

Carbon finance for safe water projects

Prepared by Pietro Galgani for 300in6

August 2012

Note from the publisher:

This report was commissioned by 300in6 early in Q3-2012. It was to provide a basis for our review of carbon finance as an operational option for ourselves and for partners in scaling-up safe water. We now actively pursue that option on a permanent basis through the review of developments in international carbon finance policy, including the Green Impact Fund established in December 2011.

Whilst this report has not yet been subjected to the standard norms of verification and peer review, it is correct to the best of our knowledge as of August 2012.

We do not accept any liability for action taken by third parties after its study.

It is published in its present form as a contribution to the comprehension and explanation which this topic requires, and not for any polemical purpose.

Published October 2012.

Enquiries: carbonfinance@300in6.org

Executive summary

Carbon markets

There are two types of carbon markets: compliance (or regulatory) and voluntary. On compliance markets emission allowances and offsets are traded between companies or governments that are obliged by law to meet certain emission targets. Examples of compliance markets are the EU Emission Trading System (ETS) and the Kyoto Protocol ETS. Within the Clean Development Mechanisms (CDM) projects in developing countries that reduce greenhouse gas (GHG) emissions can generate carbon credits (CERs) for the Kyoto Protocol ETS. On voluntary markets credits are exchanged on a purely voluntary basis.

The compliance market is regulated by the UN Framework Convention on Climate Change (UNFCCC) and by the CDM Executive Board in Bonn, while the voluntary market is unregulated, and several independent third party standards certify that real GHG emission reductions correspond to the carbon certificates. While on compliance markets credits are bought and sold mainly by project developers and entities that are mandated by law to meet emission targets, on the voluntary ones a variety of organizations buys and sells credits, from project developers to wholesalers, retailers and brokers.

Around 10 billion tCO₂-equivalent (tCO₂), for a value of 176 billion US\$ have been issued on compliance markets in 2011. The CDM accounted for 20. The volume traded on the voluntary markets is less than 1% of compliance markets. Both markets are following a trend of growth.

At the moment of writing the price of carbon on compliance markets is 3 €/tCO₂ for CDM credits and 8 €/tCO₂ for EU credits. On the voluntary markets the price is set on a transaction basis, and in 2011 it ranged between 1 and 100 €/tCO₂, with an average of 6.2 €/tCO₂. The price depends largely on the type of project that generated the offsets and the independent third party standard that certified them. Normally projects with high social and environmental benefits on target communities gain higher prices. WWF's Gold Standard credits, certified free of negative social and environmental side-effects, are traded on average at 10 €/tCO₂.

The process through which development projects that reduce emissions get certified to issue credits is similar on both the compliance and the voluntary markets. It takes on average 7 months to go through the accreditation process, which includes the organization of a local stakeholder consultation, and 5-10 months from the end of the monitoring period to the actual issuance of credits. The costs are in the range of 100-200,000 US\$, depending on the type of project, as there are simplified procedures for Small Scale projects, with emission reductions below 60ktCO₂ per year. Besides Full Scale and Small Scale projects, a third type of project exists: in Programme of Activities (PoAs) the scale is not defined ex-ante, but only the technology used. Projects in new geographical areas can be added to a PoA during its lifetime. The lifetime of CDM projects can be either 10 years or 7 years renewable 3 times.

A CDM project's emission reductions are calculated following one or more of the 152 Approved Methodologies, depending on the type of project (i.e. solar, wind, waste, clean cookstoves and so on). On voluntary markets CDM methodologies are often used, although some standards develop their own. The Gold Standard, for example, requires the preparation of an ad-hoc sustainability report and monitoring plan, as well as extra stakeholder consultations.

Carbon finance and water purification

In the last few years some projects that supply safe water to people in developing countries have been registered to issue carbon credits. The basic concept is that by providing drinking water the need for boiling unsafe water by households is avoided, and thus an energy saving is achieved which translates in a reduction of GHG emissions.

In some African countries water boiling is not a widespread practice for water purification, but applying the principle of suppressed demand carbon reductions can be claimed also for households that currently do not boil water but would start to do so in the future, once they would have access to more free time, more knowledge of health issues or more economic

resources for buying cooking fuel. The principle of suppressed demand has been subject of some debate about the effectiveness of carbon trading for safe water provision.

The first ever water project was registered with a carbon institution, the Gold Standard on the voluntary market in 2011 and issued the first credits in 2012. Since then 2 more projects issued carbon credits and many more entered the registration process in both the voluntary and the compliance markets. Vestergaard Frandsen's project in Kenya is the largest project ever registered with the Gold Standard.

Carbon finance is different from conventional funding sources for development projects in three main ways. It is performance based and ex post, as it only provides revenues after the project's results start to be documented, and it is untied, as once the revenues are cashed there is no formal requirement on how they should be spent.

The amount of credits generated is calculated by estimating the avoided emissions from the combustion of fuels for water boiling (called baseline emissions) using ad-hoc surveys and official data concerning household behavior and biomass availability. The emission reduction per household-sized water filter in the existing projects ranges from 0.46 to 3.03 tCO₂ per year. Parameters concerning both the project's advancement (number of devices supplied and share of devices in use) and baseline emissions (i.e. share of people boiling water for purification, types of fuels used for boiling, water consumption per capita, availability of other water supply sources etc.) must be monitored annually or bi-annually with a sample of the target population. Substitution of devices at the end of their product lifetime must be ensured.

There are some sets of requirements that a water project must meet in order to be eligible to register with a carbon institution, some of which are general to all carbon projects while other are dictated in the specific methodologies for safe water projects. To register for the compliance markets a project must supply water up to the host country's national standards or the WHO's "Health based targets and microbiological performance specifications", and, as from 2013, it must take place in Least Developed Countries.

The main risks involved in carbon finance are the risk that the project is rejected and application costs cannot be recovered (rejection risk), the risk that it does not deliver the expected results (implementation risk) or that it cannot provide sufficient proof of its successful implementation (monitoring risk), the risk that the credits cannot be sold at the expected price (market risk) and to some extent the risk that a project could attract criticisms from critics of carbon trading (reputation risk).

Some organizations are developing open access international water PoAs that will allow single safe water projects to join in and register for carbon finance with lower transaction costs and shorter registration time.

Table of Contents

Executive summary	2
Carbon markets	2
Carbon finance and water purification	2
Abbreviations	6
1 Carbon trading	7
1.1 Carbon markets	7
1.1.1 Types of credits	7
1.1.2 Types of markets	7
1.1.3 Market volume.....	8
1.1.4 The price of carbon.....	9
1.1.5 Buyers and sellers	11
1.2 Regulators	11
1.2.1 Compliance markets: UNFCCC and CDM Executive Board	11
1.2.2 Voluntary markets: independent standards.....	12
1.3 Carbon projects	13
1.3.1 CDM projects	13
1.3.2 Voluntary market projects	16
2 Carbon finance for HWTS	18
2.1 Basic concept: why offset carbon emissions with safe water	18
2.1.1 Suppressed demand	18
2.2 History and market overview	18
2.3 Key differences from other financing sources	20
2.4 How does it work?	20
2.5 What are the potential revenues from carbon finance?	21
2.6 Which projects are eligible?	22
2.6.1 General eligibility requirements.....	22
2.6.2 HWTS specific requirements.....	22
2.6.3 Can projects that already started be registered?.....	23
2.6.4 Who can apply?	23
2.7 What costs and duties are involved?	23
2.8 What are the risks involved?	24
2.8.1 Rejection risk.....	24
2.8.2 Implementation risk.....	24
2.8.3 Monitoring risk.....	24
2.8.4 Market risk	25

2.8.5	Reputation risk.....	25
2.9	How can carbon revenues be spent?	25
2.10	What is a PoA and what are its main features for safe water projects?	26
2.10.1	PoA procedures	26
2.10.2	PoA eligibility requirements.....	26
2.10.3	Costs	26
3	Bibliography	27
3.1	Methodologies.....	27
3.2	Useful links.....	27
Annex A	Emission reduction calculation.....	28
Annex B	Existing and planned projects	29
	Individual projects	29
	Programmes of Activities	31
	Open access international PoAs	32
Annex C	List of Least Developed Countries	33

Abbreviations

CER	Certified Emission Reduction
CDM	Clean Development Mechanism
CPA	CDM Project Activity
DOE	Designated Operational Entity
ETS	Emission Trading System
EU	European Union
EUA	European Union Allowance
GHG	Greenhouse Gas
GS	Gold Standard
HWTS	Household Water Treatment and Storage
LDC	Least Developed Country
MR	Monitoring Report
PDD	Project Design Document
PoA	Programme of Activities
UNFCCC	United Nations Framework Convention on Climate Change
VER	Voluntary Emission Reduction

Carbon trading is a cap and trade market mechanism developed after the signature of the Kyoto Protocol to make the reduction of global greenhouse gas (GHG) emissions more economically efficient. On the different carbon markets various types of carbon credits (emission rights and emission reductions) are traded.

With the Clean Development Mechanism and the voluntary carbon markets, development projects that reduce GHG emissions can generate carbon credits to be sold to companies and individuals willing to offset their carbon footprint. In the past decade carbon trading has emerged as a further way to finance development projects. Projects that provide safe drinking water in developing countries have also recently entered the world of carbon markets since, by preventing people from boiling water to purify it, they in fact save energy and GHG emissions.

Chapter 1 of this report gives an overview of the carbon market, of the regulators that oversee it and of the mechanism through which projects in developing countries can generate carbon credits. Chapter 2 focuses on how carbon finance works and can work for Household Water Treatment and Storage (HWTS) and other safe water projects.

1 Carbon trading

1.1 Carbon markets

There are various global, regional and national markets where various types of carbon credits are exchanged.

1.1.1 Types of credits

Carbon credits are certificates guaranteeing the reduction or avoidance of GHG emissions for 1 tCO₂-equivalent (tCO₂). They can be different according to how they are generated and by which organization they have been certified. Some of them are exchanged as equivalent, while others have different prices.

Examples of types of carbon credits are:

- **CER:** Certified Emission Reductions, generated through Clean Development Mechanisms
- **ERU:** Emission Reduction Unit, generated through Joint Implementation projects.
- **EUA:** European Union Allowance, traded in the EU Emission Trading System.
- **VER:** Voluntary Emission Reduction, generated according to the independent Gold Standard.
- Etc. (VCU: Voluntary Carbon Unit, generated according to the independent Voluntary Carbon Standard, NZU: New Zealand emission Unit, traded in the NZ carbon market)...

All activities that reduce GHG emissions can generate credits (from manure management to improved cookstoves, from afforestation to renewable energy etc.).

In order for a buyer to claim that the purchase of credits corresponds to a real emission reduction, all credits must be **surrendered** or **retired** at some point and cannot re-enter the market place.

1.1.2 Types of markets

There are two types of carbon markets: compliance and voluntary markets.

- In **Compliance markets** governments and companies trade credits in order to meet *mandatory* emission reduction targets. For example, cement producers in Europe are obliged to reduce their emission by a certain amount each year; if their reduction is higher they are allowed to sell the excess allowance to other companies. Conversely they can choose not to reduce their emissions and to buy credits instead. Examples of compliance markets are the *EU Emission Trading Scheme (ETS)* and the *Kyoto Protocol ETS*. The former started in 2008 and will run until 2020, the latter will expire in 2012 and its future is still subject of negotiations (see Box “What happens after

2012?" on page 11).

The United Nations Framework Conference on Climate Change (UNFCCC)'s **Clean Development Mechanisms** (CDM) regulate how projects in developing countries can generate credits for the Kyoto Protocol ETS or for the EU ETS while contributing to the sustainable development of the host country.

- In **Voluntary** markets organizations that *want* to offset their carbon footprint buy offsets. For example carbon offsets that are offered with the purchase of flights come from the voluntary market, as well as those bought by companies that want to be *carbon neutral*. Credits are exchanged between buyers and sellers who engage through a broker or an online platform.

The credits issued on the voluntary market are usually connected to projects that have a positive impact on the local community and environment besides the mere GHG emission reductions. These factors influence their price, which is usually higher than that on compliance markets.

1.1.3 Market volume

The volume of carbon markets has reached the record value of 10 billion tCO₂ in 2011, out of which 87 million tCO₂, less than 1%, were traded on the voluntary markets (Table 1). For comparison, the current emissions of the EU-15 are about 4.2 billion tCO₂eq per year, and global GHG emissions were estimated at 30.6 billion tCO₂ in 2011 (World Bank 2012).

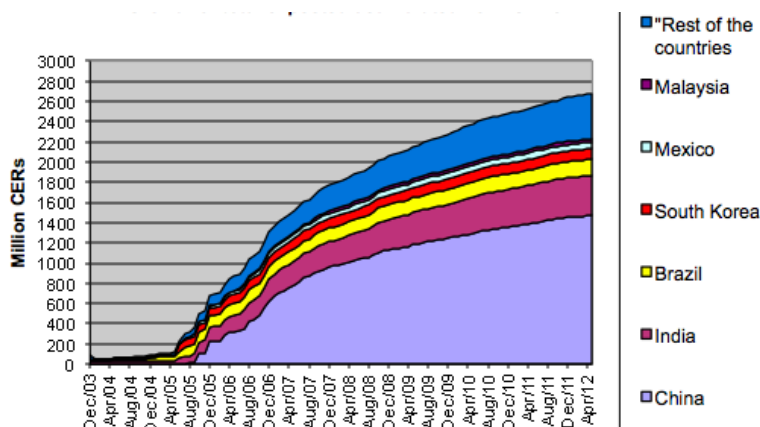
The global value of the carbon market was of 176 billion US\$ in 2011, out of which the CDM accounted for 25 billion US\$ and the voluntary market for 569 million US\$.

Table 1: Volume and value of global carbon markets in 2010 and 2011
(Source: World Bank 2012)

		Volume (MtCO ₂)		Value (US\$ million)	
		2010	2011	2010	2011
<i>Compliance</i>	<i>EU allowances</i>	6,789	7,853	133,598	147,848
	<i>CDM offsets</i>	1,484	1,998	23,128	25,313
	<i>other</i>	430	343	2,051	2,290
<i>Voluntary market</i>		69	87	414	569
<i>Total</i>		8,772	10,281	159,191	176,020

Figure 1 and Figure 2 give an overview of the growth over time of the volume of voluntary carbon markets and issued CDM credits (Certified Emission Reductions, CERs).

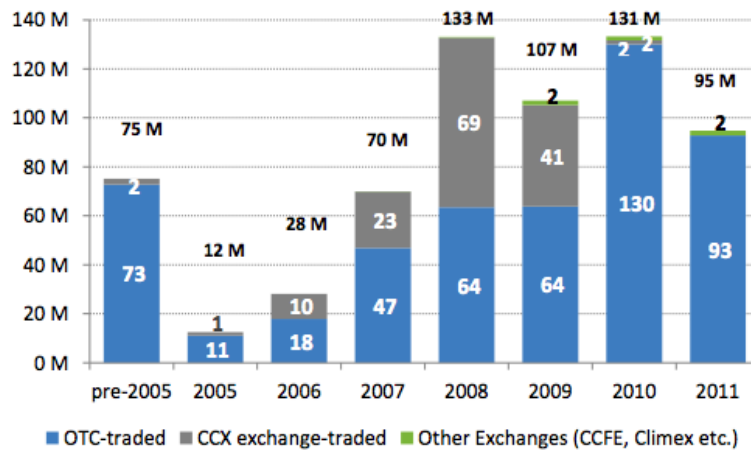
Figure 1: CDM credits issued 2003 - 2012 by country
(Source: UNEP Risoe 2012)



The amount of credits issued within the CDM has increased since its creation, although the slope of the growth is decreasing. Figure 1 shows also that at the moment about half of the total CERs is generated in China, and the majority of the rest in just three countries (India, Brazil and South Korea).

Figure 2 shows that the trends of the voluntary markets are less consistent. Being the volume smaller the market is more influenced by large one-off transactions. The trend in the past 6 years it has been however one of growth.

Figure 2: Voluntary market credits issued 2005 - 2011 by exchange market
(Source: Peter-Stanley and Hamilton 2012)



Source: Ecosystem Marketplace. Notes: Based on 1,040 observations. Annual totals may not equal sum of categories due to rounding.

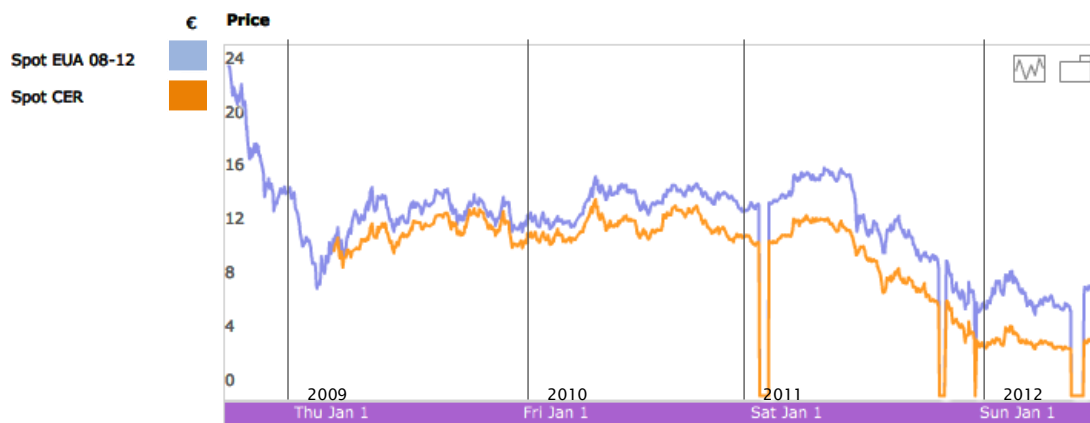
Voluntary market credits are mostly generated in North America (29% of the global volume), followed by Asia and Latin America. Africa only accounts for about 1% of the total, but it is the fastest growing, with a two-fold increase by volume in 2011.

1.1.4 The price of carbon

The price of carbon on **compliance** markets is driven by supply and demand. It is influenced by expectations on national and international regulations on energy and climate.

Presently (August 2012) the price in the EU ETS is of 7 €/tCO₂ while CDM credits are traded at around 3 €/t. It was at its peak in 2008, when it touched 30 €/t, stayed between 8 and 16 in 2009 and 2010, and started dropping in 2011 to the extremely low levels of present day (Figure 3).

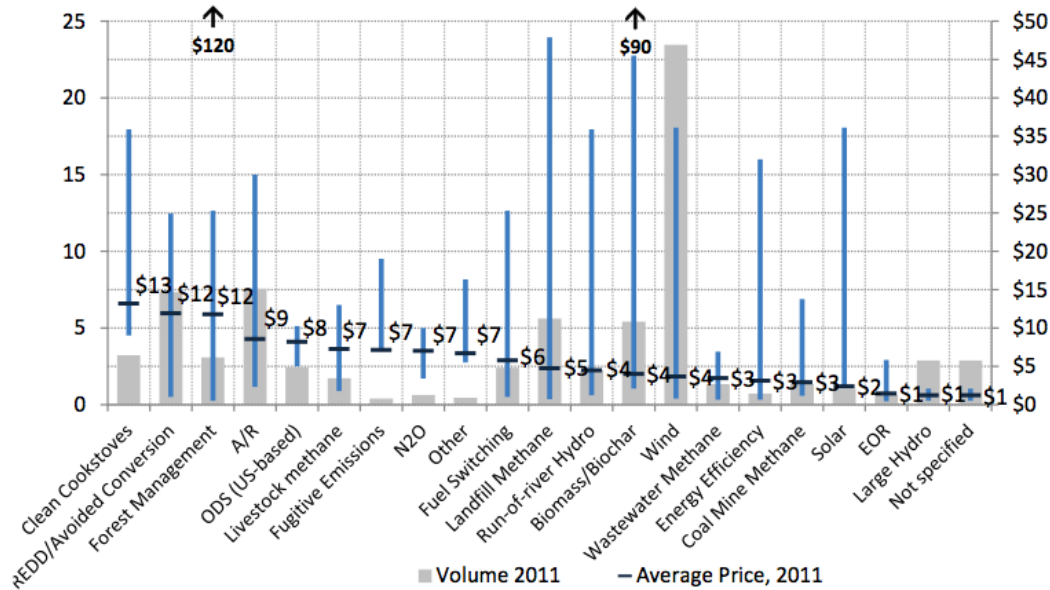
Figure 3: Carbon price on compliance market 2008 - 2012 (Source: Bluenext.eu)



On the **voluntary** market credits can be traded at very different prices according to the characteristics of the project by which they have been issued. Factors that influence the price are the availability of similar credits, the project's costs and investment risk, project credibility and co-benefits. Projects with a higher consideration for social and environmental sustainability implications other than climate usually attract a higher price.

The price can vary quite a lot, ranging from 1 \$/tCO₂ for some renewable energy projects to over 100 \$/tCO₂ for some low-volume, high-quality transactions. The average price in 2011 was 6.2 €/tCO₂.

Figure 4: Carbon price and transaction volume by project type^[1], 2011
MtCO₂ - US\$/tCO₂
(Source: Peter-Stanley and Hamilton 2012)



Source: Ecosystem Marketplace. Note: Based on 1798 observations.

Figure 4 shows the average price of carbon paid for different typologies of carbon projects in 2011 as well as the volumes traded.

Box: What happens after 2012?

In 2012 the Kyoto Protocol is expiring, and the EU ETS, the largest compliance carbon market will enter phase III, which will run until 2020.

- At the end of 2011 in Cancun the parties of the **Kyoto Protocol** came together to discuss the future of international climate policy. An agreement about extending the Kyoto Protocol, with binding emission reduction targets for each country, was not reached, but the parties committed to develop a new framework by 2015. The framework will go into effect in 2020 and is supposed to have binding targets for emerging economies (India, China, Brazil etc.) rather than only for OECD countries. From 2013 to 2020, national governments are left to define their own voluntary emission reduction targets. Several governments (including Australia, South Korea, Mexico) are looking to starting their own internal carbon markets following the example of the EU. The CDM will continue, as the EU is already by far the main market for CERs (CDM credits).

¹ REDD = Reducing Emissions from Deforestation and Forest Degradation
A/R = Afforestation/Reforestation
ODS = Ozone Depleting Substances destruction (USA)
EOR = Carbon sequestration through Enhanced Oil Recovery (USA)

Box: What happens after 2012? (continued)

- The third phase of the **EU ETS** will bring some regulation changes that will affect carbon markets worldwide. Mainly fewer allowances will be granted for free to large emitters (right now 97% of emission allowances are given away for free), in an effort to raise carbon prices. CDM credits (CERs) will be still allowed to cover part of the emission reductions, but some restrictions will start to apply.
 - The maximum cap of CERs that can be used to meet emission reduction targets will be lowered to encourage a higher adoption of low carbon technology within the EU. It will be roughly halved.
 - New projects will be only allowed if registered in Least Developed Countries (a list of LDC is given in Annex C) or countries with which the EU has a bilateral agreement. Projects in non-LDC registered before 2013 will still be able to issue CERs.
 - Credits from selected CDM project types, i.e. some industrial gases project, will not be traded anymore in the EU ETS, while other sectors will be added.

Clean cookstoves and forestry projects are those that earn the highest price, on average 9-13 US\$/tCO₂. For clean cookstoves, a relatively new type of project, the minimum price was more than 3 US\$ higher than the market average.

1.1.5 Buyers and sellers

In the **compliance** market CERs are issued by the CDM Executive Board, then forwarded to the project developers that can sell them to governments in developed countries that need to meet their Kyoto targets, or to authorized private organizations (such as financial institutions and carbon traders).

Buyers in the **voluntary** market can be all individuals or organizations that want to purchase carbon offsets. A distinction can be made between purely voluntary buyers and pre-compliance buyers, where the latter are those that purchase credits on the voluntary market in hope of receiving compliance market recognition later on. 83% of all transactions by volume were driven by purely voluntary buyers in 2011.

A research by Ecosystem Marketplace (Peter-Stanley and Hamilton 2012) identified 1200 organizations trading on the voluntary markets. Depending on their place in the supply chain, entities that sell in the voluntary market can act as one or more of the following categories:

- **Project Developers**, who develop carbon projects and generate the credits. Most of the organizations active in voluntary carbon markets are partly project developers.
- **Wholesalers**, who sell offsets in bulk and keep a portfolio of credits.
- **Retailers**, who buy and sell smaller volumes to individuals or organizations online.
- **Brokers**, who do not own credits, but facilitate transactions between interested sellers and buyers.

1.2 Regulators

To guarantee that to each carbon offset corresponds a real reduction in emissions, certification based on rigorous accounting methodologies are developed by the institutions regulating the markets and made publicly available. This section introduces the main regulators for the CDM and the voluntary markets.

1.2.1 Compliance markets: UNFCCC and CDM Executive Board

The functioning of the CDM is regulated by the UN Framework Convention for Climate Change (**UNFCCC**), which exists since 1992, and the **CDM Executive Board**. The former set out the foundations of carbon markets in several international agreements (including the Kyoto Protocol), while the latter makes the rules and takes decisions concerning specifically the CDM.

1.2.2 Voluntary markets: independent standards

On the voluntary markets there is no central authority, but independent organizations have developed their own standards to certify carbon credits and guarantee their value. Project developers work with them to certify their carbon reduction and issue offsets.

There are **8 independent third party standards** worldwide, whose market shares are shown in Figure 5.

Three of these standards, Gold Standard, Plan Vivo and CarbonFix, require projects to examine and monitor their **social and environmental impacts**, the other ones are merely carbon accounting standards². The **Gold Standard** is by far the market leader in this niche, with above 90% of market share.

Special consideration for other sustainable development impacts besides reducing GHG emissions translates in higher prices to be paid for the carbon credits. On average Gold Standard credits are traded at 10 US\$/tCO₂, the highest average price among all standards beside CarbonFix (which is specialized in forestry projects) (Figure 6).

Figure 5: Market shares of independent third party standards 2011
(Source: Peter-Stanley and Hamilton 2012)

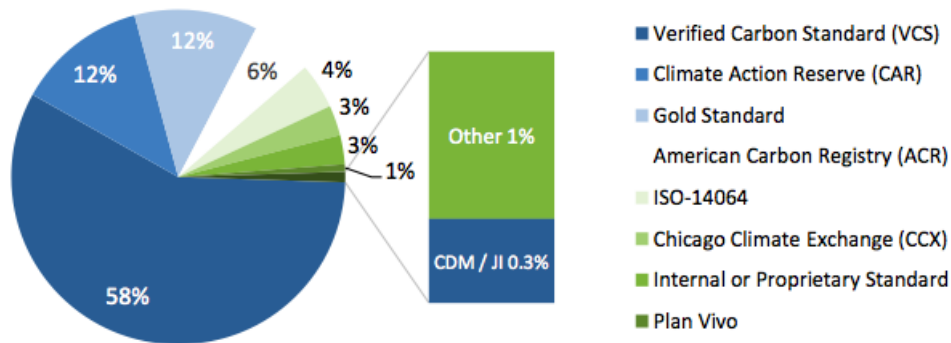
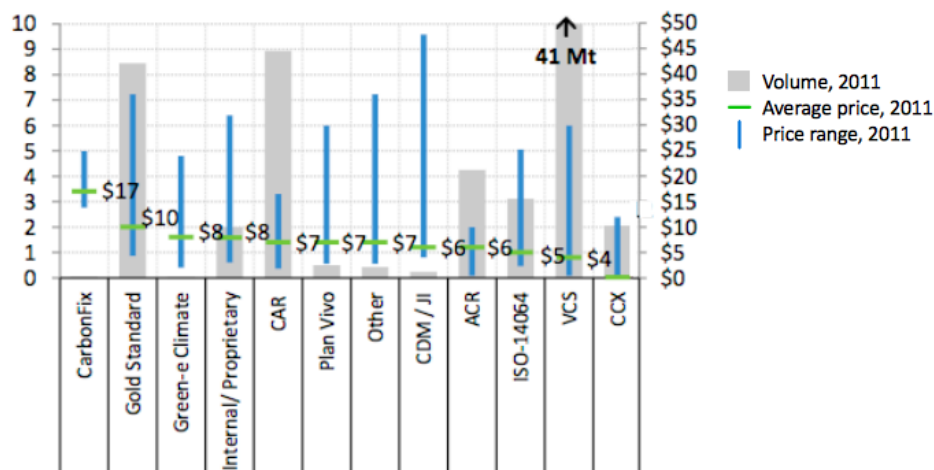


Figure 6: Average carbon price and transaction volume by standard 2011
MtCO₂ US\$/tCO₂
(Source: Peter-Stanley and Hamilton 2012)



² In some instances, however, carbon credits receive additional certifications that guarantee that the projects that issued them did not have negative social or environmental side-effects.

1.3 Carbon projects

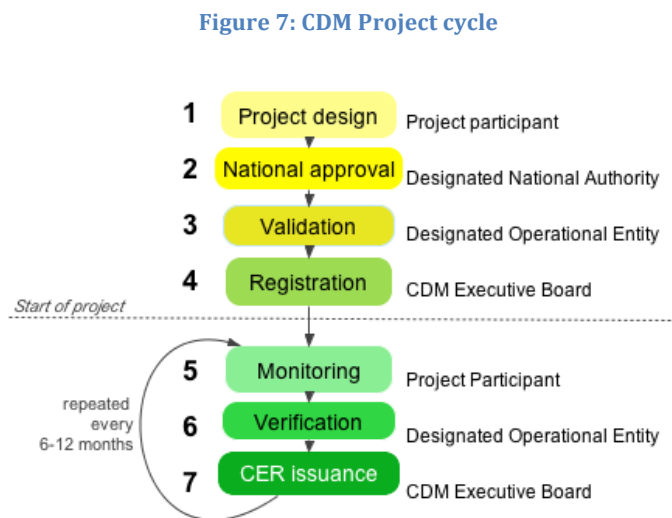
The previous section gave the big picture of what is happening globally on carbon markets. The rest of Chapter 1 explains how carbon financing works for single projects. More information about this focusing specifically on safe water projects is provided in Chapter 2.

1.3.1 CDM projects

As stated above, in the compliance market the rules and procedures for accrediting a CDM project are decided by the CDM Executive Board, based in Bonn. A list of online resources on these regulations can be found in the Bibliography.

1.3.1.1 Project cycle: from design to issuing credits

The project cycle is divided in 7 steps from project design to CER issuance (Figure 7).



The first 4 steps lead to registration as a CDM project and are based on the production of a **Project Design Document, (PDD)**, containing all the information about the project (Step 1), such as:

- Project description;
- Duration;
- Environmental analysis;
- Emission baseline and reduction;
- Monitoring plan
- Public funding sources
- Stakeholder comments

Local stakeholders of the project must be consulted in a *stakeholder workshop*, and the results must be included in the PDD. Also evidence should be provided that any concern raised during the workshops is being addressed.

The finished PDD is then submitted for public comment, approved by a designated authority in the host country (Step 2), validated by an independent auditor (Step 3) and finally registered by the CDM Executive Board (Step 4). Today on average it takes about **7 months** to go from the beginning of the PDD commenting period to the completion of the registration.

After the implementation has started 3 more steps lead to CER issuance, and must be repeated every 6-12 months. The project compiles a monitoring report (Step 5), gets it independently validated, (Step 6) and can then issue carbon credits (Step 7). It **takes 5-10 months** from the end of the monitoring period to the actual issuance of CERs.

1.3.1.2 Cost

The transaction costs of registering a CDM project are in the following range (example from improved cookstove projects by Nexus):

- PDD development: 20-60,000 US\$.
- Validation: 40-80,000 US\$
- Monitoring: 10-20,000 US\$
- Verification: 20-40,000 US\$

Overall upfront costs are in the range of 100-200,000 US\$.

1.3.1.3 Project duration

In order to be eligible for CDM certification, projects must either have a duration of **10 years**, or of **7 years** renewable up to a maximum of three times (for a total of up to 28 years). About 70% of the registered projects have opted for a duration of 7 years.

1.3.1.4 Project parties

Figure 7 also shows the different parties are involved in each step of the project cycle.

- The **project participant** can be any organization (NGO, governmental agency or business) that intends to develop a carbon project. Other partners can be involved in the process as part of the project team, which can include implementation partners, a CDM consultant, government agencies and/or a carbon credit trader.
- The **Designated National Authority** (DNA) is the body to which the government of a Kyoto Protocol country grants the authority to approve new CDM projects in its territory.
- The **Designated Operational Entity** (DOE) is a third party organization registered with the CDM which is entitled to validate projects' applications and monitoring reports, to guarantee they follow the rules and procedures. There are 38 DOEs worldwide, mainly technical certification organizations or large consultancies.
- The **CDM Executive Board** develops the rules and procedures and is responsible for the final approval of the projects.

1.3.1.5 Methodologies for calculating carbon reductions

The quantification of carbon reductions due to CDM projects is performed following guidelines explained in approved methodologies specified for each typology of projects (i.e. hydropower, reforestation, landfill gas etc.).

A project developer that enters the CDM project cycle can choose whether to use one of the approved methodologies or propose a new one, if a methodology does not exist for that specific project type or if it can make a convincing case for a new methodology. The average time between the proposal of a new methodology and the approval or rejection by the Executive Board is **between 5 and 12 months**.

Until now **152 Approved Methodologies** exist, divided into large scale, small scale³ and forestry, and 195 have been proposed and rejected or withdrawn.

Additionality

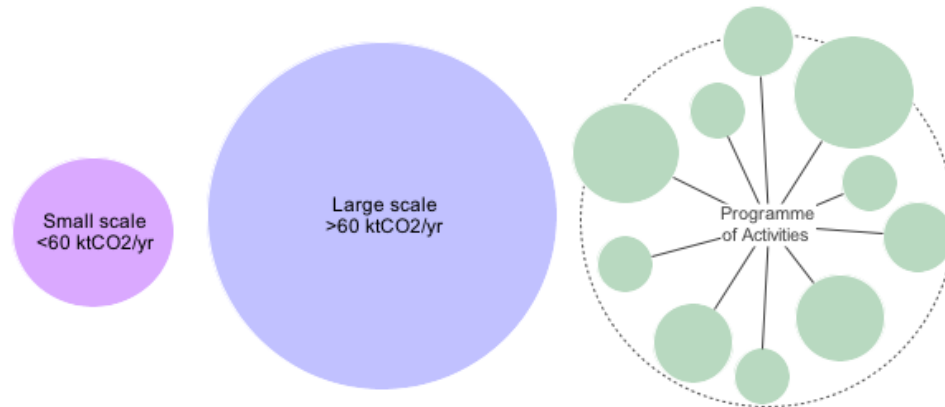
An important requirement that all project types need to meet is additionality. A project is additional when it is proved that *it could not happen without the revenues from carbon markets*. There is a specific methodology to prove additionality, according to which a project proponent needs to show that, due to **financial, institutional or technological conditions**, without revenues from the sale of carbon credits only an alternative with higher GHG emissions could be implemented. Additionality is easier to prove for emerging technologies.

³ For a definition of small and large scale projects see the following section (1.3.1.6 Types of projects)

1.3.1.6 Types of projects

The CDM regulation define three types of CDM projects, for which the accreditation procedures are slightly different (Figure 8):

Figure 8: CDM project types



- **Full scale** or large scale projects.
- **Small scale** projects, which can follow simplified procedures. They are defined as projects avoiding less than 60k tCO₂ per year, reducing energy use for less than 60 GWh per year (for energy efficiency projects) OR with an installed power lower than 15 MW (for renewable energy projects). About 40% of all CDM projects are small scale projects, which account for about 4% of all the issued carbon credits.
- **Programmes of Activities (PoA)** are a relatively recent form of projects which was developed to reduce transaction costs. A PoA consists of a group of similar projects (or CPAs, which stands for CDM Project Activities) where the scale is not defined ex-ante. When registering a PoA, the project coordinator does not need to specify the scale of the programme or the number of CPAs, but only the types of activities that can be included. During the project lifetime, then, additional CPAs and countries can be added with a shorter procedure that does not require the approval of the CDM Executive Board. Another feature of PoAs is that they can follow the simplified small scale project procedures if each of the CPAs is below the small scale threshold, even if the overall scale is larger.
Advantages of PoAs are therefore:
 - Shorter implementation time
 - Lower transaction costs
 - Full scalability
 - Reduced financial risk

Programmes of Activities are becoming increasingly popular (Figure 9), and especially in the field of household energy efficiency (Figure 10) to which safe water projects also belongs. More information on water PoAs is in section 2.10, and examples of proposed HWTS PoAs can be found in Annex B Existing and planned projects”.

Figure 9: Number of PoAs starting the public comment period each month
(Source: UNEP Risoe 2012)

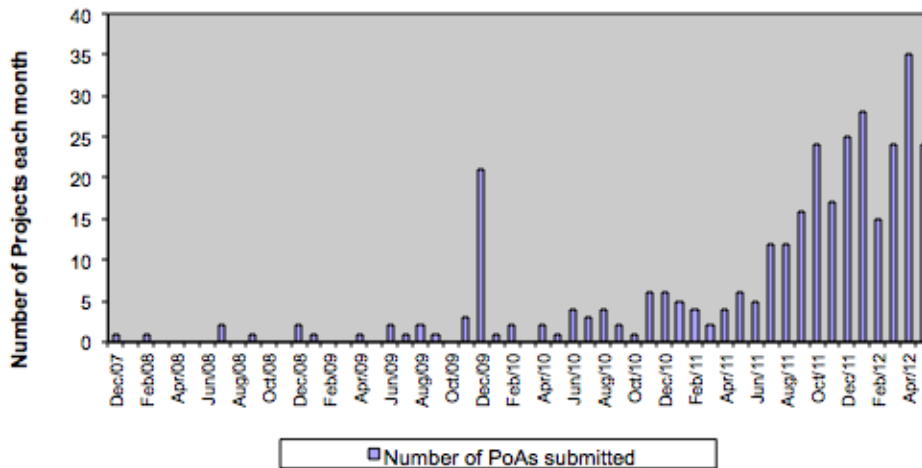
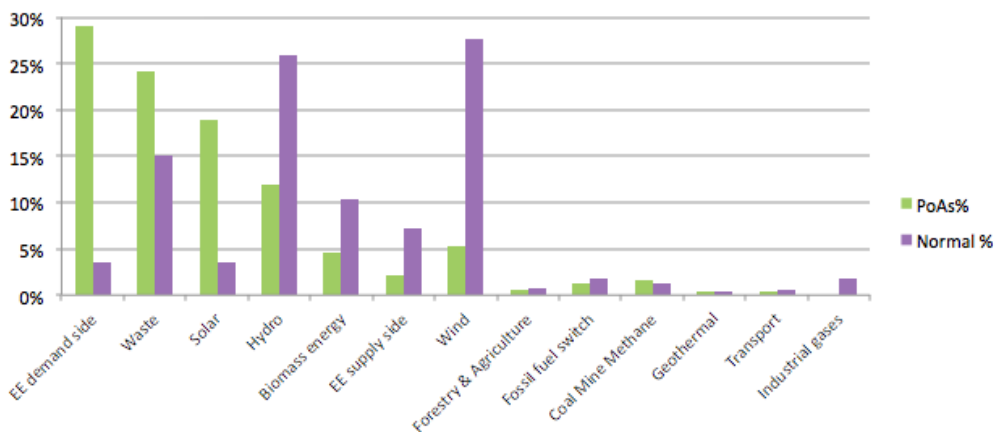


Figure 10: Number of PoAs compared to normal CDM by sector
(Source: UNEP Risoe 2012)



1.3.2 Voluntary market projects

Voluntary markets are not centrally regulated, so each standard has its own procedures and requirements, usually based on CDM procedures. This is especially true for the methodologies used to quantify carbon reductions, for which CDM Approved Methodologies are considered the benchmark.

1.3.2.1 The Gold standard

As an example here the process for accreditation with the Gold Standard (GS) is reviewed. The GS is the most used so far for HWTS projects and micro scale development projects with high social and environmental benefits in general. It is a carbon standard developed by several global NGOs led by the WWF.

The process of accrediting a project with the GS is similar to the one described above. The PDD form is the same as the one for CDM projects, and the DOEs (independent auditors) that can validate the PDD and the monitoring reports are the same CDM approved DOEs. GS projects

follow CDM Approved Methodologies for quantifying emission reductions, although the GS also developed eight own methodologies.

The main differences between GS and CDM rules are the following:

- An additional document must be submitted with the PDD, called the **GS Passport**. It contains extra information about the contribution of the project to the sustainable development of the area where it is implemented, including a Do No Harm assessment and specific Sustainable Development checklists where social, environmental and economic impacts of the project (people, planet, profit) are examined.
- An **extra stakeholder consultation** must be performed before the independent validation of the PDD, to inform the stakeholders of the measures that have been put in place to take their feedback into account.
- A specific **sustainability report** based on the GS Passport must be delivered in the monitoring phase.
- There are special procedures for **micro-scale** projects or PoAs, with a maximum of 10,000 tCO₂ per year, as well as for projects in **conflict areas**.

2 Carbon finance for HWTS

The past few years have seen the emergence of a number of projects linking carbon trading with water purification. In the first half of 2012 three water purification projects, two in Kenya and one in Cambodia for the first time received funding from the sale of carbon credits. Many more are in the pipeline and will take off in the coming months and years.

This chapter explains the basic concepts and functioning of carbon finance for safe water projects, its potential value and the risks involved, with a look at the characteristics of existing and planned HWTS carbon initiatives.

2.1 Basic concept: why offset carbon emissions with safe water

The basic concept is that supplying people with safe water prevents them from needing to treat water by boiling it, and therefore saves energy and reduces GHG emissions.

Organizations that provide people with access to clean water where there is no distribution network can register their activities as carbon projects and issue and sell carbon credits. This applies to household filters, chlorine tablets, UV cleaning or any other technology, at the household, neighborhood, school or village level.

To calculate the amount of GHG emissions that are avoided the share of population that uses boiling to clean the water, the cookstoves and fuel used for boiling and other local characteristics are determined from existing studies or with an ad hoc survey. In many regions only a minority of the population without access to clean water uses boiling to treat their water, but with the principle of **suppressed demand** families that don't presently boil water can also be accounted for.

2.1.1 Suppressed demand

According to the principle of suppressed demand a project, by providing clean water to households, is able to claim emission reductions not only for the actual substitution of boiling. It can also receive credit for avoided emissions from boiling that *would occur in the future, when families that currently do not boil water would start to do so, thanks to an increase in health education, time availability and/or budget to spend on fuel.* In many African countries the majority of carbon credits for from safe water supply consists in fact of suppressed demand.

The principle of suppressed demand has been criticized because in fact part of the carbon offsets is generated by a reduction of GHG emissions that is more theoretical than real and verifiable. However this principle is widely accepted in the carbon community. Suppressed demand has been designed to allow the benefits of carbon markets to reach out to places with low *baseline* emissions⁴. For example while installing solar panels in a city would generate carbon credits because it directly avoids demand for electricity from dirty power plants, doing the same in an off-grid village would not, in theory, without accounting for suppressed demand. Bringing electricity to new areas does not avoid GHG emissions if not by displacing future demand, suppressing the need for grid connection in the future. As this applies for renewable energy, it has been extended to household water treatment. In the HWTS field, however, it remains a controversial point, as it is not an intuitive way of calculating avoided emissions.

2.2 History and market overview

Figure 11 on page 19 illustrates the history of the carbon & water market from 2008 to 2012, showing the approval of methodologies and projects (from application, to registration, to the issuance of the first credits after the first monitoring report) on both the compliance and the voluntary market.

The first CDM methodology that stated how carbon reductions from safe water supply could be accounted for was designed in 2008 and since then new or revised methodologies have been approved by the CDM (compliance market) and the GS (voluntary market) every year.

⁴ In carbon projects emission reductions are always calculated as the difference between *project emissions* and *baseline emissions*. The former are the emissions generated by the projects and the latter are the emissions that *would occur* in absence of the project

Figure 11: Carbon finance and & safe water timeline - Methodologies and Projects
 (Sources: CDM 2012, Gold Standard 2012)

		2008	2009	2010	2011	2012
Methodologies >	Legend: Compliance (CDM) Voluntary (GS)			CDM AMS.III.AV "Low GHG emitting water purification devices" v 1.0 & v 2.0 approved		v 3.0 submitted
				GS "Technologies and practices to displace decentralized thermal energy consumption" approved		
			GS "Methodology for Improved Cook-Stoves and Kitchen Regimes" v 1.0 approved	v 2.0 approved		v 3.0 submitted
			CDM AM0086 "Installation of zero energy water purifier for safe drinking water application" approved			
		CDM AMS.I.E "Switch from Non Renewable Biomass" v 1.0 approved		v 2.0 & v 3.0 approved (clarification about water purification)	v 4.0 approved	v 5.0 approved
< Projects		E+CO Tanzania: application	Rwanda Natural Energy: application		South Pole PoA: application	
			Unilever Hindustan India: application		MicroEnergy PoA India: application	
				LifeStraw Kenya: application & registration		credits issued
				Impact Paradigm cookstoves & filters Kenya: application & registration		credits issued
				Hydrologic Cambodia: application & registration		credits issued
					DelAgua Eastern Africa: PoA application	
					LifeStraw Indonesia: application	
					Solarwave Tanzania PoA: application & registration	
					Water Purifiers India: application	
					Impact Carbon international CDM PoA: application	
					Aqua Clara Kenya: application	
					Impact Carbon international GS PoA: application	

On the **compliance** market, the first ever project in this field was a project by Unilever that applied for registration in 2008 but was never registered. The first registered project, Rwanda Natural Energy, started taking shape in 2009 and was registered in May 2011. In the same year three more projects entered the registration process. All of them are PoAs, one is based in Tanzania, one in India and one is international. In 2012 four more PoAs and a large scale an India-wide project entered the CDM registration process. None of the projects on the compliance market has issued any CERs yet.

On the voluntary market the only standard that has worked with water projects so far is the Gold Standard (GS), the most important standard for micro projects with a high sustainable development impact (for an overview of existing standards see section 1.1.2 Types of markets on page 7). The first safe water projects have been registered in 2011. There are three projects which started issuing VERs in 2012 for the first time. Two of them are in Kenya (by Vestergaard Frandsen and the Paradigm Project/Impact Carbon) and the third in Cambodia (by Hydrologic). Few more projects are undergoing registration with the GS at the time of writing.

The scale of these projects varies. Some are landmark large scale projects, such as Vestergaard Frandsen's (the largest GS project ever approved) and Unilever Hindustan (of a comparable size, but on the compliance market), reaching more than 1 million tCO₂/year. The others range from 200k down to 6k tCO₂/year. In PoA projects the size is flexible rather than specified ex ante, and some even have an international reach.

More details on existing projects is presented in a review in Annex B.

2.3 Key differences from other financing sources

Carbon finance is starting to become a new form of funding for safe water projects. However it has some features that set it apart from traditional sources of finance.

- Carbon finance is **performance-based**. Carbon credits can only be issued for proven project results, households provided with access to clean water each year, rather than on the basis of future plans or projections. Monitoring has to be performed regularly (every year or every six months) to quantify the outreach of the project and thus the amount of avoided emissions.
- It is **ex post**. Being performance based, carbon finance only translates into revenues after the first steps of the project have been implemented. Initial start up costs cannot be covered by carbon finance, unless an interested buyer of credits is willing to advance the payment.
- It is **untied** from spending requirements. Revenues from carbon finance can be spent in any way. They can be used to subsidize products, pay for marketing, maintenance or monitoring, they can be shared with the users or kept as profit. There are however some limitations, only *for project funded partly or in full by Official Development Assistance (ODA)*, in order to avoid aid diversion (see section 2.6.1 below)

2.4 How does it work?

As outlined in section 1.3, a project must achieve registration with the UNFCCC (for the CDM market) or with an independent standard like the Gold Standard (for the voluntary markets) in order to issue carbon credits. Getting a project registered takes about 1 year, although the time can vary a lot (usually newer types of projects, such as water is right now, have longer time lags that decrease after a few years).

After the registration the crediting period starts, which can be of 10 or 7 years renewable three times. Upon the submission of monitoring reports, every 6-12 months, the carbon credits are issued and then sold on the CER market (for compliance markets) or to any interested buyer (for voluntary markets) and finally generate revenues for the project.

As mentioned before, once the revenues have been cashed there are no requirements on how they should be spent, exception made for the case of projects funded by ODA (see section 2.6.1 below for more details on the ODA requirement).

2.5 What are the potential revenues from carbon finance?

The potential revenues from carbon finance for a project depend on two main factors:

1. The **amount of carbon credits** that can be generated by the project, which is a measure of the GHG emissions avoided by the projects. In turns it depends on a variety of paramaters (see Annex A for more details).
 - The **number of households** reached.
 - The average number of **household members**.
 - Their average drinking **water consumption**.
 - Current (and predicted) **water treatment habits** (i.e. how many households boil water).
 - The **type of fuel** used and, for biomass, the share of it that can be considered non-renewable (which depends on the condition of local forests and agriculture)
 - The amount of fuel necessary to boil 1 liter of water using local cookstoves.
2. The **price** at which carbon credits can be sold. Currently it can go from below 3 to over 10 €/tCO₂. On the compliance market there is a market price. On the voluntary one, where the price depends on ad hoc agreements between the project developer and interested buyers, prices can vary a lot. Credits from safe water projects, which have high social and environmental benefits beside the reduction carbon emissions, can be expected to attract above average prices (see also section 1.1.4, page 9).

Table 2: Emission reductions per household per year in existing projects (tCO₂eq)

	<i>Vestergaard Frandsen</i>		<i>Impact Paradigm</i>	<i>Hydrologic</i>	<i>AquaClara</i>
Source ⁵	PDD	MR	MR	PDD	PDD
Country	Kenya		Kenya	Cambodia	Kenya
Technology	Ceramic filters		Ceramic filters, powders and tablets	Ceramic filters	BioSand filters
Households boiling water ⁶	71%	79.6%	81.4%	97.4%	96%
Non renewable biomass	65%	93%	82%	73%	75.5%
Biomass per liter boiled (kg)	0.36	0.36	0.36	0.00009	0.42
Drinking water consumption (L/ppd)	4.11	2.96	1	1.35	5.3
Emission reduction per household (tCO ₂ e/yr)	2.02	3.03	1.05	0.46	1.07

⁵ PDD = Project Design Document (ex-ante), MR = Monitoring report (after the first implementation period)

⁶ Including suppressed demand

To give an idea of the potential revenues, a review of the amount of carbon certificates generated per household per year by existing projects is given in Table 2. The large range of the values in the table is due to the fact that all the parameters that determine the amount of credits per household per year mentioned above have a high geographical variability.

2.6 Which projects are eligible?

Projects that provide access to safe drinking water to people that previously had to treat their own water or drink unsafe water can consider applying for issuing carbon credits. Different water purification technologies can qualify, from filters to chemicals to UV filtration etc., both at the household level and at the community level (i.e. schools, water kiosks or village taps).

The formal requirements can be divided in two sets, namely the general eligibility requirements for carbon projects and those specific for water projects. A distinction is here made between CDM and GS requirements (for compliance and voluntary markets respectively).

2.6.1 General eligibility requirements

The general eligibility requirements for CDM projects stated by the UNFCCC are also adopted by the GS, and are the following:

- **Additionality.** To meet the additionality requirement a project must generate emission reductions that would not happen without the support of carbon finance. This requirement has been designed to guarantee that capital flows from carbon markets actually make a difference rather than just rewarding emission saving activities that would happen anyway. Additionality can be demonstrated through a financial analysis or an analysis of existing barriers and by comparing the project activities with possible alternatives.
- **No diversion of ODA.** Carbon projects must not divert official development assistance funds. Public grants that contribute to project financing must be disclosed. The rules that determine whether public funding is or not a diversion of ODA are complicated, but normally it is sufficient to show that the revenues from carbon finance will not be transferred back to the national government that provided the grant, but re-invested into the project itself.
- **Contribution to sustainable development.** Projects must contribute to sustainable development of the local area, by providing environmental, social or economic benefits or technological transfer.

From 2013 **eligible countries** will be, on the compliance market, only Least Developed Countries (according to UN classification, see Annex C), as emission trading regulations will change in the EU, by far the biggest market for CDM credits.

On the voluntary markets all developing countries that are Party to the Kyoto Protocol (i.e. except Afghanistan, Palestine and Western Sahara, as well as some Eastern European countries, which don't qualify as developing countries) and have designated a national authority for the CDM can be eligible.

2.6.2 HWTS specific requirements

Beside the above-mentioned general requirements, which apply to any carbon project, there are also specific eligibility criteria for water projects. CDM and GS methodologies have different requirements.

For CDM projects, the requirements described in the methodology *AMS.III.AV* "Low greenhouse gas emitting water purification technologies" are three:

1. A public **distribution network** of safe drinking water does not exist in the project area.
2. **Water quality:** the technology achieves compliance with either "protective" performance target as per WHO's 2011 "*Evaluating household water treatment options: Health based targets and microbiological performance specifications*" OR a comparable national standard or guideline.
3. Measures must be in place to ensure that **replacement devices** are made available to users, if their lifetime is shorter than project duration.

However it has to be noted that at the moment of writing an update to the above-mentioned methodology is undergoing review with the CDM Executive Board, meaning that the requirements are still in evolution.

For GS projects, the relevant methodology is called “*Technologies and Practices to Displace Decentralized Thermal Energy Consumption*” and states the following conditions to be met for a project to be eligible.

- The maximum **size** for projects that can apply is defined as the displacement of thermal energy for a maximum of 150 kW per device.
- The considered technology does not require **fossil fuels** to operate.

Also in the voluntary market a new methodology is under review, an updated version of the currently archived GS “Methodology for Improved Cookstoves and Kitchen Regimes”.

2.6.3 Can projects that already started be registered?

The GS allows **retroactive registration** of carbon reductions: VERs can be issued for project activities that were implemented up to 2 years before GS registration.

The CDM does not allow retroactive registration. However projects that already begun can still enter CDM registration provided that within 6 months from their start they file a form of “**Prior Consideration** of the CDM”.

2.6.4 Who can apply?

Any organization can become a project participant for a CDM or GS project. Applications for registering projects can be co-signed by more than one organization, and existing safe water carbon projects have been presented by governmental agencies, NGOs and project developers, carbon traders and carbon consultants (see Annex B).

2.7 What costs and duties are involved?

The costs of registering a project to issue carbon credits for an organization can be divided in the following three categories.

- **Extra project costs:** the cost of collecting all the required information to submit the application in the first year and for the ongoing monitoring (occurring every 6-12 months).
 - **Before registration** several activities must be organized to complete the application, including
 - a survey, with a sample of the target population, about household size, water consumption, water purification habits, fuel consumption for water boiling;
 - stakeholder consultations to inform local stakeholders about the project and collect feedback.
 - **During the project lifetime** some values must be monitored, such as the uptake of the project technologies and eventual changes in the parameters mentioned above.
- **External validation costs** for the independent validation of the PDD (project design document) and the monitoring reports. A list of approved validators is available on the CDM website.
- **Fees.** For CDM projects fees are paid annually on the amount of CER issued (i.e. 0.20 US\$/CER below 15ktCO₂ and 0.10 above that threshold, capped at 350k US\$ for small scale projects). There is a minimum threshold of yearly credits generated under which fees do not apply. For GS projects fees are similarly calculated.

A more detailed overview of the project cycle steps and average costs is given in section 1.3.1 on page 13.

Overall, costs born before the first credits are issued (from the creation of the Project Design Document and the other documentation to the verification of the first Monitoring Report) can be expected to be between 100 and 200k €. Annual costs for monitoring and credit issuance can be in the range of 30 to 60k €.

The required surveys and monitoring duties for both CDM and GS projects are summarized in

Table 3. The size of the samples of the target population that must be surveyed depends on the size of the project population itself and must be determined following approved guidelines. Indicatively the sample size is about 0.5-1% of the target population. The GS methodology requires testing ex ante at least 20 cooking appliances to determine experimentally energy savings from avoided boiling.

Table 3: Minimum surveying requirements

	<i>CDM</i> (AMS.III.AV v2)	<i>GS</i>
% of population that boils/would boil water	Ex ante only	Biannually
Drinking water consumption per capita	Ex ante only	Biannually
Fuel use for boiling 1 L of water	- (default value)	Ex ante only
Treated water quality	Annually	Biannually
Absence of water supply network	Annually	- (not required)
Devices in use	Biannually	Annually
Household size	Biannually	Biannually
Sales record	Continuously	Continuously

2.8 What are the risks involved?

The risk connected to carbon finance can be summarized as follows.

2.8.1 Rejection risk

The project does not manage to achieve registration. In case of rejection the initial costs for producing and validating the application documents cannot be recovered. Rejection risk is clearly higher for applications submitted by organizations without previous experience of carbon finance, and can be mitigated by hiring a carbon consultant for the drafting of the PDD and the project.

2.8.2 Implementation risk

The project is not successful in delivering results, so that even though the project is registered it does not issue as many credits as expected.

This risk corresponds to common implementation risks of any development projects. The difference is that normally the funding is granted beforehand, while carbon finance has a negative cash flow for the first 1-2 years. If the project is unsuccessful the initial costs cannot be recovered.

2.8.3 Monitoring risk

The monitoring system is not efficient in capturing the project's impact, excessive costs and/or long delays arise and prevent the issuance of carbon credits. Monitoring risk can only be mitigated by careful design of a monitoring plan.

2.8.4 Market risk

Credits cannot be sold at the expected price. This can happen due to insufficient demand as well as oversupply on the market.

On the **compliance** market *demand* is driven by commitments of national governments to reduce their GHG emissions, especially the EU's, which presently hosts the largest carbon market. Another factor that influences demand for CDM credits is the maximum share of reductions allowances that companies can buy from the CDM, as opposed to the internal market in developed countries. This limit is set by carbon regulators and will be reduced in the EU ETS starting from 2013. *Supply* of CDM credits is determined by the amount of registered CDM projects and the amount of CERs they issue. Supply is growing steadily, as more projects are registered every year (see Figure 1 on page 8). However from 2013 only CDM projects in Least Developed Countries will be allowed to register to sell credits in the EU. On the compliance market the price of CERs touched the historical low in July 2012.

An overview of the changes in compliance carbon markets that will take place from 2013 is given in the box "What happens after 2012?" on page 11.

On the **voluntary** market companies and governmental organizations that voluntarily commit to offset their GHG emissions constitute the *demand*. Buyers purchase credits in one-off transactions with the project developers and the price is agreed on a one by one basis. While on the compliance market the price is one, on the voluntary markets different projects and project typology attract different prices, which evolve over time according to their specific demand and supply. This market is driven by consumer demand for climate neutral products and services, it has been expanding since its foundation (Figure 2, page 9). It is still small, and thus sensitive to sudden variations in supply and demand. *Supply* of credits from safe water projects is rising, as more and more projects achieve registration with the Gold Standard. The first ever carbon water project, Vestergaard Frandsen's in Kenya, issued the first credits in 2012 and it is the largest GS project by credits issued ever, and issues twice as much credits as the second largest one.

A way of mitigating market risk is to achieve double GS and CDM registration for the same projects. Since GS methodologies are based on CDM ones, a CDM project can subsequently apply for GS certification. The credits so generated, called GS CERs, can be sold on both the compliance and the voluntary market.

2.8.5 Reputation risk

The project attracts negative reviews from critics of carbon trading.

Carbon trading in general has attracted criticisms in the media, as well as from environmentalists, because it can be seen as a way for western companies to keep their emissions high by just purchasing offsets. Furthermore the correspondence of offsets to real reductions has been questioned as scams have arisen in the past. In fact the application of the principle of suppressed demand by existing safe water carbon projects has already received some bad press. This risk can be mitigated by maintaining a high standard of transparency in project implementation and reporting.

2.9 How can carbon revenues be spent?

As it has been mentioned before, funding from carbon finance is awarded after the successful implementation of the project, and there is no restriction on how the revenues can be spent⁷.

When the credits are issued by the CDM Executive Board or by the Gold Standard Foundation they are transferred to the organization that has the lead in the project, which is then free to sell them for a revenue. The revenues can then be split between the project parties (that can include carbon traders or consultants, implementation partners, distributors, suppliers, government agencies or even users).

Carbon revenues can therefore be integrated in projects with different business models, as they can be used:

⁷ With exceptions for projects funded partly by ODA. See section 2.6.1.

- For subsidizing products, distributing them free of charge or at a reduced price.
- For financing social marketing and awareness creation campaigns.
- To keep a service network for maintenance and replacement of the devices.
- To pay for the carbon monitoring after the first year.
- Given directly to users, to incentivize them to adopt safe water technologies.

2.10 What is a PoA and what are its main features for safe water projects?

Most existing safe water carbon projects are currently Programmes of Activities (PoAs).

A Programme of Activities (PoA), or programmatic project, is a specific type of carbon projects that can be registered both with the CDM and the GS. As explained in section 1.3.1.6, a PoA is a platform for carbon projects of similar type, that can be registered with shorter procedures, at lower transaction costs and at any time during the programme's lifetime.

Requirements for projects to be part of the PoA (i.e. the technologies that can be used and the countries where the projects can be implemented) are defined ex ante in the PDD, but the overall scale of activity, which keeps growing as new projects become registered, is not.

Some organizations, such as South Pole Carbon and Impact Carbon are registering PoAs, both on the CDM and on the voluntary market, that are open to different implementation partners, countries and technologies. These open PoAs are designed to allow any organization implementing safe water projects to join and be registered to issue carbon credits with a shorter and less costly procedure.

A review of existing water PoAs is given in Annex C

2.10.1 PoA procedures

Registering a PoA means getting a project design document approved that describes what kind of projects can participate in the programme and how the emission reductions will be calculated. Furthermore the first individual project, called CDM Project Activity (CPA) must be registered at the same time.

Additional CPAs can then be added during the lifetime of the programme, without requiring individual approval from the CDM Executive Board.

2.10.2 PoA eligibility requirements

Formal eligibility requirements for CPAs are the same as for regular CDM projects. Each PoA however has to list the specific requirements that future CPAs will have to meet in order to be included in the POA (i.e. which technologies, project areas and types of projects).

The mechanism of CDM Prior Consideration (see section 2.6.3) does not apply for PoAs, meaning that, PoAs cannot include projects that have already started.

2.10.3 Costs

The cost of registering a PoA can be higher than for a regular project, with initial costs from start to first issuance of credits ranging around 200k €. However after the initial registration, adding further CPAs to the programme becomes much less costly, at a price of around 40-50k € each.

3 Bibliography

Clean Development Mechanism, 2012, *CDM: Project Activities*. Database available at <http://cdm.unfccc.int/Projects/projsearch.html>

Peters-Stanley M. and Hamilton K., 2012, *Developing dimension. State of the voluntary carbon markets 2012*. Ecosystem Marketplace and Bloomberg New Energy Finance. Available at

Gold Standard, 2012, *The Gold Standard Registry*. Database available at <http://gs2.apx.com/>

UNEP Risoe, 2012, *CDM Pipeline overview and PoA pipeline overview*. Excel spreadsheets available at <http://www.cdmpipeline.org/>

World Bank, 2012, *State and trends of the carbon markets 2012*. Washington DC

3.1 Methodologies

CDM - AMS.III.AV Low greenhouse gas emitting water purification systems.

<http://cdm.unfccc.int/methodologies/DB/DUFHO6ZC1Z9IE3THBDUNRN1NTV0BC0>

CDM - AMS.I.E Switch from Non-Renewable Biomass for Thermal Applications by the User.

<http://cdm.unfccc.int/methodologies/DB/11DGDUD1D5J0KMLSZFWMD3W9Z47OZZ>

CDM - AM0086 - Installation of zero energy water purifier for safe drinking water application.

<http://cdm.unfccc.int/methodologies/DB/9VTXPHAU3QSG26CDIU0EWX81JSYKKO>

Gold Standard - Technologies and practices to displace decentralized thermal energy consumption. <http://www.cdmgoldstandard.org/project-certification/gs-methodologies>

3.2 Useful links

<http://cdm.unfccc.int> - Official CDM website.

<http://www.cdmgoldstandard.com> - Official Gold Standard website.

<http://www.cdmpipeline.org/> - Overview and analysis of existing CDM projects.

<http://cdmbazaar.net/> - Directory of organizations working in the field of carbon finance.

<http://cd4cdm.org/> - Collection of open source resources for CDM project development

Annex A Emission reduction calculation

The GHG emission reduction due to the use of HWTS systems, or the amount of carbon credits that can be generated and sold, is quantified by the following formula:

$$\text{Emission reduction} = \text{Baseline emissions} - \text{project emissions}$$

Baseline emissions

Baseline emissions are the emissions that would occur in absence of the considered project.

A baseline scenario is defined by looking at average water consumption for drinking per capita in the project area, boiling habits and type of fuel used for boiling water.

A distinction is made between *renewable* and *non renewable biomass*, where the former is biomass harvested from sustainably managed cropland or forests.

Baseline emissions are calculated as the product of the following factors:

- Quantity of purified water, calculated as the product of
 - Number of devices in use
 - Family members per household/filter
 - Water consumption for drinking per capita per day (max 5.5 L)
 - Share of people boiling water or *that would boil water for purification* (according to the principle of **suppressed demand** that states that reductions can be claimed for suppressing future demand for a high emission behavior)
- Biomass required per liter boiled water, calculated by multiplying
 - Heat requirement
 - Stove efficiency (default 0.1-0.5)
 - Biomass heat content
- Share of non renewable biomass (100% if fossil fuels are used for heating)

The table below gives an overview of the values of these parameters used in the reviewed HWTS carbon projects.

Project emissions

Project emissions are the emissions generated by the implementation of the project:

- Fossil fuel combustion due to project activity
- Electricity consumption by the project activity

In all the reviewed projects project emissions were estimated to be negligible, exception made for the Unilever project in India.

Annex B Existing and planned projects

Individual projects

	<i>LifeStraw Kenya</i>	<i>Impact Paradigm Cookstoves and Water</i>
Country	Kenya	Kenya
Market	Voluntary	Voluntary
Scale	2M tCO ₂ /yr	200 ktCO ₂ /yr
Methodology used	Gold Standard Methodology for Improved Cook-Stoves and Kitchen Regimes, V.02 (<i>now archived</i>)	Gold Standard Methodology for Improved Cook-Stoves and Kitchen Regimes, V.02 (<i>now archived</i>)
Technology	LifeStraw Family	Ceramic filters (Chujio filter), powder and tablets (PuR and Aquatabs)
Status	Issued the first VERs in 2012	Issued first VERs in 2012
Project owner	Vestergaard Frandsen	Paradigm project
Partners	<i>ClimateCare</i> <i>Manna Energy</i>	<i>Impact Carbon</i> <i>Safe Water and AIDS Project</i> <i>+Local partners</i>

	<i>Hydrologic</i>	<i>Rwanda Natural Energy Projects</i>
Country	Cambodia	Rwanda
Market	Voluntary	Compliance
Scale	20 ktCO ₂ /yr	2x 3ktCO ₂ /yr each ⁸
Methodology used	Gold Standard Methodology Technologies and Practices to Displace Decentralized Thermal Energy Consumption V.01	AMS.I-E Switch from non renewable biomass for thermal application by the user. Version 2.0
Technology	Ceramic filters (Hydrologic)	Solar powered UV filters (for schools)
Status	Issued the first VERs in 2012	Registered in May 2011, has not issued CERs yet.
Project owner	Hydrologic	Manna Energy Limited
Partners	Nexus - Carbon for development	UNDP MDG Carbon Facility Rwanda Environment Management Authority Rwanda Ministry of Education Swedish Energy Agency

⁸ Manna Energy has submitted two separate CDM projects with similar features in different areas of Rwanda.

	<i>Aqua Clara water filtration program</i>	<i>Unilever Hindustan</i>
Country	Kenya	India
Market	Voluntary	Compliance
Scale	70 ktCO ₂ /yr	1.3 MtCO ₂ /yr
Methodology used	Gold Standard Methodology Technologies and Practices to Displace Decentralized Thermal Energy Consumption V.01	AM0086 Installation of zero energy water purifier for safe drinking water application
Technology	Bio Sand filters and Hollow Fibre Membrane filters	Pureit and GermKill Kits
Status	At validation	At validation
Project owner	Aqua Clara Foundation	Hindustan Unilever Limited
Partners	Viability Africa Ltd	-

	<i>Impact Carbon Sudan</i>	<i>Impact Carbon Guatemala</i>
Country	Sudan	Guatemala
Market	Voluntary (GS)	Voluntary (GS)
Scale	Large scale	Large scale
Methodology used	Gold Standard Methodology for Improved Cookstoves and Kitchen Regimes V.03	Gold Standard Methodology for Improved Cookstoves and Kitchen Regimes V.03
Technology	Launching with ceramic filters. May also pursue Chemical treatment, Community interventions: boreholes, chlorine dispensers	Ceramic filters
Status	Development in progress.	Developing project documentation; filter distribution in progress for retroactive crediting
Project owner	Impact Carbon	The Paradigm Project
Partners	Potential Energy, Practical Action. Dedicated investment from Slow Life Trust to invest in scalable, effective technologies	Impact Carbon

Programmes of Activities

	<i>LifeStraw Family in rural Indonesia</i>	<i>Water Purifiers India</i>
Country	Indonesia	India
Market	Compliance	Compliance
Scale	PoA	PoA
Methodology used	AMS.III.AV Low greenhouse gas emitting water purification systems – Version 2.0	AMS.III.AV Low greenhouse gas emitting water purification systems – Version 2.0
Technology	LifeStraw Family	Reverse osmosis, UV purification, Granular activated carbon filters, Domestic water purification based on Photocatalysis, Ceramic filters, TSRF (Rice husk ash impregnated with nano silver particles - Tata Swach), Germs kill processor (Pureit).
Status	At validation	At validation
Project owner	Vestergaard Frandsen	General Carbon Advisory Services Pvt ltd
Partners	Manna Energy Limited	-

	<i>MicroEnergy Credits</i>
Country	India
Market	Compliance
Scale	PoA
Methodology used	AMS.III.AV Low greenhouse gas emitting water purification systems – Version 2.0
Technology	Not specified. Water purifiers, solar energy systems and clean cookstoves.
Status	At validation.
Project owner	MicroEnergy Credits
Partners	Local partners

Open access international PoAs

	<i>Impact Carbon International CDM PoA</i>	<i>Impact Carbon International GS PoA</i>
Country	Open Access POA. Projects in all least developed countries eligible to participate. First crediting in Rwanda.	Open Access POA. All countries with safe water access problems eligible. First crediting in Uganda
Market	Compliance	Voluntary
Scale	PoA	PoA
Methodology used	AMS.III.AV Low Greenhouse Gas Emitting Water Purification Systems - Version 3.0	AMS.III.AV Low Greenhouse Gas Emitting Water Purification Systems - Version 3.0
Technology	Any technology that meets national or WHO standards and reduces emissions to <10% compared to boiling. Includes: ultrafiltration, ceramic filters, solar powered UV systems.	Any technology that meets national or WHO standards and reduces emissions to <10% compared to boiling. Includes: ultrafiltration, ceramic filters, solar powered UV systems.
Status	Submitted for validation.	Developing project documentation. Generation of credits possible immediately through retroactive crediting.
Project owner	Impact Carbon	Impact Carbon
Partners	myClimate	myClimate

	<i>South Pole International PoA</i>
Country	Global
Market	Compliance + Voluntary ⁹
Scale	PoA
Methodology used	AMS.III.AV Low greenhouse gas emitting water purification systems - Version 3.0 (<i>proposed, under review</i>)
Technology	Any one that reduces emissions to less than 10% compared to boiling. Grid powered UV systems are excluded.
Status	CDM: New methodology proposed July 2012 GS: Not yet applied
Project Owner	Pure Water Ltd (subsidiary of South Pole)
Partners	-

⁹ Gold Standard certified CERs can be sold on both the voluntary and the compliance market.

Annex C List of Least Developed Countries

Africa (33)			
1	Angola	18	Madagascar
2	Benin	19	Malawi
3	Burkina Faso	20	Mali
4	Burundi	21	Mauritania
5	Central African Republic	22	Mozambique
6	Chad	23	Niger
7	Comoros	24	Rwanda
8	Democratic Republic of the Congo	25	São Tomé and Príncipe
9	Djibouti	26	Senegal
10	Equatorial Guinea	27	Sierra Leone
11	Eritrea	28	Somalia
12	Ethiopia	29	Sudan
13	Gambia	30	Togo
14	Guinea	31	Uganda
15	Guinea-Bissau	32	United Republic of Tanzania
16	Lesotho	33	Zambia
17	Liberia		

Asia (14)			
1	Afghanistan	8	Nepal
2	Bangladesh	9	Samoa
3	Bhutan	10	Solomon Islands
4	Cambodia	11	Timor-Leste
5	Kiribati	12	Tuvalu
6	Lao People's Democratic Republic	13	Vanuatu
7	Myanmar	14	Yemen

Latin America and the Caribbean (1)			
1	Haiti		