

## Development of Sectoral CDM Project: A Case Study for Small Scale Biogas Project

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### 1. ISSUES AND CHALLENGES

In view of the current high fossil fuel prices and declining contribution from Ordinary Development Assistance (ODA) to national development program, innovative carbon finance could provide a timely opportunity for reinvigorating the uptake and commercialisation of small scale renewable energy (biogas, biomass, wind, hydro, solar) and energy efficiency (cleaner fuel, single phase motor) project for the creation of wealth, health and employment as creative interventions for national poverty alleviation program.

There is renewed interest in the use of anaerobic digestion (AD) processes for the efficient management and conversion of agro-industrial wastes (livestock, paper and pulp, food processing, brewery and distillery) into clean renewable energy (biogas and green electricity) and organic fertilizer source. The biogas captured will not only mitigate the potential local and global pollution but could either be combusted for electricity generation using Combined Heat and Power generator (CHP) in large to medium enterprises or use for cooking, lighting and heating of hot water for small households (Table 1).

Project	India	China	Nepal
Livestock per HH	4 cows	3 pigs	4 cows
Digester number	5,500	10,000	162,000
Digester size	2 m <sup>3</sup>	8 m <sup>3</sup>	4-10 m <sup>3</sup>
kW/digester	1.81	1kW	2kW
CER/digester/yr	4.93	1.797	4.6
CER (tCO <sub>2</sub> e /yr)	27,111	17,967	530,000
Cumulative CER	189,905 for 7 years	179,670 for 10 years	5.3 MtCO <sub>2</sub> e for 10 years
1. Baseline	- Replace firewood from non-renewable sources - Replace inefficient wood stove - Replace 46 l/yr/HH kerosene with biogas	- Replacement of firewood from non-renewable sources - Replace inefficient wood stove with biogas - Replace kerosene	- Replace firewood from non-renewable sources - Replace kerosene with biogas - Claim N <sub>2</sub> O offset from replacement of inorganic fertilizer - Claim fugitive CH <sub>4</sub> and N <sub>2</sub> O emission from manure left or stored in the field
2. Monitoring plan	- Rely on support service contractor to monitor on the number of digester installed and in operation	- Rely on Provincial Energy Bureau to carry monitoring along with Village Biogas Association	- Rely on biogas contractor to monitor installed and operational digester
Sustainable Development Benefits in meeting the Millennium Development Goals	<ul style="list-style-type: none"> <li>• Economic: Improved income from diversified activities; generate new employment</li> <li>• Social: Improved health through clean biogas; less time for firewood collection</li> <li>• Environmental: Cleaner biogas; free organic fertilizer; less greenhouse gases (GHG) emissions</li> </ul>		

Despite of the multitudes of socio-economic and environmental benefits, the widespread adoption of biogas project around the world has been rather disappointing. Except for some East Asian countries (China, India, Nepal and Bangladesh), many small and large scale biogas projects have not been able to move beyond the pilot phase and the barriers to their scaling up and ‘mainstreaming’ has been recognized to be: i) Technical ; ii) Institutional ; iii)

Social and iv) Financial. Creative carbon finance from CDM projects could provide a leverage to overcome some of these barriers and constraints (Yapp and Rijk, 2005, ter Heegde, 2005).

However, there are serious concerns that the current CDM methodologies with regards to implementing small scale CDM projects are inflexible and may hinder the poor from reaping the benefits of CDM. The outstanding issues that are inherent in current CDM methodology which could predispose small scale project from being a viable project are:

- i) High transaction cost due to new inflexible bundling rulings and restrictive project size e.g. < 15 MW
- ii) Contentious additionality issues for the non inclusion of ‘non-renewable biomass’ in the baseline and monitoring methodology
- iii) Perverse incentives for avoiding sound climate-friendly policy

The followings issues which could apply equally to all small scale hydro (Mariyappna et al, 2004), solar and wind CDM projects highlights the current dilemma faced in developing small scale CDM biogas project.

#### **i. Inflexible bundling rules of the Simplified Small Scale methodology**

The Executive Board (EB) has approved simplified baseline and monitoring methodologies for small-scale projects - projects with a capacity of less than 15 MW, annual energy production of less than 15 GWh, or annual emissions and emission reductions of less than 15 000 tCO<sub>2</sub>e. These simplified methodologies should reduce the transaction costs of registering a small project significantly (US\$ 58,400 (71%) compare to US\$ 203,000 for normal project). Small projects may also be “bundled” up to the maximum size for a small-scale project for validation, registration and verification, to further reduce transaction costs (Table 2).

Unfortunately the rules governing the ability to bundle projects are not yet clear. Instead of making the rules more flexible so that the poor host country could reap the benefits of CDM projects, EB seems to further restrict the bundling rules. As of July 2005, EB release the latest rulings<sup>1</sup>:

- i) Project activities wishing to be bundled shall indicate as of the request for registration that they will be bundled;
- ii) Once a project activity becomes part of a bundle it shall not be de-bundled i.e. project activities that are bundled at the registration should remain part of the bundle;
- iii) Composition of bundles shall not change over time (i.e. the submission of projects to be used in a bundle shall be made at the same time i.e. project activities cannot be substituted for one another later on;
- iv) All project activities in the bundle shall have the same crediting period. Moreover, although the EB did not take an explicit decision, it seems quite clear that the total size of a bundle of project activities cannot exceed the limits set for small-scale CDM projects<sup>2</sup> (e.g. 15 MW).

For example, a project developer intends to develop 200,000 small scale digesters of 2 m<sup>3</sup> capable of generating 2kW each over several districts (Table 2). If the simplified

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<sup>1</sup> These rules build upon recommendations from the recent second meeting of the Small-Scale Working Group (16-17 May 2005) –[www.cdn.unfccc.int/Panel/ssc\\_wg/sscwg\\_meetings/SSCWG02\\_rep\\_ext.pdf](http://www.cdn.unfccc.int/Panel/ssc_wg/sscwg_meetings/SSCWG02_rep_ext.pdf)

<sup>2</sup> Report of the Conference of the Parties on Its Seventh Session, Held at Marrakesh from 29 October to 10 November 2001. <http://unfccc.int/resource/docs/cop7/13a02.pdf>

methodology is to follow, then the electricity output from each Project Design Document (PDD) must be less than 15MW. Therefore the project would need to be split into 31 PDDs of 6,500 IBS each to give a total of power output 13 MW. Assuming a transaction cost of US\$58,400 for each PDD, it would cost US\$ 3,620,800 for the 31 PDDs. It would mean the prohibitive transaction cost would cost an extra US\$ 3,562,400 for the submission of 31 PDDs when compared to only submitting 1 PDD at US\$ 58,400. Given the above rulings, it is likely that the development of the 31 PDDs would take times and resources and loss of potential credits. Recruitment of new participants would lead to loss of previous crediting period. This inflexibility will place unnecessary heavy burden upon the host country already scarce in resources and will deprive the poor of the multifaceted benefits offered by small scale biogas project.

Table 2. Transaction costs for normal and small scale CDM project (US\$)				
(Bhardwaj et al, 2004)	Normal-scale (average)	Small-scale (average)	Cost reduction [%]	31 PDDs
A. Upfront	71,000	28,400	-60	880,400
1. Project preparation and review	9,000	4,800	-47	148,800
2. Project Design Document	24,000	10,800	-55	334,800
3. Validation	12,000	6,000	-50	186,000
4. Appraisal phase	20,000	3,800	-81	117,800
5. Initial verification (start-up)	6,000	3,000	-50	93,000
B. Operation	132,000	30,000	-77	930,000
6. Periodic monitoring	72,000	12,000	-83	372,000
7. Verification and certification (yrly)	60,000	18,000	-70	558,000
Total transaction costs	203,000	58,400	-71	3,620,800

If the same inflexible principle is applied nationwide across a wider region, e.g. in Far Eastern Asian countries where there is greatest SSBP development potential, approximately half of the CER revenues (48%) that could be earned by the host country would be lost as high transaction cost (Table 3). This could deprive the 2.1 billion rural population and 416 million households in these regions, access to affordable clean biogas and low carbon organic fertilizer so desperately needed in this critical time of high fossil fuel price.

Hence there is urgent need to request the Small Scale Working Group (SS-WG) of the EB to make the simplified small scale methodology more flexible so that either i) the total limits could be increased (from 15 MW to 50 or 100 MW) or ii) aggregation could be based on larger national, regional or district baseline in order to spread out the transaction cost as proposed in ensuing sectoral policy based approach.

## ii. Non-renewable biomass

For fear of non CDM eligibility, many host countries have shy away from designing sound climate-friendly policy. In order to avoid this problem of perverse incentive inherent within the current CDM methodology, the report of the Third Small-Scale Working Group (SSC-WG) meeting, held on September 12-13, 2005, seeks to revise the simplified baseline and monitoring methodologies for selected small-scale CDM project activities by deleting references to “non-renewable biomass” as a plausible baseline scenario. This recommendation, if accepted by the Executive Board, will be detrimental and jeopardise the implementation of many small scale biogas projects. Since the major source of emission reductions for the small scale biogas project originates from displacing “non-renewable biomass,” the endorsement of the SSC-WG recommendation to delete this reference would mean that the proposed activity could no longer claim any emissions reductions which could account up to 60% of the CER

claimed (Table 1). In other words, the carbon revenues on which SSBP rely to implement the program will no longer be available. Moreover, it will also jeopardize meeting the national developmental goals of improving sustainable energy access and reducing rural poverty through the CDM and undermines many of the brave initiatives undertaken by the pioneering biogas project (e.g. Nepal Biogas Umbrella Program). Hence there is an urgent need to request the EB not to implement this recommendation.

**Table 3. Potential CDM biogas digester, CER and Revenues estimated for the ruminant (cattle, dairy, buffalo and goat) livestock units in Far East Asia (Source: Global Livestock Production and Health Atlas).**

Country (2002)	Total Ruminant Livestock Units (LU)	Rural Population	Rural Households (HH) to 5	LU/HH	LU suitable for Digester (2LU/digester)	Potential HH biogas digester (45%)*	Total kWh at 2kWh per digester	Transaction cost** (US\$1000)	CER @4.7tCO <sub>2</sub> e/digester (ktCO <sub>2</sub> e/yr)	Yearly Revenues @ US\$4/tCO <sub>2</sub> e (US\$1,000)
Bangladesh	16,384,400	106,176,000	21,235,200	0.77	8,192,200	3,686,490	7,372,980	33,122	17,327	69,305
Bhutan	184,018	2,023,100	404,620	0.45	92,009	41,404	82,808	372	195	778
Cambodia	2,339,036	11,303,100	2,260,620	1.03	1,169,518	526,283	1,052,566	4,728	2,474	9,894
China	103,904,296	806,657,100	161,331,420	0.64	51,952,148	23,378,467	46,756,933	210,047	109,879	439,515
India	176,780,000	754,819,000	150,963,800	1.17	88,390,000	39,775,500	79,551,000	357,368	186,945	747,779
Indonesia	11,046,588	123,473,000	24,694,600	0.45	5,523,294	2,485,482	4,970,965	22,331	11,682	46,727
Laos	1,560,335	4,414,000	882,800	1.77	780,168	351,075	702,151	3,154	1,650	6,600
Malaysia	630,468	9,871,000	1,974,200	0.32	315,234	141,855	283,711	1,275	667	2,667
Myanmar	9,491,884	34,877,000	6,975,400	1.36	4,745,942	2,135,674	4,271,348	19,188	10,038	40,151
Nepal	6,084,477	21,526,000	4,305,200	1.41	3,042,239	1,369,007	2,738,015	12,300	6,434	25,737
Pakistan	30,958,300	99,381,000	19,876,200	1.56	15,479,150	6,965,618	13,931,235	62,583	32,738	130,954
Philippines	4,469,501	31,279,000	6,255,800	0.71	2,234,751	1,005,638	2,011,275	9,035	4,726	18,906
Sri Lanka	924,145	14,485,000	2,897,000	0.32	462,073	207,933	415,865	1,868	977	3,909
Vietnam	4,530,440	58,527,780	11,705,556	0.39	2,265,220	1,019,349	2,038,698	9,158	4,791	19,164
Total	369,287,888	2,078,812,080	415,762,416	0.77	184,643,944	83,089,775	166,179,550	746,530	390,522	1,562,088

\* 1 LU = 500 kg live weight. \*\* Assume 45% of the LUs are suitable for IBS digester development. \*\*\* Based on 6,500 digesters per PDD for simplified methodology; at US\$58,400 per PDD.

### iii. Perverse incentive - Biogas Development Program as a Common practice

If the host country has already a vibrant biogas development program with subsidy (e.g. Nepal, India, China) how could one still argue for additionality? If biogas development is already a common practice for the host country, what additionality is the CDM project bringing to the host country? This again will deter many host countries from putting in place sound climate-friendly policy.

### iv. Monitoring

Monitoring and verification is important because if CER were awarded in error, emission in annex 1 countries would be 'offset' by non-existent emission abatement, which means that global emission would rise because of the CDM project activity. In order to reduce on transaction cost, most of the monitoring plan shown in Table 2 involved the using the sale service contract as the main contact point. The monitoring plan entails recording the numbers of digester that has been installed and those are still in operation on a six monthly basis. In China's case the District Energy Bureau in collaboration with the Biogas Association served as coordinator for the gathering of biogas digester data. The size of the sampling will vary depending on project size.

## 2. SECTORAL POLICY BASED APPROACH

In order to overcome the above perverse incentive (of avoiding sound sustainable and climate-friendly policy), additionality issues and high transaction cost, there is a need to explore the feasibility of developing CDM project based on sectoral policy approach as advocated by Samaniego and Figeures (2002) and Sterk and Wittneben (2005). Unlike, many large scale CDM projects (HFC, N<sub>2</sub>O), small scale biogas project which has high Sustainable Development component offers an exciting possibility to test out the sectoral policy approach.

A policy based approach is a government-driven mechanism that enables non-annex 1 countries to develop national or local policy initiatives that discernibly lower GHG emissions in a particular sector e.g. agro-industrial waste, municipal waste, small scale biogas digester for crop-livestock farming system. The CERs flow directly to the host government that will thus be compensated for its efforts and may choose to pass some of the benefits on to industry and households affected by the measures in the form of tax incentives, subsidies or other fiscal instruments. This provides an innovative tool for government to finance climate-friendly policy measures.

However, at this point it is still difficult to ascertain exactly how the CER rewards will be distributed between the private and public actors. If the total CERs is too high, then market participants would be reluctant to follow the new policy or investors would hesitate to take advantage of the CDM opportunity. On the other hand, if the CERs were passed on directly to private investor in the sectoral CDM scheme, taxpayers would be left with the burden of the transaction cost of setting up such project without the financial benefits of the CDM. The balance in this distribution has to be struck early in the process of setting up the sectoral CDM project to avoid conflict or disappointment later.

Defining the sector establishes the CDM project boundary. For example, the agro-industrial waste stream, municipal waste or small scale biogas digester in a country, regions or district could be set as a sector with baseline established for each sector. This will be less prone to leakage. It needs to be decided whether the baseline is set as absolute or a relative emission volumes (i.e. CER per GDP or per output) and whether a baseline should be binding with sanctions attached to non-compliance. Relative baseline could be linked to economic growth, which eliminates the uncertainty of how this growth is going to impact future emission.

Hence, a policy-based CDM for the agriculture sector could entail project activities undertaken within a sound Sustainable Agriculture policy which would promote sustainable practices beyond the climate agenda. Such project activities would include IBS, conservation agriculture, zero tillage, growing of bioenergy crops (Jathropha), reduction of enteric methane emission from ruminant that will culminate in the reduction of GHG. Additionality is considered for emission below the baseline targets.

Existing CDM project could be incorporated into the sector CDM in order to avoid double accounting. Project approval could still follow current CDM procedures with bottom up baseline assessment. The sectoral approach still requires having reliable emission inventories and projections for the host countries.

Since the Sustainable Agriculture policy would become the project itself this would turn additionality on its head and reduce transaction cost because of economy of scale. This policy based project will prevent host country from shying away from climate protection strategies for fear of CDM ineligibility. On the contrary the host country should be rewarded for creative and innovative climate change strategies to bring multi-benefits to the local stakeholders. However this will require a lot of capacity building by the annex 1 countries. Technical capacity would be easier to focus and built up.

National CDM Biogas Working Group could be set up to develop agricultural sectoral policy based CDM for maximize SD integrity. Annex 1 could help to build up local capacity in

exchange for CERs. Since sectoral approach could form part of the post 2012 strategies, it is pertinent to further investigate this potential with possible presentation at the COP11 in Montreal for lobbying international support. This will help southern countries to gradually move towards emission limitation commitments and gain experience with large-scale climate protection policies. This is being tested for the CDM transport in Chile and CDM energy efficiency project in Ghana and is awaiting approval from the EB.

### **3. THE WAY FORWARD**

#### **Full commercialization of CDM project using Agricultural Sectoral policy based approach**

Where there is strong and established biogas experience such as in China, Nepal, India and Bangladesh, full CDM could be developed using sectoral approach as discussed earlier. This project will help to overcome the perverse incentive so often encounter in many project-based CDM. However, there remain many unanswered questions and a follow up research is required to: i) review current lessons learnt from the sectoral approach undertaken for the energy efficiency project in Ghana and the transportation sector in Chile; ii) how to develop national baseline inventory and monitoring plan; iii) how to allocate the CER between private and public sector; and iv) study in depth the additionality issues involved.

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