology Centre and the Network (see Figure 3.1 for an overview of Convention bodies post-Durban).

In 2012, governments will launch negotiations under the new subsidiary body—the ADP—as well as a number of technical details on the Durban package including the length of the Kyoto Protocol second commitment period, within the context of the new road toward a post-2020 package. While the Durban outcomes are complex and technical, two things stand out: the universal political will to act on climate change is tangible and increasingly ambitious; and Durban has sent a political signal to the world that the future is low-carbon.

Figure 3.1 Convention Bodies of the UNFCCC process following the Durban Conference (Carpenter, 2012)

3.3 Principle of common but differentiated responsibility

The principle of 'common but differentiated responsibility' evolved from the notion of the 'common heritage of mankind' and is a manifestation of general principles of equity in international law. The principle recognizes historical differences in the contributions of developed and developing States to global environmental problems, and differences in their respective economic and technical capacity to tackle these problems. Despite their common responsibilities, important differences exist between the stated responsibilities of developed and developing countries. The Rio Declaration states: "In view of the different contributions to global environmental degradation, States have common but differentiated responsibilities. The

developed countries acknowledge the responsibility that they bear in the international pursuit of sustainable development in view of the pressures their societies place on the global environment and of the technologies and financial resources they command" (cisdl.org, 2002).

Similar language exists in the Framework Convention on Climate Change; parties should act to protect the climate system "on the basis of equality and in accordance with their common but differentiated responsibilities and respective capabilities."

The principle of common but differentiated responsibility includes two fundamental elements. The first concerns the common responsibility of States for the protection of the environment, or parts of it, at the national, regional and global levels. The second concerns the need to take into account the different circumstances, particularly each State's contribution to the evolution of a particular problem and its ability to prevent, reduce and control the threat (cisdl.org, 2002).

3.3.1 Implications of the Principle of Common but Differentiated Responsibilities

In practical terms, the principle has at least two consequences. First, it entitles, or may require, all concerned States to participate in international response measures aimed at addressing environmental problems. Second, it leads to environmental standards that impose differing obligations on States. The principle finds its roots prior to UNCED and is supported by state practice at the regional and global levels.

Common responsibility: describes the shared obligations of two or more States towards the protection of a particular environmental resource. Common responsibility is likely to apply where the resource is shared, under the control of no state, or under the sovereign control of a state, but subject to a common legal interest (such as biodiversity – termed a common concern of humankind). The concept of common responsibility evolved from an extensive series of international laws governing resources labeled as 'common heritage of mankind' or of 'common concern (cisdl.org, 2002).

Differentiated responsibility of States for the protection of the environment: is widely accepted in treaty and other State practices. It translates into differentiated environmental standards set on the basis of a range of factors, including special needs and circumstances, future economic development of countries, and historic contributions to the creation of an environmental problem. The Stockholm Declaration emphasized the need to consider "the

applicability of standards which are valid for the most advanced countries but which may be inappropriate and of unwarranted social cost for the developing countries." In the Rio Declaration, states agreed that "environmental standards, management objectives and priorities should reflect the environmental and developmental context to which they apply," that "the special situation of developing countries, particularly the least developed and those most environmentally vulnerable, shall be given special priority, and that standards used by some countries "may be inappropriate and of unwarranted economic and social cost to other countries, in particular developing countries" (cisdl.org, 2002).

Differential responsibility therefore aims to promote substantive equality between developing and developed States within a regime, rather than mere formal equality. The aim is to ensure that developing countries can come into compliance with particular legal rules over time – thereby strengthening the regime in the long term. Practically speaking however, differential responsibility does result in different legal obligations.

A particularly important aspect of the principle is international assistance, including financial aid and technology transfer. As developed countries have played the greatest role in creating most global environmental problems, and have superior ability to address them, they are expected to take the lead on environmental problems. In addition to moving toward sustainable development on their own, developed countries are expected to provide financial, technological, and other assistance to help developing countries fulfill their sustainable development responsibilities (cisdl.org, 2002).

3.4 Questions About the Efficacy of the U.N. Forum

Some observers of the negotiations under the United Nations, including some government officials, question whether the U.N. process will be able to support future progress on cooperation to address climate change. These observers note the procedural and substantive difficulties encountered in the Copenhagen Conference of the Parties in 2009, as well as the broader challenge of reaching consensus among the 194 Parties to the UNFCCC, in the absence of agreed rules that would allow agreement by qualified majority (Jane A. Leggett 2010).

The flagging of progress under the United Nations is partly due to an apparent stalemate among key Parties and groups of Parties on major elements of cooperation. For example, in

meetings in Tianjin, China in October 2010, a number of delegates noted that much discussion has devolved into repeated restatement of well known positions, although minor movements were also visible. The challenges have been apparent since the mid-1990s, however, as Parties were unable to agree on rules for reaching agreement other than unanimous consensus. Consequently, it has been possible for only one or a few countries to obstruct formal agreement on many issues in the negotiations.

Some suggest that further development of international climate change cooperation may be more successful, at least over the next few years, through bilateral agreements (e.g., the U.S.-China Strategic and Economic Dialogue), regional arrangements, alternative and smaller multilateral processes (e.g., the G-20), and private actions. For example, the Group of 20 (G-20) Finance Ministers agreed in 2009 to end subsidies to fossil fuels (although independent observers assert that no significant reductions have been achieved). In addition, the European Union, Japan, Norway, and many other countries have well established arrangements with China. These nations anticipate bilateral activities to help generate emissions trade that will enhance their technological competitiveness, while also helping those Annex I Parties to comply with their commitments under the Kyoto Protocol (Jane A. Leggett 2010).

Interest in pursuing alternative vehicles for cooperation may be, in part, because of doubts that some countries (including the United States, China, Japan, and Australia) will follow through with their official pledges under the UNFCCC for GHG mitigation and financing. Certainly, the U.S. decision not to ratify the Kyoto Protocol has encouraged such skepticism.

Some observers, including businesses that seek greater certainty in their investment environments, now propose that an agreement among three to four countries, including the United States, the European Union, and China, would be the most productive next step. A growing number of observers suggest that using a greater multiplicity of avenues to address climate change could be most productive, with a variety of organizations taking charge in the domain to which it is best suited. Such a strategy could include such efforts as the Group of 20 Finance Ministers' commitment to end subsidies for fossil fuels,13 or the International Energy Agency's Implementing Agreement to support multi-national technology research (Jane A. Leggett 2010).

Some observers are skeptical that anthropogenic15 emissions of GHG are leading to significantly adverse climate change.16 Others are unconvinced that global agreement can be

reached and carried out. Still others object to giving greater authority to a supra-national (or national) organization, even to address global issues, or suspect that the United Nations and other institutions may be more concerned with enhancing their own influence and resources than with reducing the risks of climate change.

The outcome of the next meeting of the Conference of the Parties may corral greater cooperation under the UNFCCC, or incite greater diffusion of efforts to alternative fora. While the prospects for cooperative action may increase by diversifying the multilateral vehicles, achieving comprehensive and least-cost arrangements may be diminished (Jane A. Leggett 2010).

3.5 Conclusion

States have common responsibilities to protect the environment and promote sustainable development, but due o different social, economic, and ecological situations, countries must shoulder different responsibilities. The principle therefore provides for asymmetrical rights and obligations regarding environmental standards, and aims to induce broad State acceptance of treaty obligations, while avoiding the type of problems typically associated with a lowest common denominator approach. The principle also reflects the core elements of equity, placing more responsibility on wealthier countries and those more responsible for causing specific global problems. Perhaps more importantly, the principle also presents a conceptual framework for compromise and co-operation in effectively meeting environmental challenges.

CHAPTER 4

Implementation of the Clean Development Mechanism

The Clean Development Mechanism (CDM) is one of the three flexibility mechanisms of the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC). The goal of the UNFCCC and Kyoto Protocol is to reduce the emission of GHG emissions into the atmosphere, in order to mitigate human-induced climate change. The CDM was created to promote the hosting of GHG reduction projects by developing country parties to the Kyoto Protocol, using finance provided by developed country parties in order to make these projects possible.

By enabling the implementation of GHG reduction projects in developing countries, the CDM contributes to the sustainable development of those countries, while also allowing them to contribute to the GHG reduction objectives of the UNFCCC and Kyoto Protocol. At the same time, CDM projects assist developed country parties that finance such projects to meet their legally binding GHG reduction obligations, by generating Certified Emission Reductions (*CERs*) that can be used to meet their emission reduction obligations under the Kyoto Protocol or the European Union Emission Trading Scheme.

4.1 Clean Development Mechanism

The CDM was established under Article 12 of the Kyoto Protocol, which was agreed upon in 1992. The detailed rules and modalities for the CDM were subsequently agreed upon by Kyoto Protocol parties in 2001, as part of the so-called Marrakesh Accords (as mentioned in

chapter 4), in that same year, the CDM Executive Board was formed and began building the structure and process of the international CDM system.

4.1.1 Executive Board

The Executive Board supervises the CDM, as set out in Article 12(4) of the Kyoto Protocol. Its functions do not include the power to make decisions on the rules of the CDM. Outcomes of Executive Board meetings should be considered 'guidance' and subject to the approval of the COP/MOP. Executive Board functions include:

- Making recommendations to the COP/MOP on further modalities and procedures for the CDM;
- Approving new baseline and monitoring methodologies;
- Overseeing the accreditation of designated operational entities (DOEs), who actually validate the eligibility of, and verify the emission reduction performance of, CDM projects;
- Establishing and maintaining a database of approved rules, procedures and methodologies;
- Developing and maintaining the CDM registry.

4.1.2 Article 12 of the Kyoto Protocol

Article 12 of the Kyoto Protocol establishes the CDM, and defines its purpose as being:

to assist Parties not included in Annex I [to the UNFCCC] in achieving sustainable development and in contributing to the ultimate objective of the Convention, and to assist Parties included in Annex I in achieving compliance with their quantified emission limitation and reduction commitments under Article 3 [of the Kyoto Protocol].

The objectives of the CDM are thus threefold (Curnow & Hodes, 2009):

- To assist Non-Annex I Parties in achieving sustainable development;
- To assist Non-Annex I Parties in contributing to the avoidance of "dangerous anthropogenic interference with the climate system";
- To assist Annex I Parties in meeting their emission reduction obligations under the Kyoto Protocol.

The CDM achieves these objectives in the following ways:

- The CDM enables Annex I Parties (or, as is more often the case, companies from Annex I Parties that have been authorized by those Parties to participate in the CDM (Annex I Entities)) to provide finance for approved GHG reduction projects located within the territory of Non-Annex I Parties. This finance is provided through the purchase by Annex I Entities of CERs issued on the basis of the GHG reductions achieved by CDM projects. Each CER represents ”one tonne of carbon dioxide equivalent sequestered or abated”.
- CERs are valuable, internationally tradable instruments that can be acquired and surrendered by Annex I Parties as a means of offsetting their domestic GHG emissions and thereby meeting their Kyoto Protocol emission reduction obligations. By enabling project developers and other project participants to generate additional finance for a CDM project through the sale of CERs, the CDM enables the development and implementation of GHG reduction projects that would not otherwise be viable.
- GHG reductions may often be achieved more cost-effectively in Non-Annex I Parties than Annex I Parties, as a result, for example, of the greater reliance of Non-Annex I Parties on less efficient technologies, and the availability of relatively inexpensive resources and labor in those countries. This means that CDM projects often present relatively cost-effective GHG reduction opportunities, which if captured and used to market CERs to Annex I Parties, can reduce the need for Annex I Parties to pursue relatively expensive domestic reduction options.
- In accordance with the Kyoto Protocol’s objectives, projects approved and implemented in accordance with the international CDM rules must demonstrably contribute to the sustainable development of the Non-Annex I Party hosting them (CDM Host Country). This means by not only reducing or sequestering their GHG emissions, but also by contributing to broader Host Country sustainable development goals. Examples of ways in which CDM projects fulfill this requirement include creating employment, facilitating technology transfer, and enhancing the quality of, or access to, local infrastructure.

By channeling finance from Annex I Parties to Non-Annex I Parties to enable the implementation of CDM projects that achieve cost-effective GHG reductions while

contributing to the broader sustainable development of Host Countries, and allowing those GHG reductions to be used by Annex I Parties to comply with their Kyoto Protocol commitments, the CDM is able to achieve each of the objectives set out above.

A CDM project must provide emission reductions that are additional to what would otherwise have occurred. The projects must qualify through a rigorous and public registration and issuance process. Approval is given by the Designated National Authorities. Public funding for CDM project activities must not result in the diversion of official development assistance.

The CDM requires application of a baseline and monitoring methodology in order to determine the amount of Certified Emission Reductions (CERs) generated by a mitigation project in a project host country. Methodologies are classified into four categories (unfccc.int, 2010):

- Methodologies for large scale CDM project activities;
- Methodology for small scale CDM project activities;
- Methodology for large scale afforestation and reforestation (A/R) CDM project activities;
- Methodology for small scale A/R project activities.

In average it has taken 310 days for a full-scale CDM methodology to be approved from the deadline of submission. It takes 193 days for small-scale methodology to be approved, and 360 days for A/R methodology to be approved (Figure 4.1) (cdmpipeine.org, 2012).

Figure 4.1 The average time to get a new methodology approved or rejected (cdmpipeine.org, 2012)

Each methodology summary sheet provides the following information:

- Typical project(s) to which the methodology is applicable;
- Type(s) of greenhouse gas emission mitigation action;
- Important conditions for application of the methodology;
- Key parameters that need to be determined or monitored;
- Visual description of baseline and project scenarios.

If an approved methodology is unclear or ambiguous in its methodological procedures, a request for clarification may be submitted (unfccc.int, 2010).

4.1.3 Importance of CDM

The reason why CDM is in game is due to the fact that the projects under this market based mechanism aims for the emission reduction and in the carbon constrained scenario, authorization for emitting carbon is considered as an important product which can be traded. Figure 4.2 shows the list of actors participating in the CDM and their role in bringing this project to success (Pasopulti, 2010).

Figure 4.2 Actors in Clean Development Mechanism (Pasopulti, 2010).

4.1.4 Benefits of participating in CDM

CDM was first proposed by Brazil and as mentioned above, it's a market based mechanism for the Non Annex I nations to promote the environmentally friendly investment of Annex I nations, in turn promoting sustainable development while contributing to the reduction of GHG emission globally. For a nation that hosts CDM projects, it's a means for gaining foreign investments. A part from this, it also often benefits the host country to get cleaner air and water and environmental friendly foreign technologies, which sums up in contributing towards sustainable development which is the aim at the end of these project (Pasopulti, 2010).

For the nation which is on the investor's side, the benefits of being under CDM project is that these nations comply with the emission reduction objective that are attained from the emission reduction credits generated as a result of the CDM projects. The Annex I nations can invest in the CDM projects when their quota of commitment period is calculated and they have a system of accounting of GHGs in the national level. The Annex I nations should also submit the appropriate GHG inventory prepared at the national level and that they are complying with Kyoto protocol. The developing as well the developed nations via these CDM projects contribute in the reduction of the GHGs and for this reason, the CDM is regarded as one of the better mechanisms striving to save the planet (United Nations Conference on Trade and Development 2002).

4.1.5 Eligibility as CDM participants

CDM project involves participants from all the sectors of the society, which includes government, NGOs, business as well as the citizens in cooperation with both developing and the developed nations. It is seen that the private sector plays an important role as the CDM project participant since the emission reduction are contributed by this sector and also the private sector receives the investment flows that are associated with CDM projects. Thus, CDM projects are the combination of both public and sectors with additional participation from the local communities where the project is talking place (Pasopulti, 2010).

4.1.6 Criteria for the choosing the host nation for the CDM project

The CDM projects takes place in the developing nations. The reason for choosing a particular host country depends on the following criteria's:

- Ability of the Project to reduce GHG emission;
- Cost associated with technological upgrading;
- Potential return on investment;
- Tax scenario;
- Openness towards foreign investments;
- Availability of the finance and labor;
- Cooperation by the government;

A CDM project can commence any a time after the investor country ratifies the Kyoto Protocol (United Nations Conference on Trade and Development 2002).

4.1.7 Establishing a Designated National Authority

Parties to the Kyoto Protocol—whether or not they are included in Annex I—are required under the CDM Modalities to "designate a national authority for the CDM".

The national authorities designated by a Non-Annex I Party play a vital role in the implementation of CDM projects, most importantly by assessing and approving proposed CDM projects.

The CDM Modalities provide limited guidance on the establishment, responsibilities and functions of the national CDM authorities required to be established under the CDM Rules (known as Designated National Authorities or DNAs). The CDM Modalities do, however, specify that DNAs of Non-Annex I Parties must approve CDM projects hosted by those Parties, by issuing written approval for those projects. These approvals must confirm that:

- Participation in the proposed CDM project is voluntary; and
- Implementation of the proposed CDM project will contribute to the Host Country's sustainable development (in accordance with the broader objectives of the CDM).

Thus, prospective CDM Host Countries must establish a DNA capable of approving proposed CDM projects in the terms set out above. The implications of the need to establish a DNA mandated to assess and approve CDM projects are discussed below.

As previously mentioned, neither the CDM Modalities nor the international CDM Rules more broadly provide detailed guidance on the establishment and functions of DNAs. These issues are instead left to the discretion of individual CDM Host Countries.

DNAs may be established in a variety of ways, for example through the enactment of legislation, and may take a variety of forms, for example an inter-governmental committee. Whichever approach is adopted, it is important that a DNA can:

- Elaborate its decisions and administrative procedures based on a sound legal foundation and institutional mandate;
- Act as a clear point of contact for entities wishing to investigate or pursue CDM projects in the country;
- Approve proposed CDM projects fairly, effectively and efficiently;
- Facilitate intergovernmental coordination and decision-making to ensure that appropriate CDM polices are adopted and implemented to fully harness a countries CDM potential.

In general terms, it is important that the DNA be able to fulfill these functions in a clear and transparent manner. This is integral not only to the administration of CDM activities in Host Countries but also to building investor confidence, and therefore encouraging investment, in such activities (Curnow & Hodes, 2009).

4.2 CDM Project Cycle

A complete CDM project will follow a number of essential steps, known as CDM cycle.

Figure 5.2, shows the process of a CDM project, the needed documents and the responsible entities involved in the process. This section outlines the steps and requirements of a CDM project.

4.2.1 Project Identification and Formulation

The first stage is the identification of a potential CDM project in a Non-Annex I country. Project proponents need to take into account ant national or regional requirement for project cycle eligibility. Perspective CDM projects also need to meet the screening criteria of potential investors. It is important that locale stakeholder's needs and aspirations are considered at this early stage. Normally, a Letter of Endorsement (LoE) is obtained from the host country's government, which leads to further contractual negotiations.

In order to get a CDM project approved and registered by the EB, the project proponents must prepare a detailed Project Development Document (PDD), which includes:

- The description of the project;
- Methodology used in the quantification of the GHG benefits;
- Plans for monitoring of the reductions;
- Environmental impacts;

The project proponents can either formulate a specific methodology to be approved by the EB, or use a methodology that has already been approved and is applicable to the project.

4.2.2 National approval

Before the CDM project can be registered by the EB, it must obtain approval from the host government. It is Designated National authority (DNA)'s responsibility to facilitate this and determine whether the project will damage the sustainable development.

4.2.3 Validation

The PDD will be submitted and reviewed for validation by a Designated Operational Entity (DOE), which must have been accredited by the EB, during this period, the PDD will be made publicly available for comments. Only after the PDD is approved by the DOE ca be the project be formally registered by the EB (Liguang 2006).

Figure 4.4 Number of projects entering validation (cdm.unfccc.int, 2012)

4.2.4 Registration

For registration the validation report and the PDD will be submitted to the EB by the DOE. Registration will be finalized after the maximum of 8weeks from receipt unless a review is requested.

With the validation and registration of CDM project, proponents normally local developers and foreign investors, can start talking actions to implement the project in order to generate the CER benefits and other conventional financial income. There are different project financing forms:

- Bilateral mode

- Unilateral mode
- Multi lateral mode

The graph above shows (Figure 4.5) the total number of project requesting registration each year (using the date of signature in the request registration letter from the DOE). The yellow bar shows the number of these projects that are registered automatically. The graph shows that this fraction has gone down from 92% in 2005 to 31% in 2008. After that the system improved and in 2011 85% was registered automatically (cdmpipeline.org, 2012).

Figure 4.5 The total number of project requesting registration each year (cdmpipeline.org, 2012)

4.2.5 Monitoring

Registered projects, and those that have entered the implementation phase, will be required to maintain internal monitoring systems to demonstrate they are achieving the emission reductions specified in the PDD. The monitoring report will be submitted to a different DOE (DOE-B) from the one who validated the PDD (DOE-A).

4.2.6 Verification and Certification

The DOE-B will verify the monitored emission reductions and produce a verification report for the project. It also needs to prepare a certification report to the EB informing its certification decision.

4.2.7 Issuance of CERs

CER is the fruit from a CDM Project. According to the "Makkaresh Accord":

"CER is a unit issued pursuant to Article 12 and requirements there under, and is equal to one metric tonne of carbon dioxide equivalent, calculated using global warming potentials defined by decision 2/CP.3 or as subsequently revised in accordance with Article 5".

The EB will issue CERs to the project proponents within 15 days after the date of receipt of the verification and the certification report from the DOE-B. The CDM Registry will keep track of issuance of CERs. CER is a finale product after the above-mentioned steps and rigid 'inspection' procedures. It now becomes real and additional. When the real CER is generated, it will be transacted through trading in the global carbon market or by following the price agreed I the forward contract (Liguang 2006).

CDM cycle is a complicated CER manufacturing process with many participants involved in the process to generate and trade these real, measurable and additional assets. However, for the developing countries due to project based nature of the CDM and the capacity shortage reality, there are various institutional, legal and financial challenges to address a potential risks to manage. Host government, in partnership with the locale proponents and other actors will play important roles in promoting CDM implementation. Although many factors influence the size and stability of the global carbon market, the comprehensive analysis of market will definitely provide a solid base for the policy making and strategy development (Liguang 2006).

Technology inputs plays a key role in achieving the sustainable development which is the essence of CDM. In CDM projects there is the necessity to incorporate and transfer technologies that are environmentally sound, known as Environmentally Sound Technologies (EST) to Non-Annex I nations. The role of the Annex I nations according to the Agenda 21 of UNFCCC, is to support developing nations in providing necessary "technological know-how" and guiding them with economical, technical as well as managerial capabilities for the component use of the transferred technology as well as in further development of the technology that has been transferred. (UNFCCC 2010).

In total 8416 CDM projects are now included in the Pipeline excluding the 204 projects given a negative validation by DOEs, the 1174 projects where DOEs terminated the

validation, the 217 rejected by EB and the 56 withdrawn. 4044 of the projects are now registered and a further 179 are in the registration process. 1534 CDM projects have got CERs issued (Figure 4.6) (cdmpipeline.org, 2012).

Figure 4.6 Status of CDM projects (cdmpipeline.org, 2012).

According to Soren E.Lutken, currently there is a non availability of the exact statistics on the "involvement of bilateral investment in CDM projects". The Project Development Designs (PDDs) of most of the CDM projects shows no technology transfer but presents the fact that the technology is developed natively. Survey done on the 628 registered CDM projects show that "projects are generally unilaterally financed" (Lutken 2008).

Promoting new low-carbon technologies and their global applications is a major challenge in balancing the GHG emission. Bali Road Map of the year 2007 indicates that technology development and diffusion are the two strategic objectives for mitigating the climate change and helping the developing nations economically as well as in providing other incentives. However the barriers faced by the developing countries in importing the technologies from the developed nations are many such as tariffs, adaptation of the technology, protection of the intellectual property rights etc (un.org, 2008).

4.3 Joint Implementation (JI)

The mechanism known as "joint implementation," defined in Article 6 of the Kyoto Protocol, allows a country with an emission reduction or limitation commitment under the Kyoto Protocol (Annex B Party) to earn Emission Reduction Units (ERUs) from an emission-reduction or emission removal project in another Annex B Party, each equivalent to one tonne of CO2, which can be counted towards meeting its Kyoto target.

Joint implementation offers Parties a flexible and cost-efficient means of fulfilling a part of their Kyoto commitments, while the host Party benefits from foreign investment and technology transfer.

A JI project must provide a reduction in emissions by sources, or an enhancement of removals by sinks, that is additional to what would otherwise have occurred. Projects must have approval of the host Party and participants have to be authorized to participate by a Party involved in the project.

Projects starting as from the year 2000 may be eligible as JI projects if they meet the relevant requirements, but ERUs may only be issued for a crediting period starting after the beginning of 2008.

If a host Party meets all of the Eligibility requirements to transfer and/or acquire ERUs, it may verify emission reductions or enhancements of removals from a JI project as being additional to any that would otherwise occur. Upon such verification, the host Party may issue the appropriate quantity of ERUs. This procedure is commonly referred to as the "Track 1" procedure."

If a host Party does not meet all, but only a limited set of eligibility requirements, verification of emission reductions or enhancements of removals as being additional has to be done through the verification procedure under the Joint Implementation Supervisory Committee. Under this so-called "Track 2" procedure, an independent entity accredited by the JISC has to determine whether the relevant requirements have been met before the host Party can issue and transfer ERUs.

A host Party which meets all the eligibility requirements may at any time choose to use the verification procedure under the JISC (UNFCCC 2011).

4.4 Approved baseline and monitoring methodology AM0009

As this thesis focuses on the reduction of flaring of associated gas, the section discusses the specific methodology (AM0009) that is applicable for this project rype.

Approved baseline and monitoring methodology AM0009 is one of the clean development mechanisms that could be used in the oil and gas sector. The aim of this methodology is recovery and utilization of gas from wells that would otherwise be flared or vented.

For achievement of this methodology the following definitions must exist (cdm.unfccc.int, 2008).

Associated gas. Natural gas found in association with oil, either dissolved in the oil or as a cap of free gas above the oil.

Processing plant. A facility designed to separate substances or make new substances through chemical, physical or physical-chemical procedures.

4.4.1 Applicability

The methodology is applicable to project activities that recover and utilize associated gas from oil wells that was previously flared or vented.

The methodology is applicable under the following conditions (cdm.unfccc.int, 2008):

- Associated gas at oil wells is recovered and transported to:
    - A processing plant where dry gas, liquefied petroleum gas **(**LPG), and condensate are produced; and/or,
    - An existing natural gas pipeline without processing.
- All associate gas recovered comes from oil wells that are in operation and are producing oil at the time of the recovery of the associated gas.
- The recovered gas and the products (dry gas, LPG and condensate) are likely to substitute in the market only the same type of fuels or fuels with a higher carbon content per unit of energy;
- The utilization of the associated gas due to the project activity is unlikely to lead to an increase of fuel consumption in the respective market;
- The project activity will not lead to changes (negative or positive) in the volume or composition of oil or high-pressure gas extracted at the production site;

- Data (quantity and fraction of carbon) are accessible on the products of the gas processing plant and on the gas recovered from other oil exploration facilities in cases where these facilities supply recovered gas to the same gas processing plant;
- No gas coming from a gas lift system is uses by the project activity.

Finally, the methodology is only applicable if the identified baseline scenario is the continuation of the current practice of either flaring or venting of the associated gas (cdm.unfccc.int, 2008).

4.4.2 Projection and adjustment of project and baseline emissions on the basis of oil production

Project as well as baseline emissions depend on the quantity of gas recovered, which is linked to the oil production. Oil production may be projected with the help of a reservoir simulator, reflecting the rock and fluid properties in the oil reservoir. As projections of the oil production, the methane content of the gas and other parameters involve a considerable degree of uncertainty, the quantity and composition of the recovered gas are monitored ex post and baseline and project emissions are adjusted respectively during monitoring.

The validating DOE shall confirm that estimated emission reductions reported in the CDM-PDD are based on estimates provided in the survey used for defining the terms of the underlying oil production project as per the production sharing contract.

At verification the verifying DOE shall check the production data for oil and associate gas and compare them with the initial production target as per the information provided in survey used for defining the terms of the underlying oil production project. If the oil production differs significantly from the initial production target, then it should be checked that this is not intentional, and that such a scenario is properly addressed by the production sharing contract between the contracted party(ies) (cdm.unfccc.int, 2008).

4.4.3 Project boundary

The project boundary encompasses:

- Project oil wells where the associated gas is collected;
- The site where the associated gas was flared or vented in the absence of the project activity;

- The gas recovery and delivery infrastructure, including new collection and transmission pipelines, reservoirs, control and measurement equipment and compressors;
- The processing facility using the recovered associated gas.

The greenhouse gases included in or excluded from the project boundary are shown in Table 4.1 (cdm.unfccc.int, 2008).

Table 4.1 Emissions sources included in or excluded from the project boundary (cdm.unfccc.int, 2008)

The project area may encompass several wells under a Production Sharing Contract (PSC) with a production target.

The project area may encompass several wells under a Production Sharing Contract (PSC) with a production target.

4.4.4 Identification of the baseline scenario and demonstration of additionality

Project participants shall apply the following steps to identify the baseline scenario (cdm.unfccc.int, 2008):

Step 1: Identify plausible alternative scenarios

Plausible alternative baseline scenarios could include, *inter alia*:

(1) Release of the associated gas into the atmosphere at the oil production site (venting);

(2) Flaring of the associated gas at the oil production site;

(3) On-site use of the associated gas for power generation;

(4) On-site use of the associated gas for liquefied natural gas production;

(5) Injection of the associated gas into an oil or gas reservoir;

(6) Recovery, transportation, processing and distribution of the associated gas and products thereof to end-users without being registered as a CDM project activity;

(7) Recovery, transportation and utilization of the associated gas as feedstock for manufacturing of a useful product.

Step 2: Evaluate legal aspects

In evaluating legal aspects, the following issues should be addressed:

- Are the alternatives permitted by law or other (industrial) agreements and standards?
- Are there laws or other regulations (e.g. environmental regulations) which implicitly restrict certain alternatives?

All baseline alternatives shall be in compliance with all applicable legal and regulatory requirements, even if these laws have objectives other than GHG reductions. If an alternative does not comply with all applicable legislation and regulations, such an alternative should be eliminated unless it is demonstrated, based on an examination of current practice in the country or region in which the law or regulation applies, that applicable legal or regulatory requirements are systematically not enforced and that noncompliance is widespread.

Step 3: Evaluate the economic attractiveness of alternatives

The economic attractiveness is assessed for those alternative scenarios that are feasible in technical terms and that are identified as permitted by law or other (industrial) agreements and standards in Step 2. The economic attractiveness is assessed by determining an expected Internal Rate of Return (IRR) of each alternative scenario. The IRR should be determined using, *inter alia*, the following parameters:

- Overall projected gas production;
- The projected quantity of gas recovered, excluding gas flared, vented or consumed on-site;
- The agreed price for the delivery of recovered gas (e.g. from a Production Sharing Contract);
- The net calorific value of the gas;
- Capital expenditure for gas recovery facilities, pipelines, etc. (CAPEX);
- Operational expenditure (OPEX);
- Any profit sharing agreements and cost recovery, including cost savings through the substitution of products by the recovered gas, if applicable.

If venting or flaring of the associated gas at a given location is not outright banned but instead is subject to taxes or fines, the impact of these taxes and fines should be considered in the IRR calculation.

Figure 4.7 Demonstrating financial additionality.

The alternative scenario that is economically the most attractive course of action is considered as the baseline scenario. The project activity can be considered additional, if the IRR of the project activity is lower than the hurdle rate of the project participants (Figure 4.7) typically about 10%. The DOE should verify what value for the IRR is typical for this type of investment in the respective host country. The calculations should be described and documented transparently.

4.4.5 Monitoring Methodology

All data collected as part of monitoring should be archived electronically and be kept at least for 2 years after the end of the last crediting period. 100% of the data should be monitored if not indicated otherwise in the tables below. All measurements should be conducted with calibrated measurement equipment according to relevant industry standards.

The CDM-PDD will have to include minimal procedures to ensure that the data collection and retention will be made properly.

Uncertainty assessment (cdm.unfccc.int, 2008):

'Permissible uncertainty' shall be expressed as the 95% confidence interval around the measured value, for normally distributed measurements. The uncertainty associated with each parameter should be assessed, for example, by calculating the probable uncertainty as the mean deviation divided by the square root of the number of measurements. If this uncertainty is within the 95% confidence interval, than it is considered permissible uncertainty, and no action must be taken.

If not, then the uncertainty should be assessed as low (<10%), medium (10-60%) or high (>60%). Percent uncertainty may be calculated by dividing the mean of the parameter by the probable uncertainty and multiply by 100% to get percent uncertainty. If percent uncertainty is <10%, the uncertainty is considered low. A detailed explanation of quality assurance and quality control procedures must be described for parameters with medium or high uncertainty in an attempt to decrease uncertainty, and to ensure that emissions reductions calculations are not compromised. In the case of a parameter with medium or high uncertainty, a sensitivity analysis should be performed to determine the potential of the uncertainty of the parameter to affect the emissions reduction calculation. The authenticity of the uncertainty levels should be verified by the DOE at the project verification stage.

4.5 Conclusion

Market-based policies have shown to be cost-effective tools in mitigating emissions. Under a wide range of potential policy scenarios, international offsets represent some of the most economically efficient options for reducing global GHG emissions. The CDM is the primary international offset program in existence today and, while not perfect, it has helped to establish a global price on GHG emission reductions.

The CDM allows industrialized countries with a greenhouse gas reduction commitment to invest in projects that reduce GHG emissions in developing countries. The implementation of CDM brings opportunities and threats for project developers and host countries.

For the country that hosts CDM projects, there is the opportunity to gain foreign investments and in same time the host country could help to GHG emission reduction that it gives contribute to sustainable development which is the aim of CDM.

The host countries through the sale of CERs could implement the GHG reduction projects that would not otherwise be viable.

The AM0009 methodology fits well within the overall criteria and priorities of the Protocol. How this methodology can contribute to the reduction in GHG emission will be examined in the case study.

CHAPTER 5

Case Study

In this chapter I search to illustrate and verify the level wherewith the arguments proposed and treated in the theoretical part could be applicable in practice, for studying this purpose I have chosen 3 different oil and gas producing countries from different geographical area and economic reality, the countries are:

- Islamic Republic of Iran;
- Federal republic of Nigeria;
- Republic of Indonesia.

Following points are the points that I have chosen for the structure of my research on each case study:

- Overview;
- Political Situation;
- Oil and Gas Sector;
- Flaring of Gas in the Oil and Gas Sector;
- CDM Project Example;
- Conclusion.

First of all I begin with a brief and general overview on each country, in second step I describe the political situation relative to climate issues, afterward I talk about oil and gas sector, the production, consumption and exportation of oil and gas and the impact of this industry in internal economic development, I continue each case study talking about flaring

and venting of associated gas in the oil and gas sector with the aim of describe the level of green house gas emissions released by oil and gas industry in these countries and the main reasons that cause/give address the practice of this phenomenon, I finish each case study with description of a project activity under clean development mechanism and showing in practice how mechanism under Kyoto Protocol especially Clean Development Mechanism could give address to the reduction of flaring or venting of associate gas in oil and gas producing countries and in same time how could help to the local and national economic development in developing oil and gas producing countries.

Iran

Overview

The Islamic Republic of Iran is situated in the southwestern part of Asia and the far eastern part of the Middle East. The Caspian Sea is in the north and in the south, the Persian Gulf and the sea of Oman, connects the country to the Indian Ocean and international waterways. Iran has a total territorial area of 1,648,000 square kilometers and population of around 63.86 million in the year 2000.

Iran is located in dry and arid region and more than 60% of this country suffers of shortage of water resources for drinking and agriculture. Increasing of earth temperature caused by GHG emission in last century causes direct and negative effects in different economical sectors in Iran.

In order to participate in the international effort to mitigate global climate change and to develop national policies for adaptation to climate change, Iran had signed the United Nations Convention on Climate Change (UNFCCC) at the Rio the Janeiro Earth Summit in 1992 along with more than 150 countries, and ratified the Convention in July 1996. Iran has also ratified the Kyoto Protocol in November 2005 when the Designated National Authority to implement CDM project was established. Since then, Iran has actively participated in the Conference of Parties (COPs) and the Meetings of Parties to the Kyoto Protocol. As a Non-Annex I party to the Convention, Iran is committed to comply with its obligations, as reflected in the submission of its Initial national Communication to the COP in March 2003 and its Second National Communication (SNC) in 2011 (Sabooni & Amiri, 2010).

Iran's National Climate Change Office (NCCO) was established in January 1998 under the auspices of the Department of the Environment. Among other responsibilities, such as public awareness and national coordination of the Sub-committee for Climate Change under the National Committee for Sustainable Development, the NCCO has built national capacity to systematically address climate change issue and implement CDM projects under the Kyoto Protocol (Sabooni & Amiri, 2010).

Political Situation

More than above mentioned issue that could be resolvable with organized and specific project activities under clean development mechanism there are other issues that could indirectly effect the project activities organizations and causes the lack of CDM project activities presence in Iran in spite of the urgent need of implication of project activities in many fields specially in oil and gas and petrochemical sectors.

First one is the organizations issue that come back to the decision human resource managements department because in the modern, globally-competitive environment the need for substantial changes and creative work is always required, one of the challenges that insure the success of organizations is the demand for qualified and talented staff, there is less emphasis on this aspect of organizations. A qualified and talented decision makers in these companies that are up to date on global trends with their ability and knowledge's could make the successful, relevant and adequate decisions for project activities implementation in every sector.

Second is the international relations issue, Iran is historically subject of the international sanctions, especially the measures that struck hardly the country they has been in last decade. the sanctions effect on Iranian economy is damaging directly and indirectly the Iranian oil and gas sector.

In last decade there was different regime of sanctions against Iran that every regime had caused or is causing its impact on the oil and gas sector.

First of all is the sanction approved in 2006, prohibition of imports and exports to Iran of any tip of materials or equipment that are sensitive to the nuclear use, especially the materials with dual use. In this typology of materials could exist the material that Iran could use or in oil and gas facilities…

The second tip of sanctions that had effect the Iranian oil and gas development program was against Iranian financial sector, the sanctions against Iranian banks and companies, these typology sanctions caused the devaluation of Riyal and as the consequence the rise of inflation in country.

This sanction made extremely difficult to trade with Iran making closer circle around the Iranian economy. Iran for resist/withstand the sanctions began to enjoy the funding from the most important sector of country which is oil and gas sector. Obviously, for dedication of oil

and gas sectors income to other sector Iran must reduce heavily the investment of its energy sector.

This investment reductions effect is visible in oil and gas sector, there are lot of projects in Iran that for lack of funds are blocked or the progress of project are very slow. The Iranian government and oil and gas sectors officials are conscious and awareness that Iran has lot of GHG emissions from flaring of associated gas and they want apply the CDM project activities to capture associated gas from oil wells and consequently the GHG emission reductions, but, the prohibition of materials and facilities from one part and the sanctions against Iranian banks and companies from other part are causing directly and indirectly the avoidance of every tip of investment such as CDM project activities application in Iran.

Oil and Gas Sector

The experience of producing Iran's Second National Communication, has not only enhanced the national capacity to prepare National Communication, but also has prepared Iran for development of official national development policies addressing climate change.

Therefore department of environment (DOE) is established some programs for GHGs emission reduction. According to these programs GHGs emission in Iranian energy sector must be reduced about 30 percent. Now, GHGs emission per GDP (kg equal CO_2 per GDP) index in Iran (3.07 kg CO_2/2000US$) is more than world average (0.73 kg CO_2/2000US$) and Asia average (1.26 kg CO_2/2000US$). Also emission factor of CO_2 in Iranian oil refineries is about 3.5 times more than European ones, like England. Hence, the main goal for GHGs reduction in Iran is achievement to Asia average level. Since, potential of GHGs emission reduction is estimated about 67 million tones equal CO_2 at 2025 in oil sector. The major part of this reduction is related to petrochemical complexes. It should be considered that the most of these industries are old and worn out, so there are several effective techniques for their GHGs emission reductions. Also cost of tone CO_2 reduction in Iranian oil sector is very lower than same industries with new technologies.

Iran is OPEC's second largest oil producers and the fourth largest crude oil exporter in the world. Iran has second largest gas reserves in the world after Russia, according to the 2008 BP Statistical Energy Survey, Iran's natural gas reserves is about 27.8 trillion cubic meters, 15.67% of the world total.

Flaring of Gas in the Oil and Gas Sector

The principal GHG emissions in oil and Gas sector in Iran is flaring of associated gas during production process. The flaring of associated gas in Iran has been a common practice since the first commercial discovery in 1907.

In terms of volume, the country flares a highest volume of gas, Iran flares about 10 to 15 BCM of associated gas annually, the Government and National Iranian Oil Company(NIOC) have identified the flaring of associated gas as a priority issue on the energy sector. The priority comes from the desire to minimize the waste of gas resources which could be used for increasing the gas derived products (LPG, condensate) and protect the local environmental damage, moreover, the Government is aware of relationship between associated gas flaring and greenhouse gas emissions in atmosphere, the Government began to apply and would like to continuing the application of Clean Development Mechanism (CDM) as a way to reduce flaring gas in oil and gas sector.

According to the Global Gas Flaring Reduction a Public-Private Partnership Iran after Russia and Nigeria is the third largest gas flaring countries in the world.

The flaring of associated gas in Iran has many different reasons (cdm.unfccc.int, 2009):

- Limited need for the gas either for on-site use or Enhanced Oil Recovery (EOR)
- Insufficient market for the gas;
- The majority of associated gas is high sulfur which makes it utilization costly;
- Location of many of the oil fields is far from gas demand areas and lack gas infrastructure connections;
- Limited capital to invest in associated gas capture projects given the higher economic returns and priorities of oil investments;
- Abundant supplies of non-associated gas limited the need to capture and market higher cost associated gas.

Most of the production facilities in Iranian oil and gas sector were manufactured between 1960 and 1980 when the standards and science of technology and environment were low. Development of infrastructure for gas gathering and utilization in this period was highly limited.

Over the past decade the flaring of gas in Iran has remained roughly constant and is recognized by the Iranian government as the major source of the GHG emissions . The following figure demonstrate the flaring gas from 1994 to 2007 (cdm.unfccc.int, 2009).

Source: NOAA (World Bank/GGFR website)

Figure 1 Average Gas Flaring in Iran from 1994 to 2007

In Iran there are 11 projects under CDM that only 1 of this projects is in oil and gas sector that for implementation of projects they used the AM0009 CDM's methodology.

CDM Project Example – Soroosh&Nowrooz

For many years, Iranian Offshore Oil Company (IOOC), a subsidiary of National Iranian Oil Company (NIOC), has tried to implement a complex and expensive project named Kharg NGL project, the aim of this project is tocapture and process all the associated gas from the oil fields in Kharg and Bahregansar areas.

Flaring of the associated gas at Kharg Island and the related offshore fields has been a major source of CO2 emissions for decades. Most of the gas flared has an acidic nature, which presents a substantial technical and financial barrier to ending flaring. The proposed CDM project activity represents the first phase in the process of ending flaring for these fields and thereby reducing GHG emissions (cdm.unfccc.int, 2009).

The Kharg NGL project is designed to capture substantial amounts of associated gas (about 600 MMSCFD) and use this gas productively both for power and petrochemical uses on Kharg

Island and for export of energy products.The complexity of the project arises from the high acidity of the gas that will require that the facility have an acid gas treatment.

The Kharg NGL project consists of three components:

- Offshore gas compression platforms;
- Offshore gas gathering pipelines and gas transmission lines; and
- A facility located on Kharg Island for gas treatment, acid gas re-injection, and extraction of methane, NGLs, and condensates and the related storage and shipment facilities for these products. This component is the most expensive and technically difficult.

The high acidity of the gas needs the facilities for deacidification which increase the project cost and make the gas recovery and processing expansive.

In Kharg island area only the Soroosh and Nowrooz offshore oilfields are only two oil fields that produce sweet associated gas. Flaring of associated gas in these fields have been used since 1972 when the fields began production. The associated gas from these fields does not require acid gas treatment and the capture and transportation of associated gas is economically sustainable.

The project activity is a sub-component of the Kharg-Bahregansar NGL and Acid Gas Treatment project(Kharg NGL project) designed to capture and utilize all the associated gas in the Kharg-Bahregansar area. The Soroosh&Nowrooz Early Gas Gathering and Utilization subcomponent is brought forward as a CDM project activity.

There are different scenarios for implementation of Soroosh and Nowrooz Early Gas Gathering project. One of different possible scenarios is installation of liquefied natural gas production plants that is unfeasible because of its inconvenience for building an LNG plant for the small volume of gas and limitation of space on the platforms that exclude any capital investment. because installation of an LNG facility requires building of a new platform and therefore any investment on the small volume of Soroosh and Nowrooz associated gas is not economically sustainable.

Re-injection is another method that an oil and gas facility could apply for enhancing oil recovery, re-injection would require substantial capital investment for drilling of injection wells and installation of high pressure compression equipment, an investment such as re-injection project would generate no revenues and is unfeasible.

An option was identified to recover this sweet gas and utilize it productively, independent of the installation of the onshore gas treatment and processing facilities on Kharg Island. This option, the capture and transport of the sweet gas from the Soroosh and Nowrooz fields was identified as the potential CDM project activity during the overall CDM assessment by NIOC (cdm.unfccc.int, 2009).

The economically advantage of the proposed project was that project did not need to installation of a new gas processing facilities because the recovered gas is injected into the existing gas distribution system on Kharg Island without processing.

In August 2006, during a CDM screening sponsored by NIOC and Statoil, the sweet gas portion of the Kharg NGL project was identified as a potential stand-alone component that could be developed as a CDM project activity. This fields gas was sweet and did not require any de-acidification treatment. Therefore it seemed feasible with CDM registration for IOOC to go ahead and implement a large portion of the gas gathering and transportation infrastructure so as to stop the flaring at the Soroosh and Nowrooz fields and bring the gas for use on Kharg Island. Implementing the Soroosh&Nowrooz Early Gas Gathering and Utilization Project implied moving up the schedule of the pipeline installation and that the facilities would be substantially overdesigned for the relatively small amount of gas involved until the Kharg NGL project is commissioned. Additional capital costs were required, but these were viewed as manageable. The proposed CDM project activity captures associated gas that was flared at the Soroosh (5 MMSCFD) and Nowrooz (20 MMSCFD) offshore oil fields and connects this gas to the common trunkline at the Aboozar-GCP (AB-GCP) platform. From there, the gas will be brought to Kharg Island and connected to an existing gas pipeline and delivered to users including utilities at existing oil processing facilities, power generation, and petrochemicals on the island (cdm.unfccc.int, 2009).

On Kharg Island, onshore pipelines is utilized to transport the gas to the existing gas system and the identified end-users on the island. The gas is utilized by the Dorood oil fields facilities and a power plant owned by NIOC where it is used as fuel. The remaining gas, if any, is sold to Kharg Petrochemical Company (KPC).

The project activity in Soroosh and Nowrooz oilfield is developed with reference to approved methodology AM0009 Version 03.3 - “Recovery and utilization of gas from oil wells that would otherwise be flared or vented”. The project was applicable if could have

meted the methodologies applicability conditions. The Soroosh and Nowrooz Early Gas gathering and Utilization project meted the CDM's AM0009 methodology applicability conditions as (cdm.unfccc.int, 2009):

- The project activity comprises recovery and transportation of associated gas from the Soroosh&Nowrooz offshore oil fields to the existing natural gas pipeline system on Kharg Island;
- The natural gas that in currently sending to the pipelines was sending to Soroosh and Nowrooz producing platforms where the associated gas in excess of what was required as fuel on the platforms was flared;
- The natural gas is sending to a distribution system which serves utilities in the Dorood onshore oil processing facilities, to an small power plan and a methanol petrolchemical facility;
- The project activity has no impact on oil production and at the source fields no high-pressure gas is or was extracted at these fields.

Venting the associated gas in Soroosh and Nowrooz fields was very dangerous for two principal reasons, first, for the operators, the danger due to likelihood of explosion because of

Table 1 Gases and their sources in project activity (cdm.unfccc.net 2009).

complexity of platforms the emission of methane from associated gas (except for small volume for controlled operational reason) represent an excessive safety risk and the risk o life, second, property for inhaling of methane and other gases that would have health consequence. The Table 1 shows the gases and their sources which are include in the project boundary.

For the reasons mentioned above the NIOC's Health, Safety and Environmental (HSE) Department forbids the ongoing the venting of such large volumes of methane.

A portion of associated gas is used to fuel in the oil processing process equipment at the fields, this portion is about 10% of associated gas. The two fields are currently using the associated gas to produce all electrical power needed on site.

For IOOC to move the proposed CDM project forward, it was necessary to submit a memo to the IOOC Technical Committee so as to initiate the process for NIOC to request a budget supplement for the early implementation of the project activity (cdm.unfccc.int, 2009).

The key statistics and operating indicators are shown in Table 2.

Table 2 Additional capital for early implementation (cdm.unfccc.net 2009)

The AM0009 methodology suggests a 10% IRR, but notes that this is country and developer sensitive. The financial markets work within a specific regulatory framework, with both public and private banks operating. At the time of making the investment decision in November 2006, the minimum expected rate of return on facilities posted by the Iranian Central Bank was 16%. Commercial rates are difficult to assess as inflation in Iran is high (currently estimated at more than 25%). Clearly the economic conditions within the Islamic Republic would support an IRR above 10%, and 20% is used in this analysis. Nevertheless, the IRR for the project is substantially below 10% and thus the issue is largely academic.

Clearly without CERs the project is not economic. The actual economic lifetime of the project is ambiguous, but at the time of making the investment decision it was anticipated that the entire Kharg project was only delayed until 2010 and that this project activity was clearly a short term (two year) interim solution. Even though the Kharg NGL project has later been delayed substantially due to problems with financing, the marginally positive (and declining) annual net cash flow from the S&N project once operational indicate that as a stand-alone project activity, the project has only a limited scope and its long-term operation depends upon the ultimate implementation of the overall Kharg NGL project. The IRR (Table 3) for the project is substantially below 10%.Clearly without CERs the project is not economic (cdm.unfccc.int, 2009).

Table 3 The financial indicators for the S&N Project – before financing, CER revenues (cdm.unfccc.net 2009)

The project variables are relatively stable and there is little likelihood of any substantial variations. Gas production is lower than initially anticipated before, but the fields have long established production and any significant variations (+/- 20%) are unlikely without any major workovers of the wells, which are not foreseen with the project time period.

If the project activity is registered as CDM, the resulting income from sale of CERs makes a major impact on the project economics revenue. This point, consideration of the potential revenues from sale of CERs, has always been recognized and it is the principle reason that the project implementation was proposed (cdm.unfccc.int, 2009).

Due to the Iranian fuel prices being regulated at low levels and as a result the project had a law revenues from sale of gas, the CERs had a magnified impact on the IRR because they soldit at relatively high prices in the international market. Given that the incremental capital cost of the project activity is low, the impact of the CERs on the IRR is high, although the

total value of the NPV during the project activity is not large. It should be noted that the proposed project at the time of making the investment decision was expected to have a limited crediting period until the Kharg NGL project was implemented (two years).

Table 4 The financial indicators for the S&N Project – after financing, CER revenues (cdm.unfccc.net 2009).

Given these prospective of economic returns, it is clearly in IOOC's best interest to incur the costs of early implementation of the project activity and its registration as CDM.

The project activity encompasses the recovery of the associated gas at the Soroosh and Nowrooz oil production platform and has designated to eliminate the entire or almost entire flaring gas and GHG emission in atmosphere (cdm.unfccc.int, 2009).

Figure 2 shows the schematic of this project activity with the appropriate metering points.

Figure 2 Illustration of project boundary and monitoring points (cdm.unfccc.net 2009)

The recovered associated gas from Soroosh and Nowroozfield has the following destinations (cdm.unfccc.int, 2009):

- The on-site utilization for electricity generation at Soroosh Production Platform (SPP-1) and Nowrooz Production Platform (NPP-2). The volume of gas used for electricity generation at point D1 is defined as the measured volume of gas delivered to the power generation units at Nowrooz (n1 and n2), while the volume of gas used for electricity generation at point D2 is defined as the measured volume of gas delivered to the power generation facilities at Soroosh (n3, n4 and n5). No fossil fuels other than the recovered associated gas are used to generate electricity in these off-grid captive power units as long as the CDM project is in operation. Even ifthis tip of utilization of gas was practiced before CDM project activities application, as the result in this section they have same GHG emission in atmosphere.
- Aboozar oil Production Platform (ABPP) was using diesel as fuel for the dual-fuel turbine. After project implementation about 3 MMSCFD of the associated gas has been transporting from AB-GCP to AB-PP as a replacement of diesel fuel. The gas supplied by the project activity has no impact on the energy used by the production platform and indeed provides a lower carbon fuel for energy use. This is a positive leakage due to the project activity. In this section there is a satisfied emission reduction, they have a replacement of fuel consumption, with this project activity they substitute a high carbon fuel with a law carbon fuel that was flared before.
- Dorood II onshore oil facilitywas using an amount of about 6 MMSCFD natural gas purchased gas from KPC. The energy demand and fuel (i.e. natural gas) at this facility is not affected by the supply of gas, only the source of gas is changed. In this section they apply a substitution of fuel which is a quantity of before flared gas with the gas that currently could be stored or utilized in other sections.
- Dorood I onshore oil facilitywas using about 8.5 MMSCFD natural gas purchased from KPC. The energy demand and fuel (i.e. natural gas) at this facility is not affected by the supply of gas from the project activity, only the source of gas is changed. In this section they have a same tip of emission reduction that I explained in Dorood II onshore oil facility.

- Dorood III onshore oil facility produces fuel through desulfurization of sour associated gas. Any sour associated gas not utilized at the field is currently flared due to limited treatment opportunities. This implies that if Soroosh and Nowrooz gas becomes available in this field, flaring of sour associated gas would increase and it assume that an equivalent volume of sour gas would be flared and as a result a gas supply to this facility is included as a source of leakage emissions.

Table 5 The ex-ante estimation of emission reductions (cdm.unfccc.int, 2009)

- NIOC power plantruns at variable capacity as its demand derives from residual electricity demand, and was consuming between 2 and 7 MMSCFD. The fuel demand at this facility is not affected by the project activity, and only the source of fuel gas is changed.
- Kharg Petrochemical Company (KPC**)** was selling fuel gas to IOOC's Dorood I and Dorood II facilities and the NIOC power plant before the Soroosh and Nowrooz project activity. (KPC has gas sweetening facilities and desulfurizes the gases come from IOOC, this desulfurized gas was selling back for fuel use.) After project implementation, the KPC has available for petrochemical use both the gas backed out at the Dorood I, Dorood II facilities and the NIOC power plant, plus any

residual gas recovered by the proposed CDM project. KPC has at least 30 MMSCFD of excess capacity in both its NGL and Methanol plants. In this section there are enough emission reduction because the before flared gas at the Shoroosh and Nowrooz platforms comes to Dorood I, Dorood II and NIOC's power plan and utilizes as fuel in their facilities.

The Soroosh and Nowrooz early gas gathering and utilization's project activity is a successful project under CDM that capture and utilizes the associated gas that would otherwise be flared. Only, this project captures and utilizes the very limited quantities of sweet associated gas. Iran flares a largest quantity of associated gas every year. This project activity would be used as an example of how CDM can give address to GHG emissions reduction in Iran and could have large impact in the country thereby decreasing GHG emissions and improving resource management (cdm.unfccc.int, 2009).

One reason that Iran can flare large quantities of gas while it has a growing gas demand is that it has such large quantities of both associated and non-associated gas. Iran has the second largest reserves of natural gas in the world. Indeed Iran can meet almost all its foreseen domestic needs from the giant South Pars field alone. Iran's very abundance of gas and its ability to benefit from economies of scale to bring on giant fields like South Pars is an important reason that gas capture projects related to associated gas flaring are continually disadvantaged in the competition for limited capital funds.

This does not mean that Iran must not invest in project activities for flaring gas reduction.

Nowadays the demand of international natural gas for his lower emissions against other fossil fuels is increasing and Iran with a medium term projects activities under CDM could capture and gather the flaring gas from its oil platforms, therefore, from one standpoint will help highly to the international flaring gas emission reduction and of other standpoint with selling the CER's and natural gas will obtain an enormous economic profit that could use in investments for his domestic economic development.

There are different oil platform in Iran that are steel flaring associated gas, the five principal offshore operational regions are (cdm.unfccc.int, 2009):

- Kharg district
- Bahregansar district

- Sirri district
- Qeshm district
- Lavan district

Each of above mentioned district has different field, a part from Soroosh and Nowrooz fields that are two of Bahreqansar district all other fields are flaring the associated gas. Despite of identification of flaring of associated gas as a priority issue on the energy sector by Iranian Government and National Iranian Oil Company, there are only a small number of projects developed in this regard. These projects are not complete and some are not implemented yet, also there are fields without any gas gathering plan which result in increasing flaring volumes of associated gas each year.

These fields are not in a profit sharing agreement or other such agreement. It should be noted that NIOC do not pay taxes and instead surrender all profits to the government , NIOC annually receive a capital budget by a direct budget allocation approved by the Iranian parliament.

Oil and gas sector is the Iranian principal source of the income. Iran being a waste country and considering more than 60% of this country located in semiarid and arid area with an undeveloped agriculture system, the Government must dedicate most of its income for importation and investments in this area and afterwards the Government could not invest enormously in oil and gas sector for its technology development ex. For flaring gas that more than investment on facilities for capturing and transportation the acid gas they need a large investment on facilities for gas desulfurization (cdm.unfccc.int, 2009).

Conclusions

- CDM has had limited uses, but the one project developed does show that CDM is applicable to the flaring problem in Iran
- Basic UN/CDM structures have been set up, but have relatively little influence
- Sanctions are an issue. As one of the main reasons for CDM is technology transfer, the sanctions directly reduce this benefit. In the project example of Soroosh & Nowrooz CDM project, the largely project related to the Kharg Island Sour Gas project not being

implemented is that the acid gas technology was made difficult to access by the sanctions.

However, until the issues around Iran's nuclear program are resolved, access to advanced gas technology will likely be limited.

Nigeria

Overview

Federal Republic of Nigeria is located in West Africa with its more than 130 million population is Africa's most populated country.

Nigeria has an abundance of natural resources, its natural resources include crude oil, gold, cotton, yams, rubber, hides, and skins. Nigeria still has a very weak economy, with a GDP per capita (nominal) of about $2,400 (2009 estimate) and approximately 70% of the population living below the poverty level. These economic statistics substantiate the claim of government mismanagement of natural resources.

Nigeria is a Party to the UNFCCC, which it signed on June 13th 1992 and ratified in August 1994 and participated as a Party entity as well as a member of regional groupings to many of the Conference of Parties (COP) meetings. Nigeria ratified the Kyoto Protocol on the 10th of December 2004, and the Protocol came into force for the country on the 10th of March 2005. Even before this time, the Federal Government of Nigeria (FGN) has, over the years, encouraged activities towards meeting its climate change objectives (ICF International, 2006).

Political Situation

In Nigeria, misgovernance is epitomized by the crisis in the Niger Delta, which gained ascendancy as the various problems in the region began to acquire a seemingly intractable nature.

The growing interest in the Gulf of Guinea region derives from its endowment of lucrative vast deposit of good quality oil and gas resources aside from other marine resources the region has to offer. The discovery of oil in the region in 1956, which today accounts for most of its national revenue, has affected the region's significance in economic, strategic, and political terms. In spite of the immense wealth generated by oil production in the Niger Delta, it has remained one of the most impoverished parts of Nigeria. The Niger Delta Human Development Report's (2006, 15, 18, 44) findings indicate "inadequate, unavailable and poor quality infrastructure" and high unemployment rates. The "unstable social, economic and political situation 'has helped open the door to a high levels of poverty, estimated at an average of 69 per cent", underdevelopment and health ailments. This poverty in the midst of

wealth is a contributory factor to the violence that has engulfed the region as people seek to win back resources for their survival and development (Obi, 2010).

The linkages between argument such as the federal governments corrupt enrichment from oil extraction, dispossession, and the escalating violence in Nigeria's Niger Delta involving local ethnic-minority militias protesting against the Nigerian state–oil multinationals alliance that has extracted oil from the region for five decades, with little or no benefit accruing to the inhabitants of the region.

Between late 2005 and mid-2009, attacks against oil installations forced the shutdown of between 25% and 40% of Nigerian's oil production and exports, leading to substantial loss of revenues and profits by the state-oil multinationals alliance. These militia attacks (in addition to oil theft) have largely accounted for a drop in daily oil production from about 2.6 million barrels in 2005 to 1.3 million barrels in June 2009. The resultant loss of revenue is estimated in billions of dollars (Obi, 2010).

Oil and gas sector

First discovered crude oil in Nigeria began in the 1950s. Nigeria is the largest oil producer in Africa with most of the oil producing land located in the Niger Delta region. It produces almost 45 percent of the greenhouse gas emissions in Africa from its gas flaring by oil firms during the oil production in the Niger Delta. Nigeria with its 20 billion cubic metres of flaring gas annually after Russia is the world's second gas flaring country.

Studies show that Nigeria is vulnerable to climate change due to its geography. The country is exposed to drought and desertification and has a shore line of 800km which makes its vulnerable to rising sea level. Further studies show that a 0.2m rise in sea-level will flood 3,400 km of Nigeria's coast-land; while a 1.0m rise will also flood 18,400km sq (Okon, 2009).

Nigeria's economy is heavily dependent on the oil industry, which also accounts for a large part of exports. The country also has large gas deposits.

Over the past few decades, the Niger Delta region of Nigeria has been the focus of climate change issues. The climate change discussion began after environmental pollution associated with oil production in the Niger Delta region burgeoned and became part of the global discussion (Ukala E, 2011).

Flaring gas

One of the devastating consequences of oil drilling in the Niger Delta region is gas flaring. Gas flaring is harmful to human life and the environment. Nigeria‘s Niger Delta residents observe visible gases oozing from oil-production sites. Alarmingly, these sites are located in the midst of villages and have become a modern addition to the Niger Delta landscape. Mr. EbereUdeagu, a former deputy governor related the following (Ukala E, 2011):

Gas flaring by oil companies in the oil producing communities has terribly devastated a substantial portion of farmlands leaving the streams polluted. These areas have been turned into ghettos and swamps with the indigenes becoming destitute in their fatherland. Their sources of livelihood, which is farming and fishing, have been closed as the streams have lost life, and the lands are no longer fertile.

However, gas flares, also known as associated gas, could be emitted in environmentally safe ways, including re-injecting them into the earth or using them as an energy source.

Projects for the use of associated gas from oil production afford CDM potential. On the one hand, this can contribute to power supply and on the other the gas can be sold on the (international) market. In a study, the World Bank has identified the weak local gas market and the lack of local infrastructure as obstacles to the latter option. The government has, however, recognised the commercial scope of this gas and is looking to develop the sector. In future, this could make it difficult for CDM flare gas projects to provide proof of additionality, should the government decide to legally ban associated gas flaring and stipulate a different use. For some time, there have been repeated discussions on prohibiting flaring, also for environmental reasons, but the oil lobby, which includes the national petroleum company has successfully opposed this so far (Hackenbroch, 2011).

In general, the measures attempted by the Nigerian Government have not been effective enough in eliminating the majority of the flaring in Nigeria. Very low gas prices and an unreliable market in Nigeria make returns on investment at a level where gas recovery is generally not economically feasible for domestic gas supply. The continuation of gas flaring is permitted by the government provided that the permit has been issued and applicable fees are paid (cdm.unfccc.int, 2012).

Gas flaring in Nigeria is an issue of concern to the Nigerian Government and numerous proposals have been discussed for many years as to how to limit such flaring. Options that

have been discussed include an outright ban on flaring or substantially increasing the fees for flaring. Despite these discussions, uncertainty of the timing and stringency of future flare policy remains (cdm.unfccc.int, 2012).

Despite the Government attempts at passing bills, providing fiscal incentives, and imposing ever increasing fees, flaring of AG in the Niger Delta is still widespread. The fees imposed have been at levels that are insufficient to promote the investment required for infrastructure to capture, process, and transport AG for utilization. Also, the fiscal incentives have been insufficient to overcome the handicap of unreliable gas consumption in Nigeria. As such, flaring of AG in Nigeria remains high, at 14.9 billion m3 per year in 2008. The Nigerian Government publicly stated in December 2009 at the COP15 conference in Copenhagen that it supported CDM as the fiscal mechanism to reduce flaring in Nigeria.

The legal analysis concludes that the gas flaring legislation and accompanying fiscal incentives and fees in Nigeria have been ineffective in curtailing the volumes of AG being flared. Currently, there are no economically effective or legally binding enforcement actions undertaken by the government to stop flaring and as a result, it is widespread in the Niger Delta and it is a viable option for the baseline alternative. The current applicable laws for venting and flaring gas in Nigeria are summarized in Table 1 below (cdm.unfccc.int, 2012).

An overview on Gas flaring regulations in Nigeria has been in place for some 40 years. Over the years, these regulations have been augmented with certain fiscal reforms and incentives. The fiscal incentives and favorable economics rather than regulations have proven to be the key drivers in realizing the progress made so far in flare reduction in the Nigerian oil and gas industry (cdm.unfccc.int, 2009).

Although there has been a long history of regulation, it has by and large been a continuing situation of non-enforcement and gross non-compliance. The oil companies would rather paythe low flaring fee than make large unprofitable investments in gas flaring reduction projects. Further, any strict regulation and/or prohibition of flaring would mean disrupted oil production with serious financial consequences for the oil companies and the Nigerian Government. The prospects of flare reduction in Nigeria, which are good, are therefore primarily determined by policies and measures to achieve greater national gas utilization as laid out the Gas Master Plan (cdm.unfccc.int, 2009).

Table 1 Summary of Nigerian Regulations and Policies Relevant to Gas Flaring (cdm.unfccc.int, 2012).

Figure 1: Natural gas demand (ICF International, 2006)

In the last few years, the Nigerian government has introduced a series of economic incentives and fiscal policies designed to encourage utilization and commercialization of gas.

While there has been an increased utilization and re-injection of gas as a result of these efforts, the volumes of gas flared have remained relatively constant over the years owing to increased associated gas production which comes as a natural consequence of increased oil production targets by the Federal Republic of Nigeria (Figure 2) (cdm.unfccc.int, 2009).

Figure2: Gas Produced, Utilized and Flared in Nigeria 1996 to 2005 (cdm.unfccc.int, 2009)

Certain barriers have limited the ability to optimally exploit the natural gas resources of Nigeria over the past years. While some of the barriers are characteristics of a gas sector, others are peculiar to Nigeria. A recently concluded study on "Strategic Gas Plan for Nigeria" listed the following significant barriers to the exploitation of natural gas resources of Nigeria (ICF International, 2006):

a. The Fact that the Gas Resources are Located in Remote Locations;
b. The Fact that Major Markets (Potential and Existing) are in a State of Economic Stagnation;
c. The Limited Infrastructure Available in the Country to Transport Gas beyond the current Gas Markets in Lagos and Port Harcourt;
d. The High level of Initial Investment Required to Develop the complete Network of Gas Transmission, and distribution Facilities;
e. Poor Investment Climate due to Lack of a Proper, Consistent, Legal, Fiscal and Approval Framework.

The report concluded that for the realization of future gas projects in Nigeria, (at a level far above what we have seen in the recent past), the barriers listed above will have to be eliminated. In addition to removing these barriers, certain cogent developments must occur to catalyze the utilization of the Nigeria natural gas resources. One of these is the emergence of a revamped power sector that is able to improve its ability at implementing very dynamic capacity expansion planning. Natural gas will definitely benefit from such activities given its competitive pricing when compared to alternative fuels and the fact that it is likely to become an internationally accepted bridge fuel, due to its relatively lower carbon content, as the global economy transitions from the use of high carbon fuels to zero carbon fuels in the future. Nigeria will definitely benefit from the increased export of its gas to satisfy the expected global reliance of natural gas as a transition fuel. However, for domestic utilization to be carried along, not only must the sets of barriers earlier listed be removed with dispatch, but also Nigeria must have in place sound gas sector plans and policies, which must become components of its development plans and objectives (ICF International, 2006).

CDM Project Examples

In Nigeria there are 5 projects under CDM and 3 of this projects are in oil and gas sector that for implementation of projects they used the AM0009 CDM's methodology.

In following examples I describe 2 of these 3 project activities, I begin with general description that are common in both projects.

The OvadeOgharefe Gas Capture and Asuokpu/Umutu marginal field are 2 projects under the CDMs methodology.That are located in Golf of Niger area.

The project activities in these 2 fields are developed with reference to approved methodology AM0009 "Recovery and utilization of gas from oil wells that would otherwise be flared or vented".

Figure 3: Map showing the general area of the Project Activities (Highlighted area) (cdm.unfccc.int, 2012).

Asuokpu/Umutu marginal field

The aim of this project activity was to recover gas that was flaring at the Asuokpu/Umutu Marginal Field located in block OML 38 in Nigeria and to deliver it to the domestic market for productive use as an energy product.

In this field there are 2 development phases:

The Phase I development of the field began in August 2005. After spending two years on well testing and completion, design, construction, installation and commissioning of a 10,000

bpd oil treatment and flow station, 48 kilometres of oil delivery pipeline and ancillary facilities.

The Phase II development of the field, as indicated in the Field Development Plan approved by the Department of Petroleum Resources (DPR), entails further development drilling and ramp-up of oil production as well as providing a solution to the associated gas produced.

The project activity is developed with reference to approved methodology AM0009 Version 04 - "Recovery and utilization of gas from oil wells that would otherwise be flared or vented" (cdm.unfccc.net 2009).

The proposed CDM project does not comprise a new gas processing facility, and the recovered gas is injecting without other processing than compression into an existing gas distribution system. An illustration of the project boundary and the location of monitoring points can be found in Figure 4:

Figure 4 An illustration of the project boundary (unfccc.net 2009).

The proposed CDM project activity will recover the dry associated gas that was flaring at the Asuokpu/Umutu Marginal Field and deliver it to the Nigerian domestic market for productive use as an energy product.

Without CDM registration, the costs associated with the project activity do not generate sufficient revenues to justify the investment. Investment in the Niger Delta is difficult due to its risk category, and limited outside financing is available. The Joint Venture will attempt to secure funding, both debt and internal, albeit the difficult global economic situation

complicates this issue. The further development of the proposed CDM project activity and therefore the reduction in GHG emissions is to a large measure dependent upon the successful CDM registration of the project (cdm.unfccc.net 2009).

The primary benefit of the proposed CDM project activity is the reduction in emissions of greenhouse gases from flaring and the productive use of the recovered gas.

The table below presents the GHGs and their sources which are included in the project boundary:

Table 2 GHGs and their sources which are included in the project boundary (unfccc.net 2009).

The project contributes to the sustainable development of Nigeria through the reduction of flaring, thereby reducing local air pollution and other environmental impacts associated with the combustion of natural gas. Apart from the significant reduction in CO2 emissions, the project will also result in lower emissions of NOx, VOCs, and particulates. The project implementation will further generate jobs in the construction, and require technically skilled staff throughout the operational life of the project (cdm.unfccc.net 2009).

The project is located in an area with nearby population centers and has potential impacts on local environmental issues. The reduction in flaring will improve the working conditions for the employees working on the Asuokpu/Umutu field. The current practice of flaring of gas

leads to substantial local temperature increases and has a distinct odour that irritates the work force and nearby population centers.

The financial returns that can be earned by the project developer for implementing the proposed CDM project are found to be marginal without income from sale of CERs (cdm.unfccc.net 2009).

Table 3 Estimated amount of emission reductions over the chosen crediting period(unfccc.net 2009).

The key financial indicators for the proposed CDM project activity are:

Table 4: financial Indicators – before financing and CER revenues (unfccc.net 2009).

As can be seen from Table 4 above, the financial returns that can be earned by the project developer for implementing the proposed CDM project are marginal.

As the economic analysis shows, the project is not economically feasible in the base-case scenario. The Joint Venture partners have carefully considered this project opportunity and believe it to have long-term upside potential, based on a positive view of the national development of the gas and electrical sectors and the project's ability to be registered with the CDM and thereby monetize the carbon credits. Further the developer believes that in the mid-to-long term that the security in the Delta State will improve, further facilitating development. The ability to register the project under the CDM offers an incentive to further develop the project design and facilitate implement of the project as soon as feasible (cdm.unfccc.net 2009).

Impact of CDM Registration: If the project activity is registered under the CDM, the resulting income from sale of CERs makes a major impact on the project economics. This point is clearly recognized and is the principle reason the project was considered for implementation (unfccc.net 2009).

Due to the Nigerian gas prices being comparably low, the CERs have a magnified impact in that they are sold at relatively high prices in the international market. Given that the incremental capital cost of the project activity is low, the impact of the CERs on the expected project IRR is high. The figures are shown below:

Table 5: Project IRR after including income from sale of CERs(unfccc.net 2009).

Given these prospective economic returns, it is clearly in the Joint Venture's best interest to incur the costs of registering the project under CDM and subsequently, based on positive signals of CDM registration and the outlook for the carbon market, implement the proposed CDM project activity (cdm.unfccc.net 2009).

Pan Ocean Gas Utilization Project

The aim of this project was to eliminate gas flaring at the Ovade Ogharefe oil field operated by Pan Ocean Oil Company in partnership with Nigerian National Petroleum Corporation. The project activity is capturing and processing associated natural gas that was flared in the past. In absent of this project activity, all the associated gas would be flared untreated at the oil field flow station.

Under this project activity, the treated gas is injecting into an existing gas transmission line for sale in the domestic market while the NGLs will be transported and sold into the international market. A smaller portion of the natural gas will be injected into the oil reservoir. The project activity will reduce flaring by approximately 98% at the OvadeOgharefe field thereby contributing substantially to the reduction of GHG emissions in Nigeria. The CDM project activity is the capture, process, sale and reinjection of the associated natural gas that was flaring at the site. This flared gas is untreated (wet) and contains NGLs and condensates as well as methane (cdm.unfccc.net 2005).

Before project activity 75 million standard cubic feet per day (mmscfd) of gas was flaring at the OvadeOgharefe field, and with the further development of the oil field the volume was scheduled to increase to 130 mmscfd by 2009.

This project activity consists of a gas processing plant (GPP) to treat this associated gas and the pipeline to transport the lean gas to the existing gas grid (owned by Nigerian Gas Company, NGC). A small portion of the dry gas will possibly be transported by another pipeline for reinjection in the oil field. A crediting period of 10 years is requested for this project. Over the ten years, the net GHG emissions will be reduced by approximately 23.3 million tons CO2 equivalents.

Table 6 shows the estimated amount of emission reductions over the chosen crediting period.

The project activity encompasses the recovery of the associated gas at the Ovade-Ogharefe oil field consisting of the connection of the gas from the common flow station at the field, the construction of a gas processing plant for the production of the products dry gas, LPG and condensate in a gas processing plant. Then a portion of the dry gas is injected into a gas

transmission line owned by NGC and the remaining portion is injected into the reservoir (cdm.unfccc.net 2005).

Table 6 shows the estimated amount of emission reductions over the chosen crediting period (unfccc.net 2005).

The LPG is sold at the plant gate to a third party for transportation and sale to end-users. The near complete elimination of flaring is the means by which GHG emissions are reduced. The project activity is illustrated in Figure 5.

Figure 5: Schematic of Ovade-Ogharefe Oil Field and Proposed CDM Activity (unfccc.net 2005)

Baseline emissions are based on the quantity of gas recovered as measured at the out-take of the wet as at the oil flow station (Point A in Figure 3). This gas is precisely the gas that would be flared (and at this location) absent this project. The quantity of recovered gas is directly linked to the oil production. The associated gas production forecast in this PDD is based on the reservoir engineering studies and is directly related to the oil production vis-à-vis a gas-to-oil ratio of the oil produced. While forecasts are used in the PDD, the quantity and composition of the recovered gas are monitored ex post and baseline and project emissions are adjusted respectively during monitoring as described in Section D and the monitoring plan. The project emissions are those that occur in the infrastructure built for this project by the project developer and under his control (unfccc.net 2005).

Evaluating the Economic Attractiveness: A comprehensive project evaluation was done based on generally acceptable methods and principles used within the oil and gas industry as well as the fiscal regime under which the project developer operates in Nigeria.

The project developer generally requires a return on not less than 12% Internal Rate of Return (IRR) on an after-tax basis. The AM0009 methodology suggests a 10% IRR, but notes that this is country and developer sensitive. Clearly the security and political conditions in Nigeria would support a higher IRR. Nevertheless, the IRR for the project is substantially below 10% and thus the issue is largely academic. The calculated returns for the project are given in Table 7 (cdm.unfccc.int, 2005).

Table 7 Key Financial Indicators for Project Activity – before financing (cdm.unfccc.net 2005)

The project lifetime is estimated at twenty-two years. At the end of this period, the current expectation is that the field would be plugged and abandoned according to best-practice techniques that will assure no further GHG emissions from the field. The estimated GHG emissions by sources over the 10 year crediting period are:

Table 8 GHG emissions by sources over the 10 year crediting period (cdm.unfccc.net 2005)

The project activity is built on a brownfield site and reduces the current emissions from the existing site by reducing the gas flared by an estimated 98%. Local pollution is reduced to the degree particulates were released into the atmosphere by gas flaring (albeit this was low in the base case since the facility already had smokeless flares.) There are no transboundary impacts. The overwhelming environmental impact is global from the reduction in GHG emissions (cdm.unfccc.net 2005).

Common points in both projects activities

Based on the analysis, proposed CDM projects activities are deemed additional. Given that the proposed CDM projects cannot be implemented without the CDM component and taking into account that the projects allow for a significant reduction in GHG emissions below the baseline level, the projects activities are not considered to be the most plausible baseline scenario. In the absence of the proposed CDM projects, the most economic alternative is continued flaring of the residue associated gas in both fields.

Further, the down-time of electrical facilities in Nigeria for maintenance, repairs, and other issues is historically very high, and could mean that relevant end-users are not able to take the

full amount of gas that is available from the project. The gas will be in NAOC's overall gas grid, so some rerouting could occur, but there is a real possibility sales could be curtailed from time to time. These events would have negative impacts on project economics.

The security risk, associated with terrorism are the most difficult to quantify and very real – given that terrorism has kept fields in the Niger Delta off production on numerous occasions, and no political solution to the security issue is in sight. Terrorism can impact the project in the following ways:

- Cause the oil field to be closed in thereby causing the associated gas production to be closed in as well, ending all sources of revenues for the proposed CDM project activity;
- Physical damage to the facility itself;

The risks are not easily quantifiable, but represent real problem to the project developer. The risks are not symmetric; unexpected events could, if they materialize, have clearly negative implications on the project's financial performance.

Conclusion

The primary benefits of the application of CDMs project activities for flaring gas emission reduction in Nigeria is productive use of the recovered gas that could help the regional development in Golf of Niger.

There are 3 projects under AM0009 in Nigeria, which means the project activities under CDM for flaring of associated gas are applicable.

The oil and gas fields in Nigeria are located in remote arias and have underdeveloped gas infrastructure for transportation to the end consumers, the project activities will have high cost, without CDM registration and Certificate of Emission Reduction the projects could not generate sufficient revenues to justify the investments. Moreover the investment in Niger Delta is difficult due to its risk category.

The escalating violence in Nigeria's Niger Delta involving local ethnic-minority militias protesting against the Nigerian state caused by extraction of oil from the region for five decades by Nigerian Government and with little or no benefit accruing to the inhabitants of the

region is the principal cause of insecurity in region that could indirectly avoid the application of CDMs projects activities in the Niger Delta.

Indonesia

Overview

Republic of Indonesia is an archipelago country situated in southeast Asia and Oceania. It has 33 province with 238 million people and is the world's fourth most populous country. Indonesia has a mixed economy in which both the private sector and government play significant roles, the country is the largest economy in southeast Asia and a member of the G20. According to World Trade Organization data, Indonesia was the 27th biggest exporting country in the world in 2010 with its $ 706.73 billion estimated gross domestic product (GDP).

Increasing growth of population in Indonesia has lead to the increase of energy consumption. Continuing increase of energy consumption obligates the ability to provide energy. Indonesia with its particular geographic nature and size have its difficulties for energy grid in all territory, this provides the opportunity for an large use of clean energy technologies in Indonesia's regions.

Indonesia signed the UNFCCC in June 1992 and ratified it in August 1994, being part of this convention Indonesia could implement as one of the non Annex I parties based on the common but differentiated responsibilities principle. Indonesia has established a National Committee on Climate Change with coordination of the Ministry of Environment as the national focal point of the UNFCCC. However the House of Representatives of Indonesia had passed a law for ratification of the Kyoto Protocol. This decision was taken during one of its plenary sessions. The Ministry of Environment also took initiative to establish Indonesia's Designated National Authority (DNA). Several consultation meetings with relevant ministries, private sectors and NGOs have been conducted. Those main ministries related to CDM are Ministry of Environment, Ministry of Energy and Mineral Resources, Ministry of Forestry, Ministry of Transportation and Communication, Ministry of Industry and Trade, and Ministry of Agriculture. In addition, the Ministry of Environment with other stakeholders has been continuing effort to educate the public on Kyoto Protocol and CDM (Napitupulu, Tanujaya, Soejachmoen, 2005).

Political Situation

In establishment of required policies and measures for enabling action of National Mitigation Actions (NAMAs) in meeting the national emissions reduction target leads to a new development approach. It needs some innovation and some changes to the traditional approach. It should recognize associated impacts and opportunities posed by climate change, and establishing policies and measures that enable climate compatible development in all sectors, including regulatory as well as fiscal measures.

A wide variety of national and sectoral policies and instruments are available to governments to create the incentives for mitigation action which include regulations and standards, taxes and charges, tradable permits, voluntary agreements, informational instruments, subsidies and incentives, research and development and trade and development assistance. Their applicability depends on national and sectors frameworks, national circumstances and an understanding of their interactions in national scale and international scale that need to be confirmed. Depending on the national and sectors circumstances there are advantages and disadvantages for any given instrument. Policies that provide a real or implicit price of carbon could create incentives for producers and consumers to significantly invest in low- GHG products, technologies and processes. Such policies could include economic instruments, government funding and regulation (Thamrin, 2011).

Table 1 Selected examples for mitigation policies and measures currently discussed or in place in Indonesia (NC4ND, 2011)

As implemented in other countries, government support through financial contributions, tax credits, standard setting and market creation is important for effective technology

development, innovation and deployment. Transfer of technology to developing countries depends on enabling conditions and financing. Reporting is also important for climate policy integration because it can improve accountability and learning. Public policies frequently result in unintended side effects, and their intended impacts may be absent or far smaller than expected. It is particularly important in the case of climate change because of the uncertainties and complexity of the systems involved (Thamrin, 2011).

Oil and Gas Sector

The GHG emissions of energy sector comprise CO2, CH4, and N2O, in which, the CO2 is the major emission in the sector. These emissions were increased significantly during the last two decades. According to the Centre for Data and Information of the Ministry of Energy and Mineral Resources, the rate of GHG emissions from energy sector tends to increase from 114 million ton (Mt) in 1990 to 288 Mt in 2004 with an annual growth rate at 7%. Figure 1 presents the emission level of energy sector from 1990 to 2004. It can be seen from the figure that industrial sub-sector was the highest contributors, followed by electricity generation and transportation. Although electricity generation was not the highest contributor, however, the highest growth rate was observed in electricity generation sector, i.e. 9% per annum (Boer, Dewi, Ismawati, Anggraini, 2008).

Figure 1: Trend of CO2 emission from various activity in energy sector (MEMR, 2007)

Figure 2: Trend of CO2 emission (Mt) from various types of fuel in energy sector (MEMR, 2007).

Figure 3: Final energy consumption by sector (MMBOE 2007)

In terms of type of fuels, the share of liquid fuel (oil products) to the total emissions of energy sector was the largest compare to other fuels. The growth of these emissions followed the growth of final energy consumption, which was dominated by oil product and then followed by coal, natural gas, and electricity (Figure 2).

The oil product was consumed primarily by transportation, while coal and natural gas were consumed by industries (see Figure 3). Electricity consumption is shared by industry, household, and commercial. Concerning households electricity, Indonesian electrification ratio is still low (55%) and electricity losses is still high (±11%). The GOI sets a target to decrease

the losses and increase the ratio up to more than 90% in 2020. This target will contribute in decreasing the GHG emissions of energy sector (Boer, Dewi, Ismawati, Anggraini, 2008).

Flaring of Gas in the Oil and Gas Sector

Other significant contributor to the GHG emissions of energy sector was fugitive emissions, namely CH4 and CO2 emissions from gas flaring and venting at oil and gas field production facilities. The growth of these emissions will follow the growth of oil product and natural gas consumptions. However, recent global gas flaring reduction program at oil and gas production companies regaring their commitment to contribute with the climate change mitigation will have significant impact to the growth of these fugitive emissions in the future.

Regarding the Blue Print of National Energy Planning 2006 - 2025, it can be seen that Government of Indonesia will change the energy supply mix by 2025 by increasing the share of renewable energy and coal. The change of supply mix will dictate the level of GHG emissions (Boer, Dewi, Ismawati, Anggraini, 2008).

According to the 2008 BP Statistical Energy Survey, Indonesia is an oil and gas producing country and was until recently Southeast Asia's only member of OPEC. Indonesia left OPEC in 2009 because it ceased to be a net exporter of oil. It could not fulfill the demand of its own country’s needs. Indonesia had proved oil reserves of 4.37 billion barrels at the end of 2007 or 0.35 % of the world's reserves. Indonesia is the only Southeast Asian member of OPEC, although the country became a slight net oil importer in 2004. Indonesia produced an average of 969 thousand barrels of crude oil per day in 2007 and consumed an average of 1156.93 thousand barrels a day. The majority of Indonesia's producing oil fields are located in the central and western sections of the country. Therefore, the focus of new exploration has been on frontier regions, particularly in eastern Indonesia. Sizable, but as of yet unproven, reserves may lie in the numerous, geologically complex, pre-tertiary basins located in eastern Indonesia. These regions are much more remote and the terrain more difficult to explore than areas of western and central Indonesia (mbendi.com, 2011).

There are 82 project activities under CDM in Indonesia that only 1 of these projects are under AM009 methodology.

Afterwards I describe the Tambun LPG facilities project activity as an example under CDM’s AM0009 and explain how the projects under CDM could help Indonesian Government to GHG emission reduction.

CDM Project Example - Tambun Oil Field

Tambun Oil Field is located about 40 km west of Jakarta in West Java Province. The field started production in 2003 at 4000 BBL per day. Associated gas was flared, initially at 6 to 7 mmscfd increasing to 12 to 15 mmscfd as oil production increased to 8,000 barrels per day in 2006. Pondok Tengah Oil Field, located about 10 km North of Tambun, has recently come on stream at a faster rate than planned. The field is currently producing around 3000 - 4000 BBL per day with associated gas flow at around 5 mmscdf and was projected to increase to 25 mmscfd by the end of 2007.

The project activity is the construction of the processing and transport infrastructure to take gas that would otherwise have been flared to the Cirebon to Cilegon pipeline. The scope of the project activity includes all of the gas from Tambun and Pondok Tengah Oil Fields.

The Tambun LPG processing facility was originally built to process the gas from Tambun Oil Field. The decision to invest was based, amongst other things, on the CDM. The presence of the treatment plant and the pipeline have made it technically possible to process and transport the increased quantities of gas from Pondok Tengah which were not anticipated at the time of the original investment. Without the presence of the Tambun facility, all of the Pondok Tengah gas would have been flared until such time as Pertamina install facilities for its capture and utilization (Tambun LPG, 2009).

CO2 emissions from fuel combustion, leaks, flaring and venting' during transport and processing of recovered gas are not calculated from single emission sources, but a carbon mass balance is conducted between points A and B in Figure 4. The quantity of CO2 emissions corresponds to the difference of carbon in the products of the gas processing plant (point B) and the carbon supplied by the project activity (point A). In doing so. it is assumed that all carbon in the recovery gas released, flared, vented or combusted will be oxidized completely to CO2. This approach is appropriate, as the methodology is only applicable to projects where the energy required to transport and process the recovered gas is generated with the gas and not with other fuel sources.

Contracts were signed for the purchase of the Tambun gas on 11th November 2004; gas started flowing on 5th November 2005 and the LPG plant started operation on 27th December 2006 (Tambun LPG, 2009).

Figure 4: Schematic of Tambun LPG plant (Tambun LPG, 2009).

This project contributes to the sustainable development of Indonesia in a number of ways. Indonesia being a developing country and the largest economy in southeast Asia has an increasing need to fossil fuel and application of project activities under CDM mechanism is a great opportunity for this country.

The project provides an additional source of natural gas to support the development needs of Indonesia. It reduces the reliance on imported energy, and contributes to improved local and global air quality by improving the efficiency of combustion of methane and related gases when compared to open flaring. In addition, the project activity contributes to social and economical sustainable developments such as constructing public water facility; participating in Global Environment day; donating for flood victim, orphan and social celebration; creating local employment (60 employees hired from local area) and improving public education in project's surrounding area. The project also provides revenue for the local government of Bekasi, which is strapped for cash like local governments everywhere in the developing world, from the capture of value from gas used to generate power rather than being flared.

The technology consists of a mini LPG plant with a design input capacity of 15 mmscf per day; condensate removal facilities and a 35 km 8" diameter steel pipeline, with associated compressors, metering stations and safety valves. The LPG production plant is designed to produce 151 tonnes of LPG per day generating 12 mmscfd lean gas.

Metering points are present for the import of wet gas and the export of dry gas. LPG is sold by weight, via a weighbridge. Condensates are sold by volume via calibrated tankers. An additional metering point is located at Tegal Gede where the pipeline joins the main transmission line, but this is under the control of Pertamina (Tambun LPG, 2009).

Title and reference of the approved baseline and monitoring methodology applied to the project activity is AM0009 "Recovery and utilization of gas from oil wells that would otherwise be flared",

AM0009 is only applicable to situations where the associated gas in mainly flared in the absence of the project activity. The baseline scenario is determined in two ways:

1- By observing common practice in the oil and gas industry in Indonesia;
2- By the elimination of possible scenarios in the additionality test.

The project activity AM0009 is applicable by following justification (Tambun LPG, 2009):

- Gas at oil wells is recovered and transported in pipelines to a process plant where dry gas, LPG and condensate are produced;
- Energy required for transport and processing of the recovered gas is generated by using the recovered gas;
- The products (dry gas, LPG and condensate) are likely to substitute in the market the same type of fuels or fuels with a higher carbon content per unit of energy;
- The substitution of fuels due to the project activity is unlikely to lead to an increase of fuel consumption in the respective market;
- In the absence of the project activity, the gas is mainly flared;
- Data (quantity and fraction of carbon) is accessible on the products of the gas processing plant and on the gas recovered from other oil exploration facilities in cases where these facilities supply recovered gas to the same gas processing plant.

The evaluation of the legal aspects for both Tambun and Pondok Tengah fields regarding to venting of associated gas is restricted, but not prohibited by Indonesian law, law of the

Republic of Indonesia Number 22 year 2001 concerning oil and natural gas. Venting gas presents an explosive hazard risk assessed by Odira as Unacceptable.

The evaluation of technical feasibility and economic attractiveness for other five options are (Tambun LPG, 2009):

Option 2 flaring: For the both fields flaring at the oil production sites was feasible.

In Tambun oil fields the flaring of associated gas was practiced before the implementation of the project activity. Flaring was the simplest way of dealing with the associated gas without any barrier.

In Pondok Tengah oil field in the absence of the project activity or any means of getting the gas to market it could be flared.

Table 2: The determination of the baseline for Tambun (Tambun LPG, 2009).

Option 3 On-site consumption: In both Tambun and Pondok Tengah oil Field only a fraction of the associated gas is and can be consumed on the Pertamina E&P production sites, where there is very limited demand for electrical power. The use of this gas is not relevant to the project because in both cases, the gas is purchased net of any consumption on site.

Additional gas is utilized to run the compressors and at Tambun LPG plant to power the treatment processes for the gas. This consumption is included under project emissions, but it does not consume a significant quantity of the gas (Tambun LPG, 2009).

Option 4 Re-injection of associated gas: In Tambun field only a small amount of gas was re-injected by Pertamina at the Tambun oil field, but it was not technically feasible to re-inject the associated gas. Pertamena already re-inject water at Tambun.

Option 5 Recovery, transport, processing and distribution to end-users: This is the project activity and without CDM project activity was infeasible in both oil fields.

Option 6 Recovery and transportation to end-users without processing: Technically this is not possible because the wet gas needs to be refined to remove the liquid components. Also, without the Odira pipeline, there is no means to getting the gas to market. This option is considered technically infeasible (Tambun LPG, 2009).

Table 3: The determination of the baseline for Pondok Tengah (Tambun LPG, 2009)

Financial analysis shows that at the time of the decision to invest in the project, and during its initial stage of operation, the IRR for the recovery and treatment of the Tambun and Pondok Tengah Associated gas under either of these scenarios was negative. The same

conclusion arises under any other scenario of contracted and non-guaranteed supply combinations. With the inclusion of CDM revenues, the IRR is increased, making the project attractive at a cost of capital of 10%.

Also note that the CERs generated under the scenarios 1 and 2 are necessarily different. Projected CERs are presented for the first scenario in Section A4.4. and section B6.3 and B6.4 because the data underlying these projected CERs can be verified (i.e. the contracted gas supply is verified from the contracts and the non-guaranteed supply in early 2009 has been verified by the DOE as part of the verification and issuance process and data to June 2009 is already available).

Therefore, the actual number of emission reductions generated and claimed will change as nonguaranteed excess gas is sourced from the Tambun field in the future and as the yield of LPG in tones per mmscfd and the net calorific value and hence emission factor of the gas varies. In order to set an upper limit on the number of CERs which may be claimed if non-guaranteed excess associated gas is made available (Tambun LPG, 2009).

Table 4 Summary of the ex-ante estimation of emission reductions (Tambun LPG, 2009)

The Project Developer has evidence to support the fact that revenues from the CDM were a significant factor in their decision to proceed – in the form of official minutes from Board Meetings where individuals were instructed to pursue the development of the project under the CDM. The delay in the preparation and registration of the PDD has been brought about by limited management resources, the need to concentrate on the development of the processing plant and difficulty in finding and contracting with a suitable CDM Project Developer.

The source and gases that are included in this project activity are (Tambun LPG, 2009):

- CO2 due to fuel combustion for recovery, transport and processing of the gas;
- CO2 emission due to consumption of other fuels in place of the recovered gas;
- CH4 and CO2 emissions from leaks, venting and flaring during the recovery, transport and processing of recovered gas.

Summary of ex-ant estimation of emission reduction

Table 5: Annual estimation of emission reduction in Tambun LPG (Tambun LPG, 2009)

Leakage emissions comprise (Tambun LPG, 2009):

CO2 emissions due to fuel combustion for transport and processing of the gas, where the transport and processing of the gas is not under control of project participants. The emissions from the transport of the dry gas are already accounted in the compressors on the Odira Tambun facility. Emissions from the transport of LPG and condensate are discounted because they would arise in the baseline scenario, where displaced fuel would also be transported.

CH4 and CO2 emissions from leaks, venting and flaring during transport and processing of recovered gas, where the transport and processing is not under control of project participants. Fugitive emissions of CH4 from the 35 km pipeline and from emergency venting of the pipe counted as leakage.

Changes in CO2 emissions due to the substitution of fuels or additional fuel consumption at end users, where these effects occur. The final point is not considered relevant because the products from the processing plant do not substitute more carbon efficient fuels (ex. renewable

energy) nor do they increase fuel consumption as the market is already short of supply. The LPG is used for domestic cooking purposes and the supply from this project only displaces other supplies of the same product.

There is no reason to expect that the supply of additional fuels will fuel additional consumption – Indonesia is growing rapidly and there is a high demand for power and fuel. This fuel do not lead to increased consumption (Tambun LPG, 2009).

The supply of these fuels into the Indonesian market do not substitute for renewable energy. Indonesia is short of power and plans to build further coal fired power plants. With Indonesia's abundance of coal it is a heavily fossil-fuel intensive power market.

Since Indonesia is net importer of crude oil as well as oil products due to the oil resource of the country is limited, GOI has released new policy with main objective to reduce the dependency on oil products through increasing the use of other energy alternatives and efficiency. This policy was stated under Presidential Decree No. 5/2005. In this decree, it was targeted that by 2025 the energy elasticity is less than 1.0 (now 1.8%) , the share of natural gas, coal, and new and renewable energy in energy supply mix increase from 26.5% to 30%, from 14% to 33%, and from 5% to 17% respectively with total energy supply is estimated around 2800 MMBOE in 2025. Although the share of new and renewable energy is increased, however, the share of fossil fuels is still dominant.

Investing in renewable energy in Indonesia is attractive business opportunity since Indonesia is very rich in renewable energy sources, and could benefit from increasing the share of renewable in the energy supply mix and benefit for carbon reduction projects. However, Indonesia is still less favorable investment climate compared with other countries since there are limited access to project financing, lack of government budget, limited knowledge and capacity, and less of government policy and regulation in energy sector that directly lead to the increasing of the investment of renewable energy development in the context of climate change. Concerning policy and regulation related to renewable energy development, government regulations on renewable based power plant, particularly new power purchase agreement can boost the development of renewable energy in Indonesia (Tambun LPG, 2009).

One of the weaknesses of the policy measures in reducing the GHG emissions or climate change mitigation. The current government programs/plans address only type of energy

sources in energy supply mix with the main objective is to achieve energy supply security; there are no programs or plans related to type of technology in the energy supply side with the aim to combat the GHG emissions. Other weaknesses are technology availability, human resources capability in providing or operating such technology, government budget availability, and activities/programs availability (Tambun LPG, 2009).

In terms of type of energy sources, the GOI is to increase the share of renewable and new energy in national energy supply mix. According to the decree, although the government is planned to increase the share of renewable in the national energy supply mix, however the share of coal is also to be increased to fulfill high domestic demand of energy. Therefore, in overall it is not guaranteed that total GHG emissions from the supply side will decrease in the future. Prioritizing of the increasing share of the renewable energy, for example, increasing of the share of biofuel utilization in energy sector through Biofuel Mandatory in the Ministry of Energy and Mineral Resources Decree (September 2008) will be considered as a challenges for the reducing of the GHG emissions or climate change mitigation (Tambun LPG, 2009).

Conclusion

Indonesia being a developing country with a high growth rate and the growing need to the sources of energy for its industry with application of CDM project activities could partly satisfy its own internal energy needs and in same time could help to GHG emission reduction.

There are only 1 project under CDM for associated gas in Indonesia that mean the application of projects under CDM are feasible but this number is very little for a developing country such as Indonesia, they should recognize opportunities posed by climate change, and establishing policies and measures, incentives for mitigation action which include regulations and standards, taxes and charges, tradable permits, voluntary agreements, informational instruments, subsidies and incentives, research and development and trade and development assistance, that could enable climate compatible development in all sectors, especially in oil and gas sector for flaring reduction of associated gas.

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