

# REPORT

**General Project Flow Diagram**

The flow diagram is organized into three horizontal tracks:

- Track 1 (Green):** Site Survey & Measurement Program → Data Analysis → Assessment of Baseline Emissions.
- Track 2 (Purple):** Identify Potential Control Options & Solutions → Engineering, Operational and Feasibility Review of Best Options → Development of DMB and AFE for Final Choices.
- Track 3 (Blue):** Development of Project Design Document (PDD) → Validation and Registration of PDD → Implementation of Monitoring Program → Verification & Registration of Emission Reductions.

Key milestones and transitions include:

- Final Commissioning & Startup (occurring between Track 1 and Track 2).
- Engineering, Procurement & Construction Management (EPCM) (occurring between Track 2 and Track 3).
- Management & Regulatory Approvals (occurring between Track 2 and Track 3).

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## A Recommended Policy for CCAC Oil & Gas Demonstration Projects

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## TABLE OF CONTENTS

<b>DISCLAIMER</b> .....	i
<b>TABLE OF CONTENTS</b> .....	ii
1 INTRODUCTION .....	4
1.1 Benefits of Participation .....	5
1.2 Participants.....	5
1.3 Colloaboration.....	6
2 PROJECT DEVELOPMENT AND KEY BARRIERS.....	7
3 ACHIEVMENTS .....	9
4 CONCLUSIONS & RECOMMENDATIONS.....	11

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## 1 INTRODUCTION

This document defines the course of action that has been taken to progressively work towards achieving real reductions in emissions of short lived climate pollutants at oil and gas facilities in Mexico, Colombia and Nigeria.

The work in Mexico has been building on previous work done in that jurisdiction through the Global Methane Initiative (GMI), the Global Gas Flaring Reduction (GGFR) Partnership, Fast Start Funding provided by Environment Canada, as well as significant in-kind and cash contributions by Clearstone Engineering Ltd. These activities comprised capacity building achieved through technical exchanges including workshops, field demonstrations and study tours, as well as measurement programs and prefeasibility studies to identify specific cost effective opportunities to reduce emissions of SLCPs.

The work in Colombia has followed a similar path. Key elements to achieving progress in each country have included the following:

- Working with the technical experts from each participating oil and gas company to strategically focus on areas of interest to them that are also most likely to identify significant opportunities for cost-effective SLCP emission reductions. These types of opportunities can be attractive either because they are large and practicable to manage on an individual basis, or because they are smaller and more manageable in size as well as highly replicable.
- Targeting vent and flare gas reduction opportunities involving streams rich in volatile organic compounds (VOCs), as these streams are more valuable making emission reductions more practicable to achieve, which is particularly important given the current low energy prices. Additionally, the VOCs tend to promote black carbon emissions when the gas is burned (e.g., by flaring or as fuel), and they are also an important pollutant affecting local air quality both as an air toxic and a precursor to tropospheric ozone formation.
- Disseminating results, particularly to senior management to gain their support. Both top-down support and working level interest are critical to achieving a successful outcome.

It is clear that time to build trust and understanding with companies. Practical short-, medium- and long-term is required to build momentum and achieve a sustainable outcome.

In Nigeria, conditions are challenged by greater government and industry bureaucracy, and efforts are in a more embryonic stages. Nonetheless, significant progress is being

made in working through the technical, financial, social and political barriers being encountered.

## 1.1 BENEFITS OF PARTICIPATION

The CCAC oil & gas demonstration projects provide an opportunity for oil and gas industry stakeholders in the target jurisdictions to combine rapid climate change action with an opportunity for capacity building and exposure to practical and innovative approaches for reducing emissions of short-lived climate pollutants (SLCP) through cost-effective measures.

Reducing SLCP emissions at oil and natural gas facilities, in addition to being an effective means of addressing near-term climate forcing, also serves to conserving a non-renewable resource, improving local air quality, creating jobs, help stimulate the local economy, improve system safety and reliability, and provide participating companies and facilities best-in-class recognition. Moreover, it is fundamentally important to the industry in general for long term energy sustainability.

The demonstration projects provide accurate baseline emission quantification from measured venting and flared volumes which contributes to SLCP emissions by the oil and gas industry in each of the target jurisdiction.

Demonstration projects provide a practical means of capacity building and also supports the development of accurate emissions inventories, reporting, and verification required to enable strategic energy management and capital expenditures. Other industry sectors of the economy will benefit as a result of measurement and reporting methodologies employed in the oil and gas sector. For example, verifiable carbon credits are fundamental procedures proven in the hydrocarbon sector and then applied to the transportation or industrial sector.

Sufficient engineering and economic rigor accompanies the demonstration projects to build implementation plans to cover cost effective opportunities and strategic proposals for financial resources and project authorization.

## 1.2 PARTICIPANTS

Global expertise is being pursued through private-public sector participation. In recent years, Colombia and Nigeria have introduced private-sector participation in the form of partnerships in exploration and development. Mexico is now moving in that same direction. Fundamental to the demonstration projects is that they are focused and require

support from facility operations personnel and management. This is a bottom-up integration of new production systems accompanied by new or appropriate technology and expertise.

Efforts are being made to overcome the fundamental dilemma of financial support for climate change mitigation as a competitor for limited hydrocarbon revenues now split between government need and industry re-investment. NAMA programs introduce new funding that will inject capital directly into climate change mitigation rather than company-specific or country-specific on-going operational priorities.

The general promotion of GHG initiatives will also bring positive public perception of government in addressing public concern of weather changes in each jurisdiction affecting agriculture and will reinforce the commitment to climate change by government in the eyes of the people. NAMA, in particular, motivates a younger generation that climate change maybe the economic opportunity of their future.

NAMAs also reinforces a country's commitments to the global community that it is both a progressive country, committed as a sustainable and rapidly growing economy, and an example for proactive efforts at instilling climate change action in their countries. Taking a lead in climate change mitigation is probably more important as an emerging market economy than the alternative of historically rapid increasing GHG emissions as consumer and industrial energy demand rises.

Many as yet unappreciated benefits to each participating jurisdiction will occur, not the least of which will be public education and the training and capacity building of the work force involved in nationally focused GHG reduction initiatives

### 1.3 COLLOABORATION

Technical expertise, clean energy technologies, environmental policies, and energy strategies are directly applicable to the rapid development of each country's energy sector. While initial efforts have largely focused on the upstream oil and gas sector, program development will be advanced into downstream transportation, petro-chemical, and petroleum refining industries.

## 2 PROJECT DEVELOPMENT AND KEY BARRIERS

The basic steps for implementing a development project within any oil and gas company tend to be as follows:

- Step 1: Opportunity identification and delineation (i.e., pre-feasibility assessment).
- Step 2: Preparation of a design basis memorandum (DBM).
- Step 3: Completion of the front end engineering design (FEED).
- Step 4: Development of an itemized Class 3 cost estimate and preparation of an “authority for expenditure” (AFE) document.
- Step 5: Receipt of senior management approval and approval of the AFE.
- Step 6: Receipt of regulatory approvals.
- Step 7: Preparation of the detailed engineering design.
- Step 8: Competitive purchasing of the required equipment, materials and services.
- Step 9: Construction management.
- Step 10: Commissioning.

The challenge within an oil and gas company is that its priorities are focused heavily on increasing reserves and maximizing production, which are the key performance indicators the market understands. Reserves are increased through drilling and exploration activities. Production is maximized by building infrastructure to bring new wells on line, and keeping existing facilities operating. Any activities that detract from these priorities are discouraged. Another important factor is that companies do not pay royalties on any gas that is wasted or withdrawn from the process for use as fuel in its operations. Moreover, revenues from existing production tends to dwarf potential revenues from energy efficiency and waste gas recovery measures. The consequences of these factors includes the following:

- Any activities that are seen to put existing production at risk, whether this risk is real or perceived, will not be approved.
- If a gas stream is deemed to be uneconomic to recover or utilize when a facility is first designed, it is unlikely to be re-evaluated in the future.
- Very little interest is given to waste gas recovery, energy efficiency management and fugitive emissions control unless it is a regulatory requirement.
- Energy efficiency improvements that reduce process fuel requirements only show an immediate financial benefit if they reduce purchased fuel or energy consumption, or result in increased product sales. If the improvements simply extend the life of the reservoir, then no benefit is achieved until near the end of the reservoir’s depletion cycle.

- Oil and gas companies generally operate with very lean numbers of staff and, in many countries, simply draw on external contractors for non-routine or peak needs. Thus, although the staff at a facility often have a good idea where cost-effective GHG emissions management opportunities exist, they are rarely given the time, tools and resources needed to perform Step 1. The work supported to date has largely been limited to Step 1. Steps 2 to 4 still needs to be completed to get the necessary internal approvals and funds to proceed to the actual implementation of a control measure.
- Even if cost-effective GHG emission reduction projects do get to Step 5 and meet corporate hurdle rates, they still often fail as they do not compete effectively with comparable drilling & exploration projects or infrastructure projects. To succeed, green projects generally need an independent source of financing or external funding. Moreover, such investors or financiers may not consider participating in a project until Step 6 when any approvals that are material to the project's cost or time to completion are already in place.

Companies like PEMEX are looking at possible means of allocating some portion of the profits from green projects to perpetuate additional green projects. The key building blocks to get to this point are developing an inventory of potential opportunities and then completing pre-feasibility assessments for these (Step 1), which has already been done in Mexico and Colombia. The next building block is to develop the refined business cases for the most promising opportunities (i.e., Steps 2 to 4) and getting any critical approvals in place (Steps 5 and 6). Current plans are to progress activities with current oil and gas partner companies through to completion of Steps 2 to 4 and, where appropriate, through to Step 6. If the opportunities are solid then investor financing will be obtained through established networks self-financing. It is expected that as credible case-studies are achieved and the market and industry become more comfortable promoting green projects, that they will become self-perpetuating.

In some jurisdictions, such as Nigeria, strategic regulatory reform may be required. The first step is to identify and clearly document, through an objective multi-stakeholder process, the critical barriers (e.g., technical, financial, social and political) that are currently impeding the implementation of flare and vent gas reduction opportunities. The next step is to identify effective, and possibly innovative, options for addressing these barriers. The Senate President shall be leading a Nigerian Delegation from the National Assembly to parliamentary meetings on climate change organized by GLOBE and IPU during COP21. Senate and House standing committees have been inaugurated with dedicated committees on Climate change established

### 3 ACHIEVEMENTS

The work performed in the initial phase of CCAC support in each of the three target countries is summarized as follows:

- **Colombia:** A series of workshops were conducted in Bogota to introduce government and industry stakeholders to the opportunities and enhanced practicality of reducing methane and black carbon emissions through focusing on waste gas streams rich in valuable condensable hydrocarbons. Two major companies, Pacific Exploration & Production Corp and Mansarovar agreed to participate in measurement programs to strategically identify cost-effective flare and vent gas reduction opportunities at a cross-section of their facilities. Both companies contributed significant direct and in-kind support including covering subsistence, accommodation, domestic transportation, and security expenses during the field work, as well as provided engineering and technical support during the measurement program. Noteworthy opportunities worth more than \$20.2 million USD annually were identified.
- **Mexico:** Updated measurement results were performed at an oil terminal and major compressor station to assess reductions achieved with respect to opportunities identified previously in 2014. Additionally, flare gas measurements were performed at the most modern refinery in Mexico. Cost-effective reduction opportunities amounting to \$20.7 million USD annually were identified. Consequently, even greater opportunities are expected at the other refineries. Several workshops were held with senior management at both the head office and facility level to discuss the identified opportunities, actions being taken and potential next steps. Significant interest has been expressed in developing refined business cases for the most promising opportunities and progressing to actual third-party investment and solution implementation.
- **Nigeria:** significant time and effort was invested to obtain government and industry support for flare and vent gas reduction initiatives. Initial challenges that were overcome included the following:
  - The need to get approval from the Department of Petroleum Resources (DPR) to apply the measurement techniques that would be used during the proposed measurement programs. At this point, permission has been received from DPR to demonstrate the measurement techniques at a host facility, after which DPR will make a decision on whether to approve the techniques for continued use in Nigeria. The matter appears to be driven by procedural requirements rather than any expectation that the measurement techniques are unacceptable. The proposed methods involve inline tracer tests and are actually approved in Europe as an in-situ means of validating or calibrating conventional flare gas flow meters.

- The need to get approval from Nigeria National Petroleum Corporation (NNPC) to evaluate flare and vent gas reduction opportunities at oil and gas facilities in Nigeria. NNPC is a 60% joint venture partner in all oil and gas production activities in Nigeria and its National Petroleum Investment Management Services (NAPIMS) must approve any expenditures over \$500,000 USD. After numerous meetings with senior officials at DPR, NNPC and NAPIMS, the Minister of DPR has set up a committee to review our proposal to work with industry to pursue cost-effective vent and flare gas reduction projects in Nigeria. The terms of reference for the committee are to (1) look at the existing contracts with oil and gas producers in Nigeria to see if the waste gas at upstream facilities can be made available for projects involving third-party developers without breaching any contract provisions, (2) consider additional fiscal incentives if the existing incentives are deemed to be inadequate in the face of current economics in oil and gas investments, and (3) consider the suitability of the technologies being proposed and their application in Nigeria. The committee consists of one representative, each, from legal, gas, upstream, research and development, and commercial (NAPIMS) as well as Clearstone's representative in Nigeria. The committee has two weeks to submit its report. If the committee's recommendations are favorable, then all approvals needed to identify, evaluate and advance opportunities in Nigeria will be in place with the full backing of NNPC and the government of Nigeria. Clearstone, would then undertake an initial measurement program and begin developing specific flare and vent gas implementation projects with support from its commercial bankers, investment bankers and other potential financiers.

## 4 CONCLUSIONS & RECOMMENDATIONS

The key conclusions and recommendations of the project demonstration work completed to date are as follows:

- An inventory of project opportunities has been created for Mexico and Colombia through to the pre-feasibility stage. The results allow objective screening and ranking of these opportunities. The next step to progress the more promising of these opportunities to the point of establishing a refined business case that can be used to secure project approvals and financing.
- Obtaining green funding that does not compete with traditional funding oil and gas development projects will be critical to global transfer and replication of the demonstrated SLCPL emissions reduction technologies and practices.
- It is important for CCAC to stimulate interest at the most senior levels of oil and gas companies; without their support and endorsement, green projects of all kinds will be viewed as risk and distraction to its core business focus and competencies.
- There is a need to work with oil and gas companies to demonstrate how green funding mechanisms can be applied to establish a self-supporting approach to the ongoing identification, development, and implementation of green projects. Currently, sources of green funding exist but industry lacks the experience in engaging with such funds as well as the willingness or resource commitment to develop the detailed business cases need to gain approvals and access this financing. Notwithstanding this, industry is finding it increasingly more challenging to obtain financing for its core activities, and as regulations increase and the market develops more or a green conscious, industry is becoming more sensitized to the importance of sustainable development and the need to minimize its carbon footprint. Still the key to success will be demonstrating how pursuing opportunities to reduce SLCPL emissions can actually align with industries key priorities and performance indicators (i.e., increased production, improved safety, better system reliability, reduced operating costs and increased profits).