

Feasibility Study for Bamboo based Carbon Credit generation in Nagaland

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ABSTRACT

Having fast rate of carbon sequestration and diverse energy and non energy applications, Bamboo appears to be promising for climate change mitigation. Market based mechanisms have evolved as a response to international efforts to mitigate climate change. Clean Development Mechanism (CDM) of Kyoto Protocol and various standards in Voluntary Carbon Market (VCM) can be used to financially sustain bamboo based project activities in India.

National Bamboo Mission commissioned a feasibility study to assess the potential of bamboo based climate change mitigation activities in the Indian state of Nagaland. The study was performed and reported by Emergent Ventures India (EVI), a carbon market advisory and co-ordinated by Cane and Bamboo Technology Centre (CBTC), Guwahati. Necessary information and support was provided by Nagaland Bamboo Development Authority (NBDA).



Site visits were conducted at different locations in Nagaland including Dimapur, Tuli and Mokokchung. Collected data was analyzed and conclusions were drawn. Projects have been categorized as per priority and complexity. Some projects like bamboo plantations and energy generation should be taken up immediately as CDM/VCM projects. Some projects like Harvested Bamboo Products should be analyzed as per the remarks. Third party baseline assessments etc. are required for these projects. Details on the approaches and processes are given in the Paper.

Identified opportunities included carbon sequestration in Bamboo Plantations, Harvested Bamboo Products; Bamboo Gasification for power and thermal use, charcoal making etc. Bamboo Plantation at all the sites assessed would annually remove around 190,790 t CO₂ from the atmosphere. Harvested Bamboo Products (HBPs) are eligible under Voluntary Carbon Standard only. New baseline and monitoring methodology development is required for HBPs.

Bamboo Gasification for power (both, installed and planned) would generate small quantum of credits under present plans, hence can be taken up as a CDM Program of Activities involving whole of north eastern region/country as a whole. Similarly, Bamboo Charcoal as a replacement of non renewable wood Charcoal/non renewable biomass/coal in industries and households may also generate considerable amount of credits as a bundled project activity or as CDM Program of Activities (PoA). Carbon credit potential and methodological issues have been discussed in the paper.

Background

Bamboo is a versatile group of species with multiple uses for both socio-cultural and industrial purposes. It is among the fastest growing plants in the world. Due to its high growth rate, it has the potential to be an effective carbon sink. India has good bamboo resources particularly in North Eastern region. Despite such immense potential, the domestic bamboo sector is faced with constraints like lack of scientific methods for propagation and cultivation, lack of post harvest treatment and technology for product development, Inadequate trained manpower and inadequate infrastructure for large scale harvesting in the event of gregarious flowering³. Keeping in view the potential of Bamboo, the Department of Agriculture & Co-operation under Ministry of Agriculture, Govt. of India launched the “National Bamboo Mission” (NBM) for addressing the issues relating to the development of bamboo in the country. In order to technically support the National Bamboo Mission, four Zonal Bamboo Technical Support Groups (BTSG) have been identified and Cane and Bamboo Technology Centre, Guwahati has been designated as BTSG for all the North Eastern states along with four eastern states of India.

National Bamboo Mission commissioned a feasibility study to assess the potential of bamboo based climate change mitigation activities in the Indian state of Nagaland. The study was performed and reported by Emergent Ventures India, a Gurgaon based carbon market advisory and co-ordinated by Cane and Bamboo Technology Centre, Guwahati⁴. Necessary information and support was provided by Nagaland Bamboo Development Authority.

Key words: Clean Development Mechanism, Voluntary Carbon Market, Carbon sequestration, Harvested Bamboo Products; Bamboo Gasification, Charcoal.



Carbon Market structure and function

Carbon is a tradable commodity as a result of the evolution of financial mechanisms of climate change mitigation. International carbon market can be categorized into two structures, first the Compliance market, also called regulatory market that may be of Kyoto type that allows transactions in terms of well defined market based flexibility mechanisms like CDM, JI and IET or of Non Kyoto type that have been developed as many state legislations in the USA and as New South Wales GHG Abatement Scheme in Australia. Second structure of the carbon market is Voluntary market; segments of Voluntary carbon market (VCM) are legally binding ones like Chicago Climate Exchange and the Over the Counter (OTC) market that includes the activities of companies and individuals who offset their emission footprints from activities, products or services.

Sequence of Activities for Carbon Credit project document development have been outlined as **CDM project Cycle** which includes-

Step1-Preparing a CDM project for validation- This includes development of a Project Design Document (PDD) based on an appropriate CDM baseline and monitoring methodology. A new methodology can be proposed when no methodology is approved by CDM Executive Board suiting to proposed activity type. DOE makes an assessment of whether the PDD is consistent with approved methodology or not. PDD would also be submitted to National CDM Authority for host country approval.

Step-2: Validation- Validation is an audit of the project conducted by UNFCCC accredited validator. If the validator believes that the project qualifies as per CDM guidelines, they submit a Validation Report to the Executive Board, which makes a recommendation that the project be registered.

Step 3: Registration by the Executive Board

Step 4: Verification, certification and issuance of emission reduction credits- Once a project is registered the developer begins to monitor the reduction of emissions according to the plan they presented in the PDD and compiles a monitoring report. Periodically the client appoints a DOE as a Verification Agency that verifies the actual emission reductions according to the Monitoring Plan submitted in PDD and compiles a Verification Report and submits to EB with recommendation to issue CERs.

Voluntary Carbon Market project cycle includes different project proponents who get Emission Reductions verified based on certain standards like Voluntary Carbon Standard 2007 (VCS 2007) and these credits are sold to credit users to offset emissions.

In comparison with compliance markets, voluntary markets are less mature and trade in lower volumes. There is no umbrella regulator in the voluntary carbon market. Voluntary market considers less complex and less costly ways to handle the issue of non-permanence of forestry projects than the current approach of temporary credits under the AR CDM. In Voluntary Carbon Standard 2007 (AFOLU) and CarbonFix Standard, two major voluntary standards for forestry it is done by setting a buffer reserve based on its assessment of potential risks of carbon loss.

Observations from voluntary carbon market suggest that forestry accounted for the highest 36% of the transaction volume in the year 2006 as compared to mere 1% of expiring credits from CDM. Growing 45%, in the year 2007 Agriculture and forestry projects contributed to 18% of total OTC market



transaction⁵. Voluntary market is also to promote innovative means of emission reductions. In order to minimize the transaction costs it is important to maximize the flow of financial benefits to the farmers from the sale of good quality VERs/VCUs. This will lead to the deduction in costs to the project developer and/or promoter and make attractive to them as well as local stakeholders. Emergent Ventures is involved in developing some carbon forestry projects and is in process of proposing new methodologies for accounting emission reductions in forestry and agriculture sector.

Methodology of Feasibility Assessment

Site visits of different locations were done including detailed discussions and meetings. After collecting data/information all opportunities were evaluated on various parameters. Based on the evaluation all opportunities were categorized into three categories. Definite CDM/VCM opportunities that should be taken up immediately, Potential CDM/VCM project that would require specific studies and new methodology development, a re-look on these opportunities needed after sometime; and clear Non-CDM/ VCM projects.

Opportunity Analysis

The scope of this paper is limited to details of Carbon sequestration in Bamboo Plantations. However other opportunities like Harvested Bamboo Products and Energy components- Bamboo Gasification for power and thermal use, charcoal making etc. have also been discussed in brief.

Carbon Sequestration in Bamboo plantations

It was concluded on assumptions and observations that about 80% of total area planted is eligible. Plantations in degraded forest areas have provisionally been excluded. Assumptions for calculations are- Number of clumps/ha 400/ha (5m X 5 m spacing, as observed), Average recruitment rate of culms: 10 culms/yr/clump⁶. Specific Gravity of bamboo: 0.35⁷ and Survival rate (after gap filling) = 90%⁸.

Generation of Annual Net Removals (NR) from planted and planned bamboo plantations is calculated to be 317984 t CO₂. Conservative NR Estimate after buffer deduction comes out to be 190790 t CO₂/year with Total Projected Carbon Revenue of Rs 40 million/annum. Annual ER generation will be 10 t/ha & revenue would be around Rs. 2100/ha. Net removals (NR) given here are indicative, based on certain assumptions on past studies as available in literature. Actual ER generation may depend on a number of factors. The exact volume of credits would depend on more detailed assessment of technologies used, baseline scenarios, local conditions etc. The value of credits would also vary depending on the type (VER, CER), compliance with other standards (CCB, VCS), the year in which the credits accrue and many other factors which affect the delivery reliability of the credits.

Bamboo plantations are eligible for carbon credit generation under both A/R CDM and VCM. In its 19th meeting the A/R Working group of UNFCCC agreed that, the environmental integrity of the CDM activities is not affected by considering bamboos as being equivalent to trees in the context of A/R CDM project activities. Bamboos may be treated in the same way as trees in the context of A/R CDM project activities. The CDM Executive Board in its 39th meeting considered the response to the request for clarification prepared by the A/R WG and requested DNAs to clarify if the definition of forest as reported by them to the Board includes palm (trees) and/or bamboos⁹.



Bamboo plantations are also eligible under VCS 2007 under Afforestation, Reforestation and Revegetation (ARR) activities and also under CCB Standards for VER generation. Applicable A/R Methodologies under CDM (also applicable for VCS 2007): AR-AM0004 (“Reforestation or afforestation of land currently under agricultural use”) and AR-AM0008 (“Afforestation or reforestation on degraded land for sustainable wood production”). Shifting cultivation is the most probable scenario that can be adopted as baseline. Both VCS 2007 and CCB accept approved A/R methodologies.

Harvested bamboo products

Bamboo can be used as a replacement of building materials, and might reduce emissions associated with the production of baseline building material (e.g. concrete). Other products like furniture and household instruments/ composites can replace conventional energy intensive products. These options theoretically fall under the scope of Climate Change mitigation, but being complexities in monitoring and unavailability of methodology for estimation of Emission Reductions, it would be difficult to actually create carbon credit revenue out of these products.

Energy Components

Bamboo can be used as a source of bio-energy. Bio-energy is considered to be GHG neutral and its use poses hardly any net radiative forcing to the atmosphere. Given the large amounts of biomass that Bamboo can produce it provides a very interesting source of bio-energy in the tropics¹⁰. When grown as an agricultural crop the biomass produced by Bamboo can be considered as a renewable source of energy. Like any other biomass Bamboo can also be directly burnt for heat and/or power generation. It can be used to replace carbon intensive fossil fuel or non-renewable biomass.

Direct biomass burning:

- a. Thermal application by direct burning: Bamboo biomass can replace coal in thermal applications. Such applications are eligible under CDM and VCM both. Small scale CDM methodology ‘AMS I.E- Switch from Non-Renewable Biomass for Thermal Applications by the User’ can be used. This is a potential activity under programmatic CDM also.
- b. Power generation by direct burning: Approved CDM methodologies ‘AM0042- Grid-connected electricity generation using biomass from newly developed dedicated plantations’, ‘ACM 0006- Consolidated methodology for grid-connected electricity generation from biomass residues’ and ‘AMS ID- Grid connected renewable electricity generation’ would be applicable for such project activities. AMS-IC- Thermal energy for user with or without electricity can also be used in above options.
- c. Bamboo Gasification: Bamboo Gasification is one of the manufacturing methods which make Bamboo heated to form products under the condition of isolating air or in limited supply of air. There are three groups of pyrolysis products: they are solid (Bamboo Charcoal), liquid (Bamboo vinegar) and gas (Bamboo gas). Bamboo gas can be used for heat and power. Both are potential activities under programmatic CDM. Applicable methodologies include as for direct biomass burning.



- d. Bamboo Charcoal:** Bamboo Charcoal is a product of Bamboo pyrolysis. It has a number of uses. Bamboo Charcoal can be used to replace coal for thermal applications. Methodologies as identified above sections can be used.

Recommendations

Followings are the recommendations of the study¹¹:

SN	Project Activities	ERs Potential per annum	Remarks
1	Bamboo Plantation- All sites	190,790	All sites have been assessed separately
2	Harvested Bamboo Products	—	Eligible under VCS 2007 only, New Meth required which may include national/sectoral baseline. Success of project depends on successful approval of the proposed methodology. Detailed Baseline Assessment would be required through credible third party survey. Double Counting issues to be taken care of. Complex Monitoring.
3	Bamboo Gasification for power (both, installed and planned)	1,191	Very small in quantum hence can be taken up as a bundled project activity involving whole of north east/country as a whole. It is advisable to launch it as a CDM Program of Activities.
4	Bamboo Charcoal as a replacement of Non renewable Wood Charcoal	In households	4,460 Needs to be established through credible third party surveys that baseline wood charcoal comes from a depleting source and is non renewable. Double counting of ERs should be avoided.
		In industries	6,690 Needs to be established through credible third party surveys that baseline wood charcoal comes from a depleting source and is non renewable. Double counting of ERs should be avoided. Complex monitoring.
5	Bamboo Charcoal as a replacement of Coal	In industrial application	3,827 Only in those industries that have coal as baseline. Can be taken up as a bundled project activity involving whole of north east/country as a whole. Can be developed as a CDM Program of Activities also. Double counting to be avoided.
		In households	5,741 Baseline needs to be determined based on past data, credible third party survey of households. Double counting to be avoided. Complex monitoring.



Following will be the plan of action to move forward with bamboo based carbon credit projects:

1. EVI and CBTC have proposed to sign MoU for carbon advisory services for identified projects in jurisdiction of CBTC.
2. Model of roles/responsibility shall be adapted as appropriate. An indicative model could be:
 - a. NBM- Project Finance
 - b. CBTC- Project management and co-ordination
 - c. NBDA- Technical back up, project monitoring and implementation
 - d. EVI- Project advisory for CDM/VCM
3. Similar feasibility studies should be performed by EVI for other states also. This will also be covered under the MoU referred above.
4. Required third party assessments/ surveys to be done for some projects. After analysis based on assessment/ surveys as per remarks on these projects, projects would be taken up for carbon credits.

REFERENCES:

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⁴ Full Report is available on CBTC website-

http://www.caneandbamboo.org/pdf/news_update/feasibilityreport%20carbon%20trading.pdf

⁸ Information from NBDA & CBTC

³ DA&C, Department of Agriculture and Cooperation, Ministry of Agriculture, Website accessed in January 2009.

<http://agricoop.nic.in/bamboo/bamboomission.htm>

⁵ Ecosystem Marketplace (2007 and 2008), State and Trend of the Voluntary Carbon Market- Reports.

⁶ <http://planning.up.nic.in/innovations/inno3/fw/bamboo.htm>

⁷ http://www.simetric.co.uk/si_wood.htm#top

⁹ <http://cdm.unfccc.int/EB/039/eb39rep.pdf>

¹⁰ Fielden, D, 1999. Energy farming with the big Bamboo. Renewable Energy World, March 1999, 23-27.

See also:

Dube, Lokesh Chandra (2008) Climate Change Mitigation Opportunities in Bamboo and Bamboo applications.

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New Delhi, April 2008.



“The answer to global warming is in the abolition of private property and production for human need. A socialist world would place an enormous priority on alternative energy sources. This is what ecologically-minded socialists have been exploring for quite some time now.”

- **Louis Proyect**, Columbia University