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Leveraging carbon revenue for poverty alleviation

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Abstract

One of the intentions of the Kyoto Protocol and the Clean Development Mechanism (CDM) was to use markets to allow the developed countries to supplement their own greenhouse gas reduction efforts with carbon reductions made in developing countries by purchasing carbon offsets. By these means, it was hoped, global greenhouse gas emissions would be reduced and developing countries would benefit through incoming carbon revenue and technology transfer. This has worked for China and India, which together account for 88% of all CDM carbon credits issued so far, but it hasn't worked for Africa which has only a miserly 1% of the issued credits. The main reasons for this disparity are thought to be the high transaction costs of the CDM and the long and complicated registration, validation, monitoring and verification processes. The costs are around R400 000 to R2 000 000 per project (CCWG, 2009) . In addition it can take up to three years to get carbon revenue, if the project is one of the lucky 13% of projects to make it through to the end (see Appendix A – CDM Pipeline analysis). Partly in response to these CDM shortcomings, the voluntary carbon market has emerged. The voluntary carbon market has many players using many different standards and rules and regulations. Unfortunately, the CDM-like standards used by the bigger voluntary carbon market registries also incur high transaction costs and long lead times and therefore don't work for typical, small African poverty alleviation projects with low greenhouse gas emission reduction potential. This has encouraged the development of small, agile carbon registries using simplified standards,

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which better fit the African projects. One such small registry and one of its poverty alleviation projects are analysed in this paper.

Introduction

The problem

Poverty alleviation projects in developing countries can attract additional funding if they can prove that they reduce greenhouse gas (GHG) emissions. This funding comes from the carbon offset market – where countries, businesses or individuals buy carbon reduction credits from others in order to reduce their own carbon footprints more cost -effectively. However, there are many barriers to be overcome before the carbon credit revenue starts flowing to the projects.

One barrier is that of scale. Many projects addressing poverty in developing countries do not generate enough carbon revenue to afford the high transaction costs incurred in the mainline carbon markets – these costs are at least R400 000 per project initially (CCWG, 2009). Also, small projects often do not satisfy the mainline carbon market rules and conditions. Finally, the whole screening and approval process is often too long for most small projects which don't have large capital reserves and need the carbon revenue quickly.

The background

The carbon market can be split into two broad categories: the compliance market, governed by the Kyoto Protocol, and the voluntary market which is unregulated. The compliance market is currently dominated by the Clean Development Mechanism (CDM), whilst the main players in the voluntary carbon market (where companies and individuals choose to buy carbon offsets voluntarily), are the registries using the Gold Standard (GS) and the Verified Carbon Standard (VCS). However, the GS and VCS registration and audit processes also incur high transaction costs and long lead times for registration and the issuance and sale of carbon credits. Because of these CDM-like problems with the large registries, the voluntary market has opened up to smaller, more agile participants.

Responding to the needs of small projects, innovative carbon entrepreneurs have set up voluntary carbon registries using simple but effective standards for ensuring good quality carbon credits, whilst radically lowering the transaction costs (by an order of magnitude or more) and producing carbon revenue quickly, in months rather than years. Surprisingly, the recent carbon prices achieved in the small voluntary carbon market are comparable to the CDM, GS and VCS prices.

The purpose and rationale

This paper will describe the process of how a poor community in Umdoni, Kwazulu Natal (KZN) South Africa achieved GHG reductions and converted these into carbon revenues and then recycled the bulk of the revenue back into their community. A voluntary carbon registry, specialising in poverty alleviation projects, assisted the community with auditing, registering and selling the carbon credits. The project, Umdoni Gel Stoves, is a 'fuel-switching' project which makes use of bioethanol gel supplied under the South African Government's Free Basic Alternative Energy (FBAE) policy, and using gel stoves supplied by donors and local government (DME, 2007).

The project enables poor households to partially displace wood, paraffin and dung fuel sources with cleaner-burning bioethanol gel (a by-product of the local sugarcane industry). This results in:

- reduced paraffin fire threat and indoor air pollution
- less time spent collecting firewood
- reduced household expenditure on energy
- conservation of dung on croplands with the associated improved soil fertility

- creation of sustainable village businesses selling and distributing the bioethanol gel
- reduced GHG emissions

The bulk of the carbon revenue (70%) goes back to the community and is being used in ways determined by them. The remainder of the revenue covers project management and carbon registry fees.

Literature Review

Why the carbon market is important in sub-Saharan Africa

The carbon market is important to sub-Saharan Africa for many reasons. It incentivises GHG reductions through carbon credits which can then be sold. It helps carbon revenue-supported projects to get off the ground and be sustainable. These projects generally deliver community benefits and contribute to most of the Millennium Development Goals (MDGs); such as poverty alleviation, education and the empowerment of women through less fuel gathering and improvement of home conditions, healthy homes through interventions such as air pollution reduction and water purification. In addition, if the project is partially funded from foreign sources and uses imported technology, it may result in an inflow of foreign capital and technology transfer.

How the carbon market works

The carbon market came into being through the Kyoto Protocol under the United Nations Framework Convention on Climate Change (UNFCCC). The Clean Development Mechanism (CDM) was set up as a market instrument to encourage and help the developed nations to reduce their GHG emissions in the most cost-effective way while benefitting the developing countries through 'clean development' projects. The developed nations who were signatories to the Kyoto Protocol, known as Annex 1 countries, have committed to reducing their GHG emissions in whatever way they can. Recognising that because GHG emissions diffuse throughout the atmosphere quickly (in a matter of days), it doesn't matter where in the world the GHG reductions are achieved. Therefore, the CDM argument goes, if an Annex 1 country is having trouble reducing its own emissions then it makes sense to allow it to pay a developing country to make some GHG reductions in its stead if that happens to be more cost-effective. At the same time the developing country can benefit from GHG-reducing projects. This is known as offsetting one's carbon footprint by buying carbon credits and retiring them. This market is known as the compliance market because players are in this market in order to comply with Kyoto Protocol commitments. (UNFCCC-CDM, 2012)

How the compliance market works

The CDM Registry acts as a type of stock market for GHG emission reductions, called Certified Emission Reductions (CERs; where 1 CER is 1 metric tonne of carbon dioxide equivalent, abbreviated to tCO_2e. GHGs consist of many different gases, such as carbon dioxide, methane etc. so it is customary to measure the global warming potential of GHGs in terms of the equivalent tonnes of carbon dioxide). The CDM Executive Board (CDM EB) acts as the auditor or gatekeeper and ensures that the CERs are real, quantifiable, permanent and additional. This is to avoid CERs being issued and sold and then discovering that the project that was supposed to generate the CERs either never started or failed after a while. Or that the project would have happened anyway – this is where 'additionality' comes in – the project is only valid if its CERs are addition to business as usual.

CDM rules and processes

In an attempt to make sure that a project's CERs are valid, a complex set of standards and procedures has been set up.

The methods to be used for GHG reduction calculations are defined by the CDM Methodologies (CDM_Rulebook, n.d.). The list of methodologies is long but finite, whereas just about every project is different; so one always has to exercise judgment as to which methodology to use for a particular project.

The CDM processes are long and complex and require the services of accredited experts to ensure compliance: this is what causes the high transaction costs and lengthy lead times as described on page 1. For many projects, particularly in sub-Saharan Africa, this is just too expensive, too risky and takes too long and this is where the voluntary market provides an alternative to the CDM.

The voluntary carbon market

As its name implies, the voluntary carbon market allows companies, communities and individuals to generate and trade carbon credits voluntarily. Generally carbon credits in the voluntary carbon market are called Verified Carbon Credits (VERs) and each VER is equivalent to 1 tCO_2e.

VERs are purchased for a variety of reasons such as: ethical reasons, corporate social responsibility commitments, public relations or 'green-washing', attempting to pre-empt GHG emission regulation and many more. Voluntary carbon projects usually have low GHG reduction potential and so the carbon revenue benefits are small compared to the projects' other benefits. These projects are usually designed to deliver poverty alleviation or social development and the VER revenue is often a small side benefit – useful but not essential to the project's viability.

Voluntary carbon market players – Type 1 and Type 2

The voluntary market can be categorised into two parts: the big players using CDM-like standards and processes (which we will call Type 1) and the rest (which we will call Type 2) which use simpler processes and a variety of standards.

Type 1 carbon registries

Type 1 markets are characterised by strong additionality requirements, long delays before carbon revenues start flowing, and participating projects which achieve relatively high GHG reductions in relation to the costs of the project and the community benefits delivered.

Examples of the Type 1 standards are the Voluntary Carbon Standard (VCS) and the Gold Standard (GS) (The Gold Standard Foundation, 2012; VCS, 2012). Both these standards differ from the CDM in that they focus more strongly on developmental objectives and outcomes than does the CDM. Because the VCS and GS are as complex and comprehensive as the CDM in terms of standards and processes, they suffer from similar problems of high transaction costs and long delays before issuance and revenue flow.

These shortcomings opened the doors for smaller, innovative carbon registries with simplified standards and processes to enter the market – these are the Type 2 registries.

Type 2 carbon registries

Type 2 markets, whilst also having strict GHG emissions reduction additionality requirements, do not require financial additionality and because the carbon revenues are low, will usually require additional external funding. Their simpler acceptance criteria and on-going audit processes result in faster approvals and early starts to carbon revenue flows; which are essential to the viability of most small projects. Often, the approval and auditing processes can be done by local agencies instead of having to call in accredited overseas consultants (such as DOEs) at great expense. The projects in Type 2 markets also tend to deliver significant social benefits compared to their GHG reduction potential. Examples of Type 2 market registries are small, voluntary carbon registries such as Credible Carbon/PACE (Cartwright, 2012) and Climate Care (ClimateCare, 2012).

The next step in analysing the best route to generating carbon revenue for a project is to consider the causes of market failures and market successes of the CDM compliance market.

Where the Compliance market succeeds and where it has failed

The Compliance market and the voluntary carbon market and Type 1 and Type 2 markets overlap and sometimes compete with each other and at other times complement each other. They each have their own advantages and disadvantages and succeed in some circumstances and fail in others.

The CDM Compliance market has had the greatest penetration in China and India, both in terms of the number of projects and the scale of CERs generated and issued. This can be seen in Figure 1 below. The total CERs registered for China and India amounts to 75% as at July 2012, with Africa only getting 3% of the global CDM pie. The situation gets worse when the *issued* CERs are compared (issued CERs are ready to be sold, whereas registered CERs still have to be audited and verified); then **China and India account for 88% and Africa only 1% of issued CERs**.

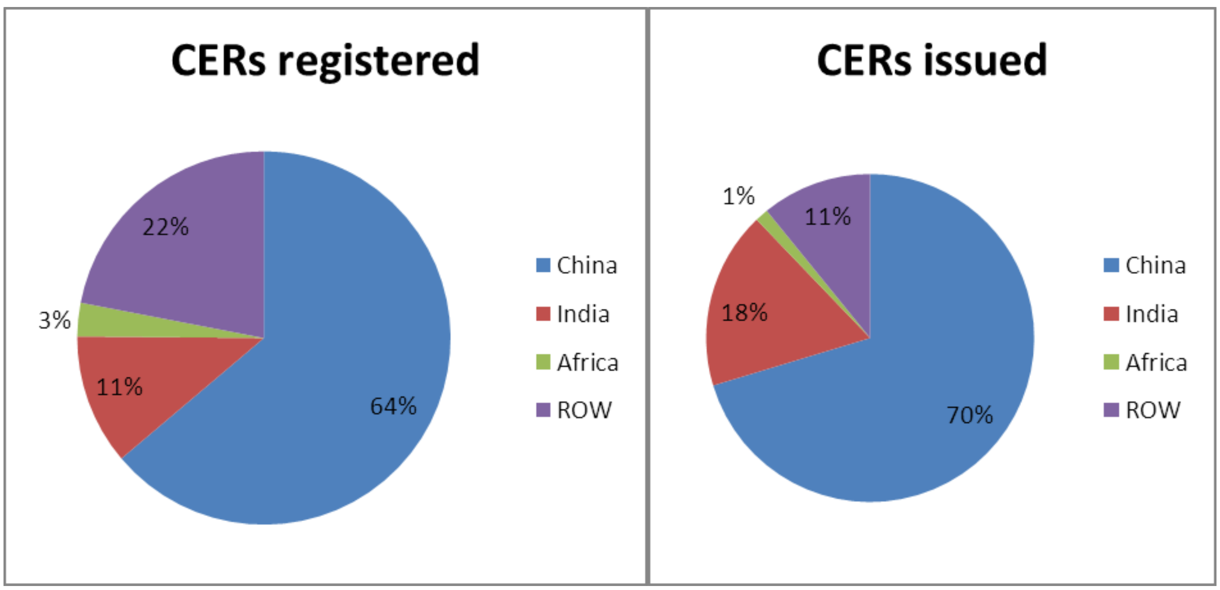


Figure 1 Comparison of quantity by country – in terms of CERs registered and issued

(Source: (Fenhann, 2012) and author's analysis in Appendix A)

This demonstrates that the CDM has had high penetration in China and India, but not in Africa.

Problems with CDM penetration in Africa

There are several reasons for this disparity between China/India and Africa CDM success; such as population size, technological sophistication, the degree of industrialisation, government involvement and general institutional capacity. China scores high on all of these factors while Africa scores low. However, it can be argued that the key factor hindering African projects is that they are generally small with a low GHG reduction potential so they simply can't afford the high CDM costs. For instance, African projects such as replacing traditional three-stone fires with efficient woodstoves only generate one or two CERs per household per year. Whereas in China, especially in the early days of CDM, there were many huge, industrial projects which simply had to flare or burn exhaust gases instead of venting them to the atmosphere, resulting in tens of thousands of CERs per year.

Low GHG reductions and high transaction costs

The problem with low-intensity GHG reduction projects is that the transaction costs per project remain high whilst the CER yields are low. For a project just to break-even, that is generate enough CER revenue to pay for the registration, verification, monitoring and validation costs, it has to generate about 5 000 to 10 000 CERs depending on the carbon prices (which are currently around R50 to R100 per CER).

Long delays and high risk of failure in the CDM processes

Other problems with the CDM generally are the long delays from application to the final issuance and sale of the CERs and the low success ratios as described on page 1: Delays of up to three years and a success rate of 13% globally (Appendix A – CDM Pipeline analysis).

GHG reduction versus meeting development objectives

After all this, CDM projects do not always fit in with African government priorities, which tend to be more about development and meeting Millennium Development Goals (MDGs) than helping the Annex 1 countries reduce their carbon emissions. Although the CDM is supposed to promote development in the project-hosting countries, in practice the CDM criteria are aimed at GHG reductions.

Addressing the CDM failure in Africa

Naturally, these problems with CDM have been noted and the CDM is actively trying to address them. The key attempts have been: allowing multiple, similar projects to be grouped together and treated as one in order to reduce the costs, introducing new methodologies suitable for small projects and loan finance to cover the CDM costs,

While these measures will probably help, it is too early to see if they will turn the tide in favour of African CDM projects. As mentioned previously, faced with these CDM problems, projects have turned to the voluntary markets. However, in an attempt to improve credibility, some of the voluntary market players have adopted CDM-like processes and standards, resulting in similar problems of high costs and long delays as will be shown below.

The voluntary carbon markets

The voluntary carbon markets can be classified into Type 1 markets (as described on page 8) which are very much CDM-based, and Type 2 markets, which are aimed at smaller projects with low unit GHG reduction potential and with a strong developmental component.

Type 1 voluntary carbon markets (GS and VCS for example)

Whilst these do address the requirement for developmental outcomes, they still suffer from high transaction costs and long delays. This is for the same reasons that apply to the CDM.

Therefore, at present, there is still a market niche for the Type 2 voluntary market players.

Type 2 voluntary markets (for example, Credible Carbon/PACE and ClimateCare)

This paper will concentrate on Credible Carbon/PACE, which is similar to ClimateCare although much smaller; details of ClimateCare can be obtained from their comprehensive web site (ClimateCare, 2012). Typical voluntary carbon markets involve more participants than just the carbon registry and carbon auditors.

Before looking at why particular registries work well with Type 2 projects, it is necessary firstly to explore how the Type 2 carbon projects work – who gets involved and how and what are the various roles and role-players.

Typically Type 2 projects are not motivated primarily by GHG emissions reductions, but rather by the need to deliver tangible community benefits; such as: poverty alleviation, health improvements, and energy provision. These needs are well-defined and motivated for in the Millennium Development Goals (MDGs).

These projects tend to be created in response to a community need. There will always be a 'champion' or project conceiver who has the vision of what the project should deliver and has the skills and the drive and the connections to make it happen. This person could be a member of the community itself, or someone in a non-government organisation (NGO), or sometimes a local government person, or perhaps a funding organisation looking for suitable projects.

The necessary role-players are:

- Community representatives
- Project Proponent
- Project Developer
- Local Government representatives
- Funders
- Carbon registry, carbon auditor and carbon offset customers

It is worth looking at these in more detail in order to get to grips with typical Type 2 project dynamics.

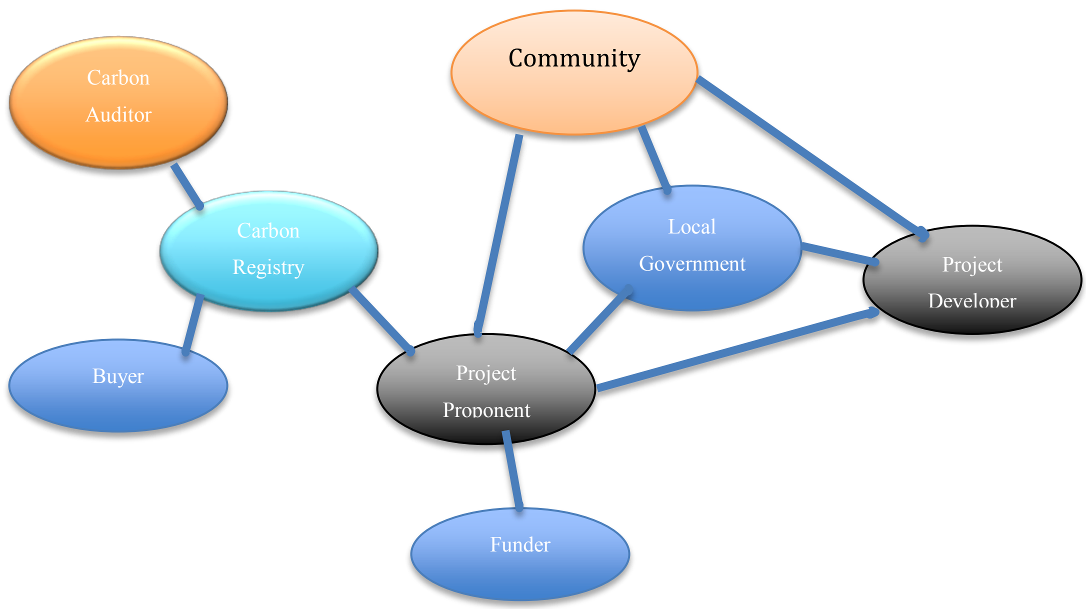


Figure 2 Typical voluntary carbon project participants

Community representatives

As with all projects, in whatever domain, one of the prerequisites for success is to ensure that the project will deliver what the proposed beneficiaries want (not necessarily 'need'). So one of the first actions should be to find out what the community wants. This is usually done by identifying legitimate community representatives who will act on behalf of the community and, hopefully, interpret the wants (and perhaps needs as well) accurately and commit the community to the project and its success. The project developer, as described below, will often assist in the wants/needs analysis by collecting data and analysing it: but the community representatives should have the final say as to what the community wants to get out of the project.

Project Proponent

The project proponent plays the role of 'deal-maker', much like the producer in the movie business. This involves working with the community representatives and the local government, appointing a suitable project developer, finding a funder and arranging funding and the carbon finance side of things with an appropriate carbon registry. The project proponent is also responsible for checking that the project has been implemented as planned, and, once running, is delivering the promised outcomes. One of the outcomes of a carbon project is, of course achieving the predicted GHG reductions. This is based on an agreed GHG reduction calculation (called a 'methodology' as in the CDM nomenclature) and a monitoring plan.

Project Developer

The project developer does the actual, hands-on work of developing the project plan and implementing the project as planned.

Local Government representatives

Generally, any community project will need to get the buy-in and possibly statutory permissions from its local government. This is done through a local government representative who will make sure that the project doesn't contravene any rules and regulations. Sometimes the local government can also be a source of funding and expertise.

Funder

Most Type 2 projects cannot survive on the carbon revenue alone and so additional funding is required. This is the role of the funder – to provide the agreed funding. The funder will mainly work with the Project Proponent. The funder will typically need to be involved during the project planning and implementation as well as once the project is up and running. Most funders will require detailed project documentation before and during the project implementation and regular audit reports once the project is running.

Carbon registry, carbon auditor and carbon offset customers

The carbon registry is responsible for registering the audited carbon reductions in the form of Verified Emission Reductions (VERs), based on the agreed carbon reduction methodology, and then marketing and selling the VERs to their customers.

The carbon registry appoints an independent carbon auditor who will verify that the project's VER projections are using the agreed methodologies. The auditor should be objective and independent of all the other project participants, have the required carbon auditing skills and be credible in the eyes of the carbon offset customers. Once the project is running, monitoring (by the project proponent) and periodic audits (by an appointed carbon auditor) have to be carried out.

The carbon offset customers can be any individuals or any business entities who need or want to offset their carbon footprints. Their reasons for buying carbon offsets could include: an ethical desire to reduce their carbon footprint, a corporate requirement to do so, a legal requirement, or to meet a commercial objective (such as reducing carbon tax cost-effectively). So, those are the players, now for the game.

A typical Type 2 project life-cycle

Naturally all projects are different and events unfold in many ways. In the real world, projects are always rather messy and they evolve rather than progress in a neat, orderly way. However process usually includes these steps:

- A community need arises or springs into prominence
- A 'champion' emerges and decides to do something about the community need
- The hero might be a member of the community, part of an NGO, a local government official, a project proponent, project developer, funder or a carbon registry looking for projects
- The hero finds a project proponent to run with the project

- The project proponent engages with the community through community representatives to establish and formalise the community needs and define a suitable project to meet some or all of the needs
- The project proponent produces a Project Idea Note (PIN) which defines the project aims and scope – this document is similar to the CDM PIN
- Once the PIN has been endorsed by the community, the project proponent then assembles the other project players: the project developer, a local government representative, the NGO representative (if there is an NGO involved) and possibly a funder
- The project proponent , with the project developer, then prepares a Project Definition Document (PDD), based on the PIN, which spells out the project details, including the promised deliverables (community benefits, GHG reduction methodology, GHG baseline analysis, GHG reduction calculations, costs, timing)
- The project proponent then ensures that the PDD is acceptable to the project stakeholders: the community, the project developer, the involved NGO if there is one, the local government representative, the carbon registry and the funder (if a funder has already been engaged)
- The project proponent now attempts to secure funding for the project (this is in addition to the carbon revenue that should be generated by the project); at this stage the funder might wish to negotiate the project scope and deliverables and make changes to the PDD
- Once all the role players are happy with the funding proposal and any changes to the PDD, the project proponent will prepare the necessary contracts (which formalise who does what, and most importantly, who will own the carbon credits)
- The project now goes ahead under the control of the project developer and normal project management processes are followed; the project proponent will usually also have an oversight role during the implementation

- Once the project has been completed to the satisfaction of all the role players, it moves into the monitoring phase
- The on-going monitoring of the project is arranged by the project proponent
- A regular audit of the project deliverables is carried out by the appointed auditor as per the project contracts
- Once the GHG reductions for a particular year (vintage) have been successfully audited, they are registered on the carbon registry as VERs and the carbon registry starts marketing the VERs to potential customers (carbon offset buyers)
- Carbon offset buyers can either buy VERs and retire them immediately, in which case the retired VERs can be used as offsets, or they can keep them to resell or retire later

As can be seen, the project process is quite complicated and can become extremely bureaucratic and expensive as has happened with the Type 1 project processes, which are even more complicated and require more documentation and accredited experts to produce the documentation.

The secret of successful Type 2 projects is to keep the whole process as simple as possible consistent with maintaining quality and credibility, so as to keep the project transaction costs down. The next point of interest is the functioning of voluntary carbon registries.

How does a carbon registry work?

A carbon registry is like a financial stock exchange in that it puts sellers and buyers together and allows them to carry out buying and selling transactions and tracks who owns which VERs and which VERs have been retired by whom. Each sale of VERs is identified by a unique transaction code in the registry so that the life cycle of a particular VER block can be tracked – this history includes: which project it originated from and when, who sold it and when, who bought it and when, and who retired it and when. In addition, a carbon registry does a number of other things, the foremost being that it guarantees that the VERs it has registered conform to a set of standards. These standards should be open to the public. The registry also has access to the project documentation (PIN, PDD and audit reports) and can make these available to legitimate, interested parties, such as potential VER buyers. Generally the registry will issue retirement certificates so that an offset customer has evidence of the VERs that have been retired and are eligible for offset purposes.

A successful carbon registry will carry a reasonable stock of audited VERs covering a range of projects and will have a track record of selling VERs at competitive prices to a range of buyers – the quality of the VER-generating projects and the legitimacy of the VER auditing will contribute to the price that its VERs will command. The efficiency of the registry's carbon auditing processes will determine the cost to the project of registering and verifying its VERs. The VER selling price less the registry costs determines the net carbon revenue available to the project stake holders.

There are many voluntary carbon registries using various standards, and rather than attempting to cover them all, this paper will look at Credible Carbon (a Type 2 voluntary carbon registry) and its allied project proponent entity, PACE (standing for Promotion of Access to Carbon Equity) and a particular project, Umdoni Gel Stoves.

Credible Carbon and PACE

The Credible Carbon and PACE standards and guiding principles are simple and are reasonably easy to implement in the real world. Credible Carbon projects must conform to the following conditions: The projects must be real and up and running, they must reduce GHGs and contribute to poverty alleviation, 70% of the carbon revenue after audit fees must be returned to the project community, the projects must be situated in sub-Saharan Africa and be locally developed, the proportion of carbon sequestration projects, such as tree-planting must be less than 25% (because of the inherent unpredictability of forestry projects), and lastly, the project deliverables must be audited by recognised carbon project auditors.

In addition, projects must answer four key questions satisfactorily:

- Is the project real?
- Is the agreed technology installed and working according to plan?
- Are the carbon calculations unbiased, verifiable and done according to industry-accepted methods?
- Is the project making a visible contribution to poverty alleviation in the community?

The benefit of this type of standard is that it is intuitively easy to understand, rather than overly legalistic and jargon-dependent and it is easy to audit for conformance to the standard. Because the standard makes sense to people unfamiliar with the carbon market, it means that potential buyers have more confidence that they are buying VERs that do contribute to poverty alleviation and do reduce GHG emissions (Cartwright, 2012).

PACE (Promoting Access to Carbon Equity)

PACE is a Project Proponent and its job is to find suitable poverty alleviation and GHG reducing projects, engage with the other stake holders, assist with feasibility studies, assist in developing the required documentation (PIN and PDD), find a suitable Project Developer and generally carry out the Project Proponent roles as outlined above. In the real world, the roles are usually blurred and overlap occurs – this can be damaging and has to be addressed right at the beginning, otherwise problems will occur later.

Credible Carbon

Credible Carbon is a voluntary carbon registry. It is a separate business entity from PACE, but works closely with PACE. Credible Carbon's role is as outlined above in the *Necessary role players* section. Credible Carbon's main purpose is to turn the VERs into carbon revenue as efficiently as possible and to get as high a price as possible for the underlying projects. In the voluntary market, carbon credits are not currently treated as a commodity and are not homogeneous as are CERs in the CDM. Rather, VERs are intimately associated with their generating projects and buyers do look for particular projects that fit their needs. The buyer project selection might involve factors such as: where they are, the type of community which will benefit, the type of GHG intervention being considered, who the funder is, who the project role players are and crucially, the credibility of the carbon registry and its auditing processes. Buyers would not want to purchase carbon credits that could be regarded as 'green washing' or that come from a controversial project. So a successful carbon registry has to be careful about its selection of projects and the integrity of its auditing processes. If it gets these right then it will attract good buyers and achieve high carbon prices for its projects. This need for the carbon registry to know the detailed origins of its carbon credits is what makes the close connection between PACE and Credible Carbon so useful.

This is the background and the theory, this paper now explores what happened in practice with the Umdoni Gel fuel project involving Credible Carbon and PACE.

Method – Case Study: Umdoni Gel Fuel low Income Housing Project

The Umdoni Local Municipality, part of the Ugu District municipality, is on the east coast of South Africa in the province of KwaZulu-Natal (KZN). It has a population of 75 000 people in about 20 000 households.

It is a predominantly poor area, with high unemployment and is approximately half rural and half urban. The map in Figure 3 shows the Umdoni area highlighted on the lower eastern coast.

Figure 3. Umdoni municipality area map
Source: (D Morgan & Cartwright, 2011)

How the Umdoni project started

The project was not initially conceived as a GHG reduction project which would attract carbon revenue, rather it formed part of the Umdoni Municipality's drive to implement its Free Basic Alternative Energy (FBAE) obligations under the South African FBAE Policy (DME, 2007). South Africa also has a Free Basic Electricity Policy (DOE, 2003), which provides grid-connected households, which have monthly energy consumption below a certain threshold, with an initial amount of free basic electricity, currently this is 50 kWh/mth in most areas (Ekurhuleni provides 100 kWh). The qualifying monthly energy threshold, which is used as a proxy for selecting poor or indigent households, also varies across the country – for instance, for Eskom customers in cities it is < 250 kWh/mth, whilst in the Cape Town municipal supply area it is < 450 kWh/mth (Ballantyne, 2012).

However, 25% (12.5 million) of South Africa's population are without electricity (DOE, 2012) and cannot benefit from the FBE. Instead they are covered by the Free Basic Alternative Energy Policy (DME, 2007), which aims to provide indigent households with alternate forms of energy equivalent to the FBE energy. In the DME Policy document this is specified as alternate energy to the value of R 55 per household per month. This amount to be escalated by the South African inflation rate plus 1.6% per. Umdoni Municipality, after discussions with the proposed Umdoni pilot community of 4 000 households, chose to implement this as 7 litres of bio-ethanol gel fuel per household per month for the pilot community. KwaZulu-Natal is home to large sugar industries of which bio-ethanol production forms part, so this choice appeared to be sensible. The ethanol stoves were funded by the Umdoni Municipality with some contribution from USAid donations. At this stage PACE, the future Project Proponent, and Project Preparation Trust (PPT), as a Project Developer (which emerged from another entity called Parallax) started to get involved and developed the plan to capture carbon revenue for the project. The stakeholders involved were: the Umdoni pilot community, the Umdoni Municipality, PPT, PACE and Credible

Carbon and its carbon auditors.

Figure 4. Umdoni residents collecting their gel fuel

Source: (Cartwright, 2012) Credible Carbon Projects

The process to generate carbon revenue

The first step was to formalise the project by negotiating and producing a set of documents. This was managed by PACE and PPT, working with all the stakeholders. The set of documents comprised: The Project Idea Note (PIN), the Umdoni Verification Report, Umdoni Audit reports, agreements with the Umdoni Municipality, PPT and the carbon auditors. These are described below.

Project Idea Note – PIN 2008

This was prepared by Derek Morgan and Anton Cartwright of PACE (Derek Morgan & Cartwright, 2008).

The PIN identified the project name, the partners, location, the 1 July 2008 commencement date and the 10 year duration.

The project was described as comprising 4 000 volunteer households who would be supplied with bio-ethanol gel cooking stoves and 7l of bio-ethanol gel per household per month. The benefits were described as:

- Fewer accidental indoor fires as ethanol gel is safer than paraffin
- Less air pollution in houses
- Reduced firewood collection
- Less money spent on household energy
- Improved soil quality as more cattle dung would be left on the fields
- Reduction in GHG emissions as bio-ethanol gel is effectively carbon neutral
- Opportunities for local businesses for the distribution and sale of the gel fuel
- Providing a model for replication of similar projects elsewhere

Part of the implementation would be training for the Umdoni community, working with the Umdoni Municipality resources. The training and awareness-raising would include how to maintain and use the stoves, the problems caused by unsustainable firewood gathering, paraffin fire danger and the health impacts of indoor air pollution. Where the demand for the gel stoves exceeds supply, preference would be given to female- and child-headed households as these would benefit the most.

Baseline methodologies, calculations and assumptions

The CDM Methodology for calculating the carbon emission reductions was the Type 2 –E Energy Efficiency and Fuel Switching for Buildings. The advantage of choosing an existing, globally endorsed calculation method such as this is that it adds credibility to the VERs and saves time and money by not having to develop and prove a new methodology, also carbon auditors would be familiar with it and have access to precedents and resources.

Part of these methodologies involves calculating the “baseline”. This is a forecast of what the GHG emissions would have been if the project intervention hadn’t happened. In Umdoni’s case the business-as-usual (BAU) baseline assumed that the households would have used paraffin if the gel fuel had not been present. The PIN argued that this assumption was conservative (in that it would understate the actual GHG emissions in a BAU case, which would have used an unknown mixture of wood and dung, some of which is unsustainable).

This is where problems can arise because one rarely has enough actual information to prove the validity of the assumptions and gathering the required information takes time and raises the project costs. In the case of Type 1 projects, much time and effort is invested into trying to firm up the baseline, with debatable benefits – a lot of paper is generated, but one is still left with assumptions about what would have happened in the absence of the project.

The baseline further assumes that households typically boil 22l of water per day, from that one can calculate the energy required and the amount of paraffin required to provide that energy. This again involves a trade-off between making broad-based assumptions about actual heated water quantities and actual paraffin stove efficiencies or doing a full-blown research project to get possibly better figures. The calculation finally came up with carbon emissions of 1.02 tCO_2e/household/year for the paraffin baseline.

At this stage a questionable assumption was made. This was that because 7l of gel fuel typically only lasts a household for seven days a month, and that therefore the VER revenue would be used to buy additional 15 l of gel fuel per month, which would then be enough for the whole month. Unfortunately, this additional fuel was never bought (due to having to wait for the project to roll out, get the audits done, sell the credits and for the community to decide what it wanted to do with the money). Consequently, the gel fuel only lasted for a quarter of the month, whilst the calculations assumed the whole month, so the carbon savings were overstated by a factor of about four.

In any event, the Umdoni project went ahead with assumed carbon reductions of between about 2 600 tCO_2e and 3 500 tCO_2e per year, depending on how many stoves would actually be rolled out. Once the roll-out had progressed for a few years, a carbon auditor was engaged to do the first verification report.

Umdoni Verification Report 2011

This was prepared by Carl Wesselink and Shehnaaz Moosa (Wesselink & Moosa, 2011).

The report was based on a review of the documentation, a site visit and some interviews with the key participants and was based on Credible Carbon/PACE's four key principles, shown below with the audit findings:

- Is the project real and working as planned? – *Yes*
- Are the agreed technologies in place and working? – *Yes, with some reservations about stove maintenance being required* (the Umdoni Municipality subsequently replaced all the damaged stoves at its own expense).
- Are the estimated GHG reductions "plausible and unbiased"? – *Yes, but the auditors proposed a different calculation method, but came to similar figures as in the PIN, these being: 2008 512 tCO_2e, 2009 1 814 tCO_2e, 2010 3 208 tCO_2e*
- Can the poverty alleviation impact be readily seen? – *Yes.*

So, based on this audit, all looked in order and the baseline calculations, although done in a different and simpler way, reinforced the original PIN.

Baseline methodologies, calculations and assumptions

Some simple tests done as part of the audit confirmed that the gel fuel does typically last for about seven days each month, which confirms the assumption that gel fuel displaces about one quarter of a typical household water heating energy consumption. The audit then says "if the estimate of 4 tons of emissions (from cooking and water heating) per annum per household is accurate, then the displacement of 1 tCO_2 per household per year through the use of gel fuel is plausible and unbiased, given the relative emissions of gel fuel, compared to paraffin." (Wesselink & Moosa, 2011). However, this author has been unable to establish where the four tonnes of emissions per year per household assumption came from or whether the quantity of water heated is 22l or 88l – and these are crucial to the calculation of the baseline using the methods described above. It will be shown later that the second audit, done in 2012, used a third calculation method, that depended on the relative amount of paraffin versus gel fuel needed to provide the typical daily energy requirement for these households.

Following on the 2011 audit, the PIN was updated to reflect the adjusted calculation method and the new assumptions, as is normal practice for carbon reduction projects.

Updated PIN December 2011

This was prepared by Derek Morgan and Anton Cartwright (D Morgan & Cartwright, 2011).

The updated PIN reflects the 2011 audit findings and calculations as detailed above, that is GHG emission reductions of 5 535 tCO_2 for the period 2008 to 2010 plus the other community benefits such as reduced fire risk, less time and money spent on gathering and buying fuel. The reduced fuel expenditure was estimated at R50 to R70 per household per month, which lines up with the FBAE benefit of R55/mth (which should escalate by inflation plus 1.6% per year).

Then, as is good practice in the carbon project world, a second audit was commissioned in 2012. The intention was to make sure the project is still delivering as promised and update the GHG reduction calculations if required. This was done by a different auditor to the previous one, also good practice – to get a fresh and possibly different view.

Umdoni Verification Report 2012

Prepared by Urban Earth (Mckenzie & Botes, 2012).

This was a much more detailed audit, covering the period January 2011 to April 2012.

As in the previous audit, the Credible Carbon/PACE four questions were addressed:

- Is the project real and working as planned? – *Yes*
- Are the agreed technologies in place and working? – *Yes, the technology is in place and functioning and the households receive 7 l of gel fuel per month which lasts for about 7 days*
- Are the estimated GHG reductions "plausible and unbiased"? – *"No, the estimates do not appear to be reasonable"* (This will be explored further below in the baseline calculation section)
- Can the poverty alleviation impact be readily seen? – *Yes.*

Baseline methodologies, calculations and assumptions – paraffin baseline

By now it was evident that the gel fuel would remain at 7l per household per month and that this would typically last for seven days, thus displacing about a quarter of a household's baseline energy, still assumed to be in the form of paraffin. At this stage, the new auditors raised the issue of whether it was reasonable to assume that paraffin should be used for the BAU baseline calculations. Many of the households could not afford to use paraffin exclusively, so this was an important question. The auditors concluded that it was reasonable on the basis of "suppressed demand".

Suppressed demand

The reasoning applied is detailed in Appendix One in the audit report (Mckenzie & Botes, 2012).

Suppressed demand is a relatively new CDM concept. In simplified terms, suppressed demand is an attempt to allow deprived communities to benefit from GHG reductions achieved against the higher baseline energy consumption that they would have enjoyed if they could have afforded it. The CDM has an elaborate set of rules to govern this what-might-have-been future and these rules are still in the process of being put to the test of practical implementation. So, in the case of Umdoni it appears to be reasonable to assume that if they could, they would use fuel other than firewood and dung. The alternatives are, in order of preference, if they were affordable:

- Electricity – discarded because FBAE benefits only apply if the beneficiaries are not getting electricity as well.
- Gas (LPG) – eliminated because gas appliances are more expensive than gel stoves.
- Paraffin – this is feasible and available so should be used for the suppressed demand baseline.

The auditors then estimated how much paraffin would be displaced by one day of gel fuel, and knowing paraffin's carbon carbon dioxide emission factor, the GHG reduction of the avoided paraffin could be calculated. It turned out that roughly one litre of paraffin would last one day as would one litre of gel fuel. So, since the gel fuel lasts for seven days per month on average, the emission reduction calculation is simply: "7 litres of paraffin * 12 month * 2.5421 kgs CO_2e per litre of paraffin (DEFRA, 2011) = 214 kgs CO_2e per household per year." (Mckenzie & Botes, 2012) Page 11. This is in contrast to the original PIN and the 2011 audit which used 1 tCO_2e/household/year.

It should be noted that there are large uncertainties in this method, for instance: it is difficult to determine how long paraffin would actually last a household because it depends on how much water they heat, is cooking done at the same time, the amount of other fuels being used to supplement the paraffin, the type of paraffin stove and how efficient it is in practice and many other factors. Similarly it is difficult to estimate accurately how long the gel fuel typically lasts for the same reasons. Because of these problems the auditors also considered two other ways of calculating the baseline and the emission reductions.

Electricity baseline

This method assumes that under suppressed demand, households would choose electricity as their main source of energy and the gel fuel would be displacing the electricity and thus reduce emissions to the amount of Eskom's grid emission factor (assumed to be 0.99 kg CO_2/kWh). The calculation was done by working out the energy produced by burning the annual amount of gel fuel (12 x 7l = 84l per household per year) and applying the Eskom grid emission factor. This yields a figure of 290 kg CO_2e per household per year (compared to the original PIN figure of 1 000 kg CO_2e and the paraffin baseline method of 214 kg CO_2e.). However, as simple as it sounds, this method is also dependent on assumptions which are difficult to verify, for instance: the useful energy produced by the gel fuel should be compared to the useful energy produced by the electrical heating device. So the relative thermal efficiencies of gel fuel and electric kettles need to be taken into account. These are all unknown factors in the Umdoni community and are influenced by how the gel fuel stoves are operated (vent open or closed), how big the pot of water being heated is, does it have its lid on, how much water is heated is used whilst it is hot and how much energy is lost through cooling of unused water. Faced with all this uncertainty, all one can do is to make the best assumptions one can with the resources available and try to ensure that they are conservative.

The last methodology considered, and the simplest, was to use the suppressed demand principle of "minimum service level" and a baseline of the Free Basic Electricity allowance of 50 kWh per month per household.

Minimum Service Level baseline

The reasoning is that the FBAE policy is intended to be equivalent to the FBE policy that more fortunate households benefit from. Therefore one can argue that the amount of the baseline energy that is being displaced is equivalent to the FBE allowance of 50 kWh per household per month. The emissions reductions are therefore simply:

12 months x 50 kWh x 0.99 (the Eskom GEF) = 594 kg CO_2e per household per year.

As the auditors pointed out, this feels wrong, because it results in exactly the same VERs regardless of what fuel is being used and how much is being used. Nevertheless, according to the report, Steve Thorne, of SouthSouthNorth, who works with the CDM Executive Board on suppressed demand issues, feels that the idea has merit. He is discussing this with the CDM EB working groups. Time will tell…

Umdoni case study discussion and conclusions

Of course each project is different and will encounter different problems and find different solutions, so it is necessary to be cautious in generalising from one case. Nevertheless some lessons can be derived from the Umdoni project experience.

- The size of the carbon reductions that can be generated from fuel switching in a poor community is small – in the case of Umdoni, the baseline is less than 1 tCO_2e per household per year for water heating, possibly up to 4 tCO_2e/hh/yr if one considers their total fuel consumption and not just the water heating part.
- The VER revenue generated from this is also small, being not more than R100/tCO_2e, and leading to less than R100/hh/yr for the gel fuel switching.

- So, although the Credible Carbon audit costs of around R35 000/yr are an order of magnitude less than those of Type 1 markets, they are still high for projects such as the Umdoni project. To cover the carbon market costs and project overheads of around 30%, a project would need to generate at least 600 tCO_2e/year.
- On the basis of the downward revised VER calculations of 0.2 tCO_2e/hh/year, this gives 800 tCO_2e for Umdoni's 4 000 households.
- Therefore, it can be seen that the project scale is critical; for instance if the Umdoni pilot could be scaled up to 20 000 households, say, then the net VER revenue becomes significant at around R500 000 per year after overheads and audit fees.
- The VER revenue is directly proportional to the carbon price, which in Credible Carbon's experience has varied between R50/tCO_2e and R100/tCO_2e for the larger transactions.
- The relatively small scale of the project makes the VER revenue highly sensitive to the GHG reduction calculation methods and assumptions and with so little carbon revenue available it is not feasible to spend large amounts of time and money improving the assumptions, instead one has to be pragmatic and conservative and not waste time and money on striving for carbon accounting accuracy.
- However, although this has not been explored in this paper, the VER price that a project can attract is sensitive to the credibility of the VERs in the eyes of the carbon customers, so too cursory an audit runs the risk of devaluing the VERs.
- Rural fuel-switching is an extremely low-intensity way of generating GHG reductions, even when exploiting suppressed demand, although switching to clean energy does have a disproportionally large effect on community well-being. This is due to health benefits through less indoor air pollution, freeing up time through less fuel-gathering, less fire risk and many others.

In spite of the short-comings of a project such as the Umdoni project, the auditors all agree that the poverty-alleviating co-benefits make it worthwhile even if the VER revenue has been disappointing.

General discussion and conclusions

The CDM Pipeline figures show clearly that the Type 1 carbon market approach (large scale projects, complex approval and auditing processes) as embodied in the CDM processes have not worked in Africa, with only 3% of the global CDM projects having been registered in Africa and only 1% of African CDM projects have got to the CER issuing stage after which they can at last be sold. The CDM process takes a long time, up to three years from first application to final registration. Along the way there is a high proportion of CDM projects falling by the wayside during the extended processes, with only 41% getting to the registration step and 13% to the issuance step. Added to this is the complexity and cost of getting through the whole process – the CDM transaction costs are typically around R500 000 initially and similar amounts for each year for monitoring and verification.

The Type 1 voluntary market mechanisms, using CDM-like standards such as the Gold Standard and the Verified Carbon Standard suffer from similar problems of long lead times and high transaction costs.

The Type 2 markets, which use simpler and less restrictive rules and focus more on community benefits, have now emerged and can fill the gap left by the Type 1 markets. Meanwhile, having recognised all this, the Type 1 markets are taking steps to try to help the developing countries also reap the benefits of generating carbon revenue whilst implementing development projects. The next few years will show whether the CDM, GS and VCS are able to change to adapt to what Africa needs and has to offer.

Meanwhile, the smaller, Type 2 voluntary markets and associated standards and registries have an opportunity to establish themselves and assist African community development carbon projects.

Appendix A

CDM Pipeline analysis spreadsheet

Regions	Projects Registered		kCERs/yr Registered		kCERs by 2012		Projects Issuing		kCERs Issued	
As at 1 July 2012	**Number**	**%**	**kCERs**	**%**	**kCERs**	**%**	**Number**	**%**	**kCERs**	**%**
Total CDM	4296	100.0%	611280	100.0%	2144237	100.0%	1352	100.0%	815695	100.0%
China	2101	48.9%	390158	63.8%	1273074	59.4%	841	62.2%	573607	70.3%
India	854	19.9%	69133	11.3%	279855	13.1%	348	25.7%	142832	17.5%
Africa	77	1.8%	17711	2.9%	62630	2.9%	15	1.1%	10670	1.3%
Sub-Saharan Africa	55	1.3%	11995	2.0%	40925	1.9%	11	0.8%	2906	0.4%
South Africa	20	0.5%	3498	0.6%	16666	0.8%	8	0.6%	2537	0.3%
Total CDM incl. rejections and withdrawals	10426	41.2%						13.0%		

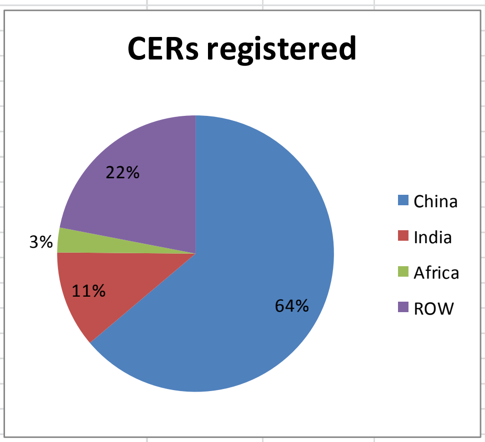
Source

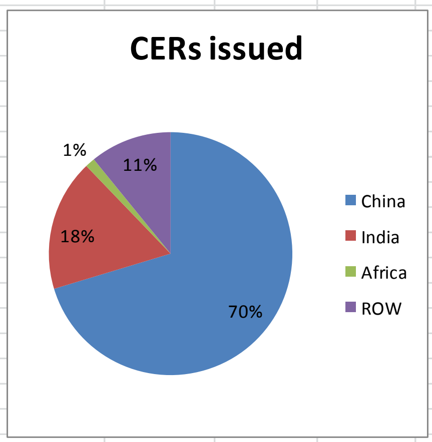
CDMpipeline UNEP Riso 2012.07.01 from the CD4CDM website, retrieved 25/07/2012

http://cdmpipeline.org/publications/CDMpipeline.xlsx

Registered kCERs by region

	kCERs reg.	% kCERs R	kCERs issue	% kCERs iss.
China	390158	64%	573607	70%
India	69133	11%	142832	18%
Africa	17711	3%	10670	1%
ROW	134278	22%	88586	11%
Total CDM	611280	100%	815695	100%





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