25 October 2009

Transaction Costs of Small-Scale Methodologies – Case Study: Fuel Switch to Biomass Residue for Household Stoves[1]

Authors: Diana Chan, Milestone Energy Development Limited
Anne Arquit Niederberger, Policy Solutions
Henry Ho, Milestone International Holdings Group Limited

Introduction

The objective of creating a special category for "small-scale" CDM (SSC) project activities was to facilitate carbon flows to dispersed, small-scale projects that typically have significant local sustainable development benefits, yet due to their small scale face investment barriers and relatively high transaction costs. In addition, it was hoped that the simplified procedures for SSC projects would make the carbon market more accessible for poor countries that may not have large-scale, high volume industrial CDM opportunities.

This paper offers some of the insights gained with applying one of the most widely used small-scale methodologies AMS I.C. ("Thermal energy production with or without electricity") to two pilot projects that involve fuel switching to agricultural biomass residues in the household sector in China.

There is a need to bundle mitigation activities to attract private investors and thereby significantly scale up investment into project types that are most beneficial for local sustainable development in the poorest regions. Yet we are finding that the SSC mode of implementation is actually less attractive than using large-scale methodologies would be. To distribute 400 000 carbon-free biomass stoves under the small-scale methodology AMS I.C. would require an extra EUR 6.7 million up-front investment, just to cover CDM-related transaction costs for 100+ SSC projects; whereas the same project, implemented under a single large-scale methodology, would have far lower transaction costs per CER and require far less DNA, DOE and EB capacity. In addition, the concept of "simplified methodologies" for SCC projects has not proven to offer clear advantages.

We have found that the larger a planned project activity, the less likely it is that the benefits that might be expected from simplified methodologies and slightly lower one-time transaction costs for SSC projects can offset the systemic disadvantages of having to register large numbers of SSC projects. It is therefore important to ensure that approved large-scale methodologies are available for the types of project activities that have the greatest prospects for local sustainable development in under-represented countries. These include the household and small and medium enterprises, generally. We are encouraged by the fact that the CDM Executive Board

[1] This paper was prepared as an input into the "Practitioners Workshop on AMS-I.E, AMS-II.G and AMS-I.C: CDM methodologies for household cooking energy supply", which was organized by the UNFCCC secretariat at the UN Campus in Bonn, Germany, on 26 October 2009.

at its 50th session has designated household energy as one of its methodological priorities.

Project Overview

The two pilot projects implemented by Milestone Energy Development Limited (via local subsidiaries in Hebei and Shanxi Provinces) involve the installation of efficient and environmentally friendly semi-gasification biomass stoves to provide thermal energy to poor rural households, in lieu of typical coal-fired stoves. The cost to households of the stoves and installation of stoves and hot water piping and radiators (as needed) is subsidized under the project to make the units more affordable to the households. The stoves will be installed and maintained by Milestone's local subsidiaries in each province.

The proposed Project seeks to claim carbon credits from the displacement of fossil fuel used in individual household stoves for thermal applications (space heating, cooking), while significantly reducing indoor air pollution and improving health conditions for rural households. The emissions reductions result from both fuel switching from coal to biomass residues and from the higher thermal efficiency of the biomass stoves.

The project stoves (see photo below, right) were locally developed and have a thermal capacity of between 11.6 and 12 kW and a thermal efficiency of about 80% (compared with thermal efficiencies typically below 35% for traditional coal stoves). Small-scale projects using AMS I.C. are limited to a maximum thermal capacity of 45 MWth, so each SSC project activity must be limited to roughly 3800 stoves.

Coal-fired stove (baseline technology)

Biomass stove (project technology)

The number of CERs that can be generated per project activity is about 15000 CERs annually – or 4 t CO_2/stove[2]. Assuming a CER price of EUR 8, gross CER revenues would be EUR 32/stove annually or EUR 160/stove over the estimated 5-year useful life of the stoves, whereas the project stoves cost approximately EUR 100 each.

Switching from carbon-intensive to no-carbon biomass fuel and more efficient stoves will reduce greenhouse gas emissions due to combustion of fossil fuels, which is the basis for CER generation under the project. Yet there are other important sustainability co-benefits, as well:

- Environmental co-benefits:
    - Mitigate impacts of indoor air pollution IAP): In China, it has been estimated that IAP caused 425,000 deaths in 2000, making it the fourth leading cause of mortality. Overall, IAP accounts for 20% of all deaths in China[3]. Stove improvements have been shown to reduce negative short-term health effects associated with fuel combustion exposures, such as acute respiratory infections, lung cancer, and headaches, by reducing IAP levels. According to the World Health Organization, IAP mostly affects women and children due to longer periods of time spent by them in the home. By switching from a coal dominated environment to biomass energy using advanced clean-burning semi-gasification technology, the Project expects to dramatically reduce long term health problems within rural households.
    - Reduce GHG emissions not credited under the CDM: The use of agricultural waste for energetic purposes will reduce greenhouse gas emissions from agricultural waste decomposition and open burning, which are not credited under the project.
    - Mitigate impacts of outdoor air pollution: Reducing open burning of agricultural waste and use of coal stoves will also mitigate impacts of outdoor air pollution on health (e.g., ambient PM10 concentrations) and natural resources (e.g., crop losses due to SO2 deposition and acid rain).
- Socio-economic co-benefits:
    - Reduction in health-care costs: Increased use of coal for heating and cooking by rural households has led to higher infant mortality, higher incidence of respiratory illness and overall decreasing health levels for rural households, all of which impose a substantial financial burden on individuals and the government to provide health-care services. With this in mind, our project has been warmly welcomed by the government, which recognizes the potential long term positive effects on the population's heath and national health budgets.
    - Reduced fuel costs: By switching to biomass briquettes which will be cheaper than coal, farmers will be able to enjoy a larger amount of disposable income. The Project therefore has gained substantial support at the local government/ town level as it complements the poverty alleviation and clean energy aims of the 11th Five Year Plan.

---

[2] A range of 3 – 5.5 CERs/stove/year has been found.

[3] A China Environmental Health Project Research Brief: Environment Health and Indoor Air Pollution in China, China Environmental Forum, May 2007.

Insights on Use of SCC Methodology AMS I.C.

Simplified Methodology AMS I.C.

As noted above, each SSC project activity is limited to about 3800 stoves, which generate about 15000 CERs annually. If we assume an effective useful lifetime (EUL) of the stoves of 5 years, then each project activity will result in a total of 75 k CERs.

Yet there is significant uncertainty surrounding this number – and it is likely that it is overly optimistic, given the simplified methodological approach used to determine coal use in the baseline. Since there is no way to automatically meter coal consumption by individual stoves, AMS I.C. allows this number to be derived indirectly from the amount heat generated by the project stoves, and divided by the thermal efficiency of the coal stove.

The only method to continuously track biomass use under the project activity is to monitor the amount of biomass briquettes purchased by each household that is part of the project activity. Yet this approach can underestimate biomass use for two reasons:

- Briquette sales records may be incomplete, since the project proponents do not control the briquette industry.
- There is a real risk that households will use unprocessed biomass residues – which they can collect for free from their fields, rather than electing to purchase processed biomass – so that only a fraction of actual biomass residue use will be captured by the monitoring plan.

In either case, the amount of CERs could be dramatically lower than estimated – and only account for a share of the emissions reductions actually achieved under the project activity. The only way to limit this source of uncertainty would be to monitor actual fuel usage *in situ*, but this would be significantly more costly for a single SSC project activity than tracking briquette sales. We come back to this issue below, after considering CDM-related transaction costs, which are summarized in the following table.

CDM Transaction Costs for SSC Projects are Still Prohibitive

The average CDM-related transaction costs for our two pilot projects in Gaoping, Shanxi Province, and Baoding, Hebei Province, are presented in the following table.

CDM-Related Transaction Costs

Item	Cost (EUR)	Number or Frequency
Baseline Survey	3 200	per survey with summary report per PDD
Feasibility Report Compilation	2 100	per report per PDD
EIA Form Compilation	520	per form per PDD
Stakeholder Consultation	2 100	per meeting per PDD
PDD Development Fee	27 500	per PDD
DOE Project Validation Fee	20 000	per PDD
UN Registration Fee	2 500	per PDD
DOE Verification Fee	5 000	annual fee (1 verification per year) per PDD, not including monitoring costs
TOTAL first year	62 920	
TOTAL for 5 years	82 920	

This table includes both one-time and recurring CDM costs for an SSC project to provide 3800 stoves[4]. If we assume a crediting period of 5 years, corresponding to the EUL of the project stoves, then the CDM-related costs shown above amount to over EUR 80 thousand. At a CER price of EUR 8, these CDM-related transaction costs represent 13% of gross CER revenues (of EUR 600 000), in the most optimistic case. If the project were to generate only 50% of the projected CERs (for reasons indicated above), over 25% of CER revenues would be eaten up by transaction costs alone.

To put this into perspective, it has been estimated that there are about 40 million polluting coal stoves in China, and Milestone Energy aims to replace 1% of these (400 k stoves) in 2010. This would require registration of approximately 106 separate SSC projects – and a corresponding up-front investment of EUR 6.7 million, just for CDM-related transaction costs in the first year (not including subsequent monitoring and verification costs).

That creates a large up-front capital requirement for an uncertain outcome, which is a hard sell in the capital markets, and leaves fewer CER revenues to actually implement the project, in particular, to subsidize the cost of stoves (EUR 100 per stove, or 40 million) to make them affordable.

SSC Projects Contribute to DOE Bottlenecks

The above example also highlights another disadvantage of trying to scale up CDM investment via SSC methodologies, namely that the amount of DOE and EB scrutiny required per CER is much higher than for large-scale project activities. Whereas it would be possible to implement a 400 000-stove project activity under a single large-scale methodology (if one existed), requiring only one validation and registration procedure for an estimated 8 million CERs, this would require 106 SSC projects, or one validation/registration per 75000 CERs. The persistent backlog of work for DOEs operating in China – and the resulting unpredictability of project validation, registration and CER issuance timelines – is a growing impediment to implementing large-scale projects that have better prospects of attracting private investment as a series of SSC project activities. Such an approach also taxes scarce host country DNA resources, particularly in the poorest countries.

It is still too early to tell whether the PoA (Program of Activities) mode of CDM implementation will alleviate these concerns, because only a single PoA has been registered to date. Given PoA liability provisions, however, even though there is no requirement for each CDM program activity (CPA) under a PoA to be validated and registered, the DOEs will need to evaluate each CPA carefully, before taking the decision to add a CPA to a PoA. Some DOEs are requiring CER set-asides or other means to offset their potential liabilities, which will increase transaction costs.

Conclusions

Milestone Energy Development Limited is committed to finding ways to massively scale up investment into biomass stove and cooker programs around the world. Our experience with pilot programs underscores the urgent need for an appropriate large-scale methodology. For this reason, the company commissioned the proposed new

---

[4] Significant staff costs borne by Milestone are not included in these figures, including designing the CDM program, obtaining DNA and local government approvals, preparing the survey plan and managing its execution, attract participating households to participle in the project, contracting with stove suppliers, DOEs, etc.

methodology NM0307, but this was recently rejected by the CDM Executive Board. We are committed and eager to collaborate with other like-minded host countries, NGOs and project developers to come up with a large-scale methodology that is conservative, robust and viable in practice – and can be expeditiously approved by the CDM Executive Board. Given monitoring challenges faced by rural household stove projects, we see two basic approaches to determining biomass fuel use (and, indirectly, baseline emissions):

- Use a qualitative, yet conservative benchmarking approach (as proposed in NM0307), taking into account the full range of best available information and relying on expert judgment to document and transparently justify conservative baseline stove efficiency and fuel mix values. There are a number of precedents for relying on expert judgment to determine values for key parameters, most recently, the methodological "Tool to determine the remaining lifetime of equipment", which includes expert evaluation as one of three options to determine the remaining lifetime of equipment;
- Rely on *in situ* fuel use monitoring, which will be more costly and can only be done where sufficient local human capacity is available to perform kitchen performance tests and such intrusive tests are socially acceptable.

We hope that one outcome of the UNFCCC stove workshop will be to immediately launch a collaborative process to draft a proposed new large-scale stove methodology that can be submitted in time for consideration by the Methodology Panel at its 43rd session in February 2010[5]. This urgent and important effort can draw on a significant body of work on host country and NGO stove programs, the Gold Standard VER methodology, NM0307, and experiences with approved small-scale methodologies. Milestone Energy Development Limited stands ready to contribute in any way possible and looks forward to cooperating with like-minded organizations in the public, private and non-profit sectors to bring clean energy to poor households.

Contact for Further Information

Ms. Diana Chan, Deputy CEO
Milestone Energy Development Limited
dianachan@milestone-energy.com

[5] The deadline for submission of a new methodology for MP 43 has not been announced yet, but this will likely be during the second half of December 2009.