Study on the applicability of Programmatic CDM to rural electrification projects.

A case study of a photovoltaic project in Alta Verapaz, Guatemala

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LIST OF ABBREVIATIONS

ACM	Approved Consolidated Methodology
AM	Approved Methodology
AMS	Approved Small Scale Methodology
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CFL	Compact Fluorescent Lamp
CO_2	Carbon Dioxide
COP	Conference of the Parties
COP/MOP	Conference of the Parties serving as Meeting of Parties to the Kyoto Protocol
CPA	CDM Program Activity
CPA DD	CDM Program Activity Design Document
DD	Design Document
DNA	Designated National Authority
DOE	Designated Operational Entity
EB	Executive Board
EE	Energy Efficiency
EsF	Energía sin Fronteras
ET	Emissions Trading
FMG	Familia Marianista Guatemalteca
GHG	Green House Gas
GWh	Gigawatt hour (million kWh)
HDI	Human Development Index
HFC	Hydrofluorocarbon
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
IRR	Internal Rate of Return
JI	Joint Implementation
kW	Kilowatt
LoA	Letter of Approval
MDGs	Millenium Development Goals
MOP	Meeting of the Parties
Mt	Million Tones
MW	Megawatt
NGO	Non-Government Organization
n.a.	Not Available

NOx	Nitrogen Oxide
OECD	Organization the Economic Cooperation and Development
pCDM	Programmatic CDM
PoA	Program of Activities
PDD	Project Design Document
PV	Photovoltaic
RE	Renewable Energy
SD	Sustainable Development
SHS	Solar Home System
SME	Small and Medium Enterprises
SO_2	Sulphur Dioxide
SSC	Small Scale
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WMO	World Meteorological Organization
Wp	Watt-Peak

“Alone we can do so little; together we can do so much.”

Helen Keller

JUSTIFICATION OF THE PROJECT

The Millennium Development Goals (MDG) represent a strong commitment from the international community to achieve global human development and reflects the multidisciplinary character of this concept. Despite energy is not being explicitly incorporated as a MDG, it is indeed a key human development driver. As will be described in this report, global warming constitutes a serious threat for human development since the poorest regions of world will face the worst consequences of climate episodes. Consequently, given the interconnection between poverty and climate change, urgent measures need to be implemented to address both these problems.

This first section of this paper will look at the urgent need to tackle both issues jointly. In this context, the Clean Development Mechanism (CDM) -one the three flexible instruments within the Kyoto Protocol-, will be pointed out as an instrument designed for this purpose. Apart from helping developed countries achieve their emissions reduction objectives, the CDM was originally designed to assist non-annex I parties in achieving sustainable development. After a comprehensive description of the tool and based on the international experience so far, a reflection about its real contribution to sustainable development will be presented, showing how, despite of its initial purposes, the poorest regions have not really benefited from this tool. This fact will lead us to present a new CDM approach, named Programmatic CDM, which attempts to benefit smaller poor communities.

In the second part of the paper, a pioneer Spanish NGO called Energía Sin Fronteras will be presented. The main goal of this organization is to contribute to human development by promoting energy access as well as water and sanitation projects across the poorest regions of the world. After the description of one their most successful photovoltaic rural electrification projects in a rural area of Guatemala, the report will be focused on answering the following research question: ***Would it be possible for Energía sin Fronteras to implement rural electrification projects using photovoltaic technology under Programmatic CDM?***

To conclude, the final section of the report will analyze the possibility to successfully replicate this case study in Guatemala as Programmatic CDM. Based on the results from this study, some recommendations for ESF will be drawn and further steps in the development of this promising mechanism will be identified.

Part 1

Energy, Development and Climate Change

Clean Development Mechanisms

1. ENERGY AND HUMAN DEVELOPMENT

Energy has historically been a major driving force of human development. Services such as lighting, heating, refrigerating, cooking, motive power, mechanical power, transport and telecommunications are key elements of any developed nation. These services, which all depend on reliable energy access, enable productivity and economic growth and, thus, social welfare. The chart below shows the direct link between human development and energy consumption:

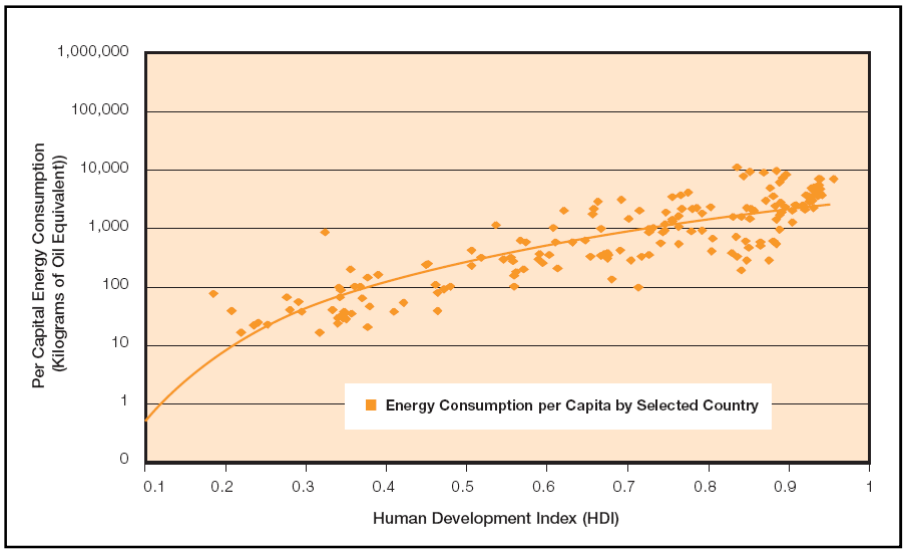


Figure1: Energy Consumption and Human Development. Source: UN-Energy, 2005

Despite of the important progress made in the last 25 years, there are still 1.6 billion people in the world that don't have access to electricity and 2.5 billion rely on biomass for cooking and heating. Moreover, most of these people live in rural areas, where the cost of energy services is very high, accounting for 20% of their total incomes[1].

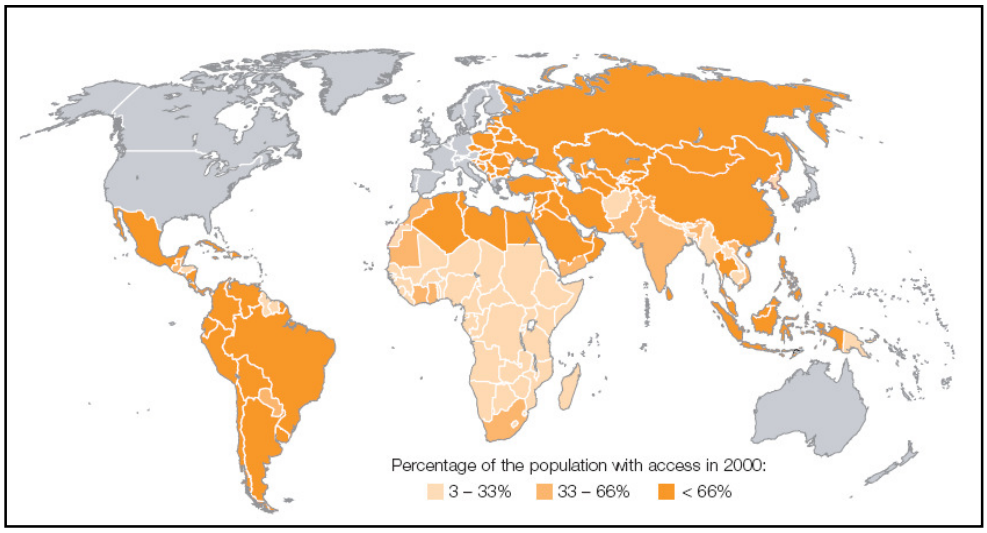


Figure 2: Electricity access in the world. Source: The World Bank, 2001

According to the definition given by the United Nations Development Program, human development is about expanding the choices people have to lead lives that they value. And it is

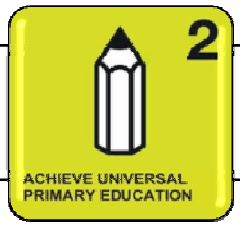
[1] International Energy Agency 2007

thus about much more than economic growth, which is only a means —if a very important one —of enlarging people's choices. The most basic capabilities for human development are to lead long and healthy lives, to be knowledgeable, to have access to the resources needed for a decent standard of living and to be able to participate in the life of the community.

This multidisciplinary character of human development is reflected by the Millennium Development Goals (MDGs). The MDGs are a set of eight goals to be achieved by 2015 that was adopted by 189 countries and signed by 147 governments during the United Nations Millennium Summit in September 2000. Each goal is broken down into different targets, as shown in the following table:

Goal 1: Eradicate Extreme Hunger and Poverty

- **Target 1a.** Halve, between 1990 and 2015, the proportion of people whose income is less than $1 a day
- **Target 1b.** Achieve full and productive employment and decent work for all, including women and young people
- **Target 1c.** Halve, between 1990 and 2015, the proportion of people who suffer from hunger



Goal 2: Achieve Universal Primary Education

- **Target 2a.** Ensure that all boys and girls complete a full course of primary schooling

Goal 3: Promote Gender Equality and Empower Women

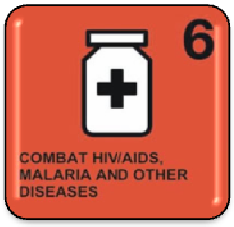
- **Target 3a:** Eliminate gender disparity in primary and secondary education preferably by 2005, and at all levels by 2015

Goal 4: Reduce Child Mortality

- **Target 4a**: Reduce by two thirds the mortality rate among children under five

Goal 5: Improve Maternal Health

- **Target 5a:** Reduce by three quarters the maternal mortality ratio
- **Target 5b**: Achieve, by 2015, universal access to reproductive health



Goal 6: Combat HIV/AIDS, Malaria and other diseases

- **Target 6a:** Halt and begin to reverse the spread of HIV/AIDS
- **Target 6b:** Achieve, by 2010, universal access to treatment for HIV/AIDS for all those who need it
- **Target 6c:** Halt and begin to reverse the incidence of malaria and other major diseases

Goal 7: Ensure Environmental Sustainability

- **Target 7a:** Integrate the principles of sustainable development into country policies and programmes; reverse loss of environmental resources
- **Target 7b:** Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss
- **Target 7c:** Reduce by half the proportion of people without sustainable access to safe drinking water and basic sanitation
- **Target 7d:** Achieve significant improvement in lives of at least 100 million slum dwellers, by 2020

Goal 8: Develop a Global Partnership for Development

- **Target 8a:** Develop further an open, rule-based, predictable, non-discriminatory trading and financial system
- **Target 8b:** Address the special needs of the least developed countries
- **Target 8c**: Address the special needs of landlocked developing countries and small island developing States (through the Programme of Action for the Sustainable Development of Small Island Developing States and the outcome of the twenty-second special session of the General Assembly)
- **Target 8d:** Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term
- **Target 8d:** Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term
- **Target 8e:** In cooperation with pharmaceutical companies, provide access to affordable essential drugs in developing countries
- **Target 8f:** In cooperation with the private sector, make available the benefits of new technologies, especially information and communications

Table 1: The Millennium Development Goals. Source: UNDP

Although none of the MDGs strictly refers to energy access, it is indeed a key factor for the achievement of each one of them. It contributes to poverty alleviation by increasing productivity and, consequently, industrial activity, employment and economic growth (MDG1); it frees women and children from carrying wood and water to meet their basic needs, allowing them to attend school as well as reducing gender inequality (MDGs2,3); concerning human health (MGDs 4,5,6), energy is a fundamental aspect that not only improves conditions of care facilities and water supply, but also prevents poor people from respiratory illness that currently cause millions of deaths in these regions, due to the use of traditional fuels and stoves that generate high levels of indoor pollution.

Energy, besides being a key driver for development, may also have negative consequences for human development when produced and used in an unsustainable way. For example, international evidence shows that traditional sources of energy used in poor countries may have serious effects on the environment, leading to land degradation, deforestation and air pollution. Similarly, fossil fuel burning is largely responsible for the greatest share of GHG emissions, and thus for Climate Change, which will be later discussed in detail.

Consequently, energy plays a key role in the achievement of environmental sustainability through the increase of efficiency and the use of clean alternatives, thus contributing to a rationale use of the resources as well as reducing pollutant emissions (MDG7).

2. CLIMATE CHANGE AND HUMAN DEVELOPMENT

According to the definition given by the United Nations Framework Convention on Climate Change, *"Climate change means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods"*. Such human activities increase the atmospheric concentrations of greenhouse gases that contribute to global warming, including carbon dioxine ($C0_2$), methane (CH_4), nitrous oxide (N_20), hydroflurocarbons (HFC), perfluorocarbons (PFC) and sulphur hexafluoride (SF_6). The so-called "greenhouse effect" is

based on the ability of these gases to absorb the infra-red radiation emitted by the earth's surface. The rising concentrations of these gases in the atmosphere result in an energetic imbalance, thus disturbing the way the climate maintains this equilibrium. The expected consequences of this effect are, among others, an increase in the average temperature of the earth's surface and shifts in worldwide weather patterns.[2]

CO_2 is the most important anthropogenic greenhouse gas. According to the Intergovernmental Panel on Climate Change (IPPC) the atmospheric concentration of this gas has increased by 30% since the Industrial Revolution. The main sources of CO2 emissions are electricity generation, industry and road transport, all of them linked to energy generation and consumption. Change of land use is another important cause of climate change, as indicated in the following graph.

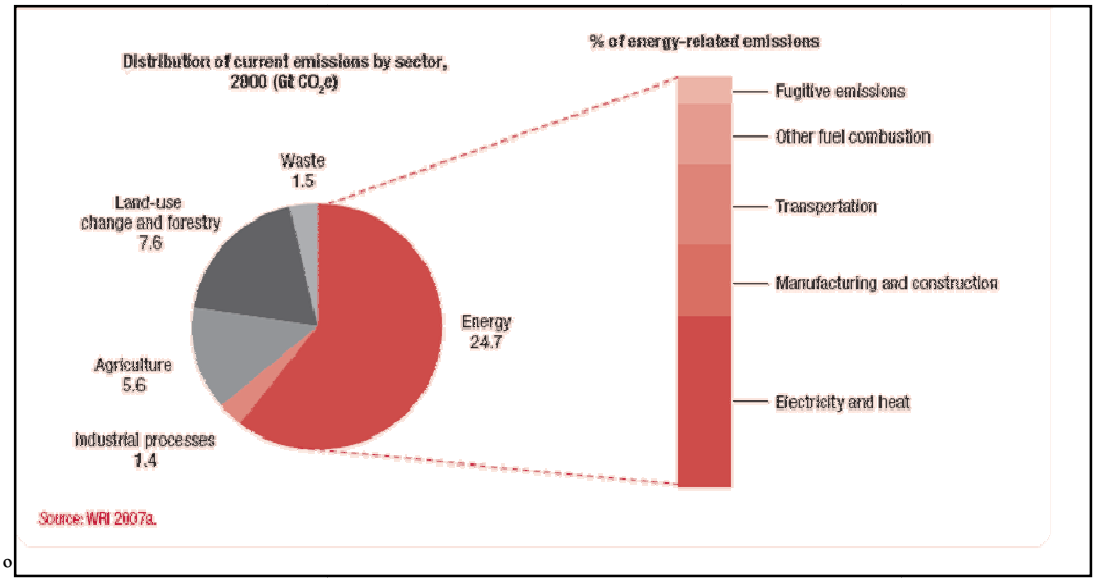


Figure 3: Distribution of greenhouse gas emissions by sector. Source: World Resources Institute, 2007

Although developed countries' energy model, based on the use of fossil fuels, represents the major cause of pollution nowadays, the role of developing markets in the increase of these emissions is expected to be very high for the coming years, contributing by 97% from now to 2030- three quarters from China, India and the Middle East alone. [3] Consequently, the concept of development needs to be separated from this unsustainable model and be based on the increase of energy efficiency and the use of modern and clean technologies.

[2] UNFCCC 2002
[3] International Energy Agency 2007

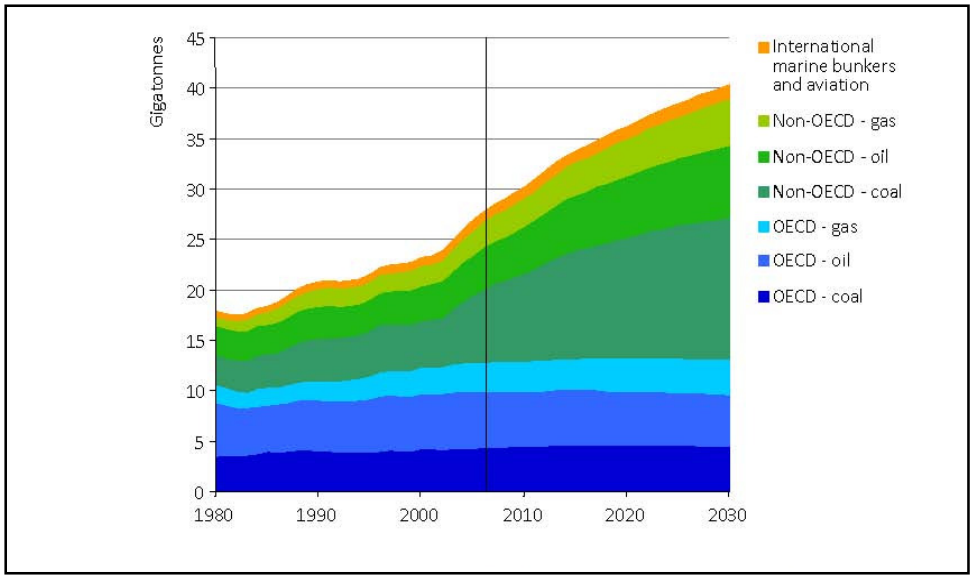


Figure 4: Energy–related CO2 emissions in the reference scenario by fuel and region. Source: International Energy Agency, 2007

Climate change and human development represent two of the main global challenges included in the international agendas nowadays. Despite of the increasing number of initiatives addressed to tackle both issues (MDGs, Kyoto protocol...) they have been traditionally treated as segregated problems. However, there are many aspects that clearly show the similarities and interdependence between them. As stated by Shalil Shetti (UN Millenium Campaign director) (i) they both are global problems that need to be solved at international levelrequiring high amount of resources and coordination, (ii) both climate change and lack of human development affect the most vulnerable communities of the world, (iii) both matters require urgent action and (iv) they are the result of market failure (UNFCC conference in Bali, 2008)

As shown in the graph below, climate disasters occurred from 2000 to 2004 were twice higher than the number of these disasters from 1980 to 1984. The graph also reflects the occurrence of them in both developed (OECD countries) and developing countries, which is around 79 times higher in the poor world.

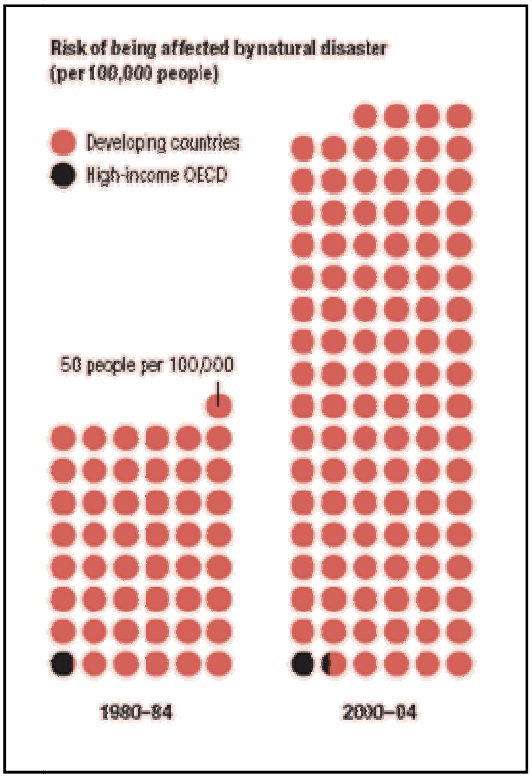


Figure 5: Disaster risks in develop and developing countries. Source: HDRO calculations based on OFDA and CRED, 2007

These figures are even bigger when taking into account unreported local climate disasters and those that do not meet the requirements to be considered as human disaster.

Although we cannot conclude that the origin of all these extreme episodes lies on climate change, global warming is actually contributing to an increase of the number of these events. It creates systemic conditions that will generate, for instance, a rise of the temperature level of the oceans or a decline of the number of rainfalls (especially in the Sub-Saharan regions), which are the main causes of droughts and floods.

There are 1.1 million people in the developing world living on less than US$1 a day.[4] It has been proven that these communities will be the most vulnerable to climate change due to different reasons. Firstly, they normally live in sensitive geographical areas, such us sub-Saharan Africa, eastern Asia and South Asia, where –according to the IPCC forecast- global warming is expected to be above the global average. Indeed, some of these areas are already suffering from water shortages. The driest regions of the world will probably face even less water availability. Thus, the consequences in terms of agricultural losses seem dramatic in societies where three quarters of the economy rely on agriculture. The following tables highlight the importance of this sector in developing regions in terms of both GDP and labour force, and the potential damage of the effects of climate change over developing countries' agriculture.

[4] The World Bank 2005

	Agricultural value added (% of GDP) 2005	Agricultural labour force (% of total labour force) 2004
Arab States	7	29
East Asia and the Pacific	10	58
Latin America and the Caribbean	7	18
South Asia	17	55
Sub-Saharan Africa	16	58

Table 2: Role of agriculture in developing regions. Source: The World Bank 2007

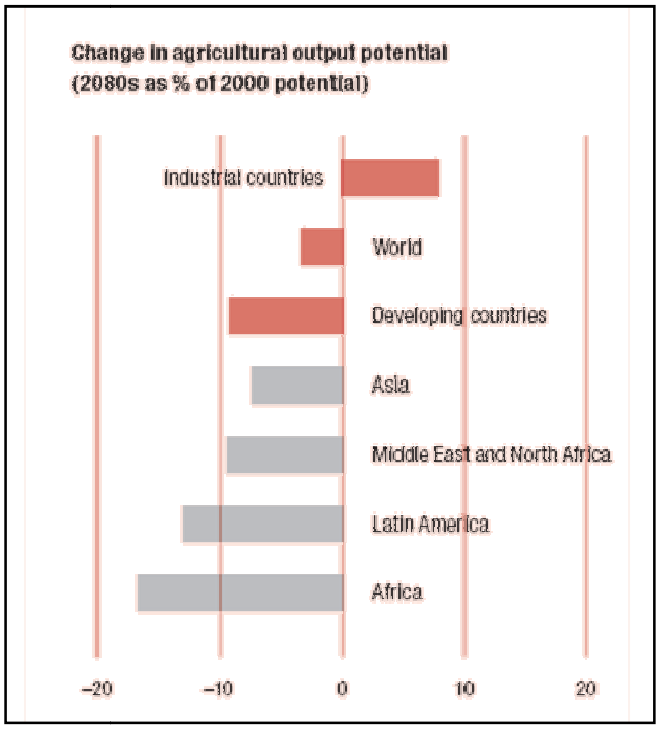


Figure 6: Climate change effects on developing countries' agriculture. Source: Cline, 2007

On the other hand, the communities´ vulnerability also lies in the lack of resources to fight against climate change, not only in terms of climate-defense infrastructure, but also institutional support and social insurance that enable people to manage the risk.

Therefore, and as shown in figure 9, climate change represents a threat for each of the MDGs, and it will slow down all the progresses made in terms of education, health and poverty alleviation over the last years if coordinated efforts are not made on this respect.

A very remarkable fact is that developing countries are the ones that have contributed the least to actual global warming. Despite of the high contribution of emerging markets to CO2 emissions forecasted for the coming years, developed countries are responsible for 70% of the emissions released to the atmosphere since the beginning of the industrial era. [5] Rich countries have the moral responsibility- and the financial resources- to lead the fight against climate change and help the poor nations to face this problem.

[5] World Resources Institute 2005

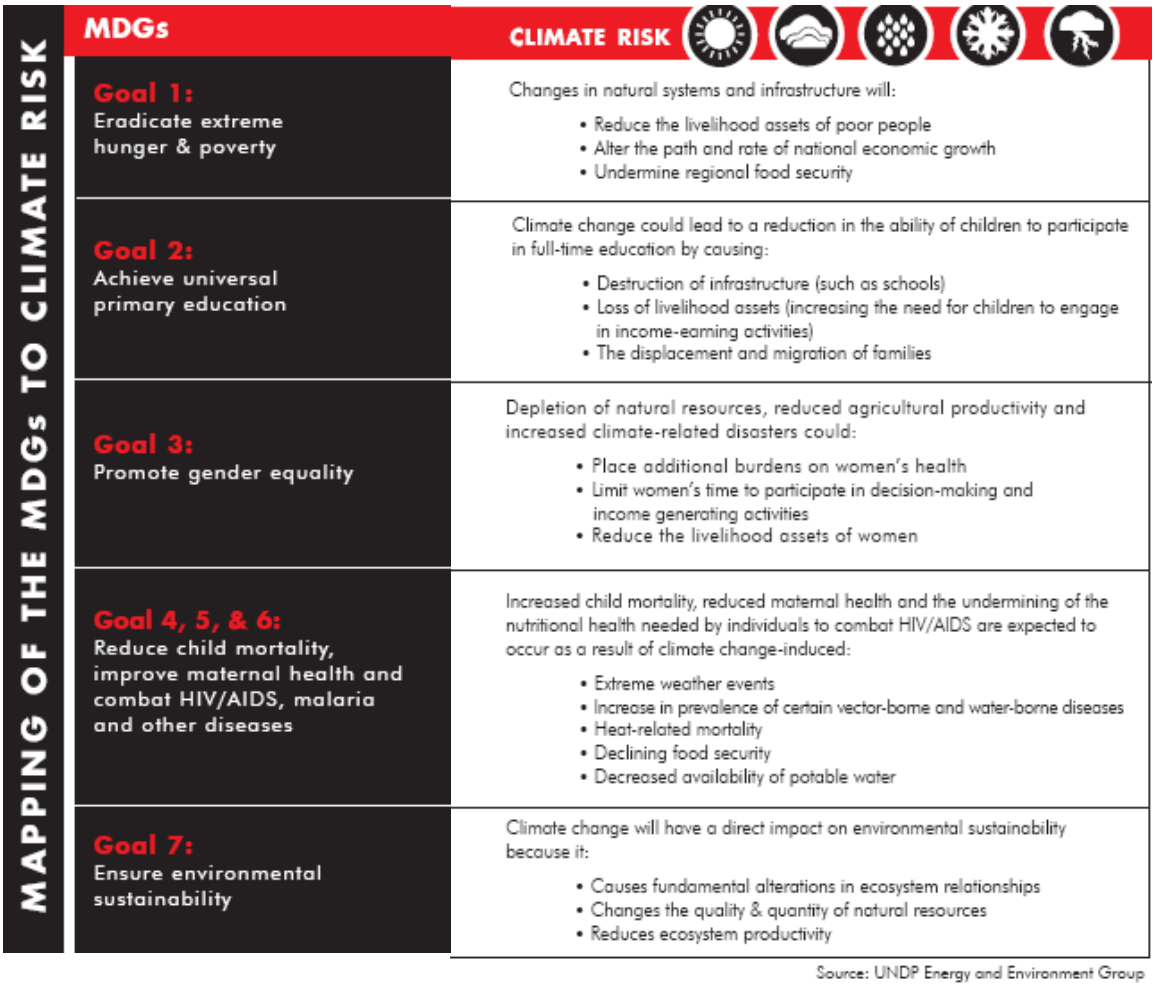


Table 3: How climate change will affect the Millenium Development Goals´achievement. Source: UNDP Energy and Environment Group, 2005

As a conclusion for this section, this situation calls for urgent action. The international community needs to base their strategy on both mitigation and adaptation actions. Mitigation efforts are aimed at cutting CO2 emissions at a global scale while adaptation efforts are aimed at helping developing countries adapt to climate change in order to avoid a human catastrophe in the poor world.

The interdependence of climate change and development analyzed along this chapter highlights the necessity to address both issues jointly. As it will be discussed in detail in the next section, within the Kyoto protocol, a new policy instrument has been developed, which attempts to tackle climate change and development challenge in a simultaneous way. The Clean Development mechanism is aimed at achieving sustainable development in developing countries while reducing greenhouse gases emissions.

3. THE CLEAN DEVELOPMENT MECHANISM

3.1. Historical Background

Climate change started to be an international growing concern in the mid-1980s, as a result of the scientific evidence related to the impact of human activities on the climate system and the increasing concern of the general public about environmental issues. In this context, the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO)

established in 1988 the Intergovernmental Panel on Climate Change (IPCC) to provide decision-makers and others interested in climate change with an objective source of information[6]. The IPCC is a scientific body that provides information based on scientific evidence and reflects existing viewpoints within the scientific community with regard to the causes of climate change, its potential environmental and socio-economic consequences and the different adaptation and mitigation options to respond to it[1].

In 1990, two years after its establishment, the IPCC published a report confirming that climate change was a real threat: unless effective measures were taken to limit emissions, the growing concentration of anthropogenic greenhouse gases (GHGs) in the atmosphere would enhance the natural greenhouse effect, resulting in the global warming of the Earth's surface.

The panel called for an international agreement to tackle the problem, call that was supported later that year by the Second World Climate Conference. The United Nations General Assembly's response was to launch negotiations aimed at preparing an international agreement on climate protection. The negotiations started in 1991; by May 1992 the United Nations Framework Convention on Climate Change (UNFCCC) was already prepared; in June 1992 was opened for signature at the United Nations Conference on Environment and Development (the Earth Summit) and, finally, entered into force in March 1994.

The Convention's final objective was "*the 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.*"[7] In order for this objective to be achieved, all countries have common but differentiated responsibilities on the basis of equity and in accordance with their respective capabilities[8]. In this regard the convention sets two groups of countries: Annex I Parties, the industrialized countries who have historically contributed the most to climate change and must therefore play an active role in the fight against it by reducing their emissions; Annex II Parties, basically developing countries suffering the consequences of climate change, and lacking the material means and expertise to tackle this issue.

The Convention established also the Conference of the Parties (COP) "*as the supreme body of this Convention, which shall keep under regular review the implementation of the Convention and any related legal instruments that the Conference of the Parties may adopt, and shall make, within its mandate, the decisions necessary to promote the effective implementation of the convention.*"[9] They have been meeting once a year since 1995.

At the third session of the COP (COP3, 1997) in Kyoto, Japan, a legally binding set of obligations for 38 industrialized countries and 11 countries in Central and Eastern Europe with economies in transition (Annex B countries) was created with the objective of "*reducing their overall emissions by at least 5 per cent below 1990 levels in the commitment period 2008 to 2012.*"[10] This is known as the Kyoto Protocol to the Convention.

After the adoption of the protocol in 1997, a harsh debate started to develop more specifically the protocol's operational details. After years of negotiations the governments finally agreed, during the COP7 in 2001, on a document on how to implement the Kyoto Protocol: the

[6] http://www.ipcc.ch/about/index.htm
[7] United Nations Framework Convention on Climate Change, United Nations, 1992, Article 2
[8] United Nations Framework Convention on Climate Change, United Nations, 1992, Article 3
[9] United Nations Framework Convention on Climate Change, United Nations, 1992, Article 7
[10] Kyoto Protocol to the United Nations Framework Convention on Climate Change, United Nations, 1998, Article 3

Marrakech Accords, which were finally adopted during the COP11 celebrated in Montreal in 2005.

The Kyoto Protocol establishes three different cooperative mechanisms to help Annex I countries meet their emissions reduction goals in a cost-effective way, by allowing them to reduce emissions in other countries at lower cost than they could achieve domestically. However these tools are strictly supplementary and should not prevent domestic reduction initiatives from being implemented. These flexible mechanisms are the International Emission Trading, the Joint Implementation and the Clean Development Mechanism.

The Emissions Trading (ET) allows Annex I countries to buy and sell emission credits among themselves. Those countries that have reduced their emissions beyond their goals can sell the excess of allowances to those countries either having difficulties with meeting their goals or finding it more expensive that buying in this market.

The Joint Implementation (JI) is very similar to CDM, but in this case an Annex I country transfers or acquires emission reduction units from another Annex I party, as a result of the implementation of emission reduction projects in this last country.

The Clean Development Mechanism will be studied in detail in the following section.

3.2. CDM Concept, Requirements and Life Cycle

This section will deal with the concept of Clean Development Mechanism, its general requirements and the different steps included in the CDM project cycle.

3.2.1. Concept

The Clean Development Mechanism is a cooperative tool established under the Kyoto Protocol "*to assist Parties not included in Annex I 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*"[11].

The CDM allows Annex I public and private sectors to implement GHGs emission reduction projects in developing countries, receiving in return the corresponding Certified Emission Reductions (CERs) that can be used by the Annex I country or company to contribute to compliance with its emission reduction goals.

At the same time, these projects promote sustainable development in the non Annex I countries where they are implemented. Therefore, CDM not only fosters green investment in developing countries, but also offers the opportunity to give a step forward simultaneously on environmental, economic and social issues.

The Kyoto Protocol also considers the possibility of unilateral CDM projects where the investors and implementers are developing countries' governments or businesses or where developing countries are the ones implementing the projects, financed by an international fund.

[11] Kyoto Protocol to the United Nations Framework Convention on Climate Change, United Nations, 1998, Article 12

3.2.2. Requirements

In order for a CDM project to be accepted it must fulfil the following **general conditions**[6]:

i. Voluntary participation approved by each Party involved.

ii. Contribute to the achievement of sustainable development in the host country.

iii. Result in real, measurable and long-term benefits related to the mitigation of climate change.

iv. Reductions in emissions must be additional to any that would occur in the absence of the project activity. The additional GHG reductions are calculated with reference to a defined baseline (the scenario used to show the trend of anthropogenic GHG emissions that would occur in the absence of the proposed CDM project[12]). It must be shown that the project would have not been implemented without the support of CDM due to economic, technological or other barriers. Without this additionality requirement there is no guarantee that CDM projects will create incremental GHG emissions reductions equivalent to those that would have been made in Annex I countries[7].

Besides, there is a number of **basic eligibility criteria** that those countries interested in participating in the CDM must meet[13]:

i. Voluntary participation in the CDM.

ii. Establishment of a national CDM authority (Designated National Authority).

iii. Ratification of the Kyoto Protocol.

In addition, Annex I countries must fulfill the following requirements[7]:

i. Establishment of the assigned amount under Article 3 of the Protocol.

ii. Establishment of a national system for the estimation of GHGs,

iii. a national registry,

iv. an annual inventory and

v. an accounting system for the sale and purchase of emission reductions.

Regarding eligibility, the CDM allows the implementation of projects in the following sectors[14]:

i. End-use energy efficiency improvement

ii. Supply-side energy efficiency improvement

iii. Renewable energy

iv. Fuel switching

[12] CDM Information and Guidebook, UNEP, 2004, Appendix A

[13] Introduction to the CDM, UNEP RISO Centre, 2002

[14] CDM Information and Guidebook, UNEP, 2004, Chapter 4

v. Agriculture

vi. Industrial processes

vii. Solvent and other product use

viii. Waste management

ix. Sinks (only afforestation and reforestation)

Besides regular CDM, small-scale projects can be also implemented. There are three possible small-scale project categories:[9]

i. Renewable energy project activities with a maximum output capacity equivalent of up to 15 MW.

ii. Energy efficiency improvement project activities which reduce energy consumption, on the supply and/or the demand side, by up to the equivalent of 15 GWh per year.

iii. Other project activities that both reduce anthropogenic emissions by sources and directly emit less than 15 thousand tonnes (kt) of carbon dioxide equivalent annually.

3.2.3. CDM Project Cycle

3.2.3.1. Overview

As it can be seen in figure 7 below, the CDM project cycle consists of seven stages: project design and formulation, national approval, validation and registration, project financing, monitoring, verification and certification and issuance of CERs. The first four steps take place before the actual implementation of the project, while the last three are performed during its lifetime. Each step will be analyzed more in depth in section 2.3.3.

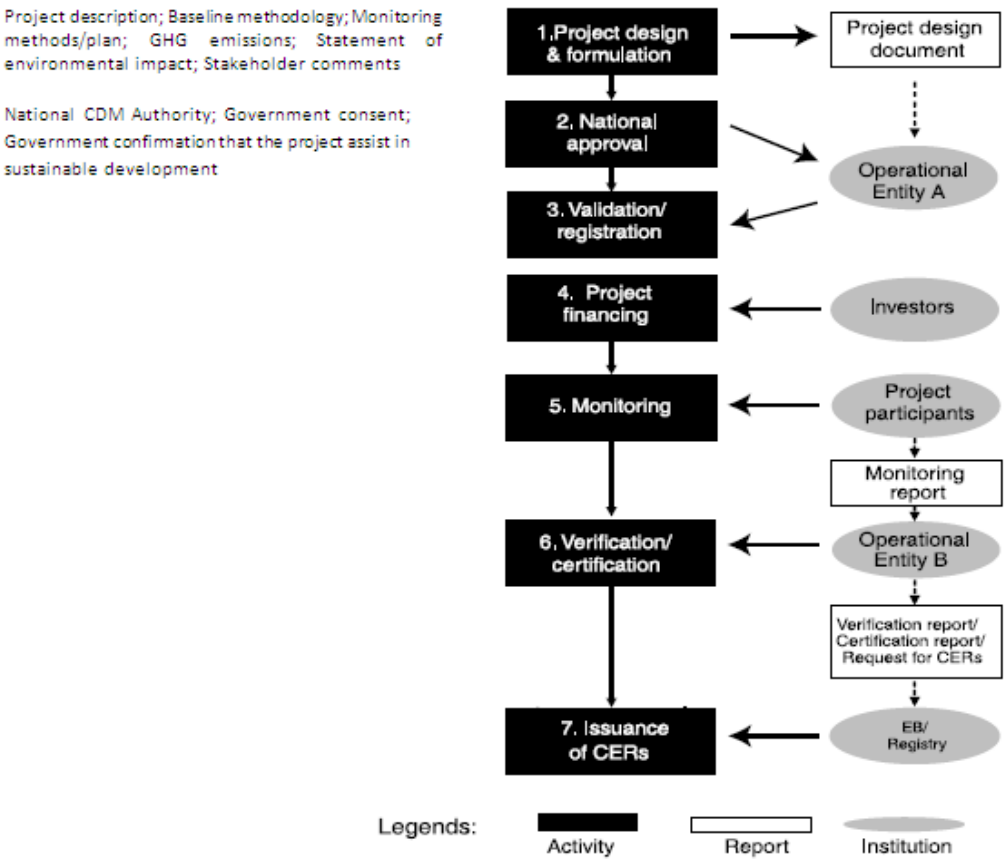


Figure 7: Project cycle for the CDM. Source: Introduction to the CDM, UNEP RISOE Centre, 2002

3.2.3.2. Actors Involved

- *Project participants*

  As it was mentioned before, most of CDM projects are bilateral: an Annex I government or company (investor country) makes an investment in a non-Annex I developing country (host country) in order to receive the corresponding CERs. However, unilateral CDM projects where investors and implementers are developing countries' governments or businesses, or where developing countries are the ones implementing the projects financed by an international fund are also considered by the Kyoto Protocol.

  In any case, project participants are responsible for the steps 1 (project design and formulation), 4 (project financing) and 5 (implementation and monitoring) of the project life cycle.

- *Designated National Authority (DNA)*

  DNAs are responsible for CDM at the local level, being its establishment a necessary condition for the parties to participate in the mechanism.

  With regards to their role, they are in charge of implementing the stage 2 (national approval) of the project cycle, being their main duties:

  - Establish a regulatory framework for evaluation and approval of CDM projects, developing criteria that ensure compliance with national policies,

laws and regulations and a transparent assessment of projects in accordance with the CDM Executive Board principles.

- Elaborate guidelines and procedures for project approval.
- Establish sustainable development criteria.
- Evaluate the project and decide whether the country wants to participate.
- Decide whether the CDM project contributes to sustainable development.
- Prepare, in collaboration with the investor country, the Project Design Document (the main deliverable of the first stage).
- Issue the required "voluntary participation" and "contribution to sustainable development" statements.

- *Designated Operational Entity (DOE)*

  These entities are usually consulting, auditing, accounting or even law firms that have the human and technical resources and skills to validate the projects (stage 3) and verify and certify the emission reductions (stage 6) in a credible and independent way. They are accredited by the CDM Executive Board.

- *CDM Executive Board*

  The Executive Board (EB) is the supreme organism of the CDM, under the direct authority of the Parties. The EB is made up of 10 members: one representative from each of the five official UN regions (Africa, Asia, Latin America and the Caribbean, Central and Eastern Europe, and the OECD); one from the small island developing states, and two each from Annex I and non-Annex I Parties[7].

  The EB is responsible for the final validation and registration of the project (stage 3) and for the issuance of CERs (stage 7). They are also in charge of the accreditation of the DOEs, the management of the adaptation and administrative expenses and the maintenance of a CDM registry for the issued CERs and a CER account for each non-Annex I country hosting a CDM project.

3.2.3.3. The Project Cycle in Detail

In this section each stage of the CDM life cycle will be studied more in depth.

1. Project design and formulation

   In this first stage, the potential CDM project is identified and formulated so that it complies with the basic requirements mentioned in section 2.2 (additionality, result in real and measurable climate change benefits, contribution to sustainable development…). The better the design and formulation of the project, the higher the probability of success through the whole process.

   The main deliverable of this stage is the Project Design Document (PDD), a document the project participants must prepare in order for the project to enter the process of approval, validation and registration. The PDD must contain the following information[15]:

[15] CDM Information and Guidebook, UNEP 2004, Chapter 5

A.	General description of project activity
B.	Baseline methodology
C.	Duration of the project activity/crediting period
D.	Monitoring methodology and plan
E.	Calculation of GHG emission by sources
F.	Environmental impacts
G.	Stakeholder comments
Annex 1.	Contact information on project participants
Annex 2.	Information regarding public funding
Annex 3.	New baseline methodology
Annex 4.	New monitoring methodology
Annex 5.	Table of baseline data

Table 4: Required content of a Project Design Document (PDD). Source: CDM Information and Guidebook, UNEP, 2004

Since the preparation of the PDD entails great complexity and it is not the actual object of our study, a detailed analysis of each issue will not be undertaken. However it is worthy to remark the importance of the baseline and monitoring methodologies. When preparing the PDD, project participants must use existing approved baseline and monitoring methodologies in order for the project to be accepted. In case they prefer or need a new one, it must be authorized and registered by the EB. Otherwise the project will be rejected or asked for revision.

2. National approval

As it was advanced in section 2.3.2, the host country, through its Designated National Authority (DNA), must evaluate the project, decide if it contributes to national sustainable development, conclude whether the project is approved, issue the corresponding "voluntary participation" and "contribution to sustainable development" statements and cooperate with the investor country in the preparation of the PDD.

3. Validation and registration

The PDD will then be reviewed by a Designated Operational Entity (DOE) chosen by the project participants. The DOE will engage other stakeholders such as NGOs or local communities through a consultation process, allowing them to give their feedbacks about the project. Finally, the DOE will decide if the project should be validated or not.

In a positive case, the DOE -having previously received from the DNA a written approval of voluntary participation and confirmation that the project contributes to the achievement of sustainable development-, will submit a validation report to the Executive Board for formal registration.

Once the EB receives the validation report it has 8 weeks to register the project. If a request for a review has been made by a Party involved in the project activity or at least three members of the EB, the registration can be delayed until the next EB meeting for a review[9].

4. Project financing

Financing is a crucial stage of the project cycle, existing multilateral as well as bilateral sources of funding to develop CDM projects. As it has been showed before, different financing options are possible. Sometimes an Annex I country (government or company) invests directly in a developing country. But it can happen that the developing country finds financial support in a multilateral source such as a World Bank fund, or it can even self-finance, being able to sell the resultant CERs.

To illustrate the complexity of the project financing, the chart below gathers the existing CER procurement funds, which are indeed growing and expanding.

Public-Private Partnerships	Government Funds	Private Funds
Multilateral Institutions The World Bank • Prototype Carbon Fund (US$ 180 million) • Community Development Carbon Fund (US$ 100 million) • World Bank Bio-Carbon Fund (US$ 100 million) • Italian Carbon Fund (US$15 million) • Spanish Carbon Fund (under discussion) European Investment Bank • Proposed Carbon Investment Trust **Other Financial Institutions** Japan *Japan Bank for International Cooperation (JBIC) and Development Bank of Japan* • Joint Carbon Fund (10 billion yen) Germany *KfW* German Carbon Fund (€ 50 million) Denmark *Ecosecurities and Standard Bank of London* • Denmark Carbon Facility (DKK 59 million)	**Own Tender** • Denmark CDM Program • Dutch Government C-ERUPT Program • Finnish CDM/JI Pilot Program (€ 20 million) • Sweden International Climate Investment Program – CDM • Austria JI/CDM Procurement Program • Belgium CDM/JI Program Through Commercial/Development Banks • Rabo Bank (Dutch Government) **Through Multilateral Institutions** • World Bank (The Netherlands Clean Development Facility - € 70 million) • IFC (IFC-Netherlands Carbon Facility - € 44 million) **Through Bilateral Transactions (signed MOUs)** • Austria: discussions with China • Canada: Costa Rica, Colombia, Chile, Nicaragua, Tunisia, South Korea • Denmark: Malaysia; discussions with China, South Africa • Finland: China, Costa Rica, El Salvador, Nicaragua, India • France: Colombia and Morocco • Italy: Algeria, China, Cuba, Cyprus, Egypt, El Salvador, Israel, Morocco • Netherlands: Colombia, Costa Rica, El Salvador, Panama, Uruguay, Bolivia, Nicaragua, Guatemala, Honduras. Under negotiation: Indonesia, Philippines).	**For trading** • ICECAP (Cumbria Energy, Investec Bank and Less Carbon) • Mitsubishi Corporation (purchased emission rights from Hidroelectrica Guardia Vieja, SA) • Mitsubishi Securities Co. • Mizuho Securities Co. • Voluntary use (carbon dioxide neutral) • Dutch Development Finance Company

Table 5: CER Procurement Funds. Source: CDM Information and Guidebook, UNEP, 2004

It must be highlighted that public funding of CDM projects must not result in the diversion of funds for official development assistance. Besides, 2% of the CERs generated by a CDM project will be transferred to an adaptation fund created to assist especially vulnerable developing countries in their adaptation to the effects of climate change. A second levy on CERs will be used to cover the CDM's administrative costs.

5. Monitoring

Once the project is running, the project participants must prepare a monitoring report including an assessment of the project's performance through a series of indicators and an estimation of the CERs generated. This report will then be submitted to the DOE for verification.

6. Verification and certification

The DOE must make sure that the CERs have resulted according to the guidelines and conditions agreed upon in the initial validation of the project[8]. Once the operational entity has made the pertinent reviews to check this, it will issue a validation report. Then it will certify that the project achieved the intended reductions through the issuance of a certification report, which will also constitute the request for the issuance of the CERs. Unless a project participant or three Executive Board members request a review within 15 days, the EB will instruct the CDM registry to issue the CERs[8.]

7. Issuance of CERs

Once it receives the request for issuance, the EB will have 15 days to issue the CERs to the project participants. The project cycle will then be complete.

To illustrate the current CER market situation, an extract of the report *CDM Projects Suffer despite CER Crisis* prepared in June 2009 by carbon**positive**, a business that develops sustainable agro-forestry and bio-energy ventures in non-industrialized countries, is presented next:

"Prices for secondary market Certified Emission Reductions (CERs) continued to gain ground in May but prices are not high enough for a healthy primary market in new CDM projects.

The benchmark CER price, in futures contracts for Dec 09 delivery, closed at €12.73 on the European Climate Exchange on May 29, up €1.30 on its April closing price. Dec 10s closed at €12.80 and Dec 12s at €13.41.

Secondary CER (sCER) prices continued their recovery in May, following European Union Allowances prices northward after the record slump in early 2009. Higher oil prices and the general return of confidence to the EU carbon market have underpinned the ongoing rise, albeit with some volatility along the way.

Things aren't so positive in the primary CER market, where CERs are generated from new projects. Forward prices in the primary CER market currently range from €7.50 to €10.00 for a flow of CERs delivered across 2009-2012, according to the IDEAcarbon pCER Index, up slightly over the last month.

The major problem of pCER market in the lower carbon price environment in 2009 is that issued CERs are selling for no or not much more than it costs project developers to produce them. Some lower-cost projects are going ahead, but many others are unprofitable. Finance in the post-credit crunch world is harder to come by in any case."

The great impact of current CER prices on the viability of CDM projects will be shown up later in this report.

3.3. CDM and Sustainable Development

3.3.1. Developed-Developing Countries Perspectives

After having presented the general features of the CDM mechanism, this section aims at presenting the value of these mechanisms from both a developed and developing countries perspective.

As previously said, *"The CDM, contained in Article 12 of the Kyoto Protocol, allows governments or private entities in industrialized countries to implement emission reduction projects in developing countries and receive credit in the form of "certified emission reductions," or CERs, which they may count against their national reduction targets. The CDM strives to promote sustainable development in developing countries, while allowing developed countries to contribute to the goal of reducing atmospheric concentrations of greenhouse gases."*[16]

Therefore, the Kyoto Protocol (adopted in December 1997), creates legally binding obligations for 38 industrialized countries, to decrease their emissions of GHGs in approximately 5.2%below their 1990 levels over the period 2008-2012.

The CDM mechanism represents an opportunity not only those countries but also for private sector companies to reduce emissions, in any place around the world where the cost is lowest, so this way they can count these reductions towards their own targets.

The objectives of CDM mechanism regarding the different parties are:

Developed countries	Developing countries
- Governments and the private companies have the chance to invest in low-cost opportunities in developing countries. - Receive credits for the resulting emissions reductions needed within their borders - CDM lowers the cost of compliance with the Protocol in developed countries.	- Attract capital for projects which will lead to a more prosperous and less carbon-intensive economy - Encourage both private and public sectors to take an active participation- - Provide an incentive for technology transfer, as long as the investment is done through projects which are replacing any kind of old fossil fuel technology as well as creating new industries using environmentally sustainable technologies - Help define investment priorities in projects aimed to meet sustainable development goals - Opportunity to progress in different issues concerning climate, human development, local communities and environment - Economic opportunities : diminishing their vulnerability and increasing their energetic security, which will help them integrate themselves in the global economy in more equal conditions

Table 6: Objectives of CDM. Source: CDM Information and Guidebook, UNEP, 2004

[16] UNEP Collaborating Centre on Energy and Environment Risø National Laboratory Roskilde, Denmark

To sum up, CDM projects result in real, measurable and long-term benefits for both parties in terms of climate change mitigation:

- Developed countries: both governments and the private companies have the chance to invest in low-cost opportunities in developing countries and receive credits for the resulting emissions reductions needed within their borders. Therefore, the CDM lowers the cost of compliance with the Protocol in developed countries.
- Developing countries: they will be benefited from the increased investment flows, as well as from the requirement that these investments represent according to Sustainable Development goals. In fact, these goals need to be addressed as a part of the CDM process. Those countries are encouraged to participate as long as the development goals are addressed as part of the whole CDM issue. This recognizes that only through a long-term development scope, all countries will be able to play a role in protecting the climate at a global level.

From developing countries perspective, the CDM contributes to:

- Attract capital for projects which will lead to a more prosperous and less carbon-intensive economy.
- Encourage both private and public sectors to take an active participation.
- Provide an incentive for technology transfer, as long as the investment is done through projects which are replacing any kind of old fossil fuel technology as well as creating new industries using environmentally sustainable technologies.
- Help define investment priorities in projects aimed to meet sustainable development goals.

Furthermore, the CDM is an opportunity to progress in different issues concerning climate, human development, local communities and environment. For developing countries, which might otherwise be preoccupied with immediate economic and social needs, the prospect of such benefits should provide a strong incentive to participate in the CDM. In fact, they must take advantage of the economic opportunities that CDM projects bring, so that they would be able to diminish their vulnerability and increase their energetic security, which will help them integrate themselves in the global economy in more equal conditions.

To sum up, CDM projects result in real, measurable and long-term benefits for both parties in terms of climate change mitigation.

3.3.2. The Case of Spain

3.3.2.1. Spain and Climate Change Efforts

As stated by Teresa Ribero Rodríguez (head of the Oficina Española para el Cambio climatic- OECC-), Spain´s position with regards to Climate Change is as follows:

- Spain is committed with Kyoto protocol in a unanimous agreement made by every parliament party member.
- The emissions need to be set by 2008-2012 under the 15% regarding the 1990 emissions.
- The main objective was to reduce the GHG emissions, keeping the business competitive advantage and the employment level.
- Spain has to face a great challenge when talking about climate change, but also it means an opportunity.

Spain recognizes climate change as a transversal problem which needs strong commitment and impending solutions Different actions to adapt and mitigate climate

change are extremely needed. Spain´s position with regards to mitigation efforts is very challenging. Current Spanish GHG emissions exceed by 54% the levels in 1990. This fact ranks Spain as one of the worst industrialized countries with regards their GHG emissions reduction commitment. With the aim of accomplishing such commitment as well as contributing to sustainable development, the Spanish Government fostered a Climate Change and Clean Energy Spain Strategy[17] which basically entails:

- Internal actions: they are complemented with the National Plan of Adaptation to Climate Change.

- External actions: carried out in developing countries and they must contribute to financing actions regarding development such as global warming, supporting multilateral actions and empowering the dialogue among climate change and renewable energy in the Iberoamerican Conference framework.

The EECCEL (Climate Change and Clean Energy Spain Strategy) includes the following working areas:

- Institutional Cooperation
- Emission reductions through two ways: CDM and JI
- International cooperation and cooperation with developing countries
- Emissions Trade
- Capture and Carbon Storage
- Land use, land use change and forestry
- Diffuse sectors (transport, agriculture, waste, domestic, HFC´s)
- Adaptation
- Information and education
- Horizontals policies (environmental management, fiscal policies, technology improvement)

It is worth mentioning that in order to articulate Spain´s efforts to fight Climate Change. Spain has committed to participate in at least nine International Carbon Funds with a contribution of approximately 300 million of Euros, which represent more than 20% of the total budget regarding Climate Change Strategy. Such funds are mainly focused in promoting clean energy in developing countries.

[17] Spanish Climate Change Office 2009

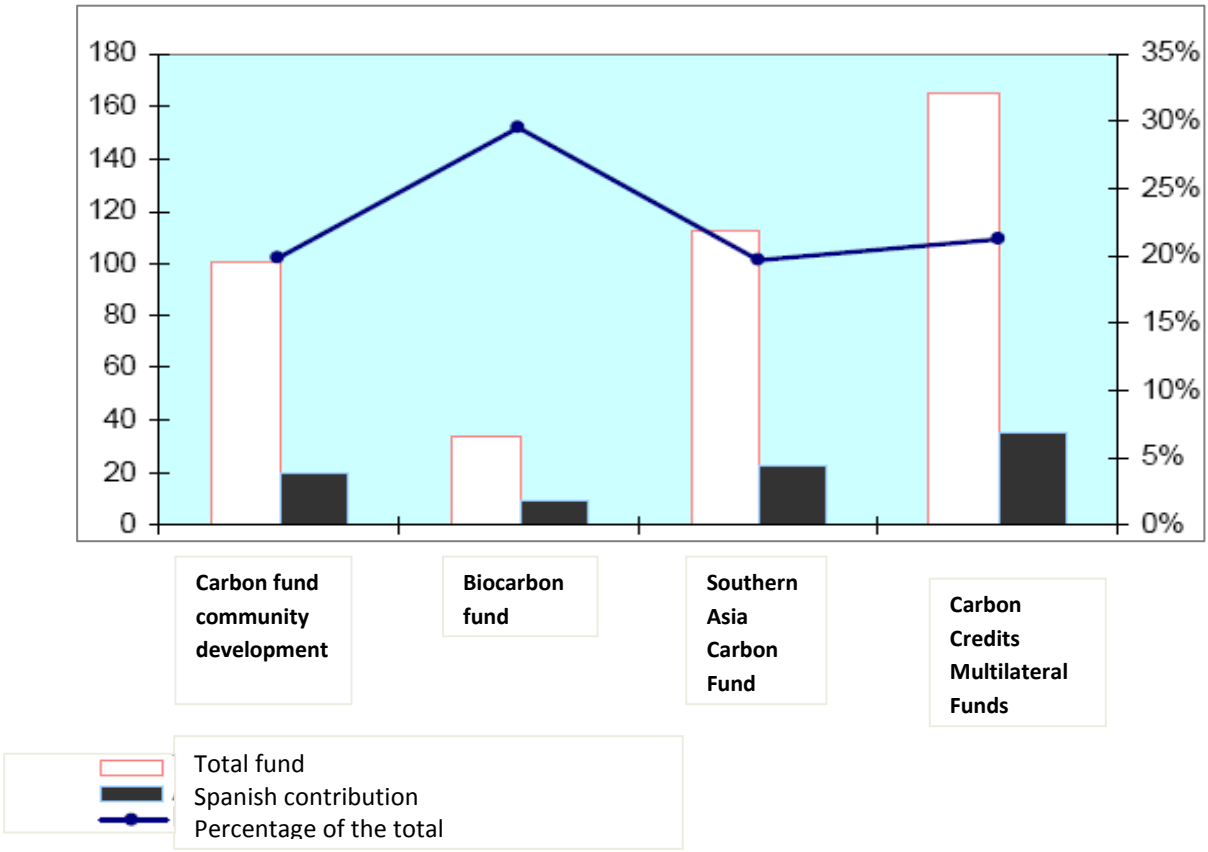


Figure 8: Spanish contribution to Carbon Funds. Source: World Bank and Ministerio de Economía y Hacienda.

3.3.2.2. Spain and CDM

Based on what has been mentioned it is possible to conclude that:

CDM represents for Spain a strategy as:

- A way to reduce costs to comply with Kyoto
- A tool to act in international cooperation
- A measure to reduce prices

Public investment in CDM:

- Obtains carbon credits
- Contributes to sustainable development through clean technology transfer, according to the national needs of the country receiving the project

The strategic areas of Spain include: Latin America, Eastern Europe, Maghreb and countries as China, Brazil, India and other countries of Pacific Asia.

It is important to point out, that Spain has a great potential in renewable energies, and therefore, CDM represents an opportunity for Spanish companies to get Spanish companies involved and to become an active player in fight against climate change. As an example, some recent and relevant initiatives are described below:

- *The Endesa Climate Initiative (2006-07)*

This initiative was the world's first large scale carbon procurement initiative launched by an industrial company. Initially aimed at buying 15 million tonnes CO_2 equivalents, Endesa succeeded in contracting over 70 million tonnes CO_2 by the end of 2006.[18]

The focus areas were:

- CDM/JI
- Green Investment Schemes
- Forestry

At the given time, Endesa was the Spain's largest energy company and the first player in the Latin American power markets. Endesa started the Endesa Climate Initiative (ECI), creating a commitment with its sustainable development policy and at the same time, complying with its requirements under the European Emissions trading Scheme.

ECI actions in Climate Change[19]:

- Project identification in China, Chile, Colombia, India, Brazil, Mexico and Russia
- Due diligence and contract negotiations
- Marketing and publicity

- *Carbon Fund FC2E (Spain)*

The Fondo de Carbono para la Empresa Española (FC2E), sponsored by the Instituto de Crédito Oficial (ICO) and Santander Investment Bank is the first mixed-capital Carbon Fund managed in Spain. FC2E uses Climate Focus' expertise in the appraisal of CDM and JI projects as well as in the regulatory and legal fields.

3.3.2.3. Contribution of CDM to Sustainable Development

When talking about Sustainable Development (SD) and CDM projects, one needs to go beyond the environmental perspective – in particular its associated CO_2 emission reduction- and pursue a more holistic approach to SD which also entails development issues such as poverty reduction, intra-generational issues, local environmental health benefits, employment generation, economic growth prospects, etc.

In order to incorporate the above mentioned criteria into the CDM, Developing countries – through their Designated National Authorities (DNA) need to define and align such criteria according to National Development Strategies (such as National development plans, sectorial or local environmental plans, social strategies, etc) [20]

Figure 9 illustrates some criteria that should be considered in order to ensure that CDM actually contributes to sustainable development.

[18] Endesa Climate Initiative, Maria Antonia Abad Puertolas, World Bank 2006
[19] Climate focus 2007
[20] UNEP project CD4CDM: CDM sustainable development Impacts, Olhoff A., Markandya A., Halsnaes K., Taylor T.

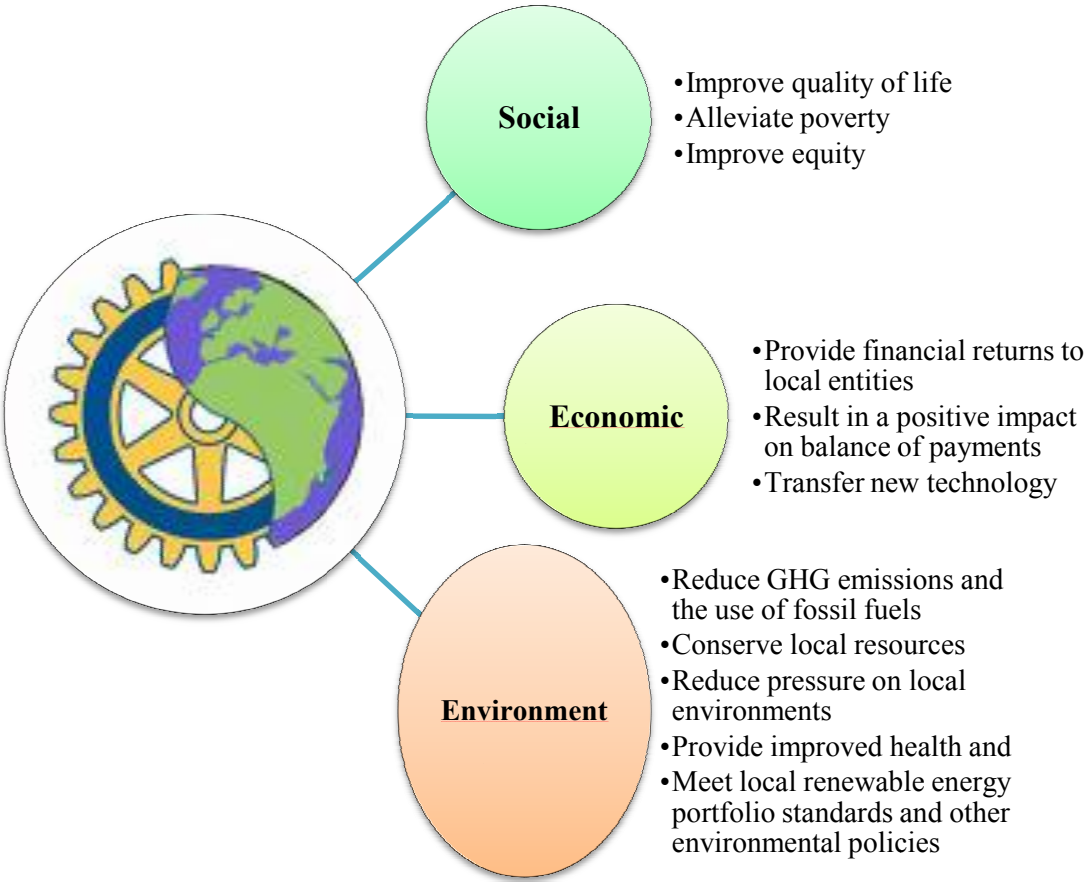


Figure 9: Integrating sustainable development into CDM. Source: UNEP Risoe Centre, 2008

From a project level perspective, the whole set of resulting impacts have to be positive for sustainable development issues. As previously said, any project should be aligned designed and executed in accordance with the national SD strategies and be coherent with the project level context.

This aspect is also important, as some critics argue that the SD impact assessment of CDM projects entails additional transaction costs and is an extra-burden developing countries cannot afford. Others argue that given the existing competition among developing countries to get CDM funds, this will lead Designated National Authorities (DNA) to relax such sustainable development criteria in order to attract a larger number of projects. One possible way to solve these issues would be to internalize such externalities (larger positive impacts on National Development Goals) into the CER price.

3.4. Current CDM Projects Worldwide

In order to see what has been the actual outcome of CDM over the last few years (in terms of where and what type of CDM have been implemented), the following figures show a classification of the projects grouped by different criteria.

3.4.1. General Overview

Status of CDM projects	Number
At validation	**2935**
Request for registration	72
Request for review	25
Correction requested	74
Under review	31
Total in the process of registration	**202**
Withdrawn	32
Rejected by EB	104
Registered, no issuance of CERs	1096
Registered, CER issued	500
Total registered	**1596**
Total number of projects (incl. rejected & withdrawn)	4869

Table 7: General overview of current projects phase. Source: UNEP Risoe Centre, 2009

3.4.2. Projects by Sector

In the graph below we can appreciate that by far, most of the projects are renewable energy projects. Indeed, this percentage has now increased up to 70 %.

Is important to point out that even though HFC´s, PFC´s projects represent the 2% of the total projects, they hold the 25% of the CER expected by 2012.

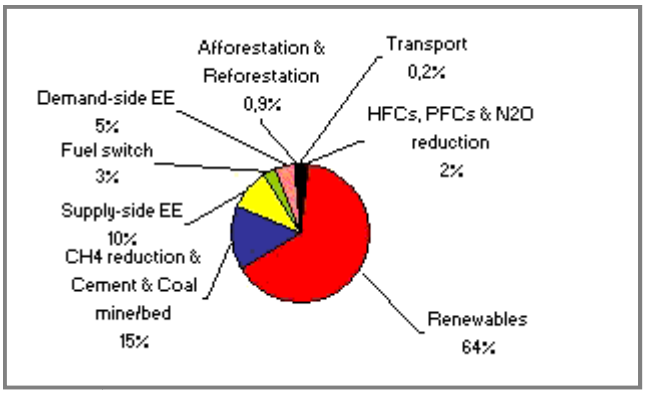


Figure 10: CDM projects by sector. Source: UNEP Risoe Centre, 2009.

	CDM							
Type	number		CERs/yr (000)		2012 CERs (000)		CERs Issued (000)	
Hydro	1259	27%	130135	21%	499943	17%	10124	4%
Biomass energy	708	15%	44051	7%	216165	7%	12145	4%
Wind	701	15%	61149	10%	264737	9%	11885	4%
EE own generation	419	9%	61457	10%	277897	9%	10701	4%
Landfill gas	357	8%	52098	8%	266944	9%	5902	2%
Biogas	301	6%	14995	2%	66667	2%	1139	0%
Agriculture	231	5%	8653	1%	51846	2%	3782	1%
EE Industry	187	4%	6654	1%	32432	1%	938	0%
Fossil fuel switch	145	3%	44566	7%	202604	7%	2334	1%
N2O	68	1%	48486	8%	253075	9%	58952	21%
Coal bed/mine methane	66	1%	28649	5%	130536	4%	733	0%
EE Supply side	55	1%	16373	3%	35245	1%	345	0%
Afforestation & Reforestation	42	1%	2806	0%	14200	0%	0	0%
Cement	40	1%	6736	1%	38708	1%	1103	0%
Fugitive	31	1%	10873	2%	57005	2%	5153	2%
Solar	30	1%	744	0%	3089	0%	1	0%
HFCs	23	0%	82498	13%	479243	16%	156032	55%
Geothermal	15	0%	3433	1%	17179	1%	318	0%
EE Households	14	0%	934	0%	3865	0%	0	0%
EE Service	12	0%	184	0%	783	0%	4	0%
Transport	10	0%	1006	0%	4951	0%	132	0%
PFCs	9	0%	1312	0%	5113	0%	0	0%
Energy distrib.	6	0%	2022	0%	8313	0%	0	0%
Tidal	1	0%	315	0%	1104	0%	0	0%
CO2 capture	3	0%	29	0%	167	0%	43	0%
Total	4733	100%	630156	100%	2931813	100%	281766	100%
HFCs, PFCs & N2O reduction	100	2%	132296	21%	737431	25%	214984	76%
Renewables	3015	64%	254820	40%	1068885	36%	35613	13%
CH4 reduction & Cement & Coal mine/bed	728	15%	107037	17%	545206	19%	16715	5,9%
Supply-side EE	480	10%	79853	13%	321454	11%	11046	3,9%
Fuel switch	145	3,1%	44566	7,07%	202604	6,9%	2334	0,8%
Demand-side EE	213	4,5%	7772	1,23%	37080	1,3%	942	0,3%
Afforestation & Reforestation	42	0,9%	2806	0,4%	14200	0,5%	0	0,0%
Transport	10	0,2%	1006	0,2%	4951	0,2%	132	0,0%

Table 8: CDM projects and CER obtained by sector. Source: UNEP Risoe Center, 2009

3.4.3. Geographical Distribution of the Projects

The analysis of the geographical distribution of the projects is focused in Africa, Latin America and Asia (with little representation in Eastern Europe and Middle East).In the figure below, we can clearly see that most CDM projects have taken place in India, China, Brazil and México representing 76% of the projects in registration process, validated and already registered and 79% of CER foreseen at the end of Kyoto protocol agreement. An important point to remark is that China monopolizes more than the half of the worldwide emissions.

							2012 CER
Total in the CDM Pipeline	**Number**		**kCERs**	**2012 kCERs**		**Population**	**per cap.**
Latin America	873	**18,4%**	80486	421214	**14,4%**	449	0,94
Asia & Pacific	3657	**77,3%**	516698	2358509	**80,4%**	3418	0,69
Europe and Central Asia	48	**1,0%**	4105	17541	**0,6%**	149	0,12
Africa	102	**2,2%**	21085	97966	**3,3%**	891	0,11
Middle-East	53	**1,1%**	7783	36583	**1,2%**	186	0,20
Less developed World	4733	**100%**	630156	2931813	**100%**	5093	0,58

Table 9: CDM project and CER obtained by country. Source: UNEP Risoe Center, 2009

Asia

Asia represents the major focus of CDM projects regarding the number of projects processed as well as the CER foreseen. In the figure below, we can clearly see China and India are the main receptors of projects, followed by Malaysia. Consequently and based on these figures, we could say that Asia holds 76, 5% of the total worldwide projects and 81, 31% of the expected CER.

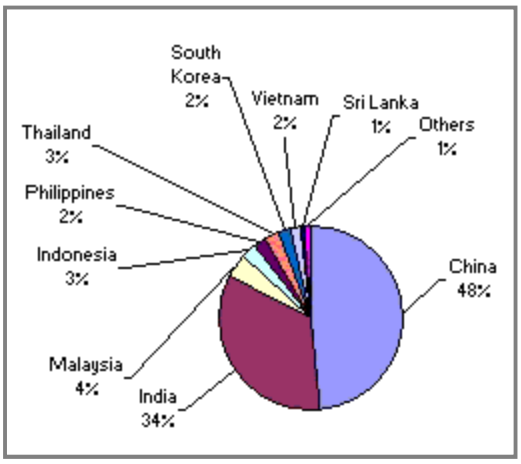


Figure 11: CDM projects in Asia. Source: UNEP Risoe Centre, 2009

Any of the countries shown in the figure above has a HDI<0,5 (according UN), so they are not among the ones considered less developed, but still, there are many people in India or China for instance, living under the verge of the poverty.

Latin America

According to UNEP figures, Latin America accounts for 20% of the total CDM projects and the 15% of the expected CER. Most CDM projects are focused in a few countries (Brazil, Argentina, Mexico and Chile) which represent 77% of the projects in process and the 76% of the foreseen CER. Within Latin America, those countries the ones with the higher HDI index, despite having an important income gap among its population.

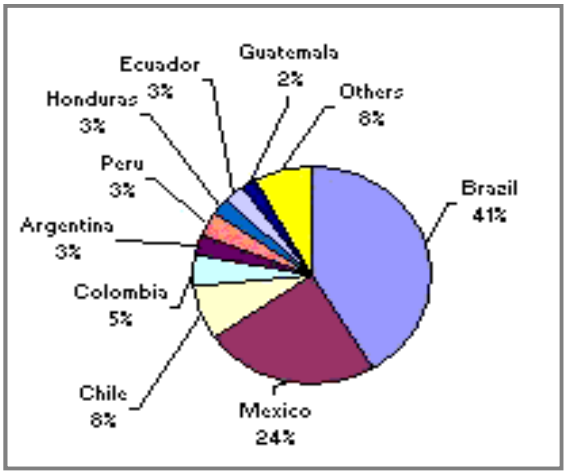


Figure 12: CDM projects in Latin America. Source: UNEP Risoe Centre, 2009.

Africa

Africa just accounts for 2% of the total projects and 3, 2% of CER. There is clear evidence for Africa not being an attractive location for CDM projects. In fact, many countries have not received yet any CDM project as Angola, Gabon, Burundi, Burkina Faso, and a few of them are not even included in Kyoto protocol (Chad, Somalia, Zimbabwe…).Moreover, the HDI index is much lower than Asia or Latin America, and as in the previous case, the countries holding the main part of the projects are the ones with higher HDI (South Africa, Morocco and Egypt) representing the 85% or CER expected in the projects in process.

Based on these facts, the following section analyzes which could be the barriers and causes which do not allow the poorest countries attract CDM projects.

Certainly, project promoters do not want to take risks and is main goal is to maximize their benefits (economic objectives vs. development).

Africa	Number	kCER2012	
South Africa	29	24075	24,6%
Egypt	12	16673	17,0%
Morocco	10	3006	3,1%
Uganda	10	1230	1,3%
Kenya	9	3798	3,9%
Tanzania	6	3758	3,8%
Nigeria	6	26983	27,5%
Ivory Coast	2	5974	6,1%
Congo DR	2	2648	2,7%
Mali	2	281	0,3%
Tunisia	2	4125	4,2%
Senegal	2	1103	1,1%
Mauritius	1	1764	1,8%
Mozambique	1	228	0,2%
Madagascar	1	210	0,2%
Zambia	1	588	0,6%
Ethiopia	1	181	0,2%
Swaziland	1	252	0,3%
Rwanda	1	74	0,1%
Cameroon	1	460	0,5%
Liberia	1	215	0,2%
Cape Verde	1	340	0,3%
Equatorial Guinea	0	0	0,0%
Total	102	97966	100,0%

Table 10: CDM projects in Africa. Source: UNEP Risoe Centre, 2009

Political instability, weak institutional framework, controversial social context etc. contribute to making the project far from being attractive. These may be some of the reasons that contribute to Africa not attracting CDM projects.

3.4.4. Conclusion

The experience accumulated over the last few years seems to indicate that there is a higher tendency from developed countries to implement projects in countries with a medium-high HDI and potential economic growth. Obviously there are different barriers and limitations that CDM face in order to generate a positive impact in the poorest communities. A recent study carried out by Intermón Oxfam and the Cooperation in Organization, Quality and Environment Group from the Universidad Politécnica, Madrid, shows that development criteria are not taken in account neither in the geographic nor sectorial project distribution (Intermón Oxfam-UPM 2009). Due to the fact that CDM is a market mechanism and that its

contribution to human development is not properly internalized, CDM projects have taken place in areas where CER are more profitable for promoters instead of focus on areas which would really need it on the grounds of promoting their human development.

3.5. CDM Limitations and Challenges

3.5.1. Contribution to Human Development

- Absence of priorities issues:
    - The impact on human development is neither considered nor analyzed in the projects design and implementation, since some countries and private entities are mainly interested in the reduction of their emissions.
- Absence of social impact and human development analysis:
    - The projects design is usually focused in environmental aspects, which is one of the requirements, but is not enough. Therefore, it is extremely necessary to consider the social and economic aspects as well as its impacts in the human development.
- Scarcity of multidisciplinary groups:
    - Multidisciplinary groups are utterly needed to make compatible the different parts of the project. Furthermore, they make a broader contribution regarding the different aspects needed in a project, improving by far the final result of the project.
- Difficulties in the implementation of a sustainable development strategy by developing countries:
    - There is a great difficulty for developing countries when implementing, set up criteria and priorities to define sustainable development activities, due to the lack of financial resources, personnel, human training. To tackle this issues, it is urgently needed the development strong institutional infrastructures in those countries in order to cover the existing gaps and help them to evaluate and support CDM projects, achieving like this positives impacts in development.

3.5.2. Contribution to Economic Development

- Market barriers:
    - Uncertainty about post-Kyoto (2012).
    - Unstable, low and volatile prices of CER.
    - Large demand of big scale projects due to their higher generation of CER makes them more attractive than small sale projects. This issue is going against the sustainability goals of CDM, as many local communities need of the smaller projects in order to cover basic needs and improve their living standards.
    - The carbon funds frequently prioritize their interests in the ones who buy the carbon credits because of economic issues over the ones who receive the project, putting off the sustainability issues.

- Some specific CDM capacity issues linked to unawareness, inexperience and high transactions costs per CER unit make small scale projects in the least developed countries non-attractive from an economic point of view.

- Lack of economic resources in receptors countries and human capital to link the human development with the CDM projects.

- The limited access to financial resources is an important barrier in order to obtain funds, technical assistance, management tools and capacity building.

- There is still weak structural and institutional administrative capacity related to the development of CDM project activities.

- In many cases, CDM process and procedures are made in such a complicate way that is usual to find insufficient guidance and limited size on bundling as well as a lack of transparency concerning the involvement of official development assistance.

3.5.3. Actors

Designed operational entities

- There is a lack of information from the CDM Executive Board to the host countries to support this actor with instructions or standards in order to help them to include development and sustainability criteria in the validation process.
- There is a strong competitiveness among the different Designed Operational Entities in terms of validation time, resulting in an inaccurate evaluation of the multiple aspects of the projects.

Designed National Authorities

- DNA in developed countries depends on the Environment Ministry and its aim is to contribute to the promotion of CDM projects in order to achieve Kyoto objectives. Nevertheless, sometimes they do not fully incorporate the development objectives regarding the country when they are going to implement the project.
- DNA in developing countries are often under pressure as they need to prioritize their issues, and sometimes they rather attract investors for the country without asking for an alignment with sustainable development regarding the project.
- So far, no DNA has asked any DOE to monitor the contribution of the CDM to the human development of the country.
- The DNA in the poorest countries does not have resources enough to promote the execution of CDM´s.

Projects promoters

- There is a lack of project public promoters, being most of them private ones. It is possible that a public approach would result in a greater implication within the communities when the projects are implemented. The legal framework has still some weaknesses as it does not contemplate the relation of the CDM projects and the promotion of SD in developing countries, focusing juts in emission reductions.

- Lack of technology transfer: usually the promoter either keeps the technological knowledge or alternatively gives it to the subsidiaries companies instead of transferring it to the beneficiary communities in order to promote their development.

Local communities

- Lack of transparency in the public presentation of projects: they are supposed to make a public consultation but they do not.
- The negative opinions are not taken in account, or even worst, some actors are not asked for participation which results in a decision made just by promoters and local authorities.
- Just in a few examples, CDM are launched from local community's initiatives.

3.5.4. Procedures

- The main challenge is the lack of funds for small scale projects, which are often the ones that contribute to local community's development.
- Additionally, the current guidelines are still poor and ambiguous for these type of projects despite their great potential in terms of possible contributions to development.
- The economic value that a CDM project has due to its associated CER does not include its contribution to sustainable development.
- As it is not mandatory to include the negative aspects in the documents of the project design, there is a high subjectivity regarding the impacts arisen from the project.
- The development of local communities is not included in the principal approach when demonstrating additionality in the project analysis.
- Moreover, a survey was carried out among the different actors (governments, private companies, multilateral organizations, NGO´s, DOE) and they stated that 70% of those kinds of projects would be executed even if CDM would not exist as a mechanism, fostering some doubts about the integrity of the additionality principle.

As a **conclusion**, the following future lines of action should be further developed:

- Coherence between the national and international policies must be ensured. Similarly, the contribution to development as well as mitigation and adaptation to climate change must be simultaneously integrated in the mechanism.
- Working capacity of public and private institutions in the poorest countries must be ensured.
- The participation of every single actor affected by the project is required at the same time as the local communities are encouraged to take the initiative and launch proposals. Obviously, to achieve this goal, it is required a greater involvement of local and national authorities.
- The specific financing mechanisms have to be very well defined in order to facilitate the execution of projects and the improvement of the living standards of the recipient communities.
- It would be better to simplify the process when the project has a great impact in development.
- Further regulation of DOE would be helpful to avoid the competition as it often causes an inaccurate analysis and evaluation of the projects, resulting in poorer requirements regarding social and economic impacts.

- In order to facilitate CDM small scale projects which largely contribute to community development, a new instrument has been created called programmatic CDM. This new instrument will be described in detail in the next section.

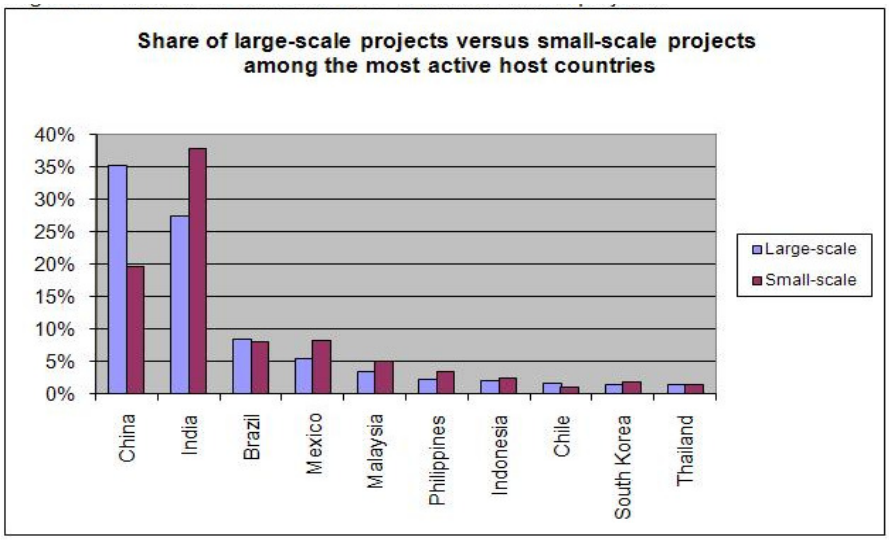


Figure 13: Large scale vs small scale CDM projects in host countries. Source: UNEP Risoe Center, 2009

Number of projects in each type	In numbers		In percentages	
	Large-scale	Small-scale	Large-scale	Small-scale
Hydro	421	436	22.7%	29.8%
Biomass energy	218	308	11.8%	21.1%
Wind	288	133	15.5%	9.1%
EE own generation	286	6	15.4%	0.4%
Landfill gas	194	71	10.5%	4.9%
Biogas	47	174	2.5%	11.9%
Agriculture	61	111	3.3%	7.6%
EE industry	31	119	1.7%	8.1%
Fossil fuel switch	69	45	3.7%	3.1%
N2O	59	0	3.2%	0.0%
Coal bed/mine methane	51	0	2.8%	0.0%
Cement	35	0	1.9%	0.00%
EE supply side	19	13	1.0%	0.9%
Fugitive	23	3	1.2%	0.2%
HFCs	19	0	1.0%	0.0%
Solar	1	16	0.1%	1.1%
Reforestation	11	3	0.6%	0.2%
Geothermal	11	1	0.6%	0.1%
EE households	0	9	0.0%	0.6%
Transport	3	3	0.2%	0.2%
EE service	0	6	0.0%	0.4%
Energy distribution	3	1	0.2%	0.1%
Afforestation	1	3	0.1%	0.2%
PFCs	2	0	0.1%	0.0%
Tidal	1	0	0.05%	0.0%
CO2 capture	0	1	0.0%	0.1%
Total	1854	1462	100.0%	100.0%

Table 11: Large scale vs small scale CDM projects by sectors. Source: UNEP Risoe Center, 2009

4. PROGRAMMATIC CDM

4.1. Program of Activities (PoA) –One Step Forward to Sustainable Development

Based on studies of the existing CDM projects portfolio, it has been recognized that there is a huge gap between the large amount/scale of CDM projects and the small scale of beneficiary population. Among all the approaches proposed to reverse the situation, a relatively new concept PoA (also called programmatic CDM) was selected as a promising remedy to reduce such gap.

According the CDM Executive Board´s definition:

*PoA - programme of activities- is a **voluntary** coordinated action by a private or public entity which coordinates and implements any **policy/measure or stated goal** (i.e. incentive schemes and voluntary programmes), which leads to anthropogenic GHG emission reductions at source or net anthropogenic greenhouse gas removals by sinks that are additional to any that would occur in the absence of the PoA, via an **unlimited number** of CDM Program Activities (CPAs).*

*CPA - CDM programme activity **-** a project activity under a programme of activities. A CPA is a single, or a set of interrelated measure(s), to reduce GHG emissions or result in net anthropogenic greenhouse gas removals by sinks, applied within a designated area defined in the baseline methodology. (EB 32, Annex 38)*

Therefore, programmatic CDM (PoA) promotes the creation of a favourable environment for similar, dispersed and small scale projects to grow together using carbon capital generated in CDM. By doing so, it contributes to reverse the current situation of low participation in CDM from households, small enterprises and rural areas.

Based upon the above definitions, the main characteristics of programmatic CDM are summarized as follow:

a) **Either voluntary or mandatory**: In principle, the requirement of eligible PoA is to be a "voluntary action by the coordinating/managing entity" which means the developing entity can not apply for PoA if the program involves actions that are mandatory in the host country; **Except** the PoA can justify the mandatory standards/policies in the host country are not being enforced or the PoA could overpass the mandatory standards, then a "mandatory" PoA could also be considered as eligible.
b) **Variables in Program**: Since there is no limitation for the quantity of CPAs or geographic boundary of CPAs (except the constrain of 1km distance for applying Small Scale Project purpose) neither for the time to enter into PoA, it is almost impossible to predict exact scale, location and life cycle of all the" to be included" activities (CPAs) at the time of registration of PoA.
c) **Similarity of CPAs**: The CPAs under the PoA may vary in size and time of entry, but since they are all in accordance with one CDM-PoA-DD and CDM-CPA-DD, using the same baseline and monitoring methodology, they must be similar to each other and many times, they are considered as copies of each other.
d) **Project Boundary**: The physical boundary of PoA may extend to more than one country, if only the host country issues a letter of Approval (LoA).
e) **Program life cycle**: There are two models of life cycle, one is non-renewable lifetime 10 years (30 years for afforestation and reforestation PoA); one is renewable lifetime 7years(20 years for A/R PoAs) for each phase, but could be extended till 28 years(60 years for A/R PoAs)
f) **Registration cost**: All the charges upon registration are based on the total expected annual emission reduction of CPA(s) submitted at the time of registration. The subsequent CDM project activities (CPAs) are not subject to further fee.

g) **Single technology and methodology**: At present, all candidate PoAs can only use one technology and one approved methodology.
h) **Erroneous inclusion**: The erroneous inclusion or erroneous renewal of crediting period could be observed by CDM EB member or DNA of host countries resulting to exclusion of CPA without option to revise or rejoin the PoA.

4.2. Life Cycle of PoA

The life cycle of PoA shares a great similarity with CDM projects, which has been described in a previous chapter. Consequently, in this section, besides a summarized introduction of the required steps, some specific requirements for PoA will be explained.

Step 1) Preparation of the 3 Design Documents:

In order to enter into the pipeline of registration, the coordinating/managing entity should firstly prepare three design documents (DD): (i) The PoA design document (*CDM-PoA-DD*); (ii) The CPA design Document (*CDM-CPA-DD generic*) and (iii) the CPA design Document of a specific activity/activities (*CDM-CPA-DD Specific*)

✓ The purpose of the **CDM-POA-DD** is defined as follows:*"A coordinating/managing entity shall develop a Programme of Activities Design Document (CDM POA-DD) setting a framework for the implementation of the PoA and unambiguously defining CDM programme activity (CPA) under the PoA" (EB 32, Annex 39, and paragraph 2).*

✓ The **CDM-CPA-DD (generic)** must explain the eligibility of the proposed CPA to the registered PoA that it belongs to and,

✓The **CDM-CPA-DD (specific)** must further justify the consistency with concrete statistic and information. Moreover, as stated in (*EB 32, Annex 39, paragraph 4),* the coordinating/managing entity shall prepare the PoA specific CDM Programme Activity Design Document (CDM-CPA-DD) using the provisions of the proposed PoA

With the three design documents in hand, the managing entity is ready for the process of registration.

Step 2) Validations of the Design Documents:

The coordinating/managing entity then submits the prepared 3 design documents to DOE for validation. In general, the DOE will check the provisions of the project documentation against the validation requirements following the modalities for normal CDM projects and then issue a validation report accordingly. In this regards, some specific requirement for PoA has been pointed out:

In addition to the validation requirements arising out of the modalities and procedures for a clean development mechanism, the validation by the DOE shall address the following issues *(EB 32, Annex 39, paragraph 7).*

- *Additionality of the PoA;*
- *Eligibility criteria for inclusion of a proposed CPA in the registered PoA, including criteria to be used for demonstration of Additionality of a CPA;*
- *Operational and management arrangements established by the coordinating/managing entity for the implementation of the PoA inter alia the issues identified in paragraph 2 (i) above;*

- *Consistency between CDM-POA-DD and the PoA specific CDM-CPA-DD to be used for inclusion of a CPA in the registered PoA*

Step 3) Registration of the PoA:

Once validation process is completed, the DOE will submit a request for registration of a proposed PoA to the Executive Board:

A designated operational entity (DOE) shall submit a request for registration of a proposed PoA using the "Programme of Activities registration request form" (F-CDM-POA-REG) along with a validation report and supporting documentation (EB 32, Annex 39, paragraph 6).

Supporting documentation include letter of approval from host country and explanation on received public comments.

In accordance with paragraph 40 (f) of the CDM modalities and procedures (CDM M&P), the request for registration of a proposed CDM project activity shall be in the form of a validation report which includes the project design document, the written approval of the host Party and an explanation of how the DOE has taken due account of public comments received on the CDM-PDD (EB 14, Annex 7, paragraph 1).

After received the request, the Executive Board appoints a Registration and Issuance Team (EB-RIT) to appraise the request for registration; and on the advice of the EB-RIT, the Executive Board either approves or rejects the proposed project activity.[21]

At this point, the PoA has been registered as defined below:

Registered PoA - has provided the framework to the Board, in accordance with the guidance and provisions, so that CDM programme activities under a programme of activities can be registered as a single CDM project activity. (EB 32, Annex 38, *Acronyms*).

Step 4) Monitoring:

As it is the case for traditional CDM projects monitoring process, monitoring of CPAs serves a purpose for verification and certification of the emission reduction from the project, in accordance with the registered monitoring plan. Rules related to monitoring in CDM project activities apply to PoA and each CPAs within a PoA as well. It is worth to mention, considering the unpredictable and potential large quantity of CPAs, random sampling method is currently commonly used to monitor CPAs.

The emission reductions or net anthropogenic removals by sinks of each CPA shall be monitored as per the registered monitoring plan according to the methodology applied to the registered PoA. The method or approach used to verify emission reductions or removals by sinks (that may include random sampling) shall ensure the accuracy of these emission reductions (EB 32, Annex 38, paragraph 13).

[21] Available at http://cdmrulebook.org/PageId/1026 July 9th ,2009

Step 5- 6- 7) Verification, certification and issuance:

In general, traditional CDM projects, PoA and CPAs within PoAs apply the same rules related to verification, certification and issuance of CERs.

The procedures for verification, certification and request for issuance of certified emission reductions (CERs) as referred to in paragraphs 62, 63 and 64 of Decision 3/CMP.1 and the procedures for review of requests for issuance of CERs as contained in Annex IV to Decision 4/CMP.1 and subsequent related decisions of the Executive Board shall apply unless modified through the provisions below (EB 32, Annex 39, paragraph 18)

EB will issue the CERs upon to the request from DOE with verification and certification reports as the key supporting documentation.

4.3. Actors Involved. Liability of DOE

The actors involved in programmatic CDM are in general the same entities involved in a CDM project which have been presented in the previous chapter. The most relevant change of the role among the actors might be DOE who now assumes much bigger liabilities and risk in pCDM compared to its accountability in CDM projects.

Compared to the normal CDM projects -where DOEs are accountable when the significant deficiencies are identified in the relevant validation, verification or certification report -, in case of PoA, if an erroneous inclusion of CPA has been identified, the DOE must refund the already issued CERS back to the account in Executive Board which arose dissatisfaction to DOEs considering pCDM is in stage of learning by doing.[22]

In that sense, as it is stated in (EB 32, Annex 39, paragraph 14), the consequences of the exclusion are:

a) The CPA that has been excluded shall not be re-included again in that or any other PoA, or qualify as a CDM project activity.
b) The DOE that included the CPA, shall acquire and transfer, within 30 days of the exclusion of the CPA, an amount of reduced tones of carbon dioxide equivalent to the amount of CERs issued to the PoA as a result of the CPA having been included, to a cancellation account maintained in the CDM registry by the Executive Board.
c) The further inclusion of new CPAs and issuance of CERs to that PoA shall be put on hold and all CPAs already submitted shall be reviewed to determine if any other CPA disqualifies

4.4. Advantages of the pCDM based on its Characteristics

Put aside the debate about the current immaturity of pCDM framework, the new approach has a great potential in overcoming many limitations encountered in traditional CDM regime and may contribute to sustainable development in a more efficient way. Some of its main distinctive features include:

- **Union is power**: To develop a PoA is to create an environment that allows unlimited CPAs to join together and to increase their impact as an integrated PoA. Small activities could grow into a large program.

- **Easy to "copy**": Taking advantages from similarity of CPAs under the PoA, due to the current principle of single technology and single methodology applied in one PoA, it

[22] In response to Call for public inputs on Programme of Activities (PoA) from DET NORSKE VERITAS (DNV) available in http://cdm.unfccc.int/public_inputs/2008/PoA/index.html July 9th ,2009

might be not difficult to identify the prospect eligible activities to be included into the PoA along with the life cycle of the program, and also, it might be not difficult for developers and participants to explore similar programs based on the good practices;

- **Development with no frontier**: Unlike most of the stand alone CDM projects, in theory, pCDM allow the CPAs to go across countries ´border as long as they are developed or coordinated by the identical entity and fulfil the requirement of PoA. For example, international institution like World Bank, energy related NGOs or regional associations have the opportunity and use their resource and multinational network.

- **Controlled risk**: Compared to traditional CDM projects, if one part of the project disqualifies, the entire CDM project activity gets on hold or rejected; in case of programmatic CDM, if an erroneous CPA is identified, the PoA excluding the identified erroneous CPA can continue to be implemented under certain conditions.[23]

- **Get public actors on board**: As described in 1.a), pCDM allows public actors (governments) to enforce mandatory sectoral policies using pCDM as an additional financial tool. Therefore, sectors related to renewable energies and energy efficiency which have low market competiveness might receive policy and financial support to overcome the starting up phase.

- **A more sustainable development oriented approach**: While traditional CDM projects concentrate in sectors that generate large amount of CERs, checking the PCDM portfolio in pipeline, PoA focus on small scales project development [24] which involves promoting sustainable development across households, isolated communities and less developed countries where resource are most needed.

- **Cultivate awareness**: Following the argument claimed above, when a traditional CDM project involving complex technologies and methodologies is implemented, local communities rarely have the opportunity to participate and as a result, the educational function of Clean Development Mechanism is prevented. Given the nature of pCDM, especially in terms of monitoring methodology, which require a extensive cooperation from beneficiaries, a more people based, capacity building and sustainable development oriented mechanism is very likely to happen through programmatic CDM.

4.5. Current Situation and Expectations

As can be seen in table 12, up to July 9th 2009, among the 11 proposed PoAs, there is only one PoA from Mexico that currently has all the supporting documentation available online and that has recently entered the process of registration request. All the other PoA have been stopped at the step of validation.

[23] After checking a sample of 10% of the included CPAs, if the Board has decided not to extend the review and all required cancellations have been confirmed, the PoA on hold can continue its implementation. EB47 Annex 30

[24] All projects in pipeline applied for small scale project standards. Refer to methodology applied to PoAs available in http://cdm.unfccc.int/ProgrammeOfActivities/Validation/index.html, July 9th ,2009

Host country	Status	Sub-type	Method.	Comment date	Credit buyer
Bangladesh	At Validation	Solar PV	AMS-I.A.	04-dic-07	CDCF
Brazil	At Validation	Manure	AMS-III.D.	22-feb-08	n.a.
South Africa	At Validation	Solar water heating	AMS-I.C.	05-jul-08	United K. (Eco Securities)
Mexico	Request review	Efficient light bulbs	AMS-II.C.	16-jul-08	United K. (Cool nrg Carbon Investments)
Uganda	At Validation	Landfill composting	AMS-III.F.	24-sep-08	Italy (IBRD)
Senegal	At Validation	Efficient light bulbs	AMS-II.C.	03-dic-08	Italy (IBRD)
Honduras	At Validation	Run of river	AMS-I.D.	16-dic-08	n.a.
Tunisia	At Validation	Solar water heating	AMS-I.C.	30-ene-09	n.a.
South Korea	At Validation	Food	AMS-II.D.	18-abr-09	n.a. (PEAR Carbon Offset Initiative)
Viet Nam	At Validation	Solar water heating	AMS-I.C.	04-jun-09	Japan (Mitsubishi UFJ Securities)
China	At Validation	Irrigation	AMS-I.B.	09-jun-09	Germany (BORDA, Atmosfair)

Table 12. List of current projects in the pipeline. Source: Adapted from document CDM pipeline overview [25]

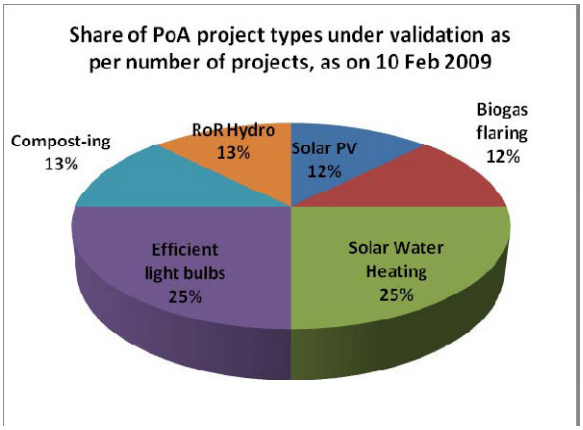


Figure 14: Distribution of proposed PoAs by sector. Source: Ministry of New and Renewable Energy, India. Framework for programmatic CDM projects in Renewable Energy May 2009.

[25] available in website http://cdmpipeline.org/ July 09,2009

Based on the table 12 and the figure 14 there are several facts which are relevant:

1) There are only 11 PoAs in CDM pipeline and only one PoA has currently arrived at the stage of ***request review***. The first PoA that entered into pipeline was in Dec 2007 which means, it took 1 and half a years without completing the registration;

2) There are many PoAs at status of ***at validation,*** but there are already buyers on the list;

3) The solar energy related sector is very likely to be a promising driver in PCDM, which present 37% in numbers of programs and 43.7% of the total emission reduction.

Based on the current situation with respect to the PCDM approach, there are several expectations for DOEs, EB, DNAs, for developers and all the prospect participants:

Expectation for DOE: More DOES are expected to be set up in Africa, where the PCDM is capable of prioritizing projects in the less developed areas; interactive discussion and dialogue panel between DOEs, DNA and EB are expected with objective of reducing the practical barriers and accelerate the PCDM development;

Expectation for EB: EB carries expectations to strengthen the capacity of DNA and DOEs who play a vital supporting role in developing PCDM; bolder steps are expected including but not limited to aligning the registration procedure with new approaches, such as designing a special group inside the EB to deal with PCDM related issues, holding dialogue panel and workshops between DNAs at international, regional and interregional level to exchange experiences and explore synergy, last but not least, from perspective of DOEs, EB has been expected to leverage or remove part of DOE's liability in case of erroneous inclusion of CPAs.[26]

Expectation for DNAs: Up to now, some countries still do not have capability to setup DNAs which makes it impossible to host CDM projects. Besides the expected support and assistance from UNFCCC panel, initiative like creating an ¨incubator¨ with objectives of helping set up DNAs in countries that lack institutional capacities and subsequently, assisting newly setup DNAs to function properly.

Expectation for developers and prospect participants: Along with the efforts from EB and DOE and DNA, more input of PoAs are expected to appear in the pipeline and consequently, more good practices or lessons learned are expected to be shared between all the participants in PCDM.

[26] During the period of making this report, the EB issued PROCEDURES FOR REVIEW OF ERRONEOUS INCLUSION OF A CPA Version 01, at EB 47. The argument is kept in the document as a witness of the refining progress of PCDM framework.

Part 2

pCDM as a Window of Opportunity for EsF?

The aim of this second section is the study the feasibility for an NGO as Energía sin Fronteras, (EsF, presented in detailed below) to implement Programmatic CDM as a financial mechanism. Since the type of projects EsF has been developing since its creation, we will raise the possibility of including them as part of the activities within the Programmatic CDM.

1. ENERGÍA SIN FRONTERAS

This section is based in information published by Energía sin Fronteras.

1.1. Principles[27], Vision, Mission and Objectives

The main **principles** driving Energía sin Fronteras are the following ones:

- EsF believes in the great importance of energy as a solution to achieve Sustainable Development and as a requirement to achieve the Millennium Development Goals.
- Freedom, justice and peace are values based in the acceptance of dignity and human rights for every community in the world.
- The development and progress must be sustainable and supportive in order to be stable and persistent.
- EsF wishes to promote civil society participation and make them comply with cooperation and sustainability commitments. It will create a trend of consciousness, exerting influence over the governments and institutions in the decision making process.

These principles are assumed as the main support for EsF to act. They are based on concepts already expressed in some documents such as "Human Rights UN charter", the "Rio Declaration", "Agenda 21" and "European initiative for energy" (Johannesburg).

Regarding the **vision**, EsF reckons energy is as an essential tool in development to supply products and services in a self-efficient and persistent way. Cooperation actions must be adapted to the needs of recipient communities and encourage them to defining the projects.

Their **mission** is to o extend and facilitate energy and water sanitation accesses both to those that do not have it or who have it on inappropriate conditions. The interventions in this field will contribute to the sustainable development of the affected communities and will be completely coherent with the above-mentioned principles: respect of human rights, traditions and cultures; promotion of participative societies and development goals.

The organization's main **objectives** are:

- To provide access to Energy: 1600 million people have not access to energy.
- To provide access to water and sanitation: 1100 million have not access to drinkable water and 2600 million do not have basic sanitation facilities.
- To develop specific programs that make facilitate the access to energy and water in isolated and rural communities.
- To influence regulatory bodies, energy policy decisions makers and development funds managers.

[27] Energía sin fronteras 2007-2008

1.2. What is EsF?

EsF is an independent organization having its own decisions and criteria which acts consequently with its ethical principles. It accepts and applies every principle and international agreement about Human Rights, International Cooperation and Environment.

EsF members are volunteers committed to contribute with its professional background with no lucrative or professional benefit intentions.

EsF actions are based in respect, cooperation, collaboration, education and training of the communities in which the projects are developed.

Values that make it different

Volunteer members have a relevant experience and time available to actively collaborate. The volunteers coordinate and lead the projects that make it easier to guarantee a successful development of the project given the fact that some communities often lack technical knowledge. Thereby, EsF is covering this specific gap in the energy field.

EsF is highly qualified in evaluating and defining projects in cooperation, due to its member's experience. EsF represents a central link among the different actors which are involved in the energy sector: companies, NGO´s, Universities, Public Administration, professionals, Volunteers, counterparts in the developing countries. This generates a reflection forum to solve problems arisen from those areas.

To be member of EsF is without a doubt an opportunity for experts or qualified people to grow in other ways, both by collaborating in this kind of initiatives and by contributing with its effort to sustainable development.

EsF establishes equilibrium between action and reflection while spreading knowledge, and also it takes the advantage of the lesson-learning process during the development of its own activities.

EsF does not depend of private interests, which allows reaching a balance between the public and the private sectors regarding the financing sources. This is the key of EsF economic independence.

The prioritization of needs is the most important fact in order to promote development. EsF work in projects is always coherent with the specific requirement needs and the intervention capacities.

Figure 15. Volunteers at EsF. Source: EsF.

1.3. Strategic Objectives, Project Approach and Project Typology

EsF's strategy has been conceived for the achievement of the following crucial objectives:

- To promote actions that contributes to community socio-economic development and alleviates poverty.
- To bring new ways of access to energy and water to areas where those services do not exist.
- To spread awareness about the current situation in the poorest areas in order to promote a debate among actors in energy and development issues.
- To contribute to education and training of communities where the projects are being developed.
- To work in collaboration with other institutions which are currently working in similar areas and with shared similar principles, always contributing with differential values.

How does EsF approach projects?

- Focuses on persons (needs and priorities).
- Broad vision: considers different solutions and alternatives.
- Global approach (reckons economic and technical situation of the community).
- Sustainable proposals (takes into account the three pillars: environmental, social, economic).
- Execution and monitoring guarantee, sustainability in time, participation and commitment of local groups.

What kind of projects is EsF interested in?

- Intellectual projects: strategic development base to solve problems.
- Projects access to water and energy as a model that could be replicated in other places that they might need them.
- Energy supply projects in isolated areas.
- Training projects to local communities.

1.4. Financing

The basic principles governing EsF's financing policies are transparency and efficiency management, maximizing the funds available for projects and minimizing operational costs.

EsF has a fixed periodic financing line due to:

- Annual quotas from employers and other institutions
- Volunteer contributions and eventually, donations

In order to fund specific projects EsF receives additional contributions from members or other organizations as well as loans and subsidies form national and international institutions.

1.5. Organizational Structure

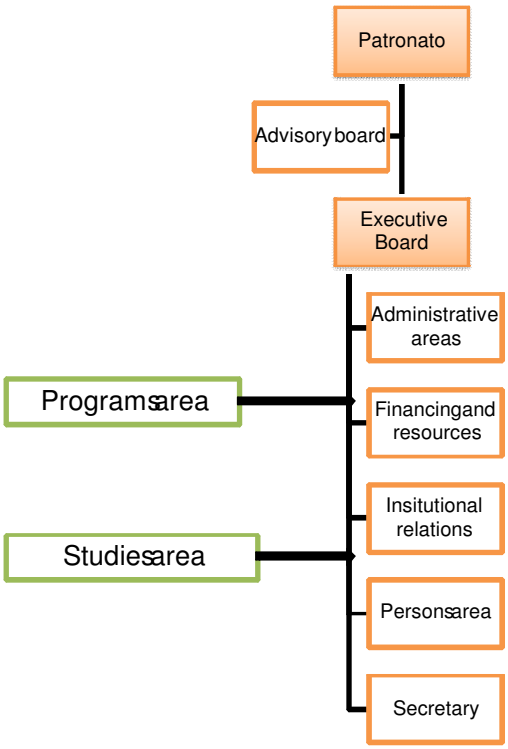


Figure 16. EsF internal structure. Source: EsF.

1.6. Which Companies and NGOs Collaborate with ESF?

The companies and NGOs currently cooperating with EsF are listed below:

Companies

APPA	Renewable energies producers association
Atersa	Pioneer Company in Spain within the photovoltaic solar power sector
Cener-Ciemat	Fundraising from Renewable Energies National Center
Cepsa	Industrial group focused in the oil and chemistry sector
Ciemat	Environment: Energy and Technology Research Center
Empresarios Agrupados	Engineer organization working on areas such as electric energy, transport infrastructures, space and aeronautic
E.ON Servicio	Energy German company
Endesa	Spanish Energy Company, electricity, gas, renewable and cogeneration
Enusa	Fuel designing, manufacturing and supply at a national and international level
H.C Energía	Electric energy production, distribution and trading of gas, renewable energies, and telecommunications distribution

Iberdrola	Production, distribution and commercialization of electricity and natural gas
Isofotón	Solutions and development in solar, photovoltaic and thermal energy generation and use
Navarro Generación	Company focused on electrochemical and electric sectors.
OMEL	Spanish energy market operator
Unesa	Spanish association of electric energy
Union Fenosa	Business group working in different areas: electric energy manufacturing and distribution, and other sectors such as gas, telecommunications and other professional services

NGOs

Ingeniería sin Fronteras
Manos Unidas
Geólogos del Mundo
National Rural Electric Cooperative Association
Fundación solar

1.7. Volunteer at EsF

The modus operandi of EsF is to have the minimum hired staff and manage an excellent volunteer's organization to achieve its objectives successfully. Therefore, ESF activity is above all carried out by volunteers.

EsF volunteers need to be committed; ensuring the compliance with the actions needed and the mission to achieve EsF goals as a NGO.

Furthermore, they must comply with the economic and administrative issues arisen from its responsibility towards public institutions, employers, other financing entities and the volunteers themselves as well as the good practices and transparency principles based in its social responsibility and ethical code.

On the heart of this commitment, it is essential the stability and criteria of the volunteers. Volunteers include retired persons with more experience and young persons with great hopes and expectative but usually with less available time. We could say this is the perfect combination of a reciprocal flow: the oldest communicate their wisdom and experience to youngest ones with energy and illusion.

This management system definitely helps to ensure the sustainability of criteria, values and activities in a medium-long term time.

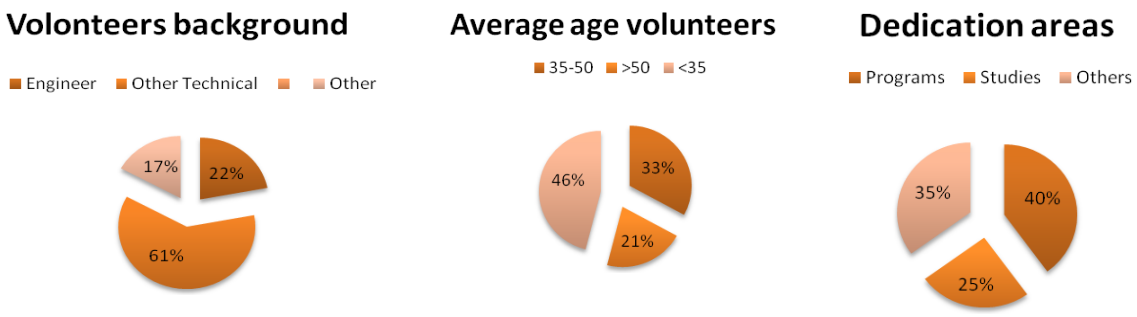


Figure 17. General overview of Volunteers. Source: EsF

Years	2006	2007	2008
TOTAL	395764	403143	425875
Employers	40%	29%	29%
Private entities	34%	20%	16%
Public entities	25%	50%	54%
Individual donations	1%	1%	1%

Table 13. Subsidies and contributions. Source: EsF

1.8. Studies Area

ESF is aimed to be a referent in promoting energy access and poverty reduction and the purpose is to influence decision makers and energy policies developers, regulatory bodies, financers and financial managers. Thereby, the following activities are being developed:

- Publishing information related to energy and poverty, aimed to be an observatory of these topics.
- Raising awareness in cooperation with other NGO´s, universities and researching centers.
- Spreading knowledge through publications, seminars, presentations, conferences, and leaflets.
- Taking advantage of the multidisciplinary teams.

1.9. Activity and Working Areas

EsF develops electrification projects as well as water and sanitation projects, specifically in local communities in rural isolated areas that do not have proper water and energy access. The final objectives are to provide an opportunity to these communities to have services such as medical assistance, education, communication and income generating activities. While doing the activities, they collaborate with local counterparts.

EsF is working in 41 projects (2008), located in 13 countries around the world, mainly in Sub-Saharan Africa and Latin America. The trend will be a major focus more in African countries as there is a good relation with the counterparts and a better knowledge of civil society. Regarding Latin America, Guatemala and Peru will be target countries to develop projects, with less attention to Asian countries.

1.10. Programs: 2008-2009 Project Portfolio

- **Rural electrification projects with photovoltaic systems**

1- Electricity supply to the radio station Sephaua (Peru)

Counterpart: Misión Dominica El Rosario.
Direct beneficiaries: 15000 inhabitants from the Urban and rural areas.
Financial entities: ESF (except the spare materials that were donated by ATERSA).

Objectives: installation of the photovoltaic panels by local technicians coming from Cuzco (they not only have technical expertise but they knew how to work in the jungle).

Achievements: the installation was very successful. A huge improvement in the radio communications is currently benefiting many people inside the communities. Some examples

were people working in the sea, on the mountains… Of course some radio programs were held, creating an interesting social debate in order to encourage people to take part in social issues concerning the development of the community, historical values, cultural knowledge…Moreover, the program has created employment for many people.

Figure 18. Radio antenna installed. Source: EsF

2- 2004-2008 Electrification of rural communities in Gujarat (India)

Counterpart: Xavier technical Institute.
Direct beneficiaries: 70 people.
Financial entities: *ICAI Engineer Association for development*. Isofotón and ESF supplied the didactic material.

Objectives:
To train people on the topics related with photovoltaic energy through the establishment of Solar Classroom. With ESF´s help, pupils will be able to design the implementation of an electricity grid for rural communities through photovoltaic systems. Furthermore, after the education program, they would be able to maintain the systems by themselves.

The goal was to achieve a sustainable, efficient and viable model to be replicated in other rural communities in the area, contributing to the region and country development.

Achievements:

- Some buildings have been built to develop classes inside.
- Teachers have been trained and the sessions have been taught.

First designing and implementation project has been done. The 4th solar course has successfully ended.

Figure 19. Installation at Patna Solar Center. Source: EsF

3- Rural schools electrification in Chalaco (Peru)

Counterpart: Piura University
Direct beneficiaries: 45 people
Financial entities: *Chalaco municipality* and ESF

Chalaco is located in the Andes. Despite a huge amount of natural resources in the area to be self-sufficient, the weaknesses of the ecosystems and the lack of education has resulted in a situation of poor living conditions within the community.
The need of electrification was identified in the strategic plan of Chalaco Municipality in collaboration with the NGO ProPeru Navarra, which has been active in that region.

Objectives:

- To incorporate the use of audio-visuals in the rural schools: TV, DVD or radios to improve education methodology.
- This audiovisual system could be also used further, to edit programs developed in universities or films projection.
- To supply energy to light the classrooms also during the night, aimed at facilitating adults education, meeting celebration or even parties.

Achievements:

- Improvement of school infrastructures
- Education through audiovisual means
- Motivation among teachers
- Cultural development
- Participation of communities
- Improvement of general welfare
- Sustainability of photovoltaic systems

Figure 20. Pupils and teacher in Chalaco school. Source: EsF.

4- Photovolatic electrification and radio systems communication for first aid posts in 44 chayahuitas communities in Yurimaguas (Peru)

Counterpart: AMJ (Jesus missionaries Association)
Direct beneficiaries: 8200 people
Financial entities: *Madrid government and* ESF.

Objectives: Lighting supply and communication through radio to medical posts to 44 indigenous communities in Yurimaguas area (Top Amazonia). The communities have been benefited with an improvement of health quality attention in a sustainable way due the electrification and communication between the two main posts in the area.

Achievements: improvement in health assistance and social communication (as the particular use of the radio is allowed).

Figure 21. Radio post. Source: EsF

5- **Electricity supply for lighting, refrigeration and radio communication through photovoltaic panels to nine medical posts in rural areas, included in the medical network in Morropón-Chulicana, in Piura region (Perú).**

Counterpart: Movimiento para la Realización del habitat Social, Mirhas Perú.
Direct beneficiaries: 101140 people.
Financial entities: *Valencia Government, ICAI Engineers for Development Fundraising, Caja de ahorros de Navarra, Red Eléctrica Española y ESF.*

The medical posts are in pretty bad conditions to attend people properly. In addition, there is a lack of communication among them due to technical problems.
The people in the area shows significant rate of respiratory diseases, malnutrition and dermatitis. Moreover, there is high rate of maternal mortality.

Objectives:

- Lighting of medical posts aimed to provide assistance during the night in case of emergency
- Installation of refrigeration systems to maintain vaccines and different antidotes
- Installation of radio communications coordination among emergencies and specialists

The project is still in course, so in the lines below we show the indicators will be taken in account to monitor the project:

- Number of medical assistances (diagnoses and treatments)
- Morbidity (maternal and children)
- Childbirths during the night
- Educative workshops
- Communications emitted and sent (radiograms).
- Cool Chain temperature (2 to 8ºC)
- Vaccination to children and fertile women
- Life expectancy

Figure 22. Solar panel connected to a medical post. Source: EsF.

6- Battambang project (Camboya)

Counterpart: Prefectura Apostólica de Battambang, Camboya
Beneficiaries: Arrupe disabled people centre**:** 31 disabled children (physical deformations, disabled by bombs, genetic deformations) most of them coming from areas affected in Vietnam War. Centre of temporary ill people: around 1000 people directly would be benefited with a special program for VIH, tuberculosis and malaria diseases. Kindergarten St. Vincent de Paul where 100 pupils use to attend. Escuela de Costura: with 15 pupils attending it. Students House Tep Im: taking 45 students.

The electric energy provided by the current system was not of a good quality and used to fail frequently during long periods of time. Besides, the electric generator caused environmental and acoustic distortions and had a high operational cost.

Objective: Installation of an energy photovoltaic system, to replace an electric generator, which might be moved to a little community in Tahen where there is not electricity.

Achievements:

- The quality of the electric supply has been improved, which will benefit in a greater assistance to people.
- Decrease of operational costs
- Decrease of the pollution associated with the power generator in the area
- Possibility to benefit another community with the spare power generator

Figure 23. Solar Panels and children. Source: EsF.

Projects in other areas

7- Emergency electrical supply to a children clinic in Abomey (Benin)

Counterpart: Religiosas de la Asunción.
Direct beneficiaries: 80000 people.
Financial entities: *Iberdrola*.
The children clinic of Buen Pastor provides medical assistance to children the local communities in Abomey, Boncom and nearly areas. This place had a really low quality electrical system with usual failures, which prevented an appropriate service to the attended population.

Objectives: Installation of a power generator aimed to work in case of emergencies (failures of the system) as well as to improve the general electric system to ensure the medical assistance.

Achievements: the installation was successfully implemented.

8- Supply and distribution of drinkable water, water sanitation system and fecal water treatment in Flores de la Paz community (El Salvador)

Counterpart: Basic sanitation, Basic Education and alternative energies**.**
Direct beneficiaries: 720 people.
Financial entities: *Madrid Local government, Tres Cantos city hall, Tapalhuaca municipality, beneficiaries and EsF.*

Objectives: the goal was to improve the access to drinkable water and general sanitation of the community through the implementation of a general system of water supply and sanitation.

Achievements: it was decided to pump water from an existing well to a communal deposit located on the top of the field, so that the water could flow down to the houses.
It was also built a very simply working system to treat the waters, consisting in aerobic bio-filter process.

9- Water Supply to local communities in Taba (Senegal)

Counterpart: Association for the empowerment of Senegalese woman´s.
Direct beneficiaries: 3500 people.
Financial entities: *TRAGSA, Valencia Government, World Geologists, APROFES, beneficiaries and EsF (still in process).*

Objectives: to build a 320 m deep well to provide water not only to population but also to the cattle that this population owns in the region of Taba (Kaolack).
The project has been divided in three phases according the specialty of each financial entity taking part in it.

Figure 24. Well works in Taba. Source: EsF

1.11. Studies

Reflection Projects

1- Water, Energy and cooperation

EsF in collaboration with Ingenieros sin Fronteras has developed a document about Energy and Cooperation. At the moment, a document with the conclusions for educational and development purposes is being developed.

2- Water and Energy: cooperation and Social responsibility in business

EsF wants to promote the inclusion of poverty alleviation programs within the CSR strategy of companies, as well as the participation of the governments in those issues through the Public Private Partnerships (PPP´s) to find efficient solutions to water and energy supply.

EsF is taking part in the program RED para RSC (Network for CSR) and a volunteer group is working in analyzing the CSR programs developed by the energy sector companies and studying how this programs are tackling with poverty. Furthermore, EsF also contemplates the possibility of PPP´s aimed to development in this sector.

3- Regulation for electrification of isolated rural areas

Governments and Companies are working to extend the electric grid until far away areas buts sometimes this is impossible because of accessibility and cost barriers. A potential solution for this would be renewable electric Microsystems, but they need from public support and strong regulatory frameworks.

EsF is carrying out the program REGERZA (Guatemala) aimed to design a regulatory model in order to provide electricity to isolated areas through independent systems from the general grid.

The Guatemala authorities applied for this project and it has been partially financed by AECID. There are more parties working on this project: Electric Energy National Commission, different universities, NGO´s, Spanish institutions such as CENER, ICAI. The same project has just started to be developed in Peru.

4- Biomass and rural development

The biomass is the common way to use energy in most of developing countries. The way they burn it, is really harmful for health. An appropriate use of biomass, an efficient combustion and a sustainable use will be a key for development of rural areas.

In 2008, a student made a study about “The current situation of bio-fuels in Central America”, under an agreement between CIEMAT and UPM. To follow with this study, another one has

been started in Alta Verapaz (Guatemala) and is based in the improvement of technologies for kitchen and the use of biogas or biodiesel in small-scale projects.

5- Awareness and education projects

EsF feels the responsibility to raise awareness about the various problems related to poverty, the scope of them and the great importance of access to energy and water in the fight against poverty. This is done through:

- Seminars on the topic (organized by EsF)
- Training Activities
- Participation on different activities of information
- Publications

2. PHOTOVOLTAIC ENERGY IN RURAL ELECTRIFICATION PROJECTS

Given the scope of this research project, the following chapter will be focus on a specific technology that will be evaluated through the lens of Programmatic CDM. The chosen technology is solar photovoltaic. As seen in the previous section, this type of technology has been applied by Energía sin Fronteras in most of their rural electrification projects. This is not surprising given the fact that photovoltaic energy has become a recurrent option for rural electrification projects around the world, which may allow us to take advantage of the all lessons learned with this regards up to now.

2.1. Photovoltaic Basics

The basic idea of photovoltaic (PV) technology is the generation of electricity from sunlight, using a semiconductor material. This physical process is called Photoelectric effect and was discovered by Edmond Becquerel in 1839. [28]

The basic unit of a photovoltaic system is the photovoltaic cell, made out of a semiconductor material, which is able to absorb part of the sun radiation that reaches its surface and generates electricity from it.

The collection of different PV cells is called PV module. These modules can be connected in series or in parallel to form larger units called arrays, which provide the necessary energy for a given consumption.

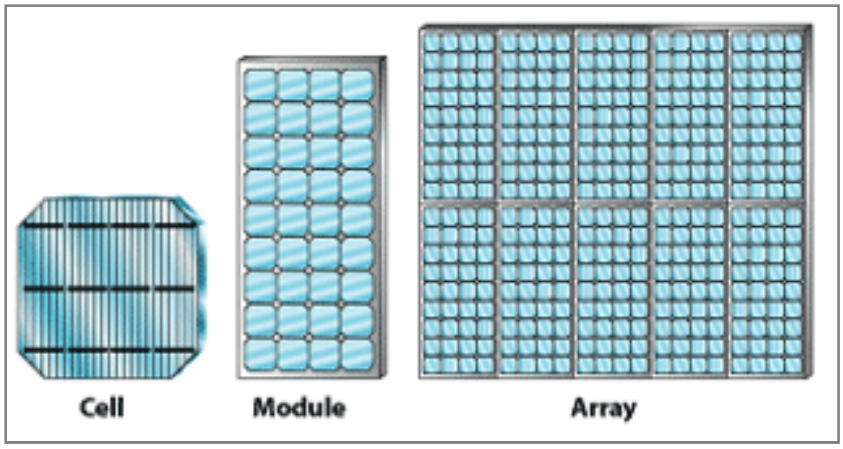


Figure 25: Units of a photovoltaic system. Source: U.S. Department of Energy

[28] U.S. Department of Energy 2005

The number of modules used will depend on the amount of power needed, initially estimated. Thanks to this modularity, these systems can be designed to meet specific electrical requirements.

2.2. Solar Home Systems

Solar home systems are one the most widespread technologies in rural contexts. They represent a popular alternative to grid-based rural electrification, usually less cost effective in poor and isolated areas. A solar home systems typically includes a 10 to 100 Wp (peak watts) photovoltaic array; a battery to store part of the produced energy that might be needed afterwards, for low irradiation periods (for example at night); a regulator that ensures the proper work of the battery, avoiding overcharging; an inverter that takes the direct-current electricity produced by the cells and converts it to alternate-current electricity; one or more lights, switches and interconnecting wires. They are commonly used for low and middle- power consuming services such as lighting, the use of small appliances (radios, TVs…), and even small engines for pumping and mills. As an exception, the use of PV systems for refrigerators containing medicines and vaccines –very demanding in terms of energy supply- has been justified by the social benefits generated from it.

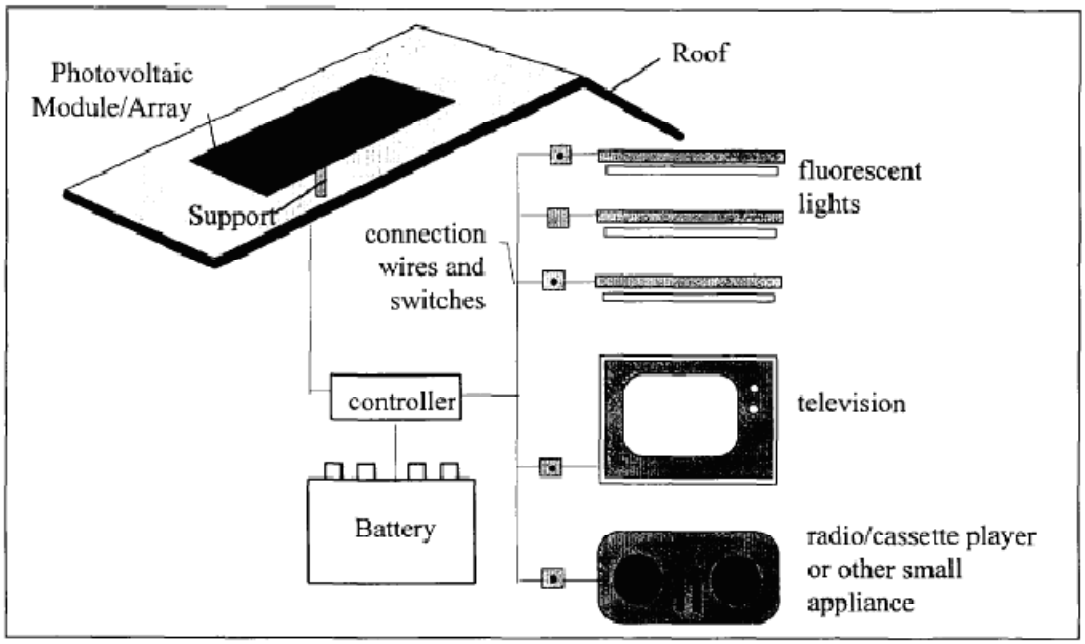


Figure 26: Typical System Components of a Solar Home System. Source: World Bank

2.3. Advantages and Limitations of PV Technology

Solar photovoltaic is considered one the most adequate technologies in rural contexts. This is due to different reasons. Firstly, sun is a free, unlimited, local and environmentally friendly source of energy that reduces the dependency on an external energy supply. Thanks to its modular structure, it can be designed and used to cover different levels of energy demand. Another important factor is that it can be easily used and maintained by the local people. Its profitability has been proven in rural electrification projects, compared to other alternatives such us diesel generators and, in some cases, grid extension.

Energy supply will be determined by sunlight availability. To guarantee this supply, it's very important that the consumption from both the generator and the accumulator do not exceed the

recharge rate of the accumulator. This brings out the importance of user´s education on a rationale use of the energy. On the other hand, solar home systems are usually designed to cover low energy consumption, thus its use for thermal applications such as stoves, refrigerators and cookers is not recommended due to their high power requirements.

2.4. Feasibility Analysis

Although it is not always easy to determine whether photovoltaic is the best alternative for a given project, since this election is normally subject to future fuel costs, inflation, cost of the grid extension, etc., there are two conditions that justify the use of photovoltaic systems in rural electrification contexts: low households density (less than 100 per community)[29] and/or low electricity consumption.

Technical and social factors that also need to be analyzed for the success of this kind of projects are shown in the table below:

SOCIAL-TECHNICAL VARIABLES
Physical and geographical aspects • Orientation • Hours of sunlight • Electrical grid • Maintenance centre • Accessibility • Topography
Climate: • Irradiation • Microclimate • Temperature

Way of life:
• Production
  • Agriculture
  • Farming
  • Fishing
• Diet
• Health and Hygiene

Social organization: • Power organization • Ethnic groups • Religions • Community associations
Family organization

[29] Ingenieros sin Fronteras 1999

• Type • Authority
Work structure
Space structure • Location of houses • Distribution of the space
Community willingness

Table 14: Social-technical variables considered in photovoltaic rural electrification projects. Source: Ingenieros sin Fronteras 1999

Within all these multiple variables, there are two key aspects that need to be carefully analyzed: way of life-property distribution and social organization.

The way of life refers to the main economic activity of the community (agriculture, farming and/or fishing) as well as their diet and health and hygiene conditions, while property distribution refers to who is undertaking those activities –usually women and children. The implementation of the new technology should be especially addressed at improving their life conditions.

Community´s social organization is another crucial factor in the implementation of these projects. Communities with democratic social rules and low levels of economic disparity are likely to be more adequate for the success of these projects. Future maintenance groups will be more easily created by this kind of communities.

The aim of studying all these factors is to develop a project that responds in the most appropriate way to community requirements. It is also very important to establish a close relation with the villagers during the whole process and let them take part of it. They need to feel they own the project.

3. ALTA VERAPAZ PROGRAM

As seen in the previous section, Solar Home Photovoltaic Systems are a suitable and attractive alternative for rural electrification purposes. The following chapter will be dedicated to describe a real and successful photovoltaic program applied by Energía Sin Fronteras in Guatemala. The purpose of this chapter is to provide a good understanding of the program in order to study the possibility to replicate it as a Programmatic CDM. The fact that there are already some photovoltaic projects in the pCDM pipeline might guide our case study and provide some clues on how the project should look like.

3.1. Description of the Program

Las Conchas is a 239 inhabitant community located in the Alta Verapaz department, northern Guatemala, 72 kilometers from Coban, the capital city of the municipality. This area reaches very low levels of human development, due to its isolation and poverty conditions. Its population is indigenous, who were displaced from their villages after a long Civil War in Guatemala (1960-1996). A high percent of them are children and the native language of these communities is Q'eqchi'.

The dominant ecosystem of this area is rainforest. The rough land makes the communication and access to this area very difficult, having only one road to connect Las Conchas with Cobán

(2-3 hours by car), with a paved extension of 40 km. The electric grid is 32 kilometers away from the village and, before the implementation of the Alta Verapaz program, wood, candles and batteries represented the only energy sources for these communities, used for lighting, cooking and heating water.

Figure 27: Map of Guatemala. Source: Google Earth, 2009

The average income per family is estimated at 18 quetzals/day, equal to 390 quetzals per month (around $1.6 per day). Agriculture is the mayor activity of this area. They frequently meet to discuss and agree on any relevant issue affecting the community and are represented by local leaders.

3.2. Scope of the Project

In November 2004, Energia Sin Fronteras received a request from Asociación Las Conchas-Verapaz to provide energy to Las Conchas. After some contacts with local representatives, it was decided that the project would be expanded to other 12 communities within the same area (located in the highlighted area of the following map):

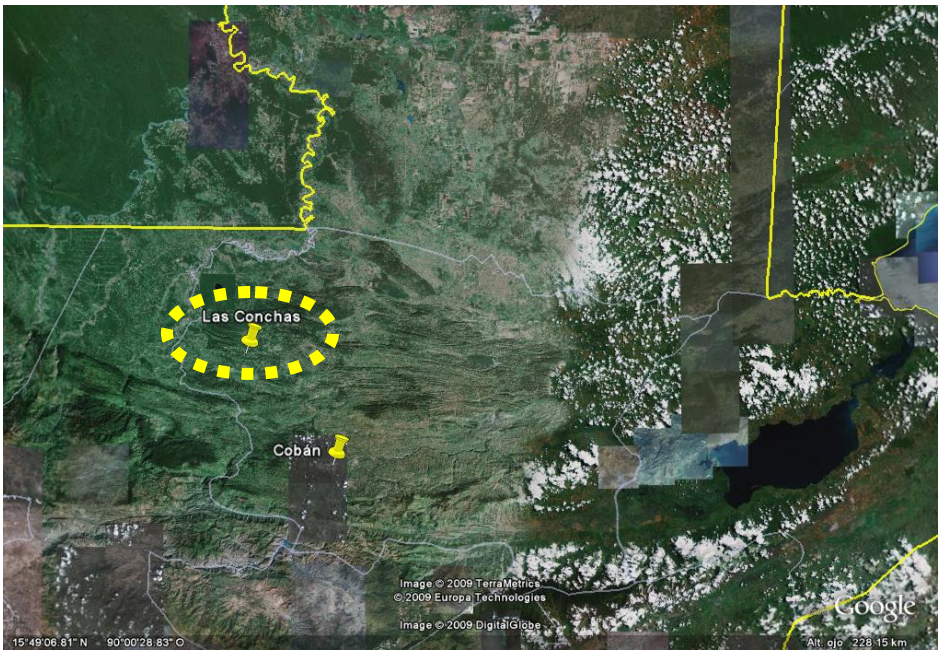


Figure 28: Location of the communities. Source: Google Earth, 2009

The beneficiary communities were agreed in local assemblies. The only two requirements from EsF were that those communities had to be in the surrounding area of Las Conchas –to facilitate the management of the program in terms of both technical and administrative aspects- as well as the expressed desire for the project. Based on these criteria, the chosen communities were:

- Las Conchas
- Copal "AA" La Esperanza
- Roc-Ha-Pasacuc
- Gancho Caoba I
- San José Peña Blanca II
- La Sultana
- Sapox
- Sesajab I
- La Cumbre Se Pacay
- Santa Elena Satolohox
- La Ceiba – Copalhá
- Cuxpemech- Copalhá
- Sa Laguna Grande

The program consisted of supplying 120 community facilities with energy services such as lighting, refrigerators containing vaccines and telecommunications (use of radios, TVs, DVDs and computers). The facilities included in the program are broken down in the following table:

High Schools	5
Primary schools	21
Teachers' bedrooms	6
Students' bedrooms	1
Churches	21
Medical centers	7

Community rooms	9
Women's associations	3
Community wine cellars	8
Community kitchens	25
Mills	8
Cardamom dryer	2
Others	4
TOTAL	**120**

Table 15. Facilities included in the program. Source: Energía sin Fronteras

The total number of families benefiting from energy access was 590, equal to 3,300 people.

The objectives of the program were to promote education as well as certain economic activities.

3.3. Technical and Financial Information

The technology chosen for the program was photovoltaic solar energy, due to the lack of feasibility of other renewable options. The maps below show the availability of renewable energy resources in the target area (wind and solar):

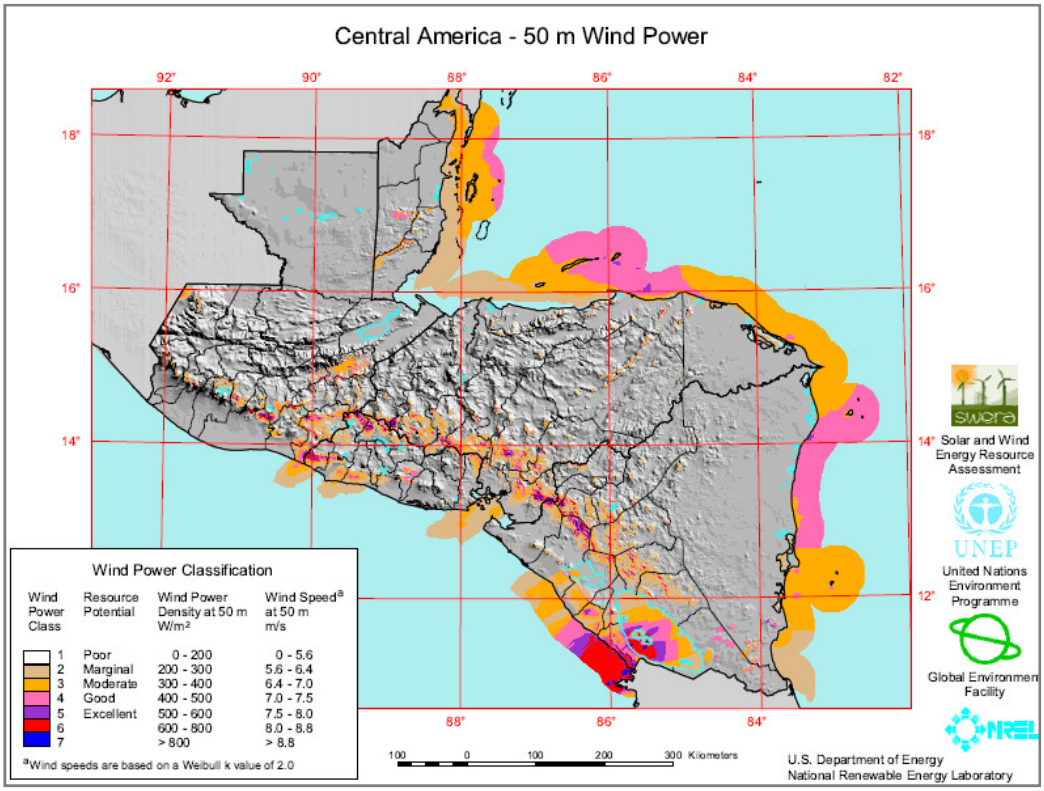


Figure 29: Wind energy availability in Central America. Source: SWERA Renewable energy Resource Explorer (UNEP), 2009

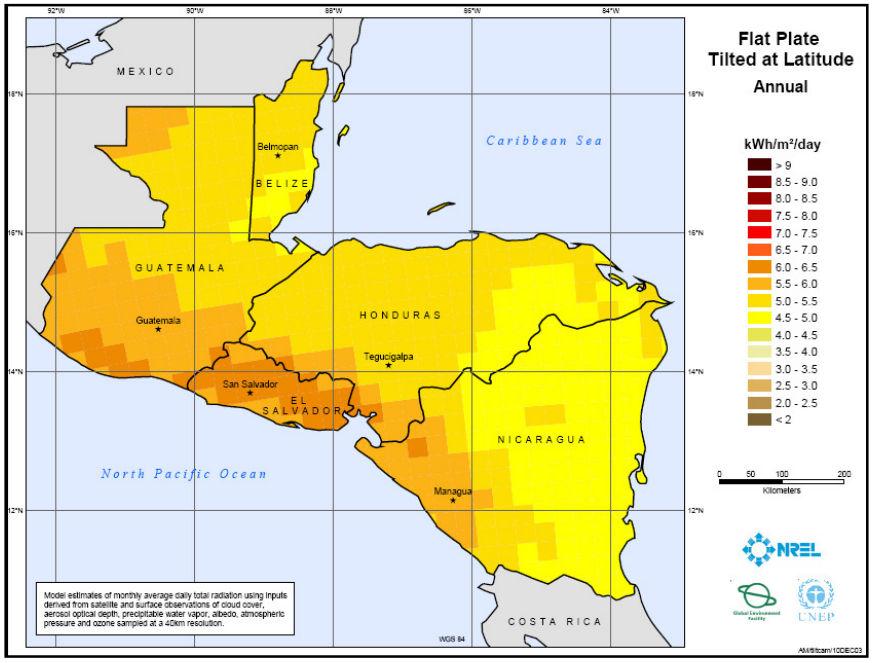


Figure 30: Solar energy availability in Central America. Source: SWERA Renewable energy Resource Explorer (UNEP), 2009

As shown in the previous resource maps, solar energy represents the most appropriated renewable alternative in Alta Verapaz region. The grid extension was discarded due to its high cost and potential economic impact on the communities.

As a result of a previous study, 71 photovoltaic systems were installed, each of them equipped with one or more solar panels, a battery, a regulator and an inverter, if needed. The modules were designed to provide 20, 60, 150, 200 and 450 Wp of power. The total installed power was 12 kW.

Different parts of these systems are shown in the pictures below:

Figure 31: Solar panels in a sanitary center in Copaláa la Esperanza. Source: Energías sin Fronteras, 2009

Figure 32: Components of a photovoltaic system in a sanitary center in Sta. Elena Satolohox. Source: Energía sin Fronteras, 2009

The total cost of the program was 170,000€ and was financed by the company Unión Fenosa, ICAI and Energía sin Fronteras.

3.4. Results of the Program

The Alta Verapaz program was divided into two stages: a first pilot project in Las Conchas, from 2005 to 2006, and the extension of the program to the rest of the communities, finished at the end of 2008.

Despite of the little time that has passed since the end of program, it has already shown some signs of success. From the begging of the project, the community expressed its support to it. They actively contributed in the execution of the project, and were designated non-qualified tasks such as transportation of materials and digging trenches. The high number of people attending maintenance courses (180 people during the last one) is another relevant indicator of their concern. Surrounding communities have openly shown their interest in similar projects.

On the other hand, the limited capacity of the photovoltaic systems, used only for basic electricity services, is not really contributing to the proliferation of economic activities.

Figure 33: Primary school in La Cumbre Se Pacay. Source: Energia sin Fronteras, 2009

4. APPLICATION OF pCDM TO THE ALTA VERAPAZ PROJECT

4.1. Introduction

After having analyzed on the one hand (i) the programmatic clean development mechanism and on the other one (ii) ESF´s most successful photovoltaic rural electrification projects in Guatemala, the aim of this section is to relate both issues and apply pCDM principles to the Alta Verapaz project.

In order to do so, the Project Design Document (PoA-DD) will be elaborated for Alta Verapaz Project as if it were to apply to pCDM. In such process, potential difficulties, pitfalls and barriers to overcome will be identified and will provide some answers to the research question initially put forward: "*Is it viable for EsF to implement electrification PV projects under pCDM?"*

The PDD preparation has been to some point experimental since no reference cases are available. pCDM is indeed a very young tool which requires a "learning by doing" approach and needs to be further developed and consolidated. The processes of additionality demonstration and baseline determination have been especially harsh due to the lack of rigorous guidelines and concise tools that define and ease these procedures.

However there are several projects on the pipeline which, in the absence of more reliable benchmarks, have been thoroughly analyzed and used as references for the development of our PDD. The project which occupies the most advanced position in the pipeline is CUIDEMOS México, a pCDM energy efficiency project based on the substitution of traditional light bulbs for more efficient Compact Fluorescent Lamps (CFLs). This project has been requested for review in order for it to be finally validated and be able to request registration in a near future. Regarding photovoltaic technology, which is our area of interest, there is no single validated or near to validation pCDM project. The closest case is the Solar Home Systems installation project in Bangladesh promoted by Grameen Shakti -an organization initiated in 1996 by the core builders of the Grameen Bank-, with the objective of facilitating electricity access to those

people living in poor rural areas. Inspired by the vision of Professor Yunus, the project aims at building synergies between renewable energy technology and microcredits. There are, though, several important unknown factors surrounding this project which have prevented us from fully understanding and coming to clear conclusions about a case that would have been of great relevance for us.

Furthermore the methodology applied in this study, AMS-I.A., has only been used once for Small Scale photovoltaic projects, which contributes to the experimental and to some extent pioneer character of this research.

The PoA-DD developed for Alta Verapaz is presented next. As it has been previously mentioned, each section has been filled following the available references. Recent decisions by COP/MOP and the CDM EB are reflected and analyzed in the document as well. Difficulties and barriers to overcome in order for Alta Verapaz to apply to pCDM are identified and the subsequent comments added at the end of each section in ***bolds and italics***.

4.2. Project Design Document (PoA-DD)

CLEAN DEVELOPMENT MECHANISM
SMALL-SCALE PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-SSC-PoA-DD) Version 01

CONTENTS

Annexes

NOTE:

(i) This form is for the submission of a CDM PoA whose CPAs apply a small scale approved methodology.

(ii) At the time of requesting registration this form must be accompanied by a CDM-SSC-CPA-DD form that has been specified for the proposed PoA, as well as by one completed CDM-SSC-CPA-DD (using a real case).

SECTION A. General description of small-scale programme of activities (PoA)

A.1 Title of the small-scale programme of activities (PoA):

>> Electrification of rural isolated areas through photovoltaic systems in the Department of Alta Verapaz (Guatemala).

Version 1
9th July, 2009

A.2. Description of the small-scale programme of activities (PoA):

>> The following information shall be included here:

1. General operating and implementing framework of PoA
   This programme of activities involves the installation of solar panels in community buildings of 13 indigenous communities of the Department of Alta Verapaz (Guatemala). The installations undertaken in each community will constitute a small-scale CDM programme activity (SSC-CPA). The PoA and each CPA will be implemented and managed by the Spanish Development NGO Energía sin Fronteras, in collaboration with its two counterparts: Familia Marianista Guatemalteca (FMG) and Asociación Maya para el Desarrollo Integral Indígena (Aj-Awinel).

2. Policy/measure or stated goal of the PoA
   The goal of the PoA is to bring electricity for lighting and low consumption activities to 13 isolated rural communities through the installation of photovoltaic systems in approximately 120 community buildings, such as primary schools, health centres and churches, gathering centres, multi-use buildings, community kitchens and corn mills. The electricity generated by the solar panels will make possible and/or will ease essential activities such as education, health and gathering in hours with almost no natural lighting, increasing life standards and contributing importantly to the sustainable development of these indigenous communities.
   Besides, the substitution of massive biomass, diesel and kerosene combustion, by a clean technology such as solar photovoltaic, will have a positive effect on public health and will reduce the emission of GHGs.
   Finally, the PoA will also include a significant public education and capacity building component, since people from the community will be trained in the correct use and maintenance of the equipment in order for them to be accountable for the correct functioning of the devices and in the end feel the owners of the project. Awareness on the real cost and value of energy will be raised, resulting in a conscious use of energy.

3. Confirmation that the proposed PoA is a voluntary action by the coordinating/managing entity.
   The coordinating entity, Energía sin Fonteras, will voluntarily design and implement the project. Its two counterparts, Familia Marianista Guatemalteca and the Asociación Maya para el Desarrollo Integral Indígena, will participate voluntarily as well since there are no mandatory requirements in Guatemala stipulating the use of photovoltaic systems.

It would be recommendable for EsF to scale up the project. pCDM's small scale spirit aims at fostering development in large underdeveloped regions. A higher number of CPAs should be implemented in order for the project to have a significant impact on sustainable development and GHGs emission reductions, as well as to increase as well the profitability of the project. This last point will be discussed in detail later on. As a conclusion, the installations of solar systems should be done

in a significantly higher number of communities, which would most probably imply the widening of the geographical scope of the PoA.

A.3. Coordinating/managing entity and participants of SSC-POA:

>> The following information shall be included here:

1. Coordinating or managing entity of the PoA as the entity which communicates with the Board
   Energía sin Fronteras (EsF)
2. Project participants being registered in relation to the PoA. Project participants may or may not be involved in one of the CPAs related to the PoA.
   Energía sin Fronteras (EsF)
   Counterparts:
   Familia Marianista Guatemalteca (FMG)
   Asociación Maya para el Desarrollo Integral Indígena (Aj-Awinel)
   Investors:
   Unión Fenosa
   ICAI
   Parties involved:
   Guatemala (host country)
   Spain (Annex I country)

The scaling up of the project will require a change in the operational structure of EsF. Currently they are almost the only ones designing and implementing the project, but if the number of CPAs is to be increased significantly strategic alliances with local NGOs and photovoltaic systems producers and distributors should be established so that the operational capacity of EsF adjusts to the requirements of the new scope of the project.

A.4. Technical description of the small-scale programme of activities:

>> The total installed power will be on the order of 12 kW for the 13 communities. Due to electricity generation limitations, this electricity will be used mainly for lighting and power supply of low consumption electrical appliances such as radios, TVs, computers or medicine refrigerators.

Standardization of photovoltaic systems will be done through the development of a series of modules with different power capacity. Besides, two different types of modules will be installed: on one hand modules for power supply for lighting purposes exclusively; on the other hand modules for low consumption electrical devices power supply. The first ones consist of solar panels, regulator, battery, lamps, plugs and voltage converters. The second ones have an additional static inverter of direct current to alternating current.

The standardization levels designed for the panel modules are 20, 60, 150, 200 and 450 Wp. The 200 Wp modules will be used for medicine refrigerators in health centres, while the others will be installed in different buildings depending on the power and energy demand foreseen in each case. The rest of the components of the modules (batteries, regulators and inverters) will be standardized as well, in a compatible way with the panels.

In those cases where buildings are close enough, groups will be created so that installations can be shared and the wiring structure minimized.

In order for the scaling up to be feasible, the degree of standardization should be higher. That is, in an ideal situation the same set of photovoltaic systems should be installed in each community, easing the scaling up process and allowing for economies of scale. From a pCDM point of view, developing tailored systems for each community or CPA would constitute a quite inefficient, time consuming and logistically far more complicated process. Efforts should be done in this direction, in order for the standardization level to resemble as much as possible the ideal situation.

A.4.1. Location of the programme of activities:

>> 5th Region of the Cobán Municipality, in the Department of Alta Verapaz, Guatemala.

A.4.1.1. Host Party(ies):

>> Government of Guatemala.

A.4.1.2. Physical/ Geographical boundary:

>> Definition of the boundary for the PoA in terms of a geographical area (e.g., municipality, region within a country, country or several countries) within which all small-scale CDM programme activities (SSC-CPAs) included in the PoA will be implemented, taking into consideration the requirement that all applicable national and/or sectoral policies and regulations of each host country within that chosen boundary;

All CPAs associated with this PoA will be implemented within the geographical boundary of the 5th Region of the Cobán Municipality, in the Department of Alta Verapaz, Guatemala.

Figure 1: Geographic boundary of PoA - Alta Verapaz. Source: Google Earth

As it has been mentioned before, the scaling up of the project would require most probably the widening of the geographical scope of the PoA, thus resulting in a larger physical boundary.

A.4.2. Description of a typical small-scale CDM programme activity (CPA):

>>Each SSC-CPA will involve the installation of photovoltaic systems in the chosen communal buildings of each community. The beneficiaries themselves will be the ones deciding in which buildings of their communities they consider it is most important to undertake the installation of the solar panels, so that they feel the owners of the project from the very beginning. Energía sin Fronteras (EsF) will design the systems, will buy the equipment and will install the devices. Familia Marianista Guatemalteca and Asociación Maya para el Desarrollo Integral Indígena will cooperate in the design and implementation of the project. Besides, local people will contribute by helping in the transportation of materials, digging, cable installation and similar tasks. In a second capacity building phase these people will be trained in the correct maintenance of the equipments, and a tariff on the price of the provided service will be set in order for the maintenance costs to be covered.

A.4.2.1. Technology or measures to be employed by the SSC-CPA:

>>The technology to be employed is, because of its adaptability to the project features, Stand Alone Solar Photovoltaic Electricity Generation Systems.

This is a clean technology since no CO_2 is generated in the transformation of solar energy into electricity by the solar panels. This electricity is then stored in batteries, allowing lighting and the usage of electrical devices after the sunset.

These systems are mainly used in those areas with no connection to the grid, where the installation of a photovoltaic device is more profitable than implementing an extension of the grid.

The solar panel modules used in this project will be of 20, 60, 150, 200 and 450 Wp. They have an average lifetime of more than 30 years.

A.4.2.2. Eligibility criteria for inclusion of a SSC-CPA in the PoA:

>> Here only a description of criteria for enrolling the CPA shall be described, the criteria for demonstrating additionality of CPA shall be described in section E.5

Eligibility criteria:

- Each SSC-CPA will involve the installation of photovoltaic systems in the communal buildings of communities within the geographical boundary of the 5th Region of the Cobán Municipality, in the Department of Alta Verapaz, Guatemala.
- Each SSC-CPA must implement the baseline and monitoring methodology AMS-I.A. "Electricity generation by the user" v.13.
- No other CPA or CDM project involving the installation of photovoltaic systems is already registered and operating in the same, specific physical geographical area.
- The coordinating entity will ensure that all CPAs under its PoA are neither registered as an individual CDM project nor included in another registered PoA, and that the CPA is subscribed to the PoA.
- Each SSC-CPA shall be uniquely identified and defined in an unambiguous manner by providing geographic information, and the exact start date and end date of the crediting period.
- Each SSC-CPA must ensure that leakage, additionality, establishment of the baseline scenario, baseline emissions, eligibility and double counting are unambiguously defined.

- Each SSC-CPA must be approved by the coordinating entity and DOE prior to its incorporation into the PoA.
- Each SSC-CPA must satisfy de-bundling rules for PoA.

A.4.3. Description of how the anthropogenic emissions of GHG by sources are reduced by a SSC-CPA below those that would have occurred in the absence of the registered PoA (assessment and demonstration of additionality):

>> The following shall be demonstrated here:

(i) The proposed PoA is a voluntary coordinated action;
(ii) If the PoA is implementing a voluntary coordinated action, it would not be implemented in the absence of the PoA;
(iii) If the PoA is implementing a mandatory policy/regulation, this would/is not enforced;
(iv) If mandatory a policy/regulation is enforced, the PoA will lead to a greater level of enforcement of the existing mandatory policy/regulation.

The information presented here shall constitute the demonstration of additionality of the PoA as a whole.

Voluntary Coordinated Action
The proposed PoA is a voluntary and coordinated action. There are no mandatory requirements in Guatemala stipulating the use of photovoltaic systems for electricity generation in rural isolated areas. In addition, the PoA requires individual households and communities to take voluntary action to participate in project activities.

Additionality Tool
UNFCCC's "Tool for demonstration and assessment of additionality", version 05.2, is used as the basis for determination of additionality of the PoA.

Step1. Identification of alternatives to the project activity consistent with mandatory laws and regulations.

Sub-step 1a. Define alternatives to the project activity

Three alternatives to the proposed PoA have been identified:

1. The activity could occur without being registered as a PoA through government support. The Guatemalan government would provide rural isolated areas of the country with access to electricity by extending the grid or by implementing renewable energy projects such as the installation of solar photovoltaic systems. There are significant barriers to this alternative scenario. Most importantly, there is currently no budget for such an undertaking, since the implementation either of the grid extension or renewable energy projects require a high investment and a very low internal rate of return due to the low income and paying capacity of the communities of these isolated areas. In addition, there is no intention or will in government to undertake such costly projects.
2. The activity could occur without being registered as a PoA through private sector support. Energy companies operating in the country, in cooperation with solar panels producers and distributors, would identify the supply of energy to rural isolated communities as a business in the bottom of the pyramid, implementing as a result electrification programmes using photovoltaic technology. The main barrier identified to this scenario is the past behaviour of

the electricity companies, very reluctant to provide services to low income isolated communities.

3. Continuation of the current situation is also a possible alternative scenario. The baseline alternatives include either continued use of candles, torches and kerosene for lighting, and biomass combustion for cooking and heating purposes, or the use of electric generators.

Outcome of step 1a

Realistic and credible alternative scenarios to the project activity have been identified.

Sub-step 1b. Consistency with mandatory laws and regulations

Each of the potential alternatives to the project discussed above:

- The project occurring without being registered as a PoA through government support
- The project occurring without being registered as a PoA through private sector support
- Continuation of the current situation

are consistent with Guatemala's laws and regulations.

Outcome of step 1b

The proposed PoA is therefore not the only alternative amongst those considered that complies with mandatory regulations. Other realistic and credible scenarios to the project activity are in compliance with mandatory legislation and regulations taking into account the enforcement in the region or country and EB decisions on national and/or sectoral policies and regulations.

Step2. Investment analysis

This analysis should demonstrate that the proposed project activity is not economically or financially feasible without the revenue from the sale of certified emission reductions (CERs).

In this case the revenue generated from the CERs will not compensate the high initial cost of solar photovoltaic systems, so that the PoA will not be financially feasible even with the revenue of pCDM.

The figure below demonstrates the gap of critical factors between two technologies based on the same baseline methodology, using as a consequence the same emission factor. Solar Related Energy has very low competiveness due to its high initial investment, as it is reflected in the higher minimum prices for break-even.

Annual CERs per biodigester	CER minimum price for break-even (EUR)	CER price for IRR of 15 % (EUR)
10	2.4	3.3
5	4.7	6.5
2.5	9.4	12.9

Table 1. Indicative level of CER revenues and CERs per biodigester required for break-even and IRR of 15%. Source: PoA Blueprint Book, KfW Bankengruppe, 2009.

Annual CERs per SWH	CER minimum price for break-even (EUR)	CER price for IRR of 15% (EUR)
2.5	6.8	13.7
1.25	13.6	27.4
0.5	33.9	68.5

Table 2. Indicative level of CER prices and CERs per SWH required for break-even and IRR of 15%. Source: PoA Blueprint Book, KfW Bankengruppe, 2009.

Therefore, it would be reasonable to adjust the emission factor in AMS-I.A to tackle this "unfairness", taking into consideration the high contribution of Solar Related System to the achievement of sustainable development and its usefulness as rural electrification tool in isolated rural areas with dispersed population.

Step3. Barrier analysis

This analysis will discuss credible barriers that would prevent the implementation of the proposed project activity from being carried out if the project activity was not registered as a CDM activity.

Institutional and regulatory barriers.

In Guatemala there is a framework for the promotion of renewable energies which is not being properly enforced by the authorities due, among other reasons, to the slow pace of economic growth and to the impact of a long period of civil war.

Regarding the current lack of electrification situation in rural isolated areas, the government does not have enough capacity (mostly due to budget limitations) to design and implement rural electrification plans, neither through the extension of the grid nor through the installation of stand alone renewable energy systems.

As a result, the proposed project would not be undertaken by the government. Consequently, private sector or, alternatively, pCDM support would be required in order to undertake such initiative.

Technological and infrastructural barriers.

The lack of properly trained labour to operate and maintain the technology in the region leads to an unacceptably high risk of equipment disrepair, malfunctioning or other underperformance which would prevent private companies from investing in these poor regions. Besides, the lack of infrastructure as well as logistic capacity for technology implementation and maintenance would constitute an additional risk for private investment.

As a result, the proposed project would not be carried out by the private sector becoming the registry as a pCDM activity necessary.

Investment barriers.

As we have seen in step 2, CDM would not help the project to overcome the investment barrier. The project would not be profitable since the initial investment would not be compensated by the revenues produced by the CERs generated. As a result, the project is not additional. The alternative scenario of continuation of current situation would be the most feasible in this case.

Step 2 together with Step 3 demonstrates that the proposed PoA is not additional, so that there is no need to go further into Step 4 "Common practice analysis". However the PoA-DD document will be further developed as if additionality were demonstrated.

A.4.4. Operational, management and monitoring plan for the programme of activities (PoA):

A.4.4.1. Operational and management plan:

>> Description of the operational and management arrangements established by the coordinating/managing entity for the implementation of the PoA, including:

(i) A record keeping system for each CPA under the PoA,
(ii) A system/procedure to avoid double accounting e.g. to avoid the case of including a new CPA that has been already registered either as a CDM project activity or as a CPA of another PoA,
(iii) The SSC-CPA included in the PoA is not a de-bundled component of another CDM programme activity (CPA) or CDM project activity.
(iv) The provisions to ensure that those operating the CPA are aware of and have agreed that their activity is being subscribed to the PoA;

Operational Category	Management Responsibilities& Arrangement
Equipment Design	Prepare specific design for each community building, place purchasing order according to specification and maintenance for the following 6 months and necessary repair work.
Equipment Purchase	Send purchasing request to suppliers, selecting suppliers and place purchasing orders of equipment and materials
Maintenance and repair	Sign contract with suppliers to guarantee the after sales service
Training and awareness raising	Organize workshop to train the operation agent based on each community
Assessment	External evaluation

In addition to the above management tasks, the coordinating entity will implement the following operational elements to ensure proper management and oversight of the proposed PoA.

SSC-CPA Record Keeping
In order for coordinating entity to ensure that each SSC-CPA will maintain appropriate records documentation:

- Committees of Energy will be created
- Contracts for the purchase of equipment and materials, data sheets and records of receipt of each of the building
- List of attendance and certificate / training reports
- Minutes signed by COCODES to the terms of the agreement with counterparts.
- Record of property release.
- Agreements between COCODE and supplier of equipment regarding maintenance and spare parts.

Double Counting
Recording the contract of purchase for each facility will avoid the double counting happening;

Based on the purchase contract and agreement regarding maintenance of each facility, double counting will be avoided.

De-bundling
If each of the independent subsystems/measures (e.g. solar home system) included in the CPA of a PoA is no greater than 1% of the small scale thresholds defined by the methodology applied [9], than that CPA of PoA is exempted from performing de-bundling check i.e. considered as being not a de-bundled component of a large scale activity. [1]
i.e. 15 kW installed capacity or 0.6 GWh annual energy savings or 0.6 ktCO2e annual emission reductions.

Given the facts that, the proposed PoA has capacity of 12KW, lower than 0.1% threshold of 15 KW mentioned above, the de-bundling concern might be put aside at the moment.

All CPAs Are Subscribed to the PoA
Purchasing contract and maintenance agreement will be signed between COCODEs (los Consejos Comunitarios de Desarrollo) who present the interest and rights of local communities, and the two local partners of managing entity EsF(Energia sin Frontera) Asociación FMG (Familia Marianista Guatemalteca), Asociación Maya para el Desarrollo Integral Indígena (Aj-Awinel).
Campaigns for raising awareness would be extensively organized;
Local workers will be trained to be able to provide maintenance services;

A.4.4.2. Monitoring plan:

>> The following information shall be provided here:

(i) Description of the proposed statistically sound sampling method/procedure to be used by DOEs for verification of the amount of reductions of anthropogenic emissions by sources or removals by sinks of greenhouse gases achieved by CPAs under the PoA.
(ii) In case the coordinating/managing entity opts for a verification method that does not use sampling but verifies each CPA (whether in groups or not, with different or identical verification periods) a transparent system is to be defined and described that ensures that no double accounting occurs and that the status of verification can be determined anytime for each CPA;

The monitoring methodology as defined in Appendix B for the category I.A. "Electricity generation by the user" version 13, has been applied in this PoA DD. This monitoring methodology shall consist of:
(a) An annual check of all systems or a sample thereof to ensure that they are still operating (other evidence of continuing operation, such as on-going rental/lease payments could be a substitute).
OR
(b) Metering the electricity generated by all systems in a sample thereof.

Given the micro scale of the PoA, option (a) will be adopted by checking annually all the solar photovoltaic systems installed in order to ensure their normal operation. Some evidence may be reported through measures below:

[1] Guidance For Determing The Occurrence of De-Bundling Under a Programme of Activities (PoA) EB 47 Report Annex 32 Page 3

Monitoring record keeping of quotas established for maintenance service, based on the agreement between COCODEs and families in the communities;

No monitoring plan has been identified in EsF's Planning Matrix (refer to Annex 6), but an external independent assessment is mentioned which might be a starting point to develop a continuous monitoring system.

A.4.5. Public funding of the programme of activities (PoA):

>>No public funding will be used for this PoA.

SECTION B. Duration of the programme of activities (PoA)

B.1. Starting date of the programme of activities (PoA):

>>November, 2010

This start date has been chosen as it is estimated that at this time registration by the CDM Executive Board will be completed. It is only after registration that implementation of CPAs will occur constituting "real action" as defined by the Executive Board. Hence the date of registration is considered an appropriate start for the PoA.

B.2. Length of the programme of activities (PoA):

>>28 years

SECTION C. Environmental Analysis

>>

C.1. Please indicate the level at which environmental analysis as per requirements of the CDM modalities and procedures is undertaken. Justify the choice of level at which the environmental analysis is undertaken:

1. Environmental Analysis is done at PoA level ☐
2. Environmental Analysis is done at SSC-CPA level ☐

C.2. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>

C.3. Please state whether in accordance with the host Party laws/regulations, an environmental impact assessment is required for a typical CPA, included in the programme of activities (PoA),:

>>

The Guatemalan Government does not require that environmental impact assessments be undertaken for SSC-CPAs included in the PoA.

SECTION D. Stakeholders' comments

>>

D.1. Please indicate the level at which local stakeholder comments are invited. Justify the choice:

1. Local stakeholder consultation is done at PoA level ☐
2. Local stakeholder consultation is done at SSC-CPA level ☑

Note: If local stakeholder comments are invited at the PoA level, include information on how comments by local stakeholders were invited, a summary of the comments received and how due account was taken of any comments received, as applicable.

Despite local stakeholder consultation has been done at the SSC-CPA level, further information regarding compilation procedures as well as the main resulting comments will be presented in the following two sections.

D.2. Brief description how comments by local stakeholders have been invited and compiled:

>>Local stakeholders' comments will be compiled through community characterization questionnaires, which will provide EsF with information about the main economic, social and infrastructural features of the beneficiary community and will compile the impressions and opinions of local people regarding the implementation of electrification projects in their communities.

D.3. Summary of the comments received:

>>The full questionnaire undertaken in Las Conchas (one of the pilot communities of the programme), can be found attached in Annex 5. However the following statements extracted from the questionnaire can give us an idea of how high the acceptance of the project is and how positively these people's lives would be improved.

"La Comunidad no sólo está anuente sino muy deseosa de poder contar alguna vez con energía para iluminarse. Es una vieja aspiración de la Comunidad (y de muchas otras del entorno),…"

"…Asigne las siguientes clasificaciones: (indique el número delante de la pregunta)

1. *Totalmente en desacuerdo.*
2. *Desacuerdo.*
3. *Indiferente (no tiene opinión formada sobre la pregunta).*
4. *De acuerdo.*
5. *Totalmente de acuerdo*

A las siguientes preguntas:

¿Con las fuentes energéticas y eléctricas que usa ahora le es suficiente y se siente bien? ***2***

¿Estaría dispuesto a pagar por obtener electricidad? ***4***

¿La electricidad es importante para la educación de los hijos? ***5***

¿La electricidad hará que se sienta más seguro? 4

¿Le es difícil adquirir información y noticias en su comunidad? ***5***

¿Podría tener más tiempo libre si dispusiese de electricidad? ***4***

¿Trabajaría más tiempo si tuviese electricidad? ***4***

¿Mejoraría su vida en términos generales si tuviese electricidad? ***5***

¿Sería importante el disponer de electricidad para el suministro de agua en su comunidad? ***2***
¿Considera la electricidad cara? ***4***
¿Sería asequible para toda la comunidad? ***3***
¿La considera más barata que otras fuentes? ***4***
¿Cómo una fuente limpia de energía? ***4***
¿Peligrosa? ***2***
¿Sería muy conveniente para la productividad de los negocios? ***5***
¿Es sólo para usarla en pocas ocasiones? ***2*** *...*"

The implementation of this kind of questionnaires is an extremely important source of information for EsF. However it would be recommendable to increase the number of interviewed people, develop a registry and design a follow-up system, repeating the consultation in different stages of the implementation of the process: design, execution, closure and monitoring. This way, EsF would obtain much more information from this useful tool, increase the probability of success of the project, avoid missing important elements, anticipate to some problems and identify potential risks.

D.4. Report on how due account was taken of any comments received:

>>

SECTION E. Application of a baseline and monitoring methodology

This section shall demonstrate the application of the baseline and monitoring methodology to a typical SSC-CPA. The information defines the PoA specific elements that shall be included in preparing the PoA specific form used to define and include a SSC-CPA in this PoA (PoA specific CDM-SSC-CPA-DD).

E.1. Title and reference of the approved SSC baseline and monitoring methodology applied to a SSC-CPA included in the PoA:

>>The approved small-scale baseline and monitoring methodology used is: AMS-I.A. Electricity generation by the user (Version 13). [2]

In E.5.the PoA will use the "Tool for the demonstration and assessment of additionality"

NOTE: The approved SSC baseline and monitoring methodology should be approved for use in a PoA by the Board.

E.2. Justification of the choice of the methodology and why it is applicable to a SSC-CPA:

>>AMS I.A. states: This category comprises **renewable energy generation units** that supply individual households or users or **groups of households or users** with electricity. The applicability is limited to households and users **that do not have a grid connection**. These units include technologies such as **solar power**, hydropower, wind power, and other technologies that produce electricity all of which is used on-site by the user, e.g. **solar home systems**, and wind battery chargers. The renewable generating

[2] http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_J55DI73SVWQ8MG9BLA622YS16UCO2G

units may be new or replace existing fossil-fuel-fired generation. The capacity of these renewable energy generators shall not exceed 15 MW.

The choice of the methodology based on the facts that:

- The project activities to be included into the PoA will use photovoltaic system to generate electricity for purpose of lighting, cooking, medicine refrigeration, agricultural production as well as supply electricity demand to electronic appliances like Radio and TV;
- The target facilities are community buildings such as school, hospital and public cantina; The majority of beneficiaries are indigenous population from 13 communities dispersed in region of Alta Verapaz;
- The solar home system has been particularly mentioned in AMS I.A version 13 as an example which is taken as a reference for the proposed PoA.
- The capacity of the whole project is proximally 12KW which presents less than 0.1% of the Small Scale threshold 15MW;

About the leakage consideration, it is addressed in the document AMS-I-A:

If the energy generating equipment is transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered.

Since the photovoltaic systems has a life time of about 30 years, and the proposed PoA is applying for a crediting period of 28 years, the equipments will be purchased and applied directly to the projects until the end of their operating lives .

Therefore, the leakage may not be accounted in this CDM-SSC-PoA-DD.

To ensure the 100% displacement of kerosene, candles and wood use in lighting and cooking after the installation of Solar Photovoltaic System, educational and institutional workshops should be planned in order to adapt the traditional energy consumption behavior to the newly installed energy generating equipments.

NOTE: In the case of CPAs which individually do not exceed the SSC threshold, SSC methodologies may be used once they have first been reviewed and, as needed, revised to account for leakage in the context of a SSC-CPA.

E.3. Description of the sources and gases included in the SSC-CPA boundary

>>The reduced emissions associated to the CPAs under this PoA are CO_2. The reduction takes place through the avoidance of fossil fuel (candles, kerosene, diesel generators) use for lightning, heating, cooking and electricity generation, by implementing the proposed PoA, setting up Solar Photovoltaic System.

E.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

>> The baseline scenario is the energy demand supplied by fossil fuel prior to installation of Photovoltaic Systems within the boundary of the PoA. According to the different use and needs of energy generated from photovoltaic system, the scenario would be:

Emissions caused from use of diesel generators in absence of solar PV system installation.

The justification of the baseline scenarios is supported by studies on energy sector in Rural area of Guatemala (conducted by University of Calgary) and by studies on the actual situation in Alta Verapaz conducted by Energia Sin Fronteras, (refer to Annex 5, questionnaire undertaken in Las Conchas).

In rural area of Guatemala, firewood is the most important source of the nation's energy and 86,1% of rural families in Guatemala's (944.000 households) use fuel wood to cook. There is no definite price for this source, since time and work load and environmental impact has not been taken into account [3].

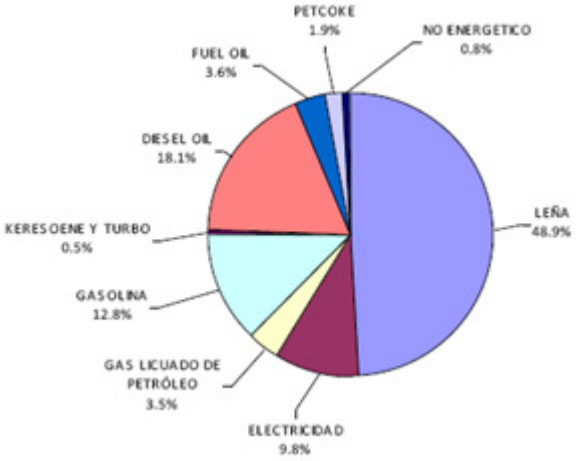


Figure 2. Energy consumption by type. Source: Departamento de Desarrollo Energético, Unidad de Planificación Energética, Government of Guatemala, June 2004

In case of Alta Verapaz, according to EsF's statistics, the main source of lighting in rural area of Guatemala are wood, candles, kerosene, torch (batteries required) while the possible source to supply the electricity for public facilities and household will be diesel generators in absence of solar photovoltaic systems provided by the PoA.

The justification of this baseline scenario is also built on the comparison of different alternatives to solve the problem we demonstrated above:

Grid Connection: Although there is legislation available to expand the grid throughout the state, but due to the low level of economic development and isolated location, there is no expectation for electricity grid access for these 13 indigenous communities in a short or medium term.

Hydropower: The alternative has been studied based on the managing entity EsF's extensive experience, and the Karstic geological condition was identified which could bring to the projects risk and uncertain results.

Wind farm: The managing entity EsF gave up developing the program with this technology due to the scarcity of wind source in this region.

[3] DIAGNOSTICO DEL SECTOR ENERGETICO EN EL AREA RURAL DE GUATEMALA
http://www.infoiarna.org.gt/media/file/areas/energia/documentos/nac/(4)%20Diagnostico_Energia_Rural_Guatemala.pdf

As a conclusion, the solar photovoltaic system has been considered the only feasible solution to supply electricity to the Alta Verpaz region. Moreover, due to some pilot projects implemented by Guatemalan Government, this PV technology has been widely and positively accepted.

The priority of the target buildings have been given to public facilities like school, hospital/health centers thus the baseline scenario would be described in detail as:

Solar photovoltaic system with capacity standards from 20Wp, 60Wp, 150Wp, 200Wp to 450Wp will be set up to generate sufficient electricity for lighting, running electronic appliance such as television, computer, DVD and medicament refrigerators which would otherwise have to be powered through diesel generators purchased by facility users; hence the baseline scenario would be emissions caused from use of diesel generators in absence of solar PV system installation.

E.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the SSC-CPA being included as registered PoA (assessment and demonstration of additionality of SSC-CPA): >>

E.5.1. Assessment and demonstration of additionality for a typical SSC-CPA:

>> Here the PPs shall demonstrate, using the procedure provided in the baseline and monitoring methodology applied, additionality of a typical CPA.

Additionality Tool

UNFCCC's "Tool for demonstration and assessment of additionality", version 05.2, is used as the basis for determination of additionality of the SSC-CPA.

Step1. Identification of alternatives to the project activity consistent with mandatory laws and regulations.

Sub-step 1a. Define alternatives to the project activity

Three alternatives to a typical SSC-CPA have been identified:

4. The activity could occur without being registered as a SSC-CPA through government support. The Guatemalan government would provide rural isolated areas of the country with access to electricity by extending the grid or by implementing renewable energy projects such as the installation of solar photovoltaic systems. There are significant barriers to this alternative scenario. Most importantly, there is currently no budget for such an undertaking, since the implementation either of the grid extension or renewable energy projects require a high investment and a very low internal rate of return due to the low income and paying capacity of the communities of these isolated areas. In addition, there is no intention or will in government to undertake such costly projects.
5. The activity could occur without being registered as a SSC-CPA through private sector support. Energy companies operating in the country, in cooperation with solar panels producers and distributors, would identify the supply of energy to rural isolated communities as a business in the bottom of the pyramid, implementing as a result electrification programmes using photovoltaic technology. The main barrier identified to this scenario is the past behaviour of the electricity companies, very reluctant to provide services to low income isolated communities.

6. Continuation of the current situation is also a possible alternative scenario. The baseline alternatives include either continued use of candles, torches and kerosene for lighting, and biomass combustion for cooking and heating purposes, or the use of electric generators.

Outcome of step 1a

Realistic and credible alternative scenarios to the project activity have been identified.

Sub-step 1b. Consistency with mandatory laws and regulations

Each of the potential alternatives to the project discussed above:

- The project occurring without being registered as a SSC-CPA through government support
- The project occurring without being registered as a SSC-CPA through private sector support
- Continuation of the current situation

are consistent with Guatemala's laws and regulations.

Outcome of step 1b

A typical SSC-CPA is therefore not the only alternative amongst those considered that complies with mandatory regulations. Other realistic and credible scenarios to the project activity are in compliance with mandatory legislation and regulations taking into account the enforcement in the region or country and EB decisions on national and/or sectoral policies and regulations.

Step2. Investment analysis

This analysis should demonstrate that the proposed project activity is not economically or financially feasible without the revenue from the sale of certified emission reductions (CERs).

In this case the revenue generated from the CERs will not compensate the high initial cost of solar photovoltaic systems, so that the PoA will not be financially feasible even with the revenue of pCDM.

The figure below demonstrates the gap of critical factors between two technologies based on the same baseline methodology, using as a consequence the same emission factor. Solar Related Energy has very low competiveness due to its high initial investment, as it is reflected in the higher minimum prices for break-even.

Annual CERs per biodigester	CER minimum price for break-even (EUR)	CER price for IRR of 15 % (EUR)
10	2.4	3.3
5	4.7	6.5
2.5	9.4	12.9

Table 3. Indicative level of CER revenues and CERs per biodigester required for break-even and IRR of 15%. Source: PoA Blueprint Book, KfW Bankengruppe, 2009.

Annual CERs per SWH	CER minimum price for break-even (EUR)	CER price for IRR of 15% (EUR)
2.5	6.8	13.7
1.25	13.6	27.4
0.5	33.9	68.5

Table 4. Indicative level of CER prices and CERs per SWH required for break-even and IRR of 15%. Source: PoA Blueprint Book, KfW Bankengruppe, 2009.

Therefore, it would be reasonable to adjust the emission factor in AMS-I.A to tackle this "unfairness", taking into consideration the high contribution of Solar Related System to the achievement of sustainable development and its usefulness as rural electrification tool in isolated rural areas with dispersed population.

Step3. Barrier analysis

This analysis will discuss credible barriers that would prevent the implementation of the proposed project activity from being carried out if the project activity was not registered as a CDM activity.

Institutional and regulatory barriers.

In Guatemala there is a framework for the promotion of renewable energies, which is not being properly enforced by the authorities due to the slow pace of economic growth and to the impact of a long period of civil war.

Regarding the current situation of lack of electrification in rural isolated areas, the government lacks the will and the budget to design and implement electrification plans, neither through the extension of the grid nor through the installation of stand alone renewable energy systems.

As a result the proposed project would not have the support of the government to be carried out, becoming the private sector support or the registry as a pCDM activity necessary.

Technological and infrastructural barriers.

The lack of properly trained labour to operate and maintain the technology in the region leads to an unacceptably high risk of equipment disrepair, malfunctioning or other underperformance which would prevent private companies from investing in these poor regions. Besides, the lack of infrastructure for implementation and logistics for maintenance of the technology would constitute an additional risk for private investment.

As a result the proposed project would not have the support of the private sector to be carried out, becoming the registry as a pCDM activity necessary.

Investment barriers.

As we have seen in step 2, CDM would not help the project to overcome the investment barrier. The project would not be profitable since the initial investment would not be compensated by the revenues produced by the CERs generated. As a result the project is not additional. The alternative scenario of continuation of current situation would be the most feasible in this case.

Step 2 together with Step 3 demonstrates that the proposed PoA is not additional, so that there is no need to go further into Step 4 "Common practice analysis". However the PoA-DD document will be further developed as if additionality were demonstrated.

E.5.2. Key criteria and data for assessing additionality of a SSC-CPA:

>> Here the PPs shall provide the key criteria for assessing additionality of a CPA when proposed to be included in the registered PoA. The criteria shall be based on additionality assessment undertaken in E.5.1 above. The project participants shall justify the choice of criteria based on analysis in above section.
It shall be demonstrated how these criteria would be applied to assess the additionality of a typical CPA at the time of inclusion.

NOTE: Information provided here shall be incorporated into the PoA specific CDM-SSC-CPA-DD that shall be included in documentation submitted by project participants at registration of PoA.

E.6. Estimation of Emission reductions of a CPA:

E.6.1. Explanation of methodological choices, provided in the approved baseline and monitoring methodology applied, selected for a typical SSC-CPA:

>> The proposed project is eligible as a small scale project category "Electricity generation by the user" AMS.I.A version 13. Emission reductions due to the project activity are considered to be equivalent to the emissions avoided by using diesel generator to supply the energy demand.

The baseline for the project activity is considered according to clause 7 of AMS I.A, Version 13, applicable for Type I.A CDM project activities, as contained in Appendix B of *Simplified Modalities and Procedures for Small scale CDM Project Activities.*

Equations for determining emission reductions are stipulated in section E.6.2 below.

As we mentioned previously, more than half of the energy source come from fuel wood, and a majority of residence also use candle, kerosene for cooking and lighting, if there is data base about wood and other biomass consumption, it is advisable to high light the comprehensive benefits that the solar photovoltaic system could bring to the indigenous communities.

E.6.2. Equations, including fixed parametric values, to be used for calculation of emission reductions of a SSC-CPA:

>> The proposed project is eligible as a small scale project category "Electricity generation by the user" AMS.I.A version 13. Emission reductions due to the project activity are considered to be equivalent to the emissions avoided by displacing the burning of fossil fuel like kerosene and diesel.
The baseline for the project activity is considered according to clause 7 of AMS I.A, Version 13, applicable for Type I.A CDM project activities, as contained in Appendix B of *Simplified Modalities and Procedures for Small scale CDM Project Activities.*
Among three options of energy baseline calculation, option 2 has been applied in this PoA energy baseline calculation considering the availability and accuracy of the data:

$E_{BL,\,y} = \Sigma_i EG_{i,y} / (1-l)$

Where:
$E_{BL, y}$ Annual energy baseline; kWh
Σ_i The sum over the group of "i" renewable energy technologies (e.g. renewable energy technologies for solar home systems, solar pumps) implemented as part of the project activity
$EG_{i,y}$ The estimated annual output of the renewable energy technologies of the group of "i" renewable energy technologies installed (kWh)
l Average technical distribution losses that would have been observed in diesel powered mini-grids installed by public programmes or distribution companies in isolated areas, expressed as a fraction[4]

For EF_{CO2} a default value of 0.8 kg CO_2-e/kWh -which is derived from diesel generation units- may be used. A small-scale project proponent may, **with adequate justification use a higher emissions factor from table I.D.1 under category AMS I.D.**

Table I.D.1

Emission factors for diesel generator systems (in kg CO_2e/kWh*) for three different levels of load factors**

Cases:	Mini-grid with 24 hour service	i) Mini-grid with temporary service (4-6 hr/day) ii)Productive applications iii) Water pumps	Mini-grid with storage
Load factors [%]	25%	50%	100%
<15 kW	2.4	1.4	1.2
>=15 <35 kW	1.9	1.3	1.1
>=35 <135 kW	1.3	1.0	1.0
>=135<200 kW	0.9	0.8	0.8
> 200 kW***	0.8	0.8	0.8

*) A conversion factor of 3.2 kg CO_2 per kg of diesel has been used (following revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories)
**) Figures are derived from fuel curves in the online manual of RETScreen International's PV 2000 model, downloadable from http://retscreen.net/
***) Default values

Table 3. . Emission factors for diesel generator systems. Source: UNFCCC, 2009.

Estimation of GHG emission reductions through installation of solar photovoltaic system as per clause 9, the energy baseline calculated in accordance with $BE_{CO2,y}$ calculated above times a default emission factor. IPCC default values for emission coefficients have been used.

$E_{BL, y} = \Sigma_i EG_{i,y} / (1-l)$
Where:
$E_{BL, y}$ Annual energy baseline; kWh
Σ_i The sum over the group of "i" renewable energy technologies (e.g. renewable energy technologies for solar home systems, solar pumps) implemented as part of the project activity
$EG_{i,y}$ The estimated annual output of the renewable energy technologies of the group of "i" renewable energy technologies installed (kWh)
l Average technical distribution losses that would have been observed in diesel powered mini-grids installed by public programmes or distribution companies in isolated areas, expressed as a fraction[5]

[4] A reasonable default value for distribution losses on low voltage rural distribution grid could be 20%

$E_B = \Sigma_i O_i / (1-l) = 12KWh/(1-20\%) = \mathbf{15KWh/year}$

From the research carried out by ESF, among all the units/locations that have been included in the PoA, the table below shows the corresponding coefficient this PoA should apply:

Types of Facilities	Hours/ Day	*EFco2*	$BE_{co2,y}$/KW	EB= Σi*Oi / (1-l)/tones*
Church	2 hours/day	1.2	15	18
School/Institution	5-7 hours/day	1.4	15	21
Sewer and Dryers	Productive applications	1.4	15	21
Hospital	24	2.4	15	36

¿Cuánto tiempo a la semana?:
La iglesia-salón, 10 h a la semana; la cocina comunitaria, 8 h a la semana; el molino, 21 h a la semana; la escuela de Primaria, 23 h a la semana; el Instituto Básico, 35 h a la semana; la secadora, solo se usa en época de cosecha, 2 meses al año, 24 h cada semana.[6]

Take the conservative value from the options listed above, the PoA use 18tCo2 as a final emission reduction quantity.

Therefore, if it is assumed that the price of CERS is 12 €, the revenue generated from the PCDM would be 216 €/year. According to a recent study carried out by Cristina Limeres, based on the actual statistic from Guatemala case, CER price would have to be multiplied at least by 25-50 times. Alternatively, the dimension of the project would have to be scaled up to at least 500KW, 40 times.

E.6.3. Data and parameters that are to be reported in CDM-SSC-CPA-DD form:

(Copy this table for each data and parameter)

Data / Parameter:	**EFco2**
Data unit:	tCO_2e/kl
Description:	Emission factor for Diesel Generators
Source of data used:	AMS I A
Value applied:	1.4
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data has been taken according to the methodology AMS I.A methodology which states that a small-scale project proponent may, with adequate justification, use a higher emissions factor from table I.D.1 under category AMS I.D. According to the table, this PoA belongs to the category of the above mentioned small-scale project under 15KW, and the emission factor varies from 1.4 to 2.4.Considering the scale may vary in the future inclusion of facilities, conservative value has been applied.

[5] A reasonable default value for distribution losses on low voltage rural distribution grid could be 20%

[6] Cuestionario para la caracterización de las comunidades

Any comment:	

E.7. Application of the monitoring methodology and description of the monitoring plan:

D.7.1. Data and parameters to be monitored by each SSC-CPA:

(Copy this table for each data and parameter)	
Data / Parameter:	N/A
Data unit:	N/A
Description:	N/A
Source of data to be used:	N/A
Value of data applied for the purpose of calculating expected emission reductions in section B.5	N/A
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	
Any comment:	

E.7.2. Description of the monitoring plan for a SSC-CPA:

>> An annual check of all systems thereof to ensure that they are operating .

E.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

>>9th July, 2009

Annex 1

CONTACT INFORMATION ON COORDINATING/MANAGING ENTITY and PARTICIPANTS IN THE PROGRAMME of ACTIVITIES

Organization:	
Street/P.O.Box:	
Building:	
City:	
State/Region:	
Postfix/ZIP:	
Country:	
Telephone:	
FAX:	
E-Mail:	
URL:	
Represented by:	
Title:	
Salutation:	
Last Name:	
Middle Name:	
First Name:	
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Annex 3

BASELINE INFORMATION

Annex 4

MONITORING INFORMATION

Annex 5

COMMUNITY CHARACTERIZATION QUESTIONNAIRE FOR LAS CONCHAS COMMUNITY

Cuestionario para la caracterización de las comunidades[7]

LAS CONCHAS

Equipo Proyecto GUATEMALA.
Energía sin Fronteras.

[7] Este cuestionario debe servir para conocer la situación actual de cada comunidad y también para ser analizadas sus respuestas en el momento de hacer la evaluación del proyecto.

INTRODUCCIÓN.

Con este cuestionario se pretende obtener una información lo más detallada posible de manera que se favorezca las posibilidades de éxito del proyecto.

Las preguntas pueden ser complementadas con las impresiones del entrevistador que sabrá orientarlas mejor de acuerdo a sus apreciaciones personales. Especialmente en la parte final del cuestionario. La única precaución es que se realicen antes de abandonar la población de manera que las dudas que pudieran surgir fuesen resueltas sobre la marcha con la ayuda del entrevistado si fuera necesario.

Para responder a las preguntas bastará seleccionar la respuesta o respuestas correctas, mediante un círculo o sencillamente subrayando lo que se desee.

Se muestra a continuación **algunos ejemplos**, de cómo se puede responder a las preguntas:

¿Existen bares o cantinas? **Sí** No

¿Existe disponibilidad de recursos energéticos renovables: solar, desechos animales o vegetales, eólicos o geotérmicos? Indicar cuáles.

Asigne las siguientes clasificaciones:

1. Totalmente en desacuerdo.
2. Desacuerdo.
3. Indiferente.
4. De acuerdo.
5. Totalmente de acuerdo

¿Con las fuentes energéticas y eléctricas que usa ahora le es suficiente y se siente bien? **Respuesta: 1 (quiere decir totalmente desacuerdo)**

Al terminar cada pregunta podrá añadir todos los comentarios que se consideren oportunos, bien por el entrevistado como por el entrevistador. Si no fuese suficiente el espacio que queda, puede indicarse al final de este cuestionario, o incluso anexar hojas con respuestas o documentos adjuntos.

1. Datos identificación encuesta:

Nombre de la comunidad:

Las Conchas

Fecha de la entrevista:

Enero de 2005

Entrevistador:

Nombre: ***Rafael Luis Luna Brea***

Cargo: ***Misionero laico y representante legal de la Asociación Familia Marianista Guatemalteca (F.M.G.)***

Entrevistado:

Nombre: ***Juan Ramón Caal***

Posición en la comunidad: ***Presidente y representante legal de la Asociación "Tierra Colorada" de la Comunidad "Las Conchas"***

Nivel de estudios: ***Primaria***

Sexo: ***Hombre***

Edad: ***34***

2. Datos poblacionales:

Número de familias en la comunidad:

39

Número de habitantes en la comunidad:

- Total: ***239 habitantes***
- Hombres: ***40 hombres***
- Mujeres: ***42 mujeres***
- Niños (ambos sexos hasta 13 años): ***145 niños + 12 jóvenes (entre 13 y 17 años)***

Acceso a la comunidad:

Ciudad más cercana:

Nombre: *Cobán*

Distancia: *72 kms (40 kms carretera asfaltada, 30 kms terracería)*

Cuanto se tarda desde la ciudad más cercana a la comunidad y en que tipo de transporte:

2 horas aproximadamente

Vehículo Pick up todo terreno con doble tracción (o microbús; 3h en camión)

3. Recursos energéticos:

3.1. ¿A qué distancia se encuentra la red eléctrica? ¿A qué nivel de tensión?
A 32 km. 110Voltios (34,5 kV)

3.2. ¿Existe algún río próximo a la comunidad? ¿Es caudaloso durante todo el año o tiene épocas de sequía?

Si. No es caudaloso. Hay épocas en que casi se seca y baja muy poco agua. (río Canilla)

3.3. **¿Existe disponibilidad de recursos energéticos renovables:** solar, desechos animales o vegetales, eólicos o geotérmicos? Indicar cuales.

Solar y desechos vegetales (no tanto animales)

4. Infraestructuras:

4.1. Viviendas

4.1.1. Tipo de viviendas:

a) Son de cemento (blocks), madera, bambú u otros materiales: ***Madera***

b) **Son viviendas fijas**

c) Son viviendas provisionales

4.1.2. ¿Están techadas?

En caso afirmativo indicar el material

Si Lámina casi todas. Solo algunas tienen techo de fibra vegetal (la lámina es de metal; latón)

4.1.3. ¿Se usan las viviendas para otras actividades? Subraye cuales

Carpintería, artesanía, sastrería, género textil, orfebrería, peluquería o manicura, lavandería, molino, tienda de alimentos o restaurante, cine o video, almacén, taller de reparación,....*No*

Indique otras (si las hay):

4.1.4. Origen del consumo del agua para beber:

Manantial, río o lago superficial, excavación directa, sistema con tuberías, se compra en algún establecimiento,

Otras (especificar):

4.2. Suministro de Agua

4.2.1. Tiempo usado en adquirir el agua para beber (minutos, si es otra unidad especificar): ***Depende de la lejanía de la casa al río o al llena cántaros, pero el promedio es de 10 minutos.***

4.2.2. Forma de transporte: (subraye la opción correcta):

manual, animal, bombas eléctricas, bombas diesel, otras .....

4.2.3. ¿Cómo se hace el suministro de agua en temporada seca?

A través del agua del río (aunque trae poca) y a través del único manantial que no se seca nunca.

4.3. Lugares comunales:

5.3.1. ¿Existen lugares comunales?, en caso afirmativo indicar cuales:

Sí: Una iglesia-salón de usos múltiples (reunión, asamblea, etc), una cocina comunitaria, un molino MIXTAMAL, una escuela de primaria, un institutobásico, una secadora de cardamomo.

5.3.2. ¿Para qué se usan?

La iglesia-salón para servicios religiosos y reuniones, asambleas, etc; la cocina para cocinar; el molino para triturar maíz y hacer harina; la escuela y el instituto para clases y reuniones; la secadora para secar cardamomo.

5.3.3. ¿Cuánto tiempo a la semana?:

La iglesia-salón, 10 h a la semana; la cocina comunitaria, 8 h a la semana; el molino, 21 h a la semana; la escuela de Primaria, 23 h a la semana; el Instituto Básico, 35 h a la semana; la secadora, solo se usa en época de cosecha, 2 meses al año, 24 h cada semana.

4.4. Existe algún hospital o posta de salud: Sí **No**

En caso afirmativo.

Dispone de sala de quirófano, internamiento: Sí No

Atendida por médicos, enfermeras o auxiliares de enfermería: Sí No

Atención :

a) Permanentemente

b) Sólo unas horas a la semana o al día

4.5. Saneamiento:

¿Dispone la comunidad de alcantarillado? Sí **No**

En caso afirmativo, ¿Qué estado tiene?:

¿Existe un basurero? Sí **No**

Tipo de letrinas o baños se usan: ***letrinas (pozo ciego)***

4.6. Educación:

¿Existe alguna escuela? Sí No

4.6.1. En caso de <u>sí existir</u> una escuela:

Máximo nivel de estudios disponible en la comunidad:

3º de Básico (Equivalente a 3º de ESO en España)

Cantidad de alumnado infantil y adulto:

Infantil: ***Escuela Primaria (1º a 6º Primaria), 85 niños (todos son de la comunidad)***

Adulto: ***Instituto Básico (1º,2º y 3º Básica), 110 jóvenes (Estos 110 jóvenes provienen de 15 comunidades o aldeas vecinas que acuden al Instituto de Las Conchas)***

¿Se va a ampliar la escuela de aquí a los próximos dos años?

Si. Se acaba de construir una nueva escuela de Primaria, de blocks y láminas. En cuanto al Instituto, se ha solicitado su amliación en 1 aula más, un salón- biblioteca, un laboratorio de Ciencias, un alojamiento (dormitorio de estudiantea) y 1 cancha deportiva. Además, dos módulos de letrinas.

4.6.2. En caso de <u>no existir</u>, ¿qué población podría ir a la escuela?

Infantil:

Adulto:

4.7. **Actividades de ocio en la comunidad:** (descríbase en el caso de existir cuanta el número de lugares, la población que disfruta de ellos habitualmente y la frecuencia, es decir si es todos los días, los festivos, los fines de semana...

Sólo actividades deportivas. Hay un campo de futbol y dos canastas de basket colocadas en el terreno de recreo frente a la escuela. Participan niños y jóvenes de la escuela y el Instituto, y además los jóvenes y hombres de la Comunidad en los fines de semana. Los niños juegan todos los días.

¿Existe video o cine? : Sí **No**

Número:

Población que lo participa:

Frecuencia de uso:

¿Existen bares o cantinas? Sí **No**

Número:

Población que lo participa:

Frecuencia de uso:

Otras actividades de ocio destacadas:

Sólo las de juego y deportes en los lugares descritos.

4.8. Se ha realizado algún proyecto en la comunidad sobre infraestructuras:

Indíquelo con un círculo: **Sí** No

En caso afirmativo:

Tipo de infraestructuras (carreteras, gaseoductos, edificaciones, industrias, otras.....): (Subraye o añada las que se hayan realizado)

¿Por parte de quién: gobierno, ONGs, particulares, asociaciones vecinales, otras instituciones (indicar): ***Municipalidad de Cobán: Escuela de Primaria, Asociación FMG: Instituto Básico***

¿Se tienen planes futuros de que se realice alguna infraestructura?

En caso afirmativo indicar cuál o cuáles y por parte de quién

Si. Se está terminando de diseñar el Proyecto de Agua domiciliaria en la Comunidad por parte de la Municipalidad de Cobán, pero no tiene aún financiación. La Asociación FMG está estudiando la ampliación del Instituto.

5. Datos económicos:

5.1. Datos de la comunidad:

Ingreso medio per cápita o por familia: (estimado)
18 Quetzales diarios = 390 Quetzales al mes = 4.680 Quetzales anuales (= 608 $ al año = 1,6 $ al día) (Q 700.00 por familia al mes)

Propiedad de la tierra (mayoritariamente):

Propietarios, arrendatarios, gratuito, comunal:

Propietarios, poseen Escritura Registrada.

Origen de la economía de la comunidad (% a cada una):

- Agricultura ***99%***
- Pesca
- Ganadería ***1%***
- Industria
- Otras (especificar):

5.2. Agricultura:

Tamaño de las tierras de cultivo (grandes explotaciones o **pequeñas y familiares)**:

Tipos de cultivos: **frutas** ***(plátano, naranja, piña)***, vegetales, arroz, coco, **cereales** ***(maíz exclusivamente),*** tubérculos u otros: **legumbre** ***(frijol); además, cardamomo***.

Son de regadío o secano:

Si son de regadío **formas de riego**: manual, animal, bombas eléctricas, bombas diesel: ***La única forma de riego es la lluvia tropical de la zona.***

5.3. Pesca:

Pesca de subsistencia, o venta en la comunidad o venta en otras comunidades,... :

Frecuencia de pesca:

Equipo de pesca: bote a motor o manual,...

5.4. Ganadería:

Tamaño (grandes granjas o pequeñas explotaciones ganaderas):

Tipo (aves de corral, ovejas, cerdos, vacas,...): ***Sólo el Comité de Mujeres posee 4 o 5 vacas y toros para carne.***

De donde se alimentan y beben agua (formas de suministro de esa agua): ***Beben en charcas y cubetas de agua.***

5.5. Industria:

¿Qué tipo de industrias existe en la comunidad? Enumerar.

¿Cuántas personas están implicadas en cada una de ellas?

¿Si tuviesen electricidad cree que los propietarios de las industrias mejorarían la industria introduciendo maquinaria?

Si tienen negocios en casa: *Sólo hay 5 tiendecitas de artículos básicos de alimentación. Son tiendas familiares (de 5 familias)*

¿Cuánto trabajan y a que horas? ***Están abiertas todo el día (de 7 a 7 de la tarde)***

Ingresos:

Agricultura, pesca y ganadería: ***Ingresos de toda la Comunidad = 39 familias: 182.520 Quetzales al año = 23.703 $ al año.***

Industria:

Negocios: ***Ingresos anuales de las 5 tiendecitas de comestibles: 36.000 Quetzales = 4675 $.***

Subsidios del gobierno:

Otros (especificar):

6. Conocimientos Poblacionales: Preferencias

6.1. Preferencias:

Ordenar de menor (1) a mayor (6) preferencia los siguientes aspectos:

Agua limpia y potable: ***2º***

Alimentación: ***1º***

Electricidad: ***4º***

Sanidad: ***5º***

Seguridad: ***6º***

Otra diferente de las anteriores:

Educación: 3º

6.2. ¿De qué tecnologías de generación eléctrica han oído hablar o tienen conocimiento de su existencia?

Solar, eólica, mini hidráulica, geotérmica, **motores diesel**,...

¿Cómo saben de ella?

Radio, periódico, vecinos, otras comunidades, comercios,...

Motores Diesel: porque dos vecinos tienen un generador de energía de diesel.

Solar: porque el Centro de Salud, que está en otra Comunidad distante tiene ese servicio con 2 paneles solares.

6.3. ¿Si tuviesen electricidad para que la usarían? :

Casas, centros sociales, escuela, alumbrado público, centro de salud,...

La usarían para todo, pero priorizan así: casas, escuela, centros sociales, y alumbrado público (Centro de Salud no tienen).

6.4. Si desean suministro eléctrico ¿estarían dispuestos a pagar la inversión necesaria? :

1. No desean comprar.
2. Mediante créditos.
3. En efectivo.
4. **Es muy caro y por eso no lo compran**
5. Lo quieren pero no tienen acceso a créditos.
6. Esta muy lejos el lugar de venta y no tienen repuestos.

6.5. Si desean suministro eléctrico ¿estarían dispuestos a pagar el consumo de esa energía? :

1. No están dispuestos a pagar nada
2. No lo consideran necesario.
3. **Depende del precio** (poner al que estarían dispuestos al mes): ***10 Quetzales al mes (1,3 $)***
4. Sí, sea cual sea el precio (Precio razonable)

6.6. Otras Comunidades:

¿Conocen otras comunidades electrificadas? **Sí** No

¿Qué impresión tienen? ***Muy positiva. Desearían tener este servicio igual.***

¿Qué cosas buenas y malas creen que tienen?

Cosas buenas: Pueden tener (luz) a cualquier hora de la noche: para una emergencia, para que los niños estudien más tiempo, para que no se perjudique la vista, etc.

Cosas malas: Piensan que es muy cara.

7. Consumos energéticos:

7.1. Disponibilidad de electricidad:

¿Cuántas personas o familias disponen de electricidad? ¿Desde cuándo?

Ninguna.

¿Cómo la obtienen?

¿Cuántas no tienen esa disponibilidad? ***Todas las familias.***

¿Se ha realizado alguna solicitud al gobierno o alguna organización para la obtención del servicio eléctrico? ¿Cuántas y cuándo?

La Comunidad no ha realizado ninguna solicitud, pero el anterior alcalde regional de la zona (que tiene 41 Comunidades) si lo hizo una vez al Ministerio de Energía y Minas de Guatemala, hace unos 5 años, pero sin recibir respuesta.

7.2. Otras fuentes de Energía

¿Qué tipo de fuentes energéticas han usado en sus actividades últimamente? :

Leña, queroseno, LPG, deshechos vegetales o animales, solar, eólica, **pilas**, baterías de carros, **velas**, geotérmica, electricidad,...

¿Para que actividades las utilizan?

Cocinar, **calentar agua** (lavar ropa, bañarse,...), negocios, **iluminación**,...

¿Cómo y quién se encarga de conseguirlo?

Recolectándolo ellos mismos, comprándolo en la comunidad ó fuera, otras...

Leña: recolectan ellos mismos.

Velas y pilas: las compran en las tiendecitas de su Comunidad

¿Se dedica alguien a vender de estas fuentes energéticas en la comunidad?

Si, las 5 familias de la s5 tiendecitas de la Comunidad (pilas y velas).

¿Existen motores que se usen para generación electricidad?

Si, hay 2 vecinos que tienen sendos generadores de diesel para electricidad.

En caso afirmativo:

¿Cuántos? : ***2***

Su uso es para **iluminación**, **alimentación de refrigeradores***, bombeo de agua, otros… ***(*En el caso de un vecino, ya que es el propietario de una de las tiendecitas)***

Costes (combustible + mantenimiento):

Cuesta 25 Quetzales por 1 galón de Diesel (es lo que consume cada generador)

Reparaciones de estos motores: ***No gastan nada en su mantenimiento***

¿Dónde se realizan: en la comunidad o fuera? ***Fuera (en Cobán)***

¿Con qué frecuencia son necesarias? ***1 vez al año (dependiendo del caso y frecuencia de uso que le da al generador)***

¿Cuánto se tarda en realizar una reparación? ¿Precio de la reparación?

Entre 1 y 3 días. Dependiendo de la gravedad, entre 100 y 300 Quetzales.

¿Qué tipo de energía utilizan para iluminarse?

Velas, **linternas**, queroseno, solar, eólica, motores diesel, red, otras.

¿Se usan pilas y/o baterías de coches?

¿Para qué usos y cuánto tiempo? :(señalar e indicar el tiempo a la derecha)

Para cocinar, cenar, estudiar (los niños y jóvenes), para reuniones.

a) Usos productivos (**cazar***, tiendas,...): ***(* sólo algunas veces)***

b) Usos domésticos (electrodomésticos, **radio/casete**, televisión,...)

c) Otros usos: ***Especialmente linternas.***

¿Dónde las adquieren y a que precio inicial tienen?

Las adquieren en las 5 tiendecitas de la Comunidad. Cuestan 2,5 Quetzales cada pila mediana para linterna o radio-cassete.

8. Características sociales:

¿Qué tipo de asociaciones existe en la comunidad? : (Selecciones una o varias respuestas)

Cooperativas, asociaciones campesinas, vecinales, ONG's, comités de desarrollo rural...***Existe 1 Asociación Civil: "Tierra Colorada" y 1 Comité de Desarrollo rural (COCODE: Consejo Comunitario de Desarrollo.***

¿A qué se dedican?

La Asociación Civil se dedica a defender sus derechos sobre la tierra, y el COCODE se dedica a gestionar proyectos de desarrollo.

¿Alguna de ellas se implicaría en un proyecto de electrificación?

Si. Cualquiera de las 2 instancias se implicaría en un proyecto de electrificación con mucho gusto.

¿**Qué actividades o asociaciones están organizadas y gestionas por la propia comunidad?**

¿Existe algún tipo de persona y/o establecimiento relacionado con aspectos técnicos generales? Aspectos técnicos equivalen a personas que trabajen en algún taller o trabajos parecidos a talleres de mecánica, de soldadura, etc...

¿Cuáles?

¿Existe alguno relacionado con la electricidad y/o electrónica? ¿Cuántos?

¿Existen distintas culturas dentro en la comunidad? ¿Cuáles?

¿Existen varias clases sociales en la comunidad?

¿Hay gente con muchos menos recursos que otros?

¿En que esta basado su sistema de intercambio de bienes? ¿En el trueque, en sistemas comunales, en la moneda?

¿Hay medios de comunicación con otras poblaciones? (En caso afirmativo seleccione una o varias)

Radio, televisión, emisora de radio, teléfono, teléfono celular, Internet,

Otros medios: .....

¿Qué idioma se habla habitualmente en la comunidad?, ¿Hablan y entienden todos el español?

¿Qué religión se practica en la comunidad? Si son más de una, indicar porcentajes aproximados.

¿Cuál es el porcentaje de alfabetización en la comunidad? ¿Cuál es el porcentaje de los que saben leer y escribir? ***(76%)***

Papel de la mujer en la comunidad:

¿Existen tareas encomendadas de manera específica a las mujeres? ¿Cuáles son?

¿Participa la mujer de forma activa en la vida social de la comunidad?

9. Impresiones:

Asigne las siguientes clasificaciones: (indique el número delante de la pregunta)

6. Totalmente en desacuerdo.
7. Desacuerdo.
8. Indiferente (no tiene opinión formada sobre la pregunta).
9. De acuerdo.
10. Totalmente de acuerdo

A las siguientes preguntas:

¿Con las fuentes energéticas y eléctricas que usa ahora le es suficiente y se siente bien? ***2***

¿Estaría dispuesto a pagar por obtener electricidad? ***4***

¿La electricidad es importante para la educación de los hijos? ***5***

¿La electricidad hará que se sienta más seguro? 4

¿Le es difícil adquirir información y noticias en su comunidad? ***5***

¿Podría tener más tiempo libre si dispusiese de electricidad? ***4***

¿Trabajaría más tiempo si tuviese electricidad? ***4***

¿Mejoraría su vida en términos generales si tuviese electricidad? ***5***

¿Sería importante el disponer de electricidad para el suministro de agua en su comunidad? ***2***

¿Considera la electricidad cara? ***4***
¿Sería asequible para toda la comunidad? ***3***
¿La considera más barata que otras fuentes? ***4***
¿Cómo una fuente limpia de energía? ***4***
¿Peligrosa? ***2***
¿Sería muy conveniente para la productividad de los negocios? ***5***
¿Es sólo para usarla en pocas ocasiones? ***2***

Otras aclaraciones:

Escriba a continuación las aclaraciones y/o sugerencias y lo que consideren relevante y no haya sido tratado.

1.- Por parte de la persona entrevistada:

2.- Por el entrevistador:

La Comunidad de Las Conchas cuenta con una estructura organizativa que es la siguiente:

A) Un CONSEJO COMUNITARIO DE DESARROLLO = COCODE, cuyo presidente es a la vez el Alcalde Auxiliar de la Comunidad y que está recién electo: Don Santiago Coy.

En este COCODE se integran todos los demás Comités de la Comunidad, y que son:

- ***COEDUCA: Encargado de gestionar y administrar la escuela de Primaria supervisada y acreditada por PRONADE (Programa Nacional de Educación). Cuenta con 7 miembros. Presidente: Victor***
- ***Comité de Mujeres: Encargado de gestionar y administrar el molino Nixtamal y las 4 o 5 vaquitas que han conseguido comprar con los ahorros de la explotación de dicho molino.***
- ***Comité de Agua Entubada: Encargado de gestionar la solicitud de un proyecto de agua domiciliaria, que tras dos años de trabajo intenso se está logrando sacar adelante en sus fases de pre-inversión y diseño, por parte de la Municipalidad de Cobán. Tiene 7 miembros. Presidente: ……. López. Tras el estudio previo y el levantamiento topográfico se concluyó con que sólo es viable un proyecto de agua entubada mediante bombeo con bombas de agua desde un nacimiento próximo (alimentada por gasolina). La Comunidad está a una cota más elevada que el nacimiento.***
- ***Comité de ancianos o chinames, que se ocupa de los rituales y festividades religiosas (apoyado por 2 catequistas). Presidente: Ricardo Paau.***
- ***Comité de Tierras: Representa a la vez a la Asociación legal "Tierra Colorada", en la que se integra toda la Comunidad en pleno para asuntos relacionados con la tenencia y posesión de la tierra. Acaba de ser elegido como Presidente: Juan Ramón Caal.***
- ***Comité de espiritualidad: Integrado por 3 catequistas que colaboran con el Comité o Consejo de Ancianos. Presidente: Julio Coy.***
- ***Comité de comadronas: Formado por 3 comadronas que atienden partos. Presidenta: Julia Pop Ché.***

B) Una ASOCIACION LEGAL, llamada "Tierra Colorada", única que tiene personería jurídica y que integra a toda la Comunidad. Su presidente era Jorge Coc hasta hace una semana, fecha en que terminó su mandato. Ahora es Juan Ramón Caal.

Además la Comunidad cuenta con: 2 promotores de salud: Alfredo Coy y Jesús(?) Coc, capacitados esporádicamente por Cruz Roja (?), pero que no cuentan ni con instalación sanitaria ni con instrumental, ni con medicamentos para sus prácticas sanitarias.

Además de todo esto, en la Comunidad existe un Instituto Básico que es de carácter intercomunitario y que está regido por un COMITÉ DE PADRES del BASICO, en el que se integran padres de varias comunidades, no sólo de Las Conchas. Dicho Instituto actualmente cuenta sólo con 2 aulas de blocks con tejado de lámina y fue construido por la Asociación Las Conchas-Verapaz (Cádiz) con apoyo de su contraparte FMG (No dispone, al igual que el resto de edificios de la Comunidad, de ningún tipo de energía, por lo que las clases, el estudio y las reuniones, sólo pueden darse mientras hay luz solar, hasta las 4:30 o 5:30 de la tarde, según la época del año.

La Comunidad no sólo está anuente sino muy deseosa de poder contar alguna vez con energía para iluminarse. Es una vieja aspiración de la Comunidad (y de muchas otras del entorno), que la UNION FENOSA, a través de su filial distribuidora DEORSA, quienes proveen de electricidad en gran parte de Guatemala (con muchos conflictos y deficiencias), no están dispuestos…(a atender?) a corto ni a medio plazo.

Además en el centro de la Comunidad se levanta la casa de habitación de la Asociación FMG, desde la cual las personas que activan, trabajan o colaboran con dicha Asociación, desarrollan su labor con ésta y otras Comunidades.

Este edificio, grande (1 salón, 1 cocina, 2 baños, y 2 dormitorios), de blocks y tejado de lámina, es el único en 10 kms a la redonda que cuenta con energía (paneles solares).

Sobre las horas de luz solar en esta zona, varía ligeramente según la época del año (lluvias o sequía, ya que no existe la tradicional división entre: verano, otoño, primavera e invierno), pero el promedio es de unas 11 a 12 horas: de 6 de la mañana a 6 de la tarde (muy aproximadamente).

Parte que debe ser rellenada por el entrevistador:

Acceso a la comunidad:

Breve descripción del camino, carretera, río,... para acceder a la comunidad como que tipos de camino se deben recorrer y sus distancias (cuantos kilómetros por carretera cuantos por camino de tierra,...), su estado y que tipos de vehículos pueden transitar de manera sencilla por ellas.

¿Hay alguna época en que se dificulte el acceso a la comunidad? (por ejemplo lluvias o inundaciones en época húmeda):

Para acceder a la Comunidad desde Cobán, se toma la carretera asfaltada que va en dirección a CHISEC (Municipio a 75 Kms de Cobán). En el Km 40 de esa carretera, a la altura de la Comunidad BALBATZUL-CUBILGÜITZ se desvía la ruta para ir en dirección a PLAYA GRANDE CANTABAL (IXCAN), que ya es otro Municipio grande en otro Departamento. Esta desviación es ya una carretera de terracería (arena, piedra prensada) de 70 Kms de longitud, que acaba en SALAWIN (Comunidad grande en el extremo Norte de esta carretera que confluye en el cruce de la carretera asfaltada que va de CANABAL a CHISEL, por el Norte). Pues en el Km 32 de esa carretera de terracería que va de Cubilgüitz a Salawin está la Comunidad Las Conchas. El estado de la carretera es variable según la estación del año, aunque a lo largo de todo el año (los 12 meses) se puede llegar bien hasta la Comunidad. En época de lluvias …(hasta noviembre o enero ¿)hay lodo, … y los baches son muchos, empeoran, se agrandan y profundizan. En época de calor mejora, pero siempre hay … hoyos que salvar.

A pesar de que la carretera no es buena por su firme, si es lo suficientemente ancha y llana. De hecho, hay varias furgonetas y hasta 2 autobuses que la recorren todos los días. El acceso por esta carretera de terracería debe hacerse preferentemente con vehículos todo terreno, pick-ups, land-rover y mejor aún si es de doble tracción, aunque algunos se aventuran a hacerlo con turismos, a pesar de los hoyos y lo que sufren los amortiguadores. (……..?).

Conocimientos Poblacionales: Preferencias, ¿Conocen otras comunidades electrificadas?

En caso afirmativo, ¿cuáles son las tecnologías empleadas?, y si pueden valorar
Si. Hay 1 sola Comunidad en toda la región que está dotada de electrificación con ENERGIA SOLAR domiciliaria (un panel en cada casa). La Comunidad se llama NIMLAJACOC y es, digamos, la capital de la región. Está a 20 minutos en coche de Las Conchas.
¿Les parece buena esa tecnología o creen que otra sería mejor? ¿Cuál?
Si, es excelente, limpia, barata, inagotable y sostenible. Es la mejor de las opciones. Además, esta opinión no sólo es de los habitantes de esa Comunidad (NIMLAJACOC), sino de los responsables que lo proyectaron.
El Proyecto de electrificar NIMLAJACOC con paneles solares lo ejecutó hace unos 5 años el Ministerio de Energía y Minas de Guatemala, con el apoyo de un Consorcio de Instituciones (ONG´s, Municipalidad, etc) que lo avaló.

Tiempo empleado en rellenar este cuestionario (desde que empieza la entrevista hasta que llega a esta pregunta):
2 días (unas 4 ó 5 horas cada día)

Annex 6

PLANNING MATRIX

	RESUMEN DESCRIPTIVO	INDICADORES VERIFICABLES OBJETIVAMENTE	FUENTES DE VERIFICACIÓN	HIPÓTESIS
OBJETIVO GENERAL	Mejorar las condiciones de vida de la población en los ámbitos sanitarios, educativo y social favoreciendo su precaria actividad económica.	- Incremento Horas Asistencia Sanitaria - Incremento Horas Lectivas Educación - Incremento Horas Autoorganización social - Mayor productividad económica	Actas de aceptación de las instalaciones firmadas por los COCODES de las comunidades.	Las instalaciones funcionan correctamente y a satisfacción de los beneficiarios
OBJETIVO ESPECÍFICO	Electrificación mediante energía solar fotovoltaica, limpia, sostenible y de bajo mantenimiento de 120 edificios de uso comunitario en las 13 comunidades indígenas mayas anteriormente identificadas.	- Potencia total instalada - Puntos de luz y fuerza instalados	Recibos de Pago de cuotas Informes de los Comités de Energía.	- Las familias pagan sus cuotas. - Los beneficiarios utilizan la luz.

RESULTADOS	1. Se ha completado satisfactoriamente la electrificación de edificios de las comunidades. 2. Se ha realizado la capacitación de los agentes que se ocuparán del mantenimiento de las instalaciones en cada una de las aldeas y la formación a las comunidades sobre el uso eficiente y el cuidado de las instalaciones. 3. Los COCODEs de las comunidades se han hecho cargo de la conservación y mantenimiento de las instalaciones en sus respectivas comunidades.	1. 116 edificios disponen de suministro eléctrico: - (Comunidad / Edificios) - (Las Conchas / 8), - (Copalaá la Esperanza / 10), - (Roc-Ha-Pasacuc / 11), - (Gancho Caoba I / 5), - (San José Peñablanca II / 8), - (La Sultana / 9), (Sapox / 8), - (Sesajab I / 9), - (La Cumbre Se Pacay / 10), - (Santa Elena Sa Tolohox / 10), - (La Ceiba-Copalhá / 8), - (Cuxpemech-Copalhá / 8), - (Sa Laguna Grande / 10). 2. 72 personas de los Comités de Energía de las comunidades (el 25% mujeres) están capacitadas para la operación y mantenimiento de los sistemas. En todas las familias que pagan cuotas por el uso de la energía alguien conoce el uso eficiente y seguro de las instalaciones (el 30% mujeres). 3. Las instalaciones funcionan con la única asistencia de los COCODEs de las comunidades.	1. Contratos de compra de equipos y materiales, fichas técnicas y Actas de recepción de cada una de las instalaciones. 2. Listados de asistencia y Diplomas/Informes de capacitación. 3. - Acta de compromiso firmada por los COCODEs aceptando los términos del Convenio con la Contraparte. - Creación de Comités de Energía. - Actas de Cesión propiedad. - Eventuales acuerdos del COCODE con el suministrador de los equipos para el mantenimiento y repuestos.	1. - El diseño y especificaciones de las instalaciones es correcto. - La exención de derechos arancelarios para la importación de equipos se hace efectiva. Ley Incentivos Desarrollo Proyectos Energía Renovable (Decreto 52-2003) - No hay retrasos significativos en los suministros. 2. El personal de los COCODEs está suficientemente cualificado para recibir la formación. 3. Los COCODEs llegan a acuerdos con las familias para el pago de las cuotas para el mantenimiento.

ACTIVIDADES	0.1 Dirección, coordinación, seguimiento y control de pagos 1.1 Preparar diseño modular para cada tipo de local y especificaciones de compra de equipos y materiales. 1.2 Emitir solicitudes de oferta, seleccionar suministrador y emitir pedido de equipos y materiales, incluyendo su instalación y mantenimiento durante 6 meses desde la entrega de las instalaciones, y los repuestos necesarios. 1.3 Recepcionar y almacenar equipos en almacén de la contraparte. 1.4 Instalar equipos y su cableado hasta los puntos de consumo en todos los edificios designados en cada comunidad y completar las pruebas funcionales. 2.1 Realizar jornada de capacitación de los agentes de operación y mantenimiento para cada una de las comunidades. Formación en grupos de 6 personas por comunidad, en sesiones de un día de duración, impartida por instructores locales del suministrador. 2.2 Realizar sesiones de instrucción sobre el uso eficiente y la seguridad de las instalaciones para los representantes de las familias en cada una de las comunidades. Sesiones de 4 horas impartidas por instructores locales del suministrador. 3.1 Firma de acuerdos entre los COCODEs de las comunidades y la contraparte para que los COCODEs se hagan cargo del mantenimiento de sus instalaciones. 3.2 Realizar acuerdos entre los COCODEs de las comunidades y las familias para establecer cuotas por el servicio eléctrico destinadas a financiar el mantenimiento de las instalaciones. 3.3 Firma de acuerdos entre los COCODEs de las comunidades y el suministrador de los equipos para el mantenimiento y suministro de repuestos. 3.4 Hacer entrega formal y documentada de las instalaciones a las 13 comunidades. 4.1 Actividades transversales destinadas a promover la participación de las mujeres en los Comités de Energía y su asistencia a las sesiones de instrucción sobre el uso eficiente y seguridad de las instalaciones.	**Recursos y Costes** Actividad 0.1 - 3 Personas Dirección y Coordinación (dedicación 5% durante 20 meses) ---------- 1.243,66 € - Supervisión de contrata (130h)---------- 0,00 € Actividades 1.1 y 1.2 - Equipo de Ingenieros (120h) y viaje de replanteo – 2.078,77 € Actividades 1.3 y 1.4 - Equipos según especificaciones ---------- 100.868,22 € - Mano de obra no cualificada (20 meses-hombre) --- 498,09 € - Transporte e instalación ---------- 11.700,36 € - Contrato de mantenimiento, asistencia y garantía -- 3.714,40 € Actividades 2.1 y 2.2 - Material de capacitación ---------- 15.695,71 € - 2 Personas (dedicación 5% durante 20 meses) ----- 1.243,66 € Actividad 3.4 - Evaluación de resultados EsF y externa ---------- 13.379,08 €

Part 3

Conclussions

Proposed Future Research Lines

Throughout the analysis and research work undertaken to prepare this report, a better understanding of the complexity of the Clean Development Mechanism and its applicability was achieved. In doing so, new ideas, reflections and conclusions have arisen and provided us information to answer the initially proposed research question: "*Does pCDM represent a window of opportunity for EsF?*" The **conclusions** reached are the following ones:

1. **It would not be recommendable for EsF to apply pCDM to the Alta Verapaz rural electrification project since:**
    - **The profitability of the project is very low.**
      The initial investment needed to carry out the project is very high due to the current lack of competitiveness of solar photovoltaic technology compared to conventional fossil fuel systems. Due to the low baseline CO_2 emission levels, the CERs generated are quite low as well, thus being the CER associated revenues not sufficient to compensate the high initial required investment. This is so even if the project was scaled up. As a result, CDM does not help overcome the investment barriers to the project which is, as a consequence, not additional.
    - **EsF's scale up capacity is at present quite limited.**
      EsF's current operational structure should be updated if a scale up process is to be undertaken. EsF should establish partnerships with other NGOs, technology suppliers and distributors looking for synergies that allow them to gain the managerial and implementation capacity to undertake a new scaled up project with a substantial higher magnitude.
      Besides, scaling up would require higher levels of technology standardization. The ideal situation would involve the development of a common set of PV modules for all communities, easing the scale up process and allowing economies of scale. The Bangladesh project of installation of Solar Home Systems is a good example of how the standardization of the equipment installed eases the scale up process. This standardization is pretty difficult to achieve in Alta Verapaz due to the different energy demands and the diversity of needs and uses each community gives to electricity. The development of tailored systems constitutes a quite inefficient, time consuming and logistically far more complicated mechanism.
    - **The lack of reliable and consistent reference cases.**
      As it has been mentioned before, there is no one single pCDM PV project registered or even validated in the pipeline. The closest case -in terms of technology applied and general features of the project-, is the Grammeen Shakti's Solar Home Systems installation project in Bangladesh. This case has not been validated yet, and it is still in an initial phase –both in terms of format and content of its PDD- to play a role as reliable reference case. The only pCDM project almost validated (currently asked for review) is CUIDEMOS Mexico, an energy efficiency project which involves light bulbs substitution. This case can be useful to some extent, but since the technology used is so different and it has not been registered yet, it is not a totally reliable source of information.
      Together with the lack of reference cases, the youth of the mechanism results in a lack of experts and people actively involved in this kind of projects to contact to and lessons learnt. Even if EsF had the resources and will to undertake a pCDM project, the lack of references to learn from would constitute a barrier to success.
    - **Transaction costs are still pretty high**.
      Despite the efforts made to reduce the transaction costs associated to a pCDM, as it has been previously pointed out, the high level of bureaucracy surrounding the mechanism still results in high transaction costs. Being optimistic, around

48.000€ are to be devoted to this kind of expenses, a not very reasonable figure for an organization like EsF.

- **The youth and ambiguity of pCDM result in a lack of consistency of this tool.**
  pCDM is a young tool lacking rigorous guidelines and concise tools that define and ease processes such as additionality demonstration or baseline determination. This results in a design failure that prevents developers from getting involved in such a complicated process and partially explains the small amount of pCDM projects currently in the pipeline. Its youth, on the other hand, provides a window of opportunity for future development and further improvement. This is the main reason why keeping the track of pCDM is highly advisable.

2. **The feasibility of the project could significantly increase if certain adjustments were implemented:**
   - The value of CERs should be adjusted so that not only CO_2 emissions reduction had a market value, but also the contribution to the achievement of sustainable development. This adjustment could be carried out in two different ways:
     - Through the emissions factor in the baseline calculation.
       While doing the baseline calculation, the emissions factor could be weighted by a SD coefficient so that the calculated amount of emissions reduced and therefore the CERs generated would be higher, even when the actual emissions reduction is not so significant but there is a remarkable contribution to sustainable development.
     - Through the creation of "Sustainable Development CERs".
       A parallel sustainable development CERs system would be created. A series of sustainable development indicators should be defined aligned with SD national strategies. Then a baseline could be defined and the resulting improvements associated to the implementation of the project would generate SD-CERs. Despite the increase in cost and difficulty of measuring this kind of indicators, from our point of view, it would constitute an interesting issue to explore.
   - Given the current lack of competitiveness of photovoltaic technology, a microcredit financing scheme similar to the one being successfully implemented in Bangladesh would be an interesting option for this kind of projects. The model is based on a soft credit system through installments to make the acquisition of Solar Home Systems affordable to low-income householders, who could at the same time see how their repayment capacity increases due to the income generation activities favored by the microcredit framework.
   - As it has been already pointed out, EsF's operational structure should be modified, and networking and partnering fostered. This should take place in order to undertake a significant scaling up and further successful implementation of the pCDM project.
   - Transaction costs reduction, bureaucracy cutback, elimination of ambiguity in procedures and guidelines in favor of consistency and reliability are examples of other important general adjustments to be undertaken for the future improvement of the mechanism.

3. **There are some external benefits not taken into account leading to a market failure.**
   It seems that a certain detachment exists between the market mechanisms driving CDM and sustainable development, which apparently is not properly incorporated in this market scheme. Some externalities in the form of social and development benefits are taking place in this economic transaction without being taken into account in the CER

price. Put it in another way, the current CER price does not reflect the full benefits derived from rural electrification projects. An internalization of such socio-economic externalities is needed if pCDM is intended to really help non-Annex I countries in achieving sustainable development.

4. **Is it too much for CDM?**
   A crucial question arises at this point: Is too much being demanded from CDM? These mechanisms were born with the double objective of helping Annex I countries in complying with their emissions limitation and reduction commitments as well as non-Annex I countries in achieving sustainable development. Given the magnitude of both objectives, this is probably a too ambitious goal for a single mechanism.
   Specific tools for the promotion and achievement of sustainable development could be developed, offering incentives other than revenue generation through CO_2 emissions reduction. Different formulas would be possible. For instance business in the bottom of the pyramid, where the incentive would be the access to a huge emerging market of low-income people (which will constitute the middle class of the future). Alternatively, regulatory measures agreed at the international level would also be possible, through the creation, for instance, of a sustainable development fund similar to the adaptation fund. Those Annex I countries and companies investing in non-Annex I should devote a certain percentage of their revenues to the SD fund, which would be later used to implement projects focused to promote the achievement of the Millenium Development Goals. Finally, Corporate Social Responsibility linked projects, where the incentive would be the creation of blended value for both the company and the society and the environment, would be also an appealing approach.

5. **However, pCDM is a very interesting and promising tool to take into consideration since:**
   - **It contributes to sustainable development, giving a step forward compared to the original CDM approach.**
     Furthermore, pCDM broadens the scope of CDM due to the nature of the projects it includes, such as dispersed mitigation activities like renewable energy or energy efficiency in homes and buildings; transportation projects; emission reductions projects at household and small and medium enterprises level as well as projects in developing countries currently underrepresented in CDM portfolio due to the fact that they have no/few large point emission sources.
   - **It contributes to the achievement of the Millenium Development Goals.**
     As it has been previously mentioned, providing poor people with access to electricity is crucial for the achievement of each one of the MDGs.
   - **It is an innovative concept.**
     pCDM's spirit, despite being of small scale, is to foster development in broad underdeveloped regions. It highlights "the power of the small": great impacts can be generated and ambitious goals achieved through the establishment of synergies between small little actions.
   - **It is a dynamic mechanism, in constant evolution.**
     During the course of this research and analysis project -which has taken place during a relatively short period of time-, various relevant improvements have been achieved such as the possibility of application of several methodologies to the same PoA and the reduction of the liability of the DOE. This shows that pCDM is a "learning by doing" tool constantly evolving and improving for its future mainstreaming.
   - **It is a flexible mechanism.**
     pCDM can be easily integrated in a microfinance based government strategy for the promotion of sustainable development.

- **When photovoltaic technology becomes more price competitive, pCDM will be a very interesting option to reckon.**

This study should be considered as a starting point which leads many opened doors to continue working. In particular, other approaches that provide pCDM projects with flexible, handy and effective toolkits should be explored. When such new approaches are undertaken, EsF could take advantage of these approaches in order to be able to implement successfully rural electrification projects under the pCDM.

We suggest continue building a strong base of knowledge management in order to help pCDM become a more efficient tool to mitigate climate change and help achieve sustainable development.

Our recommended **future lines** of research include:

Develop core sets of indicators to measure sustainable development in parallel with indicators to measure emission reduction of CO_2**. Such indicators should** take into account specific sectors, technologies as well as geographic and social context so that Executive Board members, together with project developers would be able to incorporate these indicators into new methodologies.

Promote and recommend different types of partnership models between government, private sectors, financial institutions and civil society. By doing so, it would be possible to ensure the project viability through interdependent alliances while taking into account specific sectors, technologies, social and historical context as well as development priorities in host countries. Through these recommendations, future developers could adopt the most suitable partnership model based on their specific requirements.

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Annex I

CONTACTED PEOPLE AND ATTENDED CONFERENCES

The experts, academics and professionals, consulted for the preparation of the present report are listed below:

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The conferences and events attended for the compilation and update of information are presented next:

- EsF's Project Presentation. **April 2009.**

- Presentation of the United Nations Climate Change Conference 2009 by the Danish Minister of Foreign Affairs Dr. Per Stig Møller. Organized by Climate Consortium Denmark. **11th May 2009.**

- Conference "*Energías Renovables: Una Oportunidad de Desarrollo para Zonas Rurales Aisladas de América Latina"*. Presentation of the EU programme Euro-Solar. Organized by SOCOIN. **20th May, 2009.**

- *"Jornada sobre la Contribución al Desarrollo Humano del Mecanismo de Desarrollo Limpio (MDL) del Protocolo de Kyoto"*. Organized by Grupo de Cooperación en Organización, Calidad y Medio Ambiente (GOCMA), Universidad Politécnica de Madrid and Intermón Oxfam. **19th June, 2009.**

Study on the applicability of Programmatic CDM to rural electrification projects. A case study of a photovoltaic project in Alta Verapaz, Guatemala

EXECUTIVE SUMMARY

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July 2009

ABSTRACT

There is a growing international awareness regarding two of the greatest challenges the world is currently facing: climate change and poverty. Efforts to tackle these problems can no longer be separated if we want to promote sustainable development in a holistic way. Moreover, developing countries, despite having the least responsibility in climate change, are the ones facing its greatest consequences which greatly jeopardize their achievements towards meeting the Millennium Development Goals (MDGs). In this context, promoting sustainable energy access can contribute to poverty reduction efforts as well as to fight climate change.

Within the Kyoto Protocol policy instruments, the Clean Development Mechanism was designed as a flexible mechanism which was aimed at reducing global emissions at the same time as promoting sustainable development in developing countries. However, international experience shows that despite this original dual goal, it has not yet benefited some of the poorest rural communities. In order to amend this limitation, a new CDM approach has recently been created named Programmatic CDM (pCDM). However, given its early stage of development, doubts exist regarding its capacity to become an effective market instrument that helps finance rural electrification projects, which greatly contribute to sustainable development in developing countries.

Given such background, this work attempts to analyze wether or not Progammatic CDM is a viable instrument to partially finance rural electrification projects, like the ones promoted by Energía Sin Fronteras (EsF), a pioneer Spanish NGO whose goal is to fight poverty by promoting energy access as well as water and sanitation projects around the world.

In order to shed some light to this debate, two approaches have been taken: Firstly, a thorough review of existing pCDM has been conducted in order to extract some lessons learned. Secondly, a real ESF project case has been studied. In particular, a successful photovoltaic rural electrification project in Guatemala, the Alta Verapaz case, has been considered and it has been hypothesized if scaling up this project would meet the Programmatic CDM requirements.

Results of this research project indicate that:

i. It would not be recommendable for EsF to submit the Alta Verapaz project to the pCDM procedures given its low CER associated revenues and its high photovoltaic technology investment costs compared to fossil fuel based systems. Besides, the current scale up capacity of EsF is quite limited and the transaction costs are still very high, thus out of the scope of this organization. Finally, the youth and ambiguity of pCDM result in a lack of consistency of the tool, discouraging investors and leading to a lack of reliable and sound reference cases.

ii. The feasibility of the project could significantly increase if the price of CERs were adjusted so that the revenues generated would compensate for the high required initial investment. The implementation of a microfinance financing scheme would also increase the viability of the project, as well as the reduction of transaction costs and the elimination of ambiguity in procedures and guidelines.

iii. Some externalities in the form of social and development benefits are taking place in this economic transaction without being taken into account in the CER price. In other words, the current CER price does not reflect the full benefits derived from rural electrification projects. An internalization of such externalities is a must if pCDM is to help non-Annex I countries in achieving sustainable development.

iv. CDM was born with the double objective of helping Annex I countries in complying with their emissions limitation and reduction commitments as well as non-Annex I countries in achieving sustainable development. Given the magnitude and complexity of

both objectives, this is probably a too ambitious goal for a single mechanism to properly and simultaneously account for both aspects.

v. Despite there are certain barriers to overcome, pCDM is a very interesting and promising tool to take into consideration since, compared to its predecessor, it represents a step forward in the contribution to sustainable development and the achievement of the Millenium Development Goals. Its most important features include: its dynamism, its flexibility and its innovative nature ("the power of the small": great impacts can be generated and ambitious goals achieved through the establishment of synergies between small little actions). Consequently, it is advisable to keep track of future developments of pCDM.

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1. LINKING ENERGY, HUMAN DEVELOPMENT AND CLIMATE CHANGE

There are 1.6 billion people in the world that don't have access to electricity and 2.5 billion rely on biomass for cooking and heating. On the other hand, 80% of the world`s population that do not have access to electricity live in rural areas.

Energy contributes to human development by many ways: it enables economic growth by increasing productivity, industrial activity and employment creation; moreover, electricity services improve conditions in schools and clinics, as well as facilitates telecommunications; other energy services such as refrigeration, heating or cooking have also direct impacts on health, mortality reduction or poverty alleviation. In conclusion, energy represents a key factor for social welfare.

However, energy consumption may also have negative consequences for development if it continues based on an unsustainable model. The current energy system, mostly based on the use of fossil fuels, is generating serious effects on the environment and has led to one of the major problems that the world faces nowadays: climate change.

The concentration of CO_2 in the atmosphere has increased by 30% over the last century, and it is attributed directly or indirectly to human activity. The energy sector is responsible for more than a half of those emissions. Although developed nations have contributed by 70% to the emissions growth, developing countries –especially China and India- are expected to increase their emissions enormously.

Climate change represents a serious threat for human development. This can be observed by analyzing the impacts of global warming on each of the Millennium Development Goals – set of eight goals to be achieved by 2015 adopted by the United Nations. It will lead to agricultural losses, main economic activity of developing countries, as well as other material goods; it will increase the number of certain diseases; natural resources will be also altered… The interconnection of both issues seems clear.

On the other hand, due to both geographical reasons as well as to the lack of infrastructure and solid institutional framework, the poor world is especially vulnerable to climate change. Evidence shows that these areas are already suffering from the most devastating climate episodes.

This situation requires urgent action from the international community, through both mitigation and adaptation measures. The first category of actions is aimed at reducing CO_2 emissions worldwide, while the second one implies help from developed to developing nations to fight climate change and to adapt to its consequences.

The interrelation of human development and climate change requires coordinated efforts from the international community. In this sense, the Kyoto Protocol contains a market instrument created to tackle both issues in a simultaneous way: the Clean Development Mechanism (CDM).

2. THE CLEAN DEVELOPMENT MECHANISM

Historical Background

Mid-1980s: Climate change started to be an international growing concern as a result of the scientific evidence related to the impact of human activities on the climate, thus increasing concern of the general public about environmental issues.

1988: A scientific body, The Intergovernmental Panel on Climate Change (IPCC) was set by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) in order to provide information based on scientific evidence regarding climate change.

1990: The IPCC published a report confirming that climate change was a real threat. The growing concentration of anthropogenic greenhouse gases (GHGs) in the atmosphere would enhance the natural greenhouse effect, resulting in the global warming of the Earth's surface. In this context the Panel called for international agreements to deal with the problem.

1994: Creation of the United Nations Framework Convention on Climate Change (UNFCCC) and establishment of the Conference of the Parties (COP).

1997: Kyoto Protocol Convention about climate change set the objective of "*reducing their overall emissions by at least 5 per cent below 1990 levels in the commitment period 2008 to 2012.*" The Protocol establishes three different flexible mechanisms to help Annex I countries meet their emissions reduction goals by allowing them to reduce emissions in other countries at lower cost than they could achieve domestically.

These flexible mechanisms are the International Emission Trading, the Joint Implementation and the Clean Development Mechanism (CDM).

The CDM allows Annex I public and private sectors to implement GHGs emission reduction projects in developing countries, receiving the Certified Emission Reductions (CERs) in return, which can be used by the Annex I country or company to comply with its emission reduction goals. In addition, these projects have to promote sustainable development in the host countries.

A series of requirements are needed to obtain the project acceptance. The most relevant are the voluntary participation approved by each Party involved, the contribution to sustainable development in the recipient country, and the additionality principle, which implies that CO_2 reductions would not have occurred in absence of the project activity.

Actors involved

The agents involved in the process are: project participants, in charge of the design, formulation, financing, implementation and monitoring processes; Designated National Authority (DNA), in charge of the implementation of the national approval; Designated Operational Entity (DOE), in charge of the validation of the projects as well as the verification and certification of the emission reductions; Executive Board (EB), supreme organism of the CDM that, under the direct authority of the Parties, is in charge of final validation and registration of the project, issuance of CERs and accreditation of the DOEs.

Projects phases

- Project design and formulation: compliment with the basic requirements mentioned above. The main deliverable of this stage is the Project Design Document (PDD), showing the importance of both the baseline and monitoring methodologies used.
- National approval: evaluation of how the project contributes to national sustainable development
- Validation and registration: the PDD is reviewed by a DOE, which will engage the different stakeholders through a consultation process. DOE decides about the project validation and will submit it to the EB for formal registration.
- Project financing: it can be done by an Annex I country (government or company) or by a developing country, either through self financing or with the support of a multilateral source, such as a fund of the World Bank.

- Monitoring: project performance will be evaluated through indicators. The CERs generated are estimated in this phase too.
- Verification and certification: it ensures that the CERs have been obtained according to the conditions agreed upon the initial validation of the project.
- Issuance: the EB delivers the CERs.

Value of these mechanisms from both a developed and developing countries perspective

- Developed countries: they have a chance to invest in low-cost opportunities in developing countries whereas receiving credits for the resulting emissions reductions needed to comply with their emissions reduction objective.

- Developing countries: the mechanism creates an opportunity for them to attract international capital for projects, thus moving towards a less carbon-intensive economy. These projects will help them to decrease climate change vulnerability while increasing energy security.

The case of Spain

Spain is committed with the Kyoto protocol through a unanimous agreement made by every parliament party member. This agreement set an emissions reduction of 15% by 2008-2012, compared to 1990 emissions, which has been considered as a very challenging position in terms of mitigation efforts. Nevertheless, Spain is ranked as one of the worst industrialized countries with regards their GHG emissions reduction commitment, and consequently, a Climate Change and a Clean Energy Strategy were created. It is worth to remark that, in order to articulate Spain´s efforts to fight climate change, Spain has committed to participate in, at least, nine International Carbon Funds with a contribution equal to 20% of the Climate Change Strategy total budget. CDM represents, on one hand, a strategy to reduce costs to comply with Kyoto and, on the other, a tool to contribute in international cooperation projects. The public investment in CDM projects is aimed at obtaining carbon credits as well as contributing to sustainable development through clean technology transfer. The Spanish CDM projects are mainly developed in Latin America, Eastern Europe, Maghreb and emerging economies such as China, Brazil, India and other countries of Pacific Asia.

Contribution of CDM to sustainable development

The holistic approach to sustainable development entails issues such as poverty reduction, intra-generational issues, local environmental health benefits, employment generation and economic growth prospects. Environmental, social and economic criteria must be considered in the project design in order to ensure that CDM actually contributes to sustainable development. The set of resulting impacts arisen from the projects have to be positive for sustainable development issues.

Projects distribution

The total number of CMD projects (including rejected and withdrawn) accounts for 4869. 2935 out of them are at validation state; 202 of them are currently in process of registration; and 1596 have already been registered.

If we look at the sector distribution of the projects, we can conclude that most of them correspond to renewable energy activities, accounting for 70% of the total. It is important to point out that even though HFC´s and PFC´s projects represent the 2% of the total projects, they hold the 25% of the CER expected by 2012.

Regarding the geographical distribution of the CDM projects, it is especially remarkable that most of them have taken place in India, China, Brazil and México, representing 76% of the projects that have been registered, validated or that are under registration process.

The experience accumulated over the last few years seems to indicate that there is a higher tendency from developed countries to implement projects in countries with a medium-high HDI and potential economic growth. The development criteria are not taken in account neither in the geographic nor sectorial project distribution.

CDM limitations

The limitations of CDM in terms of contribution to human development are very remarkable. A range of market barriers are found, mainly linked to high transactions costs per CER unit for small scale projects, limited access to financial resources and weak structural and institutional administrative capacities.

Communication problems, competitiveness and controversial interests of the actors involved are other problems usually found. These interests are sometimes far from the achievement of sustainable development goals. On the other hand, scarcity of resources and lack of participation from the affected communities are also recurrent limitations.

The procedures contemplate as well some constraints such as the lack of funds for small scale projects and doubts about the integrity of the additionality principle.

Consequently, some future lines of action should be further developed including the promotion of working capacity of public and private institutions, the proper definition of the specific financing mechanisms and the encouragement of participation of every single actor affected. In order to facilitate CDM small scale projects which largely contribute to community development, a new instrument has been created called programmatic CDM

3. PROGRAMMATIC CDM

A Program of activities (PoA) –often called Programmatic CDM- is a newly created tool designed to develop an unlimited number of small scale projects (called CDM Program Activities, or CPAs) under the umbrella of an only program (PoA). This mechanism arises as a response of many of the criticisms that CDM has been subject to, especially those that point out the lack of real contribution of CDM to sustainable development.

The basic characteristics of a PoA are that it is a voluntary instrument, including a variable number of activities that have to apply the same baseline, technology, methodology and monitoring system. The PoA may be applied in more than one country and have both a non renewable lifecycle and a renewable one, up to 28 years (60 for afforestation and reforestation projects). Regarding the costs, they will be based on the expected annual emission reduction registered, which means that future activities will not be charged.

In general terms, the life cycle of a PoA is very similar to the CDM's. A remarkable difference is that the PoA requires the preparation of two more documents, apart from the PDD, that include detailed information on the proposed CPAs. On the other hand, the DOE assumes higher liabilities in the case of Progammatic CDM.

The advantages of the use of this tool can be summarized as follows: it allows small activities to be gathered and, consequently, have a bigger impact; the activities can be easily replicated; it makes possible the development of transboundary programs; it encourages public sector participation; and, what it is crucial, it implies tangible impacts on the achievement of sustainable development, allowing the inclusion of poor rural areas to take part of it by

developing small and affordable activities in these communities. Programmatic CDM seems a promising opportunity for solar energy projects, which represent 37% of the pipeline programs.

Despite of the interesting benefits that this new mechanism might offer, there are few PoA experiences so far, and with the exception of one, all of them are still at validation state. The information available on these programs so far is poor.

Our research project analyses the expectations of the use of this instrument and suggest further steps in the development of this powerful tool, which needs to be strengthened by higher cooperation among the different actors involved. Poor countries have serious difficulties to host CDM projects, and they the need for international commitment and cooperation to be able to take advantage of the opportunities offered by Programmatic CDM.

4. ENERGIA SIN FRONTERAS GENERAL OVERVIEW

Energía sin Fronteras (EsF) is a Spanish independent organization, whose mission is to extend and to facilitate the access to energy and water sanitation to poor people. They also develop training programs and the places where they operate. Their projects are intended to contribute to the sustainable development of the beneficiary communities and have to be completely coherent with EsF's ethical principles, including respect of human rights, traditions and cultures, promotion of participative societies and development objectives.

EsF has a periodic financing source provided by annual quotas from employers, other institutions, volunteer contributions and occasional donations. For some specific projects, the financial source consists of loans and subsidies from national and international institutions.

Professionals and experts on the energy sector, volunteers companies, NGO´s, universities, public administration and counterparts in the developing countries are the main agents involved within the organization. It is important to point out that at EsF there is almost no hired staff, as it counts with excellent volunteers who carried out most of the organization activities.

Projects typology is based on both water and energy accessibility in isolated areas as well as training programs to local communities.They develop electrification, water supply and sanitation projects, especially in local communities in rural isolated areas,thus facilitating the access to services such as medical assistance, education, communication, etc.

EsF also has a study area, conducting publications of information related to energy and poverty, spreading awareness on these topics in collaboration with other NGO´s, universities or researching centers through seminars and conferences.

EsF mainly works in Sub-Saharan Africa and Latin America. Since 2004, EsF has been successfully developing different projects in 13 different countries.

5. PHOTOVOLTAIC ENERGY IN RURAL ELECTRIFICATION PROJECTS

Photovoltaic technology is based on the ability of certain materials (called semiconductors) to absorb sunlight and convert it into electricity. This effect is called Photovoltaic effect.

The basic unit of a photovoltaic system is the photovoltaic cell, which can be combined with more cells to form larger unites called modules. The collection of different modules is called array. These modular systems are designed according to the total amount of energy needed.

Solar home systems have become very popular for rural electrification applications. Its efficiency and profitability have been proven especially in remote areas, where grid extension is expensive and not affordable for the community. This technology is commonly used for low and middle- power consuming services (such us lighting and low to middle power consuming devices), which, at the same time, represents one of its main limitations.

There are many variables that determine the feasibility of a photovoltaic project in a given area. Experience has shown that both the way of life of the community as well as their social organization are key factors for the success of these projects. It is very important that the community participates and gets involved from the beginning of the process, so that they can feel as the owners of the project.

6. ALTA VERAPAZ PROGRAM

The Alta Verapaz Project aim was to provide energy for 13 communities of the Alta Verapaz region (Guatemala). This is one the poorest regions of the country, inhabited mainly by indigenous that were settled in this area after the Civil War. These communities reach very low levels of human development and suffer from very bad communication conditions. The beneficiary population amounted to 3.300 people, equal to 590 families. The technology chosen for the project was photovoltaic, due to reasons of affordability for the community and availability of the energy source. The grid extension option was discarded due to its high cost. Due to energy capacity restrictions, the program was limited to community buildings. The services provided were lighting, the operation of low power appliances and refrigeration for vaccines.

The total number of utilities within the program was 120, and they included schools, churches, clinics, community kitchens, mills, etc. In total, 71 photovoltaic systems were installed, and the installed power reached 12 kW. Each system consisted of one or more solar panels, a battery, a regulator and, in some cases, an inverter. The program was developed by Las Conchas Verapaz association in collaboration with Energia Sin Fronteras, and was finance by ICAI, Unión Fenosa and EsF. It has been very positively accepted by the communities. They contributed during the construction phase and have shown a high interest in learning about its maintenance.

7. DOES pCDM CONSTITUTE A WINDOW OF OPPORTUNITY FOR EsF?

After having studied Alta Verapaz case in detail and tried to apply pCDM by developing the Project Design Document some ideas, reflections and conclusions have arisen and provided us with the keys to gain some insight into how worthy it is for EsF to implement rural electrification projects under pCDM using photovoltaic technology.

The **conclusions** reached are the following ones:

1. **It would not be recommendable for EsF to apply pCDM to the Alta Verapaz rural electrification project since:**
    - **The profitability of the project is very low.**
      The initial investment needed to carry out the project is very high in relation to the low CO_2 emissions reduction achieved and CERs generated, thus being the revenues associated to the CERs not sufficient to compensate for the high initial investment required. As a result, the project is not additional.
    - **EsF's scale up capacity is at present quite limited.**
      EsF's current operational structure should be enlarged if a scale up process is to be undertaken. Partnering and establishing synergies are crucial in order for EsF

to gain the managerial and implementation capacity the new magnitude of the project would demand.
Besides, scaling up would require higher levels of technology standardization, easing the scale up process and allowing economies of scale. This standardization is pretty difficult to achieve in Alta Verapaz due to the different energy demands and the diversity of needs and uses each community gives to electricity.

- **The lack of reliable and consistent reference cases.**
  There is no one single pCDM PV project registered or even validated in the pipeline. Together with the lack of reference cases, the youth of the mechanism results in a lack of experts involved in this kind of projects to contact to and lessons learnt.
- **Transaction costs are still substantially high**.
  The high level of bureaucracy surrounding the mechanism results in high transaction costs, despite the efforts made to release pCDM of this heavy charge.
- **The youth and ambiguity of pCDM result in a lack of consistency of this tool.**
  pCDM is a young tool lacking rigorous guidelines and concise tools that define and ease processes such as additionality demonstration or baseline determination. Its early stage of development, on the other hand, provides it with a window of opportunity for future development and further improvement. This is the main reason why keeping the track of pCDM is highly advisable.

2. **The feasibility of the project could significantly increase if certain adjustments were implemented:**
   - The value of CERs should be adjusted so that not only CO_2 emissions reduction but also the contribution to the achievement of sustainable development has a market value. This adjustment could be carried out in two different ways:
     - Weighting the emissions factor by a SD coefficient in the baseline calculation.
     - Through the creation of a parallel system of "Sustainable Development CERs".
   - Given the current lack of competitiveness of photovoltaic technology, a microcredit financing scheme based on a soft credit system would be an interesting option for this kind of projects.
   - EsF's operational structure should be modified through networking and partnering for the proper scaling up and further successful implementation of the pCDM project.
   - Transaction costs reduction, bureaucracy cutback or elimination of ambiguity in procedures and guidelines are examples of other important general adjustments to be undertaken.

3. **There are some external benefits not taken into account leading to a market failure.**
   Some externalities in the form of social and development benefits are taking place in this economic transaction without being taken into account, thus resulting in the final price of CERs not reflecting the full benefits derived from the projects. An internalization of socio-economic externalities is needed if pCDM is intended to really help non-Annex I countries in achieving sustainable development.

4. **Is it too much for CDM?**
   CDM was born with the double objective of helping Annex I countries in complying with their emissions limitation and reduction commitments and non-Annex I countries

in achieving sustainable development. This is probably a too ambitious goal for a single mechanism.

Specific tools for the promotion and achievement of sustainable development could be developed, offering incentives other than revenue generation through CO_2 emissions reduction. Different formulas would be possible such as business in the bottom of the pyramid, regulatory measures agreed at the international level or Corporate Social Responsibility linked projects.

5. **However, pCDM is a very interesting and promising tool to take into consideration since:**
    - **It contributes to sustainable development, giving a step forward compared to the original CDM design.**
      Furthermore, pCDM broadens the scope of CDM due to the nature of the projects it includes such as disperse mitigation activities, energy efficiency, transportation or emission reductions projects at household and small and medium enterprises level.
    - **It contributes to the achievement of the Millenium Development Goals.**
      Providing people with access to electricity is crucial for the achievement of the MDGs.
    - **It is an innovative concept.**
      pCDM's spirit, despite being of small scale, is to foster development in broad underdeveloped regions. It highlights "the power of the small": great impacts can be generated and ambitious goals achieved through the establishment of synergies between small little actions.
    - **It is a dynamic mechanism, in constant evolution.**
      pCDM is a "learning by doing" tool constantly evolving and improving for its future mainstreaming.
    - **It is a flexible mechanism.**
      pCDM can be combined with other approaches such as microcredit financing schemes or government intervention through regulations.
    - **When photovoltaic technology becomes more competitive, pCDM will be a very interesting option to consider.**