CSPR Briefing

Sustainability and climate impact of selected CDM projects –

A compilation of seven student papers from a course in climate science and policy

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Centre for Climate Science and Policy Research

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PREFACE

This CSPR briefing is a compilation of seven course papers written in an advanced level university course called “Climate science and policy” led by the Centre for Climate Science and Policy Research (CSPR) in Norrköping. Madelene Ostwald, assistant professor at the centre, was the course leader. The students are all from different backgrounds and took the course as a Single Subject Course.

The main examination in the course was to write a paper, assessing sustainable development and climate impacts for different Clean Development Mechanism (CDM) projects as well as to discuss this in relation to the methodological parameters in a CDM project; baseline, additionality, permanence, leakage and monitoring. The students chose themselves which project to assess as well as which aspects to focus on. Out of the seven assessed CDM projects, five are Afforestation/Reforestation projects, one of which is large-scale and the rest small-scale projects. Two biomass projects are also assessed, one small-scale and one large-scale.

The editor for this CSPR briefing has been Lina Lundgren with assistance from Sabine Henders and Madelene Ostwald.

ABBREVIATIONS AND COMMONLY USED CONCEPTS

A/R – Afforestation/Reforestation
CH_4 – Methane
CO_2 – Carbon Dioxide
CO_2e – Carbon Dioxide equivalent
CER – Certified emission reduction[1]
GHG – Greenhouse gas
lCERs – long-term certified emission reduction[2]
PDD – Project Design Document
tCO_2e – tons of carbon dioxide equivalents
tCERs – temporary certifies emission reduction[3]
UNFCCC – United Nations Framework Convention on Climate Change

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[1] Unit issued in Article 12 of the Kyoto protocol equal to one metric ton of carbon dioxide equivalent.
[2] Expires by the end of the crediting period.
[3] Expires by the end of the commitment period of A/R CDM projects.

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INTRODUCTION

The United Nations Framework Convention on Climate Change (UNFCCC) was created in 1992 in order to address the threats of climate change. The main aim of the convention is to stabilize the concentration of greenhouse gases (GHG) in the atmosphere on a level where no dangerous interference with the climate system should occur. The Kyoto Protocol[4], created in 1997 during a UNFCCC parties meeting, sets binding targets for the identified Annex I[5] parties to reduce GHG emissions. Although emission targets are set in the Kyoto Protocol, it is up to each individual country to decide how the reduction should occur. As a supplement to national measures in reducing emissions three market-based mechanisms were established: Emissions Trading, The Clean Development Mechanism (CDM) and Joint Implementation (JI). The CDM focuses on projects in developing countries (see below for more details). These so-called flexible mechanisms were created to allow reducing emissions of GHGs in a cost efficient way, based on the assumption that one ton of emissions reduction has a global effect regardless of where it occurs - so it can be implemented where it is least expensive to reach the reduction (UNFCCC, 2008).

CLEAN DEVELOPMENT MECHANISM (CDM)

The CDM is defined in Article 12 of the Kyoto Protocol and allows Annex I parties to engage in projects to reduce emissions in developing nations, in addition to domestic measures within the own nation. When emissions are reduced the projects earn certified emission reductions (CERs), which can be sold on the carbon market. Apart from reducing emissions, CDM projects should help promoting sustainable development in the host country (United Nations, 1998; UNFCCC, 2008).

CDM projects can focus both on reducing emissions at sources (called source projects) and on removing emissions that already happened from the atmosphere, storing them in a sink (so-called sink projects), through land use, land-use change and forestry activities. These are limited to afforestation- and reforestation (A/R) projects, where new and additional carbon sinks are established (UNFCCC, 2008).

[4] An international agreement under the UNFCCC for reduction of GHGs.
[5] i.e. industrialised countries.

ASSESSED CDM PROJECTS

This briefing document is a compilation of seven assessments of different CDM projects, made by students at a master's level course in Climate Science and Policy. The main focus in the analyses is on sustainability and climate impacts of the projects, but different aspects of CDM have been highlighted by the authors. The following assessments are presented:

A. Afforestation and Reforestation projects

CDM Project 2241: Reforestation of severely degraded landmass in Khammam District of Andhra Pradesh, India under ITC Social Forestry Project

– *How do monoculture plantations compare to agroforestry when it comes to CO_2-sequestration and sustainable development?*

Host country: India
Author: Fredrik La Fleur, student at Master's programme in Science for Sustainable Development, Linköping University.

CDM Project 1578: Uganda Nile Basin Reforestation Project No. 3

– *Climate impact, sustainable development and CDM components*

Host country: Uganda
Author: Igor Keljalic, fil. mag. in Environmental Science, Linköping University. Took the course as a single subject course.

CDM Project 2694: Reforestation of croplands and grasslands in low income communities of Paraguarí Department, Paraguay

– *An assessment on sustainable development and climate impacts*

Host country: Paraguay
Author: Emelie Hallin, student at Master's programme in Political Science, Linköping University.

CDM Project 2345: Small Scale Cooperative Afforestation CDM Pilot Project Activity on Private Lands Affected by Shifting Sand Dunes in Sirsa, Haryana, India

– *Can it help achieving a more Sustainable Development in the Sirsa district?*

Host country: India
Author: Lina Lundgren, student at Master's programme in Science for Sustainable Development, Linköping University.

CDM Project 2363: Cao Phong Reforestation Project

– *An assessment of climate benefits and sustainable development promotion*

Host country: Vietnam
Author: Lotten Wiréhn, student at Master's programme in Science for Sustainable Development, Linköping University.

B. Biomass Projects

CDM Project 0231: CAMIL Itaqui Biomass Electricity Generation Project
– *Implications on sustainability*

Host country: Brazil
Author: Teiksma Buseva, student at Master's programme in Science for Sustainable Development, Linköping University.

CDM Project 0876: Partial substitution of fossil fuels with biomass in cement manufacture
– *A critical assessment of climate impacts*

Host country: Argentina
Author: Yaser Rezania, student at Master's programme in Science for Sustainable Development, Linköping University.

SUMMARY OF ASSESSED CDM PROJECTS

A summary of the projects and their climate impacts in form of carbon dioxide equivalent (CO_2e) reductions, as well as baseline conditions, can be seen in Table 1.

Table 1. Summary of the assessed CDM projects.

Project No	Country	Year of activity Start	Year of CDM registration	Length of first crediting period (yrs)	Type of project	Total Baseline removals/ emissions (tCO_2e)	Annual net reduction (tCO_2e)	Total net reduction (tCO_2e)
2241	India	2000	2009	30	L A/R	437.6*	57 792*	1 733 753*
1578	Uganda	2007	2009	20	S A/R	-	5 590*	111 798*
2694	Paraguay	2007	2009	20	S A/R	8 737*	1 523*	30 468*
2345	India	2008	2009	20	S A/R	860*	11 596*	231 920*
2363	Vietnam	2009	2009	16[6]	S A/R	-	2 665*	42 645*
0231	Brazil	2001	2006	7	S [1]	429 975**	57 341***	401 388***
0876	Argentina	2000	2007	10	L [2]	50 794**	5 271***	52 712***
						Total	**141 778**	**2 604 684**

tCO2e - tons of carbon dioxide equivalents,
L – Large scale, S – Small scale, A/R – Afforestation/Reforestation
[1]Energy industries, waste handling and disposal, agriculture,
[2]Manufacturing industries
* Sequestration, ** GHG-emissions, *** Emission reduction

The baseline in A/R projects is the removal (sequestration) of GHGs from the atmosphere through photosynthesis in vegetation already existing in the region before the project starts, and the reduction represents the sequestration by the planted forest. The baseline removal in

[6] Usually, A/R projects can have a crediting period of either 20 years (that can be renewed twice) or 30 years. A crediting period of 16 years is however given for project No 2363 in the project documents. Calculations for annual sequestration and total sequestration are therefore based on 16 years.

the table is the total removal from the baseline carbon stock, the existing vegetation, for the whole crediting period. In the case of Uganda (project 1578) and Vietnam (project 2363) no calculation was made for the baseline removal. This is because baseline removal is assumed to be zero due to the degradation of the land with an expected continued deterioration without the project (see further discussion in chapters 2 and 5).

The baseline in the non-forestry CDM projects 0231 in Brazil and 0876 in Argentina is the emission from the activity in the baseline scenario (the conditions without the project activities realized) and the reduction represents the emission reduction due to replacement of fossil fuels with biomass. The table shows the total baseline emissions for the whole crediting period.

The column for total reduction or removal represents the reduction/removal during the first crediting period. The amount is therefore dependent on the duration of the project. The annual reduction/removal represents the mean value for the amount of reduced emission or removed amount of GHGs from the atmosphere during the first crediting period.

Chapter 1

CDM project 2241: Reforestation of severely degraded landmass in Khammam District of Andhra Pradesh, India under ITC Social Forestry Project

– How do monoculture plantations compare to agroforestry when it comes to CO_2-sequestration and sustainable development?

by
Fredrik La Fleur

1 INTRODUCTION

This CDM project aims at creating a carbon sink by reforestation of severely degraded land in the Khammam district of the Andhra Pradesh region in India. The land is owned by poor tribal villagers and the project aims at creating both a carbon sink and income for the villagers when the planted Eucalyptus trees can be harvested (PDD No 2241, 2007).

The project has three objectives:

- To create a long-term secure income for the poor tribal villagers;
- To create a carbon sink through reforestation activities;
- To improve the soil and water erosion problem in the Godavari catchment area (PDD No 2241, 2007).

2 THE PROJECT

Local NGOs initiated the project, which should sequester carbon dioxide (CO_2) but also help promoting a more sustainable development in the region. The main developer of the project is ITC's Paperboards and Specialty Papers Division (PDD No 2241, 2007), which is India's largest paper and paper board producing company (ITC, 2010).

The project activity started in 2000, with consideration to future sale of CERs under the CDM, and was then registered as a CDM project in 2009. The crediting period is 30 years and started in 2001. The project has created a carbon sink by establishment of 3070 hectares Eucalyptus plantation. The project is planned around two plantation cycles, each 16 years long, which give the project an expected lifetime of 32 years (PDD No 2241, 2007).

The land area is according to the "Approved afforestation and reforestation baseline methodology - AR-AM0001" classified as severely degraded. The soil in the area is sandy with very low fertility and the ecosystems in the area consist of a handful of tree species, shrubs and underbrush, most of which show signs of stunted growth (PDD No 2241, 2007).

2.1 CLIMATE IMPACT

A few years after planting the trees the entire plantation is estimated to have a net removal between 50 000 and 75 000 tons of CO_2 equivalents (tCO_2e) per year. The first couple of years has a lower removal due to smaller amount of biomass in the plantation. The fluctuations between 50 000 and 75 000 tCO_2e removal are due to differences in sequestration depending on where in the plantation cycle the projects is. The yearly average net removal is 57 792 tCO_2e (PDD No 2241, 2007).

2.2 SUSTAINABLE DEVELOPMENT IMPACT

The Ministry of Environment and Forestry in India has developed four indicators when it comes to determining the level of sustainable development in a CDM project:

- Social well being
- Economic well being
- Environmental well being
- Technological well being (PDD No 2241, 2007)

All these aspects have been taken under consideration in the planning and implementation of the project. The “Social well being” is achieved by strengthening the village level institutions to empower the poor and deprived. The “Economic well being” is addressed by providing new sources of income for the tribal villagers. When it comes to aspects of the “Environmental well being” the project is not only a carbon sink but it also creates a “green belt” that reduces the soil erosion problem in the region. The “Technological well being” is solved by the information and technology sharing that takes place between the project developers and the tribal villagers. These techniques can be used by the villagers themselves to improve their situation (PDD No 2241, 2007).

3 DISCUSSION ABOUT METHODOLOGICAL PARAMETERS

3.1 BASELINE

The baseline term is used to define the reference case that the CDM project is compared to, this can be determined on a “business as usual” or scenario basis (UNFCCC, 2010a).

This CDM project uses the approved methodology AR-AM001 “Reforestation of degraded land” to determine the baseline carbon stock. Several baseline scenarios are established and discussed, but according to the PDD the only realistic and credible alternative use of the land is to continue down the same road as before (historical baseline), with no improvement in the area’s ability to act as a major carbon sink. This would mean that the entire area continues to remove between 14 and 15 tCO_2e every year, as established in the baseline. These calculations are based on both satellite imagery and vegetations surveys carried out before the plantation activity (PDD No 2241, 2007).

3.2 ADDITIONALITY

The project is required to result in greenhouse gas (GHG) removal from the atmosphere that would not have taken place without the project; this is called the additionality (UNFCCC, 2010a).

Studies in the area and interviews with the project´s stakeholders have determined that the only realistic and credible alternative to the CDM project is a continuation of the degrading land use practices in place today. The land used in this project is considered as economically unattractive and any development of the area outside the CDM project is hindered by financial, technical and institutional barriers and market risks (PDD No 2241, 2007).

The estimated sink created by the project during the crediting period is 1 733 753 tCO_2e, which gives an annual sink of 57 792 tCO_2e for the entire plantation area of 3070 hectares (PDD No 2241, 2007).

3.3 PERMANENCE

The concept of permanence is complex when it comes to A/R CDM projects. The reduction that takes place by sequestration may partially or completely be reversed by both natural events (e.g. wildfire or pests) and human activities (e.g. unplanned logging) (Shrestha et al., 2005).

Little is discussed in the PDD about the permanence of the project. The project has chosen long term CERs (lCERs) to address the non-permanence of the carbon sink created by the project (PDD No 2241, 2007). This means that the carbon credits are valid until the end of the crediting period (UNFCCC, 2010a), and have to be replaced with other, permanent carbon credits when the 30 year crediting period is over.

3.4 LEAKAGE

Leakage is a term that describes any GHG emission caused by the project that takes place outside the project boundary or timeframe (UNFCCC, 2010a). When it comes to leakage the project is assumed to not displace any activities that would increase the emissions in other places. The leakage that the project causes is mainly emission from transports of seedlings and harvested wood (PDD No 2241, 2007).

3.5 MONITORING

All CDM projects have to set up a monitoring plan for collecting and keeping track of the emissions caused, avoided and removed (UNFCCC, 2010a). This is an important component for future verification and should provide confidence that emission reductions and objectives are being achieved (Lee, 2004).

The project has a monitoring plan with parameters for most of the objectives previously discussed in the PDD. It covers aspects from preparation of the land and survival check to measurements of growth and emissions from transports (PDD No 2241, 2007). Monitoring plans act as the basis for future verifications, wherefore the focus is on emission reductions.

Social, economic and environmental impacts are generally not monitored, unless it is specified in the monitoring plan.

4 REFLECTIVE DISCUSSION

Of the 2015 CDM projects that have been registered by the end of 2009, only eleven of them are Afforestation and Reforestation (A/R) CDM projects. However, of those eleven projects, nine were registered in 2009, which indicates that the number of A/R CDM projects is on the rise (UNFCCC, 2010b).

The type of A/R CDM project (native forest or monoculture plantation) will have a large impact on how the project can improve the sustainability in the targeted region. According to Palm et al. (2009) the local conditions in the area considered for an A/R CDM project are crucial for understanding which type of project will be accepted. If only sustainable development parameters were considered then creating a forest plantation that resembles "natural" forests[7] with the variety of species and the same functions would yield better results, however, this may not result in same climate benefits as plantations (Palm et al., 2009). When it comes to reconstructing "natural" forests, studies have showed that many tree species are capable of growing on degraded land (Shono et al., 2007). Several studies also point towards the importance of matching species to the local conditions for successful reforestation (Shono et al., 2007; Dierick & Hölscher, 2009).

One technique that can lower the investment cost and in the long run create a form of natural forest built around several species that is capable of providing livelihood for small landholders, is Agro-Successional Restoration. This technique incorporates both agroecology and agroforestry techniques that generate income from an early stage onwards and increase in complexity and resilience over time when new species are added (Vieira et al., 2009).

The permanence aspect of A/R projects is influenced by both natural events and human activities (Shrestha et al., 2005). However, the acceptance by local inhabitants must also be calculated into this equation. According to the findings in a study by Palm et al. (2009) the natural-like forests are preferred as a resource by the villagers when sustainable development parameters are considered. This can help achieve a higher level of acceptance for the projects and help the restored areas to be preserved after the project ends.

There are many native species that can grow on degraded land and interplanting can speed up the restoration (Shono et al., 2007). Also the selection of species is important when it comes to the effect that the restoration will have on a region (Dierick & Hölscher, 2009). The species selected for this project are *Eucalyptus tereticornis Smith* and *Eucalyptus camaldulensis Dhen* and they will create a monoculture plantation with the preparation practice of burning the area before plantation and clearing of weeds to improve growth (PDD No 2241, 2007). This practice will severely limit the growth of native species that could have created more services that would benefit the villagers. Theories on Agro-Successional restoration of tropical forests presented by Vieira et al. (2009) become very relevant when this type of monoculture

[7] Conservation or management of natural forest (preventing deforestation) is not eligible as CDM projects.

plantations is analysed. The incorporation of agroecology and agroforestry has the possibility to create many benefits both for the small-scale landholders and for the preservation of the forests. This approach often involves the landholders in the restoration process and by including many different types of crops and trees it creates a diversified income that yields both short and long-term incomes (Vieira et al., 2009).

In the light of research being made in recent years (Shono et al., 2007; Dierick & Hölscher, 2009; Palm et al., 2009; Vieira et al., 2009) there should be some concern about where the A/R CDM projects are heading. To really achieve long-term sequestration of GHGs, the reforestation processes need to provide both self-sustaining ecosystems and areas that have value for the landowners. It is very hard today to say how these CDM projects will play out when they end in 20 to 30 years, however, research seems to suggest that there are better ways of reforesting severely degraded areas than the monoculture-type of plantations, such as agroforestry.

Chapter 2

CDM project 1578:
Uganda Nile Basin Reforestation Project No. 3
- Climate impact, sustainable development and CDM components

by
Igor Keljalic

1 INTRODUCTION

Uganda, a non-coastal country in East Africa and one of fairly few African countries involved in implementation of the Kyoto Protocol, is currently involved in a small-scale afforestation and reforestation (A/R) CDM project activity. One of the reasons for the CDM reforestation project is increasing demand for wood and wood products. This small-scale CDM A/R project is part of a cluster of five similar A/R projects in Uganda, aiming at overcoming barriers for timber plantations in Uganda and to benefit communities from CDM. This project is the first project cluster. Some of the project objectives are: counteracting the growing deforestation rate of Uganda's natural forest, regional economic benefits, and creating a new financing mechanism to overcome existing barriers to timber plantations in Uganda (PDD No 1578, 2006).

2 THE PROJECT

The project activities cover 342 hectares altogether and are located within the Rwoho Central Forest Reserve, which is a woodland reserve covering an area of 9 100 hectares. 50% of the reserved area is currently available for reforestation activities. The specific planting area for this project consists of degraded grasslands (since at least 1964) and there are no records of red-list species in the area. The following wood species will be planted: *Pinus caribaea* (75%), *Maesopsis eminii* (20%) and *Prunus Africana* (5%). Most up to date forest management techniques will be implemented and knowledge and information will be shared among project participants (PDD No 1578, 2006).

The main participants in this small-scale A/R CDM project are Uganda's National Forest Association (NFA), the Italian Ministry for the Environment and Territory and the BioCarbon Fund (The World Bank). Start-up funds for the projects are provided from the UK Department for International Development and the country of Norway. NFA is in charge of 93% of investors shares and project area (319.2 ha), whereas community groups consisting of private and community-based planting initiatives are in charge of the remaining 7% (22.7 ha). The reason for this distribution during the initiating stage of the project is that NFA is the only organisation in Uganda that currently provides confidence and insurance to the international investors. NFA is able to provide the required replacement guarantees in case of failure of project activities. The idea is that community groups like RECPA (Rwoho Environmental Conservation and Protection Association) with currently 250 members, some of which have experience in timber planting, will take responsibility for a larger portion of investor shares and project area as the project progresses and experience grows. It all depends on the outcome of this first project cluster. NFA will supervise the project and provide community groups with seedlings and technical advice, among other things. The community groups will receive monetary compensation for each ton carbon dioxide (tCO_2) sequestered. The price for every tCO_2 will be decided in an Emission Reductions Purchase Agreement between the NFA and the buyers. The community groups will be in charge of plantations protection and simple monitoring, among other things (PDD No 1578, 2006).

2.1 CLIMATE IMPACT

The project has a 20 year crediting period with the possibility of up to two renewed crediting periods. Thus the expected operational lifetime of the project is maximum 60 years (20 years times three crediting periods). The following carbon pools are considered: Above ground biomass; trees and woody perennials and below ground; i.e. roots. Annual average removal of greenhouse gases (GHG) is estimated to be 5 590 tCO_2e and for the first crediting period (20 years) the estimated net average removal is 111 798 tCO_2e (PDD No 1578, 2006).

2.2 SUSTAINABLE DEVELOPMENT IMPACTS

The main focus of discussion in CDM projects has been on GHG emission reductions or sequestration. When it comes to sustainable development the only requirement is a description from host countries on how the CDM project meets the pre-defined national sustainable development requirements (Winkler et al., 2005).

When it comes to CDM forestry projects in particular there are several positive effects in relation to sustainable development besides the previously mentioned investment and cost difficulties. Forestry can, for example, benefit the local environment when it comes to fulfilling energy needs locally and nationally, it may prevent droughts, floods and erosion, among other things (Haupt & von Lüpke, 2007). According to the PDD No 1578 (2006) there are several social and financial benefits for the local communities in the project area. For example, the forestry project will contribute to employment, education and steady incomes, especially in the early stage of the project where the NFA expects to employ 500 people from the local area (PDD No 1578, (2006). This is all in line with the goals for sustainable development that closely interlink with CDM investments. The objective of the CDM is not only to contribute to global reduction of GHG and to the emission rights market. CDM projects should also contribute to sustainable development at national level according to Article 12 of the Kyoto Protocol (United Nations, 1998). So even though the contribution to GHG reduction may be insignificant globally there may be several positive effects locally when it comes to sustainable development.

3 DISCUSSION ABOUT METHODOLOGICAL PARAMETERS

3.1 BASELINE

The chosen Baseline methodology is specially adapted for small-scale A/R projects (AR-AMS0001/Version 5). As mentioned earlier the chosen planting area for the project consists of degraded grassland. A historical baseline approach is used and a historical survey was conducted in the preparatory phase of the project to establish which significant changes in the carbon stock could occur in absence of the CDM project. No significant positive changes in the carbon stock are assumed to occur without the project (PDD No 1578, 2006).

Calculations considering the removals in the baseline scenario were not performed, as the biomass in woody perennials and belowground biomass is expected not to exceed the actual net removal of GHGs by sink. The change in carbon stock is therefore assumed to be zero and no calculated baseline removal of GHGs is found in the PDD.

3.2 ADDITIONALITY

According to the PDD it would have been impossible for NFA and community groups to implement and finance a project of this scale without financial support from the CDM. It would have been impossible to get a loan or sell the project on the market given the long period between investment and positive cash-flow. According to the baseline description in the PDD the project activity would not occur without CDM due to several barriers (besides financial barriers that are already mentioned) in the community area, e.g. lack of contemporary planting knowledge, local ecological conditions and because communities in the vicinity of the planting area are not able to sell agricultural crops at fair prices due to the long distance to nearest markets (PDD No 1578, 2006).

3.3 PERMANENCE

The project applies the use of tCERs when addressing permanence. The temporary nature of CERs from forestry projects is important to discuss when it comes to the non-permanence element of the project. According to the PDD, the project is designed so that harvesting and replanting are done during carefully calculated periods to minimize emission from the stock (PDD No 1578, 2006). Although measures are taken to minimize GHG emission from the stock it is practically impossible to foresee the future events that may cause emission of sequestered GHGs. There are both biotic and abiotic risks when it comes to permanence of a forest, such as storms, uncontrolled harvest, pests and plant diseases (Neef & Henders, 2006). Such risks and uncertainties are included in all A/R projects, which is why the carbon credits are not permanent but expire after a certain time, in the case of tCERs after 5 years. Then they have to be renewed either through re-issuance if the biomass is still in place at the next verification, or they have to be replaced through other carbon credits.

3.4 LEAKAGE

Another integral part of CDM projects is the issue of leakage, which is *"...the net change of anthropogenic emissions by sources of greenhouse gases (GHG) which occurs outside the project boundary, and which is measurable and attributable to the CDM project activity"* (UNFCCC, 2010, p. 21).

According to the PDD it has been concluded that no significant leakage will occur, given that no one will be forced to relocate as a result of the project and there are no agricultural production activities directly in the project area. There are some grazing cattle in the area but since it was established that average grazing is below 10% of the area's grazing capacity it can be neglected as specified in the methodology (PDD No 1578, 2006). Therefore a conclusion of the PDD No 1578 (2006) is that *"no leakage monitoring is required"* (p. 27).

3.5 MONITORING

Monitoring of carbon stock is yet another crucial component of A/R CDM projects. *"Monitoring refers to the collection and archiving of all relevant data necessary for estimating and measuring the net anthropogenic GHG removals by sinks during the crediting period"* (UNFCCC, 2010, p. 22). According to the PDD, monitoring will be divided in four steps. Step 1 includes monitoring of planting progress and measuring of the survival ratio during the initiating stages of the plantation. Step 2 includes monitoring of carbon stocks through a random sampling procedure. During step 3 measurements of tree height and diameter will be conducted and finally, during step 4, documentation of above-ground biomass and stem volumes will be conducted (PDD No 1578, 2006).

4 REFLECTIVE DISCUSSION

There are still many questions to be answered when it comes to small A/R CDM projects and their contribution to GHG reduction and sustainable development fulfilment, especially as the projects are still in an early stage. There are many sceptics who consider these kinds of A/R projects to be waste of time and money. Indeed Africa has a long way to go when it comes to work against corruption and bureaucracy that contributes to mistrust from potential investors. Project implementation and authorization have overall been slow and bureaucratic and that is one of the main reasons to low interests from foreign investors (Whitman & Lehmann, 2009).

The focus on GHG reduction can be questioned when it comes to small-scale A/R CDM projects given that their contribution to GHG reduction is relatively small globally. Maybe the greater gain would be to focus on local positive sustainable development effects, such as positive effects on local environment or income. According to Winkler et al. (2005) Africa as a continent only contributes to 2.9% of GHG and most of those emissions are based on so called survival emissions, resulting from fulfilment of basic human needs. Winkler believes that: *"Mitigation efforts should start with sustainable development, taking into account the current status of African countries"* (Winkler et al., 2005, p., 208).

One of the main problems when it comes to A/R projects is the issue of permanence. Dutschke (2001) mentions that there are many difficulties involved when it comes to permanence of carbon sequestration. He argues that, in theory, a few tons of sequestered GHGs do not contribute to any long-term reduction, given that catastrophic events such as fire, uncontrolled harvesting or something similar are enough to emit GHG fixed in vegetation. Dutschke (2001) alleges that sequestration (A/R) projects are only a temporary solution when it comes to GHG reduction. The Kyoto Protocol shares this assumption through the issuance of temporary carbon credits.

When it comes to monitoring, there are certain risks involved. According to Dutschke et al. (2005), there is always a risk of reduced interest and focus on monitoring, documentation and verification over time and this can lead to involuntary closure of the project. However, it is important to mention that these risks are bigger when it comes to ICER than tCER. tCERs are compensated at delivery so it is in project management's own interest to maintain an approved level of monitoring and verification (Dutschke et al., 2005). Monitoring can also lead to the dissemination of knowledge e.g. the residents in the project area or other project participants can be trained to monitor and document. This could lead to greater involvement on grass-root level and increase level of local control of the project and maybe even give back something to those who need it the most (Staddon, 2009).

In conclusion I believe that there are many obstacles when it comes to small-scale A/R projects especially in Africa due to already mentioned reasons. However, such projects are an important feature anyway when it comes to sustainable development and reduction of poverty. I think that primary reasons and focus for implementation of small-scale A/R CDM projects should be on these two features. These effects should be highlighted when it is time for assessment of the A/R CDM projects. It may show potential future investors that even though contribution to GHG reduction is limited there are other positive effects that may pay off in the future.

Chapter 3

CDM project 2694: Reforestation of croplands and grasslands in low income communities of Paraguari Department, Paraguay

- An assessment of sustainable development and climate impacts

by
Emelie Hallin

1 INTRODUCTION

The project is implemented in low income communities in the Acahay and the San Roque González de Santa Cruz Districts in the Paraguari department, one of the poorest departments in the south of Paraguay. The project was initiated by JIRCAS, the Japan International Research Center for Agricultural Sciences and is conducted in cooperation with INFONA, the National Forest Institute in Paraguay (PDD No 2694, 2009).

Due to El Niño, the lands experience heavy rainfall every five years, which leads to soil erosion. Frost is also a recurring phenomenon, and is more severe during the years of El Niño. The area is part of a grassland ecosystem with palm savannas called the Humid Chaco (PDD No 2694, 2009).

The farmers in the project area have a low income from small-scale farming on small eroded patches of soil. According to the PDD, they lack financial possibilities to change soil management practices on their own (PDD No 2694, 2009).

The general idea of the project is to improve soil conditions, achieve biodiversity and alleviate poverty among farmers by reforestation of croplands and grasslands. The project covers a total of 215 hectares of land (PDD No 2694, 2009).

2 THE PROJECT

The farmers within the project area lack besides technical skills and know-how, also the finances to start new and environmentally friendly practices by themselves (PDD No 2694, 2009). A technology transfer will take place through manuals, building on information from a study conducted in 2002 by the Government of Paraguay and the Japanese International Cooperation Agency, which will be handed out to the farmers: "*The implementation of the project activity will be carried out in a sustainable manner by JIRCAS, which will lead to valuable technology transfer*" (PDD No 2694, 2009 p.32).

The decision on which trees to plant was made in 2007 and 2008 after interviews with the farmers, also considering the trees' rates of carbon sequestration, biodiversity effects and values of forest products. Two kinds of Eucalyptus (*Eucalyptus grandis* & *Eucalyptus camaldulensis*) and Silver oak (*Grevillea robusta*) were chosen. Depending on the species, the first harvesting will take place when the trees are 12 or 20 years old (PDD No 2694, 2009).

Agroforestry will be used in a few of the areas, totally 52 hectares where farmers will combine planting *Grevillea robusta* with crops such as beans, corn, manioc and cotton (PDD No 2694, 2009).

2.1 CLIMATE IMPACT

A climate impact is achieved through capture of carbon dioxide (CO_2) from the atmosphere by the trees. An additional effect is that the planting of the trees will help prevent soil erosion. The plantations will sequester 30 468 tons of CO_2 equivalent (tCO_2e) in total, that is, annually approximately 1 523 tCO_2e over the crediting period of 20 years (PDD No 2694, 2009).

2.2 SUSTAINABLE DEVELOPMENT IMPACTS

In order to better respond to the needs of the population, the farmers were invited to participate in the process. Socio-economic benefits from the reforestation project are 'sustainable fuel wood supply', 'strengthening social cohesion', 'technical training and demonstration' as well as 'income generation'. Relevant is also that the participants or the host party could not think of any important negative socio-economic consequences (PDD No 2694, 2009).

Action is taken to ensure that the negative climate impacts will be as small as possible, for instance there will be no machinery used during the planting and the maintenance of the plantation, nor will any synthetic fertilizer be used by the farmers (PDD No 2694, 2009).

The disturbance at the sites will also be kept to a minimum. The existing trees that are in the area will not be removed and there should not be any endangered flora species within the area according to surveys (PDD No 2694, 2009).

3 DISCUSSION ABOUT METHODOLOGICAL PARAMETERS

3.1 BASELINE

The baseline scenario is calculated according to the "Simplified baseline and monitoring methodologies for selected small-scale afforestation and reforestation project activities under the Clean Development Mechanism, AR-AMS0001 (Version 04.1)". The baseline is in this document described as the use of land prior to the project activity; and in this case the land was used as grassland or cropland. According to the calculations the displacements of previous activities, such as crops and grazing cattle will be small, and some of the farmers will because of their financial situation not take up their activities in a new area (PDD No 2694, 2009).

In this project the baseline carbon content was estimated to be 8 737 tCO_2e. To establish the baseline, field surveys, literature reviews, interviews and expert consultations were used. Before the initiation of the project, the soil content of organic material, phosphorus and other substances was measured (PDD No 2694, 2009).

Relying on the guidelines from the simplified baseline and monitoring methodology, it was decided to focus on two of the carbon pools, above and below ground (PDD No 2694, 2009). A number of parameters need to be measured in order to calculate the environmental effects; among those are carbon stocks in the living biomass above and below ground, through measures of stratum, biomass, woody perennials, root shoot ratio and wood density (UNFCCC, 2008).

3.2 ADDITIONALITY

The project is additional in the sense that it could not have taken place otherwise, due to barriers such as problems with investment, institutional frameworks, prevailing practice and local ecological conditions. For example there were, according to the PDD, no possibilities for farmers to borrow money or get loans because payback would not have been possible until the first harvesting. Also, the project can be seen as risky due to a lack of previous experience among farmers. Only with funding from both JIRCAS and INFONA to provide the necessary initial funds for providing seedlings and training for the farmers the project could take place. INFONA would not have funded the project without expectation of carbon credits (PDD No 2694, 2009).

3.3 PERMANENCE

Permanence can be discussed both regarding the forest itself as well as the products produced. There are significant risks while growing the forest that can impend on the permanence, such as storms, forest fires and pest attacks, but also human interference. Some risks can be managed by ensuring heterogeneity of species, different generations of trees and methods to prevent illegal logging. One method to prevent locals from stealing wood could, according to Subak (2002), be to make alternative fuels available and promoting long-term employment in the surrounding areas.

In order to assure permanence, JIRCAS have formed “contractual relationships” with the farmers. Relevant for permanence is also the farmer’s legal situation and their rights to the land. In this case, the farmers do usually not own their land, but their occupation of the land is supported by national civil law (PDD No 2694, 2009).

For this project issuance of tCERs was chosen over lCERs (PDD No 2694, 2009). The tCERs expire at the end of the commitment period in which they are issued, unlike the lCERs that expire at the end of the project crediting period (Lee, 2004).

3.4 LEAKAGE

A problem with afforestation and reforestation is that leakage can occur if activities are displaced by the project, which means that carbon uptake in the forest has little or no effect on climate because carbon is released in another area: *“Leakage is defined as the net change of anthropogenic emissions by sources of greenhouse gases (GHG) which occurs outside the project boundary, and which is measurable and attributable to the CDM project activity”* (UNFCCC, 2010).

The amount of leakage is estimated to be in total 18 983 tCO_2 for the whole crediting period of 20 years due to displacements of activities in cropland and grassland (PDD No 2694, 2009).

Other types of leakage can be difficult to calculate and predict. As examples, Subak (2002) mentions how the planting could lead to an ending of less productive plantations or that a smaller number of new forests are planted in other areas of the country. New plantations can decrease prices of timber, as the supply becomes larger. As a result, the economic incentives for starting a new plantation will be smaller (Subak, 2002). A possible solution is to increase demand for timber, which would lead to a rise in prices, and outweigh the effects of a large supply (Subak, 2002).

JIRCAS have advised the farmers to choose sites on their farm that they did not manage so that the reforestation would not lead to any loss of food or income. Where there were no suitable sites, JIRCAS recommended agroforestry instead. Therefore they conclude that there will be no leakage due to mere relocation of the previous activity (PDD No 2694, 2009).

3.5 MONITORING

The monitoring will start in 2010 and then occur every five years, following the "Simplified baseline and monitoring methodologies for small-scale afforestation and reforestation project activities under the clean development mechanism implemented on grasslands or croplands AR-AMS0001" (2008). The methods vary from field surveys, aerial photography to satellite images aided by GPS. Focus for the monitoring will be size of the areas of strata, diameter of trees and their height. Calculations of carbon dioxide, surveys of land ownership and estimates of the wood density will also be made. There will also be one investigation regarding leakage; the number of hectares used for forestry instead of cropping and the number of displaced grazing animals. The monitoring of leakage will be done through surveys (PDD No 2694, 2009).

4 REFLECTIVE DISCUSSION

Important to keep in mind is that there are critical voices regarding CDM projects in general. For instance, it has been questioned whether the projects really have a positive climate effect or if they merely lead to offsets at other places (Gilbertson & Reyes, 2009). It is also demanded to improve CDM so that the projects to a higher degree implicate a transition towards a more sustainable development in the sense of a lower fossil fuel dependency.

Regarding poverty reduction and sustainable development as possible outcomes of the project, growth and poverty alleviation among small-scale workers can be restricted by several factors such as lack of infrastructure, insurance, government regulations (Bardhan, 2006). Some additional measures taken by the government, such as improved infrastructure, might also heighten the effect of the project, as products would be easier to transport. Pandey (2002) also suggest that there could be gains in productivity when combining formal science with the local knowledge.

Furthermore, to avoid risks is of high importance for poor people as they live on small margins where a drought, for instance, could have severe consequences (Duflo, 2006). Additional measures, both regarding climate effect on a long term and poverty alleviation, might therefore be necessary in order to achieve genuinely good results. Regarding the socio-economic benefits there is not much written in the PDD, and no explanation is given to how 'strengthening social cohesion' should be achieved. A satisfactory description on the 'income generation' is also lacking. The various ways of how farmers will use the wood and what will be produced could have been useful. What the farmers will produce could as well have a climate effect.

Subak (2002) concludes that the production of timber in plantations can help protecting the natural forests from clearing as they provide an alternative source of timber under certain circumstances, though that might be of less importance in the case of Paraguay. These kinds of effects are not accounted for in the project, but they could have an environmental effect as well.

There are also other alternatives and methods of supplying carbon sinks than pure forestry. For instance Pandey (2002) highlights the possibilities of agroforestry as a way to promote sustainable development. Agroforestry is according to him a good option as it combines food production and strategies for rural poverty reduction with carbon sequestration. Perhaps a higher rate of agroforestry within the project could better alleviate poverty.

One aspect to consider in relation to storage of carbon and forestry products, although it is not recognized by the IPCC, is that forest-products can be seen as an additional storage possibility: "*Promotion of species used in wood-carving industry has three advantages: it facilitates long-term locking-up of carbon in carved wood coupled with creation of new sequestration potential through intensified tree-growing; supports local knowledge on wood-carving and tree-growing, therefore, strengthens livelihood security, and helps trade and industry*" (Pandey, 2002 p. 373). Monitoring of what happens to the wood products is however not possible, partly since it is difficult to trace components and partly because the duration of the product in homes is unknown (Subak, 2002).

There are clearly both pros and cons with reforestation CDM projects. Forestry and forest products are under these circumstances a sustainable way for the farmers to make their living; while at the same time it has a positive effect on the environment. A larger production can, even if the products durability is limited, be an additional way of binding and storing carbon, although this is not accounted for by the Kyoto Protocol and thus not recognized under the CDM.

Planting forests is not the only solution to the problem of climate change as the area and locations available for forest plantations are limited. But as part of combined efforts the project could have positive effects in combination with actions to transform our society into a sustainable one.

Chapter 4

CDM Project 2345:
Small scale cooperative afforestation CDM pilot project activity on private lands affected by shifting sand dunes in Sirsa, Haryana

- Can it help achieving a more Sustainable Development in the Sirsa district?

by
Lina Lundgren

1 INTRODUCTION

The district of Sirsa is located in the state of Harayana in the great Indian That desert. The area is affected by shifting sand dunes, which blow up sand and dust to the surrounding area. The storms have left the land almost free of vegetation and the water sources are threatened. The land needed for agriculture is lost due to soil erosion and the degraded land can only be used for cultivation once every third year. People living in the Sirsa district are poor and 92% live under the international limit for poverty (PDD No 2345, 2008).

The Sirsa District is now part of a project under the Clean Development Mechanism (CDM) where a mixed forest will be planted to sequester carbon dioxide (CO_2) from the atmosphere, but also to help retain water in the soil, reduce problems with erosion and help promoting a more sustainable development in the region (PDD No 2345, 2008).

The Sirsa District once had natural forests, which was cleared when the population increased in the 1950´s to be used as fuel and to earn livelihood. Due to the sand storms and the climatic conditions in the area (with very high temperatures in summer and low temperatures with occasional frost in winter, little precipitation and frequent draught), there is no natural regeneration of the sparse vegetation existing in the area. The land is therefore classified as degraded and is continuing to degrade. At present it is used for agricultural activities with barley cultivation once every third year, which also hinders natural regeneration of forest. The land is left fallow during the years when it is not cultivated (PDD No 2345, 2008).

The shifting sand dunes have led to soil erosion and air pollution of sand particles which has implications on the social and economic well-being in the Sirsa district. The area also has bad drainage which leads to water logging when it rains, which in turn makes the soil more saline and threatens the water quality and drinking-water supply (PDD No 2345, 2008).

2 THE PROJECT

Eight villages in the Sirsa district will be included in the project and an area of around 370 hectares of land will be afforested. 227 farmers use the land, which is divided into 270 land parcels. The land set aside by the farmers is degraded and does not contribute to the livelihoods of the farmers. As the farmers considered 30 years being a too long period, a time period of 20 years was chosen as crediting period (PDD No 2345, 2008).

A combination of short rotation species (10 years) and medium rotation forest (20 years) will be used. This means that trees will be replanted once during the crediting period. Several aspects have been taken into consideration when the tree species were chosen. The farmers were interviewed and consideration was taken to the rates of carbon sequestration as well as how the soil and biodiversity would be affected by the species chosen, and whether these would be suitable under the specific climate conditions. Seven tree species were chosen, including six native species and one exotic eucalyptus hybrid (that has been planted in the region for over 50 years) because it was wanted by the farmers. 1000 trees will be planted on each hectare.

Not only will the project help remove greenhouse gases (GHG) from the atmosphere, but it will help improve the quality of the soil by increasing soil moisture and the content of humus, as well as decrease the blowing sand dunes and the soil erosion (PDD No 2345, 2008).

2.1 CLIMATE IMPACT

As the planted trees grow they will sequester CO_2 from the atmosphere, which will be stored in the biomass. The project is estimated to sequester a total of 231 920 tons of CO_2 during the crediting period of 20 years (year 2008-2027) (PDD No 2345, 2008).

The increase in GHGs due to the project is considered to be marginal in relation to the removal. The project aims at avoiding emission of GHGs from transport by using bullock-carts for transportation of fertilizers. The fertilizers will be organic manure produced locally, to avoid contributing with GHGs. The emissions are in total less than 10% of the removal, which means according to the methodology they can be neglected and are thus assumed to be zero (PDD No 2345, 2008).

2.2 SUSTAINABLE DEVELOPMENT PARAMETERS

CDM projects should not only reduce emissions but help achieving a sustainable development in developing countries with all its dimensions considered: economic, social and environmental. The focus generally tends to be on social aspects such as equity and poverty reduction. CDM projects are required to follow national criteria and indicators for sustainable development, as defined by the government of the host country (Olhoff et al., 2009).

The local environmental benefits with this project have been considered previously but can be summarized to:

- Prevention of blowing sand
- Prevention of soil erosion
- Improved water and air quality
- Increased water holding capacity of soil
- Increased humus content in soil (PDD No 2345, 2008).

There are also many socioeconomic values expressed in the PDD and these are objectives that should be fulfilled to promote local sustainable development:

- Create income for farmers; from selling of carbon credits and timber
- A more sustainable fuel supply; at a closer distance which leads to less work for women to collect fuel
- Social network; strengthening of communication and cooperation between individuals, communities and local governments
- Social well-being; employment, gender equality, ensuring participation of women
- Improved agriculture production; due to stabilized soil, increased soil moisture and humus content
- Technical training; in seedling handling, nursery of plantation, site preparation and planting, fire and pest control (PDD No 2345, 2008).

3 DISCUSSION ABOUT METHODOLOGICAL PARAMETERS

3.1 BASELINE

A measurable decrease in CO_2 emission or increase in CO_2 sequestration must be achieved in a CDM project, wherefore a baseline needs to be established to compare before and after the project. The baseline is the level of emission (removal) that occurs without the CDM project. The baseline should be decided upon specifically for the project and take into consideration all GHGs emitted or removed within the project boundary (Shrestha et al., 2005). The baseline for this small-scale CDM project is determined following pre-approved methodologies for both baseline and monitoring "Simplified baseline and monitoring methodologies for small-scale afforestation and reforestation project activities under the clean development mechanism implemented on grasslands or croplands" (AR-AMS0001-version 04.1) (PDD No 2345, 2008).

The land is assumed to continue to be used in the same way, because there are no financial resources to make the investment to start up a plantation project. The vegetation in the area would likely decrease without the project which means less carbon captured by existing vegetation. The carbon stock in the baseline is however assumed to be constant at today´s level when assessing the additionality (PDD No 2345, 2008).

The baseline was based on the existing vegetation in the area. In 2007, when the baseline survey was carried out, a total of 492 trees were growing in the region as well as 2093 woody perennials. Due to the shifting sand there is little grass. The carbon stock is calculated based on both the aboveground and belowground biomass. The carbon stock in the area is calculated to a total of 259,8 tons of carbon (tC) (205,7 tC above ground and 54,1 tC below ground equal to 952,6 tCO_2e). This baseline carbon stock is expected to be constant during the whole project, except for a small decrease in woody perennials as trees are planted, which leads to a carbon stock of 200,2 tC in the above ground biomass and a total of 256,3 tC (PDD No 2345, 2008).

3.2 ADDITIONALITY

In order for a small-scale Afforestation/Reforestation project to be additional the project activity must increase the carbon stock compared to the baseline. "*actual net greenhouse gas removals by sinks are increased above the sum of the changes in carbon stocks in the carbon pools within the project boundary that would have occurred in the absence of the registered smallscale afforestation or reforestation project activity under the CDM*" (UNFCCC 2010, p. 5). Additionality therefore refers not only to a sequestration, but a sequestration that would not have occurred without CDM. In this case, there are investment barriers (lack of finances for investment), technological barriers (lack of knowledge and access to technology) as well as barriers due to social conditions (no organization for initiating the project). This means that this conversion of the land would not be possible without CDM. No natural regeneration of forest would occur (PDD No 2345, 2008).

As the forest is planted the carbon stock will increase and so will the sequestration of CO_2 from the atmosphere. The sequestration adds up to 231 920 tCO_2e removed from the atmosphere during the first crediting period of 20 years, which is an annual average removal of 11 596 tCO_2e per year. When the short rotation species are cut (2018), the decrease in carbon stock means emissions of 16 110 tCO_2e. (PDD No 2345, 2008).

3.3 PERMANENCE

Permanence refers to how permanent, or long-lasting, the removal or decrease of GHGs is. As is pointed out by Ellis and Kamel (2007) there is an inherent problem when it comes to the permanence of A/R projects. The CO_2 only stays sequestered as long as the trees are still there. Once the trees are removed the CO_2 is re-emitted and the climate benefits are lost. Cutting of trees, logging, pests or other environmental problems as well as storms or fire can cause the CO_2 to be released (Ellis & Kamel, 2007). Although there are problems with permanence in A/R projects many see it as a rather quick and cost-effective method for removing CO_2 that can help to buy some time until "real" permanent emission reductions can be achieved (Van Vliet et al., 2003).

As mentioned before, a crediting period of 20 years was chosen for the project as it was preferred by the participating farmers. The project issues temporary carbon credits (tCERs) in relation to the permanence of the project. After the first 20 years crediting period, the participants can chose to renew the crediting period twice. This gives the project an expected operational lifetime of 60 years. Verification will occur every fifth year.

3.4 LEAKAGE

Leakage refers to the emissions that the project causes outside of the project boundaries during the time when the project is running, such as emission from transport or displaced land use activities. If the leakage is significant this needs to be stated in the project description (Shrestha et al., 2005). Leakage in A/R projects is often connected to displacement of activities to other areas, such as displacement of grazing animals, which could lead to lost climate benefits in the new grazing areas.

Leakage is considered unlikely in the project as the degraded land is not used today. No cultivation was practiced on this land before the project. This means no displacement of activities such as grazing or agriculture is assumed to occur. Transport does not have to be taken into consideration according to the small-scale methodology used; however, bullock carts will be used to avoid any transport emission (PDD No 2345, 2008).

3.5 MONITORING

Monitoring is a crucial part of the CDM project process. Monitoring aims at collecting data so that the emission reduction or sequestration can be verified and at checking whether the project objectives are achieved. Risks or uncertainties in the project can also be better understood by monitoring them. A special monitoring plan is required, which has to follow an approved monitoring methodology. For small-scale projects there are simplified methodologies for monitoring (Lee, 2004).

The carbon stock in the area that has been planted will be monitored within the project boundaries and on stratified spots for sampling based on the different species planted, in accordance with recommendations for monitoring in the methodology (AR-AMS0001-version 04.1). Data for the diameter as well as the height of the trees will be collected. Possible leakage due to displacement of activities will be monitored using participatory methods. The aspects that will be considered for monitoring of leakage are the percentage of displaced families, grain production, as well as fuel wood and timber production. The number of displaced grazing animals per hectare will also be monitored in relation to the average grazing capacity of the land (PDD No 2345, 2008).

4 REFLECTIVE DISCUSSION

The circumstances in the Sirsa District show, I would say, clear signs of an unsustainable situation with large potential as an A/R-CDM project as there are large areas of land that are not used as they are too degraded. As most of the people living in the area are very poor and strongly affected by the shifting sand dunes, deteriorating water quality and soil erosion (PDD No 2345, 2008), there is much that can be done in relation to sustainable development fairly easily.

India has a large potential when it comes to A/R projects when one considers land availability. Around 23% of the total land area is degraded and around 40% of this degraded land could potentially be used for A/R projects (Palm et al., 2009).

The potential of implementing systems for CO_2 sequestration in developing countries is recognized by Nair et al. (2009). The global effect is the same, independent upon where the plantations are constructed; the mitigation will still occur. However, forestry projects can be implemented in rural areas in remote settings, where many poor people live and where a small increase in income can have a large effect on the well-being. Zomer et al. (2008) recognizes the potential of A/R in rural communities on a small scale. These projects do not only help to sequester significant amounts of CO_2, but also help increasing food security and increase adaptive capacity of smallholder farmers and their communities.

The importance of finding the right villages or farmers to participate in an A/R project is however highlighted by Palm et al. (2009). There needs to be willingness to participate in the project and to realise the benefits from CDM. CDM project 2345 indicates that there is willingness in the Sirsa district to participate in the project (PDD No 2345, 2008). This in combination with the current unsustainable situation (as discussed above) makes it, I argue, a good example of a suitable project area.

Many aspects in relation to sustainable development are taken into consideration in the project. Economic and social values are both integrated and the social as well as economic benefits from the environmental improvement are clearly highlighted. Therefore I consider that the sustainable development approach is a broad but thorough one. The right of the land owners, the farmers, to the benefits from the project, such as carbon credits (PDD No 2345, 2008) is also an important factor.

One critical issue could be the lack of resources in the Sirsa District to work with the project effectively. The Haryana Forest Department will help financially with investigation and preparation as well as setting up the tree nursery (PDD No 2345, 2008). The project would likely not be possible without this support. Another issue is the lack of technology and technical know-how, where the Haryana Forest Department are also to help with training (PDD No 2345, 2008). The application of the training and good use of the resources is essential for the success of the project. However, if the application of the technical training does not work effectively there is, I fear, a large risk that the positive benefits of the project are lost.

There are many aspects that could be dealt with in the Sirsa district, which the project seems to recognize, such as poverty reduction and better conditions for agriculture. The multiple benefits that could be achieved on a global and local scale are significant. If the project is carried out in line with the participants' ideas and desires and application of training is successful, I see great potential of achieving a more sustainable development in the Sirsa district.

Chapter 5

CDM Project 2363: Cao Phong Reforestation Project

- An assessment of climate benefits and Sustainable Development promotion

by
Lotten Wiréhn

1 INTRODUCTION

The Cao Phong district is located in the northwest parts of the rural and mountainous Hoa Binh province in Vietnam. Before 1980 the government promoted more agricultural production which resulted in deforestation in many parts of the Cao Phong district. After deforestation, intensive crop cultivation took place and the land became degraded, especially in the slopes. The degraded land was eventually abandoned and shrubs and grass grew to cover the land. Today, a small-scale Afforestation/Reforestation (A/R) Clean Development Mechanism (CDM) project has been proposed for this region (PDD No 2363, 2009).

The CDM project area consists of five sites in the communities of Xuan Phong and Bac Phong. The smallest site is 23.5 hectares whereas the biggest site is around 107 hectares. In total the project area is around 366 hectares, which will be used for the establishment of tree plantations. The tree plantations will store carbon by capturing carbon dioxide (CO_2) from the atmosphere via photosynthesis (PDD No 2363, 2009).

This chapter aims to review and assess the climate benefits and sustainable development impact of this small-scale Cao Phong reforestation CDM project.

2 THE PROJECT

The Cao Phong CDM project was created in a capacity building project which was funded by Japan's International Cooperation Agency (JICA). The host party of the project is the Socialist Republic of Vietnam, whereas the Forest Development Fund (FDF) is the project participant. The land use right holders in the project area are the households living in the surroundings. These households will be the ones who build up, manage, protect and monitor the tree plantations and the FDF will function as a guide throughout the project. The profits from the harvested wood and carbon credits will be shared between the farmers and the project management body. The project has an expected lifetime of more than 30 years (PDD No 2363, 2009). According to UNFCCC (2010) the crediting period for small-scale A/R-projects can be either 20 years (with possibility for renewal twice) or 30 years. However, in the PDD of this project a crediting period of 16 years is chosen. All calculations are based on a time period of 16 years.

Two tree species were selected for the plantations: *Acacia mangium* and *A. auriculiformis*. The rotation period for the plantations is planned to be 15 years (longer than usual for these species) in regard to the rehabilitation and improvement of the land that has to be performed. These species are fast growing and tolerant to the degraded land (PDD No 2363, 2009).

The overall implications and objectives with this CDM project are: "*(a) to rehabilitate degraded land and improve land productivity and environmental condition through reforestation, (b) to reduce the carbon dioxide in the atmosphere by sequestration of carbon in forest carbon pools (c) to increase the income of the local people by timber production and sale of carbon credits*" (PDD No 2363, 2009, p. 2).

2.1 CLIMATE IMPACT

The terrestrial carbon stock is an important part of the global carbon cycle; the tree biomass stock encloses about half the amount of carbon as the atmospheric storage (IPCC, 2000). In the years 2000-2005 the Earth's forest cover was 3 952 million ha and the mean deforestation rate was 12.9 million ha/yr (IPCC, 2007). These are two arguments why forestry, including reforestation, have the potential to be used in a portfolio to mitigate climate change (IPCC, 2007). The PDD states that the Cao Phong reforestation project will remove 42 645 tons of CO_2 equivalents (tCO_2e) from the atmosphere via carbon sequestration during the 16 years (PDD No 2363, 2009).

2.2 SUSTAINABLE DEVELOPMENT IMPACT

In the PDD, environmental and socio-economical impacts are discussed. It is stated that the restored forest on degraded land can possibly decrease the erosion and surface runoff. Further, the plantations are expected to increase soil fertility through higher amounts of soil organic matter and nitrogen fixation by the *Acacia*-trees (PDD No 2363, 2009).

The Cao Phong reforestation project will also have socio-economic impacts. It is stressed that the local population will have an increased income; the planting and tending of trees will generate payments and they will also get to share the project benefits, including the harvested trees as well as carbon credits. It is declared in the PDD that no significant negative environmental impacts are foreseen. Further, it is claimed that no environmental impact assessment is necessary since the project area is less than 1000 ha (PDD No 2363, 2009).

The PDD does not present any socio-economic impact assessment or monitoring plan. Hugé et al. (2009) stress that Vietnam does not yet have a comprehensive indicator framework for sustainable development and it is therefore hard to evaluate whether or not the CDM project contributes to sustainable development. Hugé et al. (2009) conducted a selection of 44 economical, social and environmental sustainability indicators for CDM projects through a participatory exercise. None of these indicators were brought up in the PDD. According to the Kyoto Protocol, decision makers should use the indicator selection as a guide in regard to approval and possible implementation of new CDM projects (United Nations, 1998).

3 DISCUSSION ABOUT METHODOLOGICAL PARAMETERS

The project applies the approved methodology *AR-AMS0001: "Simplified baseline and monitoring methodologies for small-scale afforestation and reforestation project activities* *under the clean development mechanism implemented on grasslands or croplands AR-AMS0001"* (UNFCCC, 2008).

3.1 BASELINE

The carbon pools to be considered in this type of project are above- and below ground biomass, as specified by the methodology. When determining the baseline net greenhouse gas (GHG) removals by sinks, the project area was classified into six strata (which are more accurate than two strata as proposed in the methodology). The baseline biomass was determined for each stratum by conducting a field survey with random sample plots based on the applied methodology. The biomass in two of the strata, bare land and cropland, was assumed to be zero. The biomass in the other four strata was used to determine the baseline carbon stock by using equations from the applied methodology (UNFCCC, 2008). The baseline carbon stock in living biomass was calculated to be 2 826.88 tons of carbon (tC). Expert judgment together with field observations indicates that the carbon stock of living biomass is expected to decrease in absence of the CDM project activity. Therefore, the baseline net GHG removal by sinks was assumed to be zero, hence, the baseline carbon stock is constant and equal to the carbon stock in the onset of the project; 2 826.88 tC[8] (PDD No 2363, 2009).

The UNFCCC guidelines for establishing baseline scenarios for CDM recommend covering five carbon pools in assessments: except from above- and below ground biomass, also litter, dead wood and soil organic matter. However, it is in accordance with the applied methodology (UNFCCC, 2008) to only consider above- and below ground living biomass in the carbon stock (PDD No 2363, 2009). This is due to the modality that one or more carbon pools can be left out if the project participants can show that the carbon pool left out does not lead to an overestimation of the sequestration (Shrestha et al., 2005). In the PDD, one cannot find transparent and verifiable information regarding this point.

3.2 ADDITIONALITY

CDM projects have to be additional; which means in this case, that the sequestration would not occur in absence of the proposed project activities. The PDD presents barriers for why the project could not have been realised without CDM, such as that no natural regeneration of forest will happen due to the degraded soil and environmental pressure caused by human activities. Further, there is a great lack of investment opportunities; the financial support to locals from the government is very small. Moreover, the free grazing practices in the area causes problems; if a landholder decides to plant trees it would be difficult to protect the plantation from the free grazing (PDD No 2363, 2009). These arguments seem to be reasonable; however, Schneider (2009) declares that there are problems with barrier analysis. He stresses that barriers not always are credible, that they often are highly subjective and sometimes bear little relation to the project (Schneider, 2009).

[8] The PDD refers to the methodology and states that "*the baseline net GHG removals by sinks shall be assumed to be zero*" because "*the baseline carbon stocks in the carbon pools are constant and equal to existing carbon stocks measured at the start of the project activity*" (p. 24). No calculation was therefore made for the baseline removal.

It is estimated in the PDD that the Cao Phong reforestation project will remove GHGs of 42 645 tCO_2e from the atmosphere during the first 16 years of the project, which corresponds to an annual removal of 2 665 tCO2e (PDD No 2363, 2009).

3.3 PERMANENCE

The atmospheric GHG removal by sequestration is considered temporary since natural or anthropogenic events can happen, which can result in losses from the sequestered carbon (Shrestha et al., 2005). The permanence issue is brought up by Maréchal & Hecq (2006) and they argue that *"no one can assure that the amounts of carbon stored by a forest will indefinitely continue to be sequestered when the project reaches its end. This fact brings up a real challenge which is to scientifically assess the minimum period during which a ton of carbon would need to be sequestered for it to generate a real environmental benefit"* (p. 701).

The PDD addresses non-permanence by issuing temporary CERs, which are issued retrospectively only after the biomass has grown for 5 years. After another 5 years, the carbon credits expire and have to be replaced (PDD No 2363, 2009).

3.4 LEAKAGE

The displacement of croplands and domesticated roaming animals should be considered as leakage according to the applied methodology (UNFCCC, 2008). Domesticated grazing animal were not included since there were no domesticated (settled) grazing animals permanently located in the project area in the baseline situation. The total leakage for the first crediting period was estimated to be 11 090 tCO_2 and is a result of displacement of cropland and domesticated roaming animals, calculated using a simplified format in the applied methodology (UNFCCC, 2008). A fodder production activity will be implemented in the context of this CDM project, which is expected to lead to high quality domestic animal feed and decreased grazing pressure on the project area. Thus, this will be a measure to reduce the leakage from the project (PDD No 2363, 2009).

3.5 MONITORING

The monitoring responsibility in this CDM project lays in the hands of the land use right holders, although with guidance from FDF. Forest establishment is one of the parameters that will be monitored. This includes the locations of the boundaries, size of the planted area and size and location of permanent sample plots. These monitoring activities are planned to be done before the verifications. Moreover, once every year the condition and quality of the plants will be checked by an expert in the field. The carbon stock (below- and above ground biomass) will be monitored in accordance to the applied monitoring methodology (UNFCCC, 2008). Fertilizer will be monitored once it is used, the amount and name of the fertilizer will be recorded. The last thing to be monitored is the leakage. This will be monitored one time after project establishment but before the first verification.

4 REFLECTIVE DISCUSSION

Clean Development Mechanism projects are, in my view, a good way to mitigate climate change and promote sustainable development. However, the complexity with conducting a CDM project may hamper implementation of projects to some extent, at least forestry projects, from what I can tell from this assessment. On the other hand, it probably would be problematic to further simplify the small-scale projects. Small-scale projects can already use simplified methodologies with facilitated requirements. In general, I believe that reforestation is a good way to reduce the CO_2 in the atmosphere, but it is crucial to investigate the baseline land use and yields and further possible leakage when terminating the previous land use for project establishment.

There are most certainly many issues concerning the methodology of CDM projects, but I believe that coordination between sectors and stakeholders could help to overcome concerns about e.g. baseline land use and yields. In the PDD, the question regarding leakage is treated well with no queries. However, the simplified methodology used would probably not have been acceptable without the intended implementation of fodder production, since the simplified method only can be used if the displacement is less than 50% (UNFCCC, 2008).

The baseline calculation of this CDM project does only include above- and below ground biomass as carbon pools. To include the carbon pools of litter, dead wood and soil carbon in the calculation would possibly have given a different baseline carbon stock and, hence, other values of the project's GHG sequestration. It is hard to assess soil organic carbon but it is necessary according to Goidts et al (2009). The result of their study showed that the mean soil organic carbon concentration in grassland soils in Belgium is around 30 gram carbon per kilo soil (gC/kg). Further, one could criticize the PDD for assuming the biomass on bare land and cropland to be zero. This simplification could give rise to an overestimation of carbon sequestration since soil organic carbon in cropland soil contains about 10 gC/kg (Goidts et al., 2009). However, since the same carbon pools were used for the baseline as for the project scenario the exclusion of some carbon pools does not affect the amount of carbon credits obtained.

It is claimed that no environmental impact assessment is necessary since the project area is less than 1000 ha (PDD No 2363, 2009). Even if that is acceptable according to national legislation, it certainly would have been good to conduct some kind of monitoring and impact assessment. Biodiversity, land and water resources can be affected by sequestration projects. Shrestha et al. (2005) argue that analysis of environmental and socio-economic impacts of sequestration project activities should be mandatory. The biodiversity is not discussed in the PDD. The project foresees to use non-native species in the plantations, although these have been introduced to Vietnam a long time ago and is nowadays common in the country. In addition, two species are going to be used in the proposed project in monocultural plantations. Paquette et al. (2009) stress the importance to use native species in plantations, they also stress the importance of mixing species to maintain or reintroduce biodiversity. The use of monoculture could also increase the farmer's risk in unstable markets (Paquette et al., 2009).

In conclusion, from studying the PDD and the methodology, I believe that the Cao Phong reforestation project will be beneficial for the area, in the environmental-, economical- and in the social aspect. However, the project developers are the ones that have conducted the PDD and this might have caused a somewhat subjective view of the project, one should be aware of that.

Chapter 6

CDM project 0231: CAMIL Itaqui Biomass Electricity Generation Project

- Implications for sustainability

by

Teiksma Buseva

1 INTRODUCTION

This paper assesses a biomass CDM project in Brazil, called *CAMIL Itaqui Biomass Electricity Generation Project*. It is located in Itaqui city, Rio Grande do Sul state, Brazil and is in working stage since 2001. CAMIL is the biggest rice company in Brazil.

Rice production is the main activity in the region. However, rice production causes some environmental problems due to large amounts of rice residues (mostly rice husks) left for decay, a process that generates methane emissions. Brazilian legislation does not allow burning or unlicensed displacement of leftovers from rice production, so that these are usually dumped on landfills to decay (PDD No 0231, 2005).

2 THE PROJECT

The purpose of the CDM project is to create a biomass electricity generation plant in the city of Itaqui. The electricity is produced using rice husks, which, if not used, would be left to decay.

Two obvious benefits from the project are, firstly, the efficient use of rice husks to produce cleaner energy and avoid methane emissions. Secondly, the self sufficient energy generation plant with capacity to produce surplus for the national grid.

Due to the fact that this biomass electricity generation plant is the first environmentally sound technology of this kind in the region, the project has created interest among many rice mill owners. This means that the project is seen as a technology, knowledge and capacity transfer project and might promote the use of this technology in Brazil.

This small-scale project have been classified under *Type I; Category I.D.: Grid connected renewable electricity generation* and *Type III; Category III.E.: Avoidance of methane production from biomass decay through controlled combustion*

2.1 CLIMATE IMPACT

The positive climate impact of this project comes from the use of renewable biomass for electricity generation, which substitutes electricity from carbon-intense coal fired power plants. The capacity of the biomass plant is 4.2 megawatt of electricity (MWe), using only rice residues as fuel. Methane emissions from rice husks which were left in landfills are also significantly reduced. Before the project, 81% of rice husks were transported to landfills. Now when the projects is running and in combination with new legislation which allows selling energy surplus to the national grid, only 7% of produced rice husk are disposed in landfills. Unfortunately the PDD does not talk about the rice husk residues which are not put in landfills or combustion. This is not considered as part of project emissions and is therefore not mentioned (PDD No 0231, 2005).

According to the PDD, the climate impact in terms of emission reductions is 401 388 tCO_2e for the entire crediting period of seven years or 57 341 tCO_2e annually (PDD No 0231, 2005).

2.2 SUSTAINABLE DEVELOPMENT PARAMETERS

The Brazilian Agenda 21, which is the main document concerning sustainable development in the country was adopted in 2002. Most of the objectives are similar to the Global Agenda 21 and cover all three milestones of the concept – social, environmental and economical ones (MMA, 2002).

Factors which will contribute to sustainable development of the project area have been identified. First of all, the project aims at increasing employment in the region. The second contribution to sustainable development is "diversification in the sources of electricity generation" (PDD No 0231, 2005, p. 4), which can also be seen as reduction of dependency on fossil fuel power plants and generation of cleaner energy. This might also mean that the project serves as a good practice example for the whole country and can contribute not only to the mitigation of climate change, but also to making the country more resilient and adaptive, due to increased ability to produce energy from biomass.

Finally, the reduction of uncontrolled rice residue disposal strengthens environmental sustainability goals, while the reduction of biomass dumped in landfills will reduce the amount of methane emissions. The local utilization of husks is significantly increased through the project.

3 DISCUSSION ABOUT METHODOLOGICAL PARAMETERS

3.1 BASELINE

Shrestha et al. (2005) defines baseline as the quantity of emissions "*against which the reductions of greenhouse gas emissions due to a CDM project are measured*" (p. 14). Therefore the baseline is a very important component of a CDM project, but it is also one of the components which are strongly scrutinized (Meijer et al., 2005; Flues et al., 2008). It is simple to understand the concept baseline, but as explained by Boyle et.al. (2009) it is difficult to set a credible baseline scenario because the described situation will never occur due to the project. All calculations are assumptions and will therefore not be able to be monitored and verified.

The baseline scenario for the analyzed CDM project is based on two criteria: grid connected electricity generation and avoidance of methane production. The baseline for the whole project period is accordingly 63 301 and 366 674 tons CO_2 equivalent (tCO_2e), respectively. These data represents the baseline for the specific project as well as demonstrates a significant amount of the reduction of greenhouse gases (PDD No 0231, 2005).

3.2 ADDITIONALITY

In the process of proving additionality, two scenarios were created to prove that the biomass energy generation plant would not be built if it were not a CDM activity. The first scenario assumes that the electricity is produced using a carbon intense energy source and risk husks are left for decay which leads to emissions representing 38 704 tCO_2e annually. The second scenario is the construction of the biomass electricity plants, which is realized through this proposed project.

The main barrier to implementation for this project was the financial viability, due to the large investments needed for the construction. This position is also supported by Lora and Andrade (2009), who have investigated the biofuel potential in Brazil and concluded that even "*today there are no highly reliable commercial technologies available for small-scaled power generation out of biomass that presents low investment costs and easy operations and maintenance (O&M)*" (p. 778). This means that most likely the CDM project in Itaqui city in Brazil would not have happened without foreign investment providing the required upfront funding.

However, on the other hand additionality arguments are blurry by nature. As researchers (Olsen, 2007; Schneider, 2009) have recognized, many CDM project use financial and policy risks as argument, but are lacking the credible prove of proposed barriers. For example, financial analysis results looks promising for the potential investors if the project is classified as a CDM, but the methodology for assessing these numbers are unclear, black-boxed. Schneider (2009) found, by analyzing 97 different CDM projects, that about 30% of the projects do not provide transparent and detailed calculations, thus confirming my observation.

3.3 MONITORING

The monitoring approach of the project - metering of the produced electricity by renewable biomass input - looks like the adequate as well as approved way to do it and will show the amount of replaced electricity from grid. While the monitoring of avoidance of methane production from biomass decay through controlled combustion is more complicated it is still manageable and acceptable (PDD No 0231, 2005).

However, I would like to bring up monitoring of social aspects of sustainability, which are not mentioned in the PDD. Even though the goal was increased employment there is no further reference to this point in the document. It seems as if sustainability issues are considered as formal contributions to assure that project will be classified as CDM.

3.4 PERMANENCE AND LEAKAGE

When it comes to permanence and leakage, the project has specified that the expected operational lifetime of the project is 30 years, although the crediting period is seven years. No leakage calculation has been done within this project; due to that renewable energy technology is implemented where leakage is unlikely (PDD No 0231, 2005).

Another side effect of this CDM project is that the plant capacity makes it possible to produce electricity surplus and sell it to the national grid and thereby earn extra income. This could increase the demand for rice residues and biomass. This might, if so, have an impact on land use. Nevertheless, I think it is less likely to happen, because CAMIL is one of the biggest rice producers in Bazil's south and I doubt that surplus energy sold to the grid is so profitable.

4 REFLECTIVE DISCUSSION

After studying this specific CDM project a couple of serious issues came to my mind. The basic requirement for CDM projects concerning promotion of sustainable development in the host country can be hard to achieve. As we know sustainable development combines at least three major directions – economical, environmental and social. Within the analyzed CDM project there is a clear environmental benefit in terms of reduction of emissions. The economic perspectives are also more or less covered, by developing new ways of electricity production. However social development or benefits are rather vague, subjective and little explored. Critique about CDM projects as presented above also questions the sustainability aspect due to the fact that there are no real measures and many projects are a kind of "end of pipe fix" (Lopez et. al., 2009), which means that the dominant focus is on the technological solutions for emission reductions, rather than lifestyle changes, attitude changes etc.

In relation to the social aspects of sustainability, I question the local peoples´ ability to work with the new technology, as special educational training will be needed. Furthermore, the project does not specify how many people will be employed, which means that if one person is employed the goal is reached. I am in agreement with a number of other authors who claim that there should be more concrete measures of how to evaluate the sustainability impacts of CDM projects (Brown and Corbera, 2003; Sutter and Parreño, 2007). Due to the complexity of the concepts and lack of objective measures, it is difficult to assess whether a project contributes to sustainability (Driesen, 2007; Olsen, 2007; Teräväinen, 2009).

Olsen (2007) talks about the duality of CDM projects, when it comes to combining the interests between industrialized and developing countries. Schneider (2007), on the other hand, sees CDM projects as monetary projects instead of sustainability, due to the lack of realistic sustainability objectives. In other words, nowadays the focus of project acceptance is on the quantity of Certified Emission Reductions (CERs) issued, whereas the contribution to sustainable development in the host country is usually of secondary importance. According to national data (MMA, 2002; Stratos, 2004) 10% of the inhabitants of Brazil control more than 50% of income. This indicates that there is strong gap between rich and poor people. The CDM project host is Brazil's biggest rice company and accordingly has power and resources and might therefore gain a more favourable position.

Another issue I would like to mention are the mechanisms and procedures of CDM. After studying one project in detail and reading scientific articles about the CDM, I could not stop thinking that even though there are methodologies and requirements which need to be fulfilled in order to be accepted as CDM, many issues like baseline, leakage, permanence, and sustainability are largely matters of interpretations and writing up the needed things. On the other hand, it is called flexible mechanism and even though it is not perfect, it still helps to reach the goal of reducing GHGs.

Finally, I think that CDM can be considered as good practice and incentive in coping with climate change. However, the regulations and access to it needs to be modified in a way that countries which really need these investments get access to it, and that sustainable development becomes a truly integrated objective next to the climate benefit achieved by CDM projects.

Chapter 7

CDM Project 0876:
Partial substitution of fossil fuels with biomass in cement manufacture

- A critical assessment of climate Impacts

by
Yaser Rezania

1 INTRODUCTION

The cement manufacturing industry is one source of carbon dioxide (CO_2) emissions. Around 5% of man-made CO_2 emissions are produced in cement industries (Worrell et al., 2001), which makes them alluring to include in CDM projects. Most of the emissions are created by calcinations of calcium carbonate, which produce CO_2 and lime, and the rest is due to fuel combustion in cement kilns (US EPA, 2009). Burning the raw material to form cement clinker in kilns, which react in high temperature (900-1500°C), necessitate the producer to burn fossil fuels to provide heat (Hendriks et al., 2004).

2 THE PROJECT

In Cementos Avellaneda S.A., a cement factory in La Calera, San Luis Province, Argentina, a CDM project is implemented to substitute the fossil fuel which is used to heat up the cement kiln with biomass (peanut shells), to reduce the CO_2 emissions from fossil fuel combustion. The project has been carried out since December 2000 with the help of two Spanish participants; Cementos Molins Industrial S.A. and Corporacion Uniland S.A (PDD No 0876, 2006).

In the project a method has been proposed to enhance the fuel system, by adding a secondary burner to the cement kiln, which works with biomass. The aim of adding this secondary burner is to reduce the fossil fuel consumption of the main burner. Like that, the essential heat to produce clinker is provided by two different sources; fossil fuel and biomass, which in this case is peanut husk. The main burner has a rated power of 40 mega watt (MW), and the secondary burner has 17 MW rated power (PDD No 0876, 2006).

2.1 CLIMATE IMPACT

Unlike fossil fuel, biomass does not increase the quantity of greenhouse gases, as it is considered as part of the natural cycle of CO_2. So, the more we use biomass instead of fossil fuel, the more we cut CO_2 emissions. This project is estimated to reduce greenhouse gas (GHG) emissions with 52 712.43 tons of CO_2 equivalents (tCO_2e) (PDD No 0876, 2006).

2.2 SUSTAINABLE DEVELOPMENT IMPACTS

Beside the environmental aspects, this project has more socio-economical benefits. In Argentina, the industries are mostly depended on gas as fuel. There are powerful gas producers and a very well-developed network infrastructure, but due to a dramatic increase in gas demand the country experienced a serious gas shortage and power cuts in early 2004 (Honore, 2004). The gas crisis in 2004 was an incentive to decrease Argentina's dependency on gas. So, projects like substitution of gas with biomass help the companies to elude from dependency on a single fuel source, and diversify their fuel portfolio. An additional advantage from using peanut shells is the reduced cost compared to relying on fossil fuel. Moreover, this project can foster other companies in the cement industry sector to go forward with similar projects which are helpful to reduce emissions (PDD No 0876, 2006).

These are advantages not only for the company, but also for the neighbouring communities. First of all, instead of disposal costs for local producers for getting rid of residue wastes, they can earn extra income by selling them to the company and the whole process can be classified as non-hazardous waste management. Moreover, residues used to be burnt in open air; which is now avoided and thereby decreases the possible risk for public health due to emissions from combustion. Burning the residues in open air always has the danger of fire transmission to other close farms as well. Also, using peanut shells as fuel has prevented usual traffic accidents caused by smoke produced during open air burning time. Finally, collecting, conditioning and transporting the peanut shells as fuel, has provided more job opportunities for local people (PDD No 0876, 2006).

3 DISCUSSION ABOUT METHODOLOGICAL PARAMETERS

3.1 BASELINE

The baseline of the project is based on the emissions in a common cement factory which burns natural gas and fuel oil to provide the required temperature in the cement kiln, and the boundary of the project is set by clinker production. The gases that are emitted in baseline conditions consist of; CO_2 from the cement kiln, on-site and off-site transportation; methane (CH_4) from transportation and decomposition in open field; and nitrous oxide (N_2O) from transportation. Emissions due to the project activity for on-site and off-site transportation will still occur, but the emissions from fuel combustion are significantly reduced due to the use of carbon neutral fuels. The baseline emissions in the project are estimated to a total of 50 794 tCO_2e for the whole crediting period of 10 years (tCO_2e) (PDD No 0876, 2006).

3.2 ADDITIONALITY

Three alternative scenarios were discussed in relation to the additionally and baseline of the project; (1) "*Continuation of the current practice (use of natural gas and fuel oil as main fuels)*", (2) "*Investment in energy efficiency improvement projects motivated by potential by energy cost savings*" and (3) "*...traditional fuels are partially substituted with alternative fuels*" (PDD No 0876, 2006, p. 17-18). The last alternative represents the actual project realized through this CDM project.

There are two main barriers towards realization of the project in line with the third scenario without CDM; investment and technological barriers (PDD No 0876, 2006). Considering the investment barriers, the project is highly dependent upon the domestic market, which means too high risk without realization of a CDM project. Argentina is also suffering from a severe debt crisis, which affects capital income and causes economical uncertainty. This economic uncertainty forced Argentina to freeze the credit market, which makes it impossible to realize the project without CDM. There are also technological barriers because biomass technology is not commonly used in cement factories. There is lack of information and knowledge for using biomass instead of fossil fuel in cement manufacture industry and also too few suppliers of proper technology (PDD No 0876, 2006).

According to the project design documents, by applying the project since 2000, annual reductions in CO_2 emission can be seen in Table 1 (PDD No 0876, 2006).

Table1. Yearly reduction of CO_2 from Cementos Avellaneda S.A cement factory

Year	**Tons of CO_2 equivalents (tCO_2e) emission reduction**
2000	1 183.67
2001	5 517.69
2002	6 368.23
2003	4 347.99
2004	3 143.52
2005	3 143.52
2006	7 251.95
2007	7 251.95
2008	7 251.95
2009	7 251.95
Total estimated emission reduction	**52 712.43**
Annual average of estimated CO_2 emission reduction over this 10-year period	5 271.24

Peanut shell is the waste of regional agricultural activity in the area, and by using this alternative fuel, the estimated annual average of certified emission reductions is approximately 5 271.24 tCO_2e/year over the 10-year crediting period for this project. Also, the methane emission from anaerobic decomposition of these residues in landfill, when they did not use them in this project, is avoided (PDD No 0876, 2006). Methane itself has a big role in greenhouse effect and in comparison to CO_2 it has a global warming potential of 21 on a 100-year time horizon (IPCC, 2007).

But the environmental benefits are not limited to emissions cuts, there are more advantages. First of all, using the husk decreases the amount of nitrogen oxide compounds in comparison to conventional fuels. Secondly, in kilns which use peanut shells, there is no heavy metal contribution in clinker composition (PDD No 0876, 2006).

3.3 PERMANENCE AND LEAKAGE

The calculated leakage is the emitted GHGs from on-site transport and drying of peanut shells (PDD No 0876, 2006). Emission reductions are considered to be permanent as the use of fossil fuel is permanently decreased through biomass.

3.4 MONITORING

The monitoring methodology which is used for this CDM project is the approved method "*Emission reduction through partial substitution of fossil fuels with alternative fuels in cement manufacture*" (ACM0003, version 04)

For monitoring the process, the amount of used gas is measured by electronic flow meters, and the peanut shells are calculated based on stock balance. Also, calorific data about fuels, both gas and biomass, are calculated based on lab sampling. In addition, the energy for transportation of fuel oil and shells as an input into the plant is also measured and monitored (PDD No 0876, 2006).

4 REFLECTIVE DISCUSSION

Permanence and success of the project is highly dependent on availability of peanut shells and agricultural residue, which according to the document should be 1.5 times more than required for the project and other sectors (PDD No 0876, 2006). On the other hand, Argentina is one of the major producers of agricultural products in the world and agriculture is one of the main drivers for economic growth in the country. The production is based mostly around cereals and oilseeds (Official Promotion Portal for Argentina, 2010). In such an economy, it is always possible to switch cultivation to another crop depending on which has a better market. Thus, the market might make local farmers switch to cultivating something else instead of peanut and then the residue which is supposed to be used in the project might not be as abundant as it should be. Therefore, the permanence of the project can be endangered by fluctuation in the biomass market.

The emission from burning peanut shells is excluded when calculating the greenhouse effect, because it is considered as part of natural carbon cycle. But, if the farmers use any fertilizer, which usually is very energy-intense in its production and thus very carbon-intense, then we have just omitted a potentially large part of emissions from our calculation which is not part of natural carbon cycle. Minimizing the use of fertilizers for producing peanuts could therefore further decrease the GHG emissions. Also, the emission of preparation of peanut shells, except the transportation emission, is not evaluated. However it might be hard to calculate these emissions, but it should not be excluded from the decision making process.

The investing company obtains the Certified Emission Reductions (CERs) annually from running the project. Since the project started in December 2000 they have achieved 3098 CERs for the first year, 6197 CERs for the second year and are thereafter getting 9295 CERs for the next eight years. So even though the document was verified in October 2006, they got the credits retrospectively since 2000 for the whole project period of 10 years. This means that the project was running for 6 years before the document was verified and validated by Designated Operational Entities. In the PDD they however state that CDM was taken into consideration when the project was initiated (PDD No 0876, 2006). By substituting fossil fuel with biomass there are many other economic advantages, because the new fuel used is a waste product in the region. This means that not only will the company earn money from selling of CERs but will also achieve a large reduction of the running cost of the factory. One could, if you have a critical approach, question the real incentive for the switch to biomass.

CONLUDING DISCUSSION

This briefing has highlighted different aspects and issues in relation to CDM in general and to the specific CDM projects that have been assessed[9]. Although CDM is seen as a good way to mitigate climate change by most authors, there are still problematic issues. Emelie Hallin (chapter 3) brings up that "*it has been questioned whether the (CDM) projects really have a positive climate effect or if they merely lead to offsets at other places*". The promotion of sustainable development is also discussed as one problematic issue by many of the authors.

The problems when it comes to promoting sustainable development were expressed by Teiksma Buseva (chapter 6) "*as we know sustainable development combines at least three major directions – economical, environmental and social*". Although the economic aspects often are considered, she argues that "*social development or benefits are rather vague, subjective and little explored. Critique about CDM projects /.../ also questions the sustainability aspect due to the fact that there are no real measures and many projects are a kind of "end of pipe fix" /.../, which means that the dominant focus is on the technological solutions for emission reductions, rather than lifestyle changes, attitude changes etc.*"

Most of the projects assessed in this briefing are small-scale A/R forestry. Small-scale A/R projects are especially problematic, but nevertheless of certain importance in light of sustainable development. Lina Lundgren (chapter 4) writes that many of the people living in the areas where this kind of projects is realised are very poor and hence "*there is much that can be done in relation to sustainable development fairly easily*". Igor Keljalic argues that small A/R CDM projects can contribute to many positive effects, not just when it comes to GHG removal, but also the great opportunities for sustainable development in the project region and maybe even at national level if the project is successful. Small-scale A/R CDM projects can lead to positive effects on the local environment such as prevention of droughts, floods and erosion, among other things. They can also lead to greater diversity of animal and plant species or preservation of already existing species. Even opportunities for eco-tourism may occur. Wood as raw material may support the fulfilment of energy needs locally and nationally. Potential social benefits that may occur are for example employment opportunities, steady income and education for people in the project areas.

Fredrik La Fleur (chapter 1) and Lotten Wiréhn (chapter 5) both urge the importance of biodiversity and the problems of monocultural plantations. Lotten Wiréhn writes "*Biodiversity, land and water resources can be affected by sequestration projects. /.../ Analysis of environmental and socio-economic impacts of sequestration project activities should be mandatory*". Fredrik La Fleur further discussed that achieving higher sequestration in a monocultural plantations can be in conflict with promoting sustainable development in small-scale A/R-projects: "*If only sustainable development parameters were considered then creating a forest plantation that resembles "natural" forests with the variety of species and the same functions would yield better results, however, this may not result in same climate benefits as plantations*". He also argues that "*natural-like forests are preferred as a resource by the villagers…*"

[9] Igor Keljalic (author of chapter 2) discussed many of the problematic issues in relation to small-scale A/R-projects his course paper and part of his discussion are therefore moved to this concluding discussion.

Leakage and permanence are highlighted as the most problematic issues of A/R-projects. Igor Keljalic addresses secondary leakage that can occur in several different forms, for example as market effects that have negative impacts on timber prices because of the shifts in supply and demand chain (Aukland et al., 2003). Leakage is a problematic and difficult aspect of CDM projects especially when it comes to figuring out whether a project is directly or indirectly involved in negative environmental effects. Emelie Hallin further discusses that plantations under CDM can *"...lead to an ending of less productive plantations or that a smaller number of new forests are planted in other areas of the country. New plantations can decrease prices of timber, as the supply becomes larger. As a result, the economic incentives for starting a new plantation will be smaller"*.

Permanence in A/R projects is, as mentioned, also problematic. Fredrik La Fleur writes *"The reduction that takes place by sequestration may partially or completely be reversed by both natural events (e.g. wildfire or pests) and human activities (e.g. unplanned logging)"*. Igor Keljalic (chapter 2) however discusses the importance of temporary CERs to better assure permanence "*the temporary nature of CERs from forestry projects is important to discuss when it comes to the non-permanence element of the project*". Fredrik La Fleur also argues that "*to really achieve long-term sequestration of GHG emissions, the reforestation processes need to provide both self-sustaining ecosystems and areas that have value for the landowners*" so that logging will not take place. Although permanence is problematic Lina Lundgren writes that "*although there are problems with permanence in A/R-projects many see it as a rather quick and cost-effective method for removing CO_2 that can help to buy some time until "real" permanent emission reductions can be achieved"*.

Lotten Wiréhn also criticizes the assumption of a baseline carbon stock of zero in her project "*...one could criticize the PDD for assuming the biomass on bare land and cropland to be zero. This simplification could give rise to an overestimation of carbon sequestration...*". This type of assumption can be problematic in relation to the additionality of A/R-projects.

Igor Keljalic brings up one question that is commonly asked when it comes to small-scale A/R projects; whether projects of this size are viable in the long run from an economical point of view. According to experts in the area the high transaction cost and the low return in terms of GHG removal they are not a viable solution (Michaelowa & Rawat, 2007). Ultimately, the CDM is governed by market forces (Streck, 2004). A question that must be raised is how competitive and cost-efficient a small-scale A/R project is on the global emission rights market considering the high investments and low reduction of GHGs? Igor Keljalic further argues that promotion of sustainable development and poverty reduction should be the main focus of small-scale CDM projects.

Leakage and permanence in biomass projects (as those assessed in this briefing) are, unlike most A/R project, easier to understand and monitor. Both assessments of biomass projects do highlight the potential for positive effects locally when a local waste product is utilized as fuel. It can lead to both positive environmental effects and positive socio-economic effects in form of employment and income. Yaser Rezania (chapter 7) writes: "*...instead of disposal costs for local producers for getting rid of residue wastes, they can earn extra income by selling them to the company and the whole process can be classified as non-hazardous waste management. Moreover, residues used to be burnt in open air; which is now avoided and* *thereby decreases the possible risk for public health due to emissions from combustion"*. Although many positive impacts are described in biomass projects, the issue of monitoring socio-economic impacts is described as a problem in both assessments of biomass projects. The potential impact on land use when the demand for biomass grows as a result of the project is also pointed out by Teiksma Buseva: "*Another side effect of this CDM project is that the plant capacity makes it possible to produce electricity surplus and sell it to the national grid and thereby earn extra income. This could increase the demand for rice residues and biomass. This might, if so, have an impact on land use"*.

To better promote and take sustainable development under consideration is expressed in many of the assessment. Teiksa Buseva states "*In other words, nowadays the focus of project acceptance is on the quantity of Certified Emission Reductions (CERs) issued, whereas the contribution to sustainable development in the host country is usually of secondary importance*". This is an important point that is made by many of the authors. For small-scale projects, especially A/R projects, this is of certain importance. Forestry projects as CDM projects are still unfortunately rather uncommon. As Fredrik La Fleur writes "*Of the 2015 CDM projects that have been registered by the end of 2009, only eleven of them are Afforestation and Reforestation (A/R) CDM projects*". He however expresses some optimism "*...of those eleven projects, nine were registered in 2009, which indicates that the number of A/R CDM projects is on the rise*".

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