CLEAN DEVELOPMENT MECHANISM
PROPOSED NEW METHODOLOGY: MONITORING (CDM-NMM)
Version 01 - in effect as of: 1 July 2004

CONTENTS

SECTION A. Identification of methodology

A.1. Title of the proposed methodology:

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"Monitoring improvement in recovery of waste biomass from process streams and use of that biomass in energy generation"

A.2. List of category(ies) of project activity to which the methodology may apply:

>> The project activity is applicable to 'Category 4 – Manufacturing industries', as per the CDM sectoral scope (CDM-ACCR-06). In the absence of an appropriate project category definition, a new project category may be considered titled "Recovery and use of waste biomass[1] from process streams"

A.3. Conditions under which the methodology is applicable to CDM project activities:

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The project activity consists of (a) and (c) with or without (b) and (d):

a) Additional waste biomass recovery from process stream;
b) Improvement in energy efficiency of waste biomass recovery from process stream;
c) Utilization of biomass for energy generation with consequent displacement of fossil fuel
d) Improvement in utilization of biomass for energy generation

This methodology is applicable to projects recovering additional waste biomass that was previously been discharged and use of that recovered biomass for energy generation with or without improved efficiency.

Other applicability conditions include:

a) the local regulations / programs do not constrain the facility from using coal and other fossil fuels to generate energy;
b) the project is not a common practice in the industry sector for industries of a similar nature and size;
c) the proposed project activity generates additional waste biomass from process stream and use of which is not prohibited by the national regulations;
d) energy would have otherwise been generated using fossil fuel under the control of the project operator;
e) the process output(e.g., quantity of blown pulp)can be directly correlated to waste biomass(e.g., black liquor) concentration in process stream
f) biomass is not stored in the plant and is directly fired;

[1] Biomass in a process stream that in the absence of the project activity would otherwise have become a constituent of waste

A.4. What are the potential strengths and weaknesses of this proposed new methodology?

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Potential Strengths

a) the methodology demonstrates a clear displacement of a fossil fuel to generate energy substituting with a biomass fuel that was otherwise entering the waste stream;
b) the methodology uses the parameters that are normally monitored in the industry sectors to which this methodology is applicable for such project activity to take place;
c) the methodology considers specific energy requirement within the project boundary to calculate emission reductions;
d) emission reduction due to expansion of the plant are not considered in calculating emission reductions
e) this methodology does not allow any scope for perverse incentive to increase waste biomass in process streams that is later recovered and claimed as emission reduction;
f) project emissions have to be considered even though the emissions can be shown to be "zero" i.e. based on emissions from an existing climate neutral fuel based energy delivery system, i.e. biomass source;
g) most of the project and baseline data would be from actual and verifiable facility level records, that are easy to obtain, cost effective to use and at the same time, considered reliable.
h) the methodology has built-in flexibility for being applied to industries like pulp, paper and paperboards, brewery and distillery, starch, sugar, meat processing, dairy etc.

Potential Weakness

The potential weaknesses could be :

a) the methodology does not take into consideration the possible change in product characteristics due to increased waste biomass recovery ;
b) the methodology neglects emission reductions from lower chemical consumption and reduced effluent organic load in subsequent process steps;
c) the methodology assumes that process vis-à-vis bio-mass content in the process stream and feed-stock would remain static during the crediting period (which in fact could is a conservative approach)
d) the methodology does not consider the monitoring of any economic variables to assess continued viability of the project activity
e) cost of implementing the monitoring methodology under various project, nationality and sectoral situations have not been assessed.

SECTION B. Proposed new monitoring methodology

B.1. Brief description of the new methodology:

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This monitoring methodology follows the formulae / algorithms and the basic logic for estimating emission reductions as described in "SECTION B.: Overall summary description:" of the proposed new baseline methodology. The reader is referred to this reference for description of all relevant parameters that need to be monitored to compute the baseline, project emissions and leakages in a conservative and transparent manner. Almost all the data are based on facility specific records and consequently would be linked to the quality management system of the unit for precision and accuracy of the data.

B.2. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario:

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B.2.1. Data to be collected or used in order to monitor emissions from the project activity, and how this data will be archived:

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
PEy	Total project emissions	*Project*	*tCO_2e*	*E*	*continuous*	*100%*	electronic/ paper	
P_ENi	energy of type (i) used by any new equipment / process in the project activity	*Project*	Kcal	*M*	*monthly*	*100%*	electronic/ paper	*Energy (steam and/or power) consumed by the new equipment/ process in the project boundary. Energy meters should be installed at the point of supply and at the point of delivery for cross check and same should be recorded*
Eff	Efficiency of fossil fuel energy generation	*Project*	*%*	*M*	*quarterly*	*100%*	electronic/ paper	*Efficiency of the boilers and turbine should be evaluated based on standard energy efficiency techniques as per BIS or ISO. Average of last two years baseline*

B.2.1. Data to be collected or used in order to monitor emissions from the project activity, and how this data will be archived:								
ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
								data to be used for te baseline.
FF_CV	Average calorific value of fossil fuel monitored in the plant	*Project*	kcal/kg	*M*	*daily*	*100%*	electronic/ paper	*Calorific value of the fossil fuel used by the project at the baseline should be evaluated based on standard laboratory invention techniques as per BIS or ISO.. Same can be cross checked with document from the supplier(s).*
C%	Percentage of Carbon in fossil fuel used	*Project*	*%*	*M*	*Quarterly*	*100%*	electronic/ paper	*Percentage of Carbon present in the fossil fuel used should be evaluated based on standard laboratory invention techniques as per BIS or ISO.*
ENPi	energy of type i used by the project by processes whose efficiencies have improved	*Project*	*%*	*M*	*Daily*	*100%*	electronic/ paper	*Energy meters should be installed at the point of supply and at the point of delivery for cross check and same should be recorded*
ENBi	energy of type i used in the baseline by processes whose efficiencies have improved in the project	*Project*	*%*	*M*	*daily*	*100%*	electronic/ paper	*-do-*
BIOB	Biomass generation in	*Project*	Tonne	*M*	*Continuous*	*100%*		*Total biomass generated in the baseline*

B.2.1. Data to be collected or used in order to monitor emissions from the project activity, and how this data will be archived:								
ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
	baseline							
BIOP	Biomass generation in project	*Project*	Tonne	*M*	*Continuous*	*100%*	electronic/ paper	*Total biomass generated by the project activity*

B.2.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

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Project emissions are considered even though the emissions can be shown to be "zero" i.e. based on emissions from a climate neutral, i.e. biomass source;

Total project emissions PEy = PE_new_y + PE_ex_y **(6)**

Step 1: For any new equipment / process in the project activity:

PE_new_y = (SP_ENi / Eff) / FF_CV *C% * 44/12 *(1/1000) **(7)**

Where,

P_ENi= energy of type I used by new equipment / process in the project activity (kcal)
Eff= Efficiency of fossil fuel energy generation (%) monitored periodically;
FF_CV= Average calorific value of fossil fuel (kcal/kg) monitored in the plant;
C% = Percentage of Carbon in fossil fuel used (%);
44/12 = conversion of tC to tCO2 equivalent
1/1000 = conversion from kg to tonnes

Step 2: Incremental energy for other processes inside the project boundary

PE_ex_y = (DELTA_EN / Eff) / FF_CV *C% * 44/12 *(1/1000) **(8)**

Where,
DELTA_EN = (SENPi/BIOP- SENB/BIOB)*(BIOP-BIOB)
ENPi = energy of type i used in by the project by processes whose efficiencies have improved
ENBi = energy of type i used in the baseline by processes whose efficiencies have improved in the project
BIOB = Biomass generation in baseline (tonne)
BIOP = Biomass generation in project (tonne)
Other parameters are as define above

B.2.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of greenhouse gases (GHG) within the project boundary and how such data will be collected and archived:

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
BEy	*Baseline emission in the year "Y"*	*Project*	tCO_2e	*E*	*continuous*	*100%*	electronic/ paper	
EP	extra energy generated by the project using biomass as fuel	*Project*	Kcal	*E*	*continuous*	*100%*	electronic/ paper	
Eff	Efficiency of CFBs generating steam	*Project*	(%)	*M*	*continuous*	*100%*	electronic/ paper	
FF_CV	Average calorific value of fossil fuel	*Project*	kcal/kg	*E*	*continuous*	*100%*	electronic/ paper	
C%	Percentage of Carbon in Fossil fuel used	*Project*	*%*	*E*	*continuous*	*100%*	electronic/ paper	

B.2.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of greenhouse gases (GHG) within the project boundary and how such data will be collected and archived:								
ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
EP_bio	Energy generated from additional biomass available from the project	*Project*	Kcal	*E*	*continuous*	*100%*	electronic/ paper	
EP_proc	Energy saved due to efficiency improvements in biomass processing	*Project*	Kcal	*E*	*continuous*	*100%*	electronic/ paper	
EB_util	Energy saved due to efficiency improvements in biomass utilization for energy generation	*Project*	Kcal	*E*	*continuous*	*100%*	electronic/ paper	
SBIOB	Steam generated using biomass in baseline	*Project*	(tonnes)	*M*	*continuous*	*100%*	electronic/ paper	
SBIOP	Steam generated using biomass energy in project	*Project*	tonnes	*M*	*continuous*	*100%*	electronic/ paper	
Enth_ SBIOB	Enthalpy of steam generated using biomass in baseline	*Project*	kcal/tonne	*E*	*continuous*	*100%*	electronic/ paper	
Enth_ SBIOP	Enthalpy of steam generated using biomass in project	*Project*	Kcal/tonne	*E*	*continuous*	*100%*	electronic/ paper	

B.2.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of greenhouse gases (GHG) within the project boundary and how such data will be collected and archived:								
ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
PB	Blown pulp attributable to waste biomass source in baseline	*Project*	tonne	*M*	*continuous*	*100%*	electronic/ paper	
PP	Blown pulp attributable to waste biomass source in project	*Project*	tonne	*M*	*continuous*	*100%*	electronic/ paper	
BIOB	biomass generation in baseline	*Project*	Tonne	*M*	*continuous*	*100%*	electronic/ paper	
BIOP	biomass generation in project	*Project*	tonne	*M*	*continuous*	*100%*	electronic/ paper	
EN_B	steam consumed to process biomass in baseline	*Project*	tonnes	*M*	*continuous*	*100%*	electronic/ paper	
EN_P	steam consumed to process biomass in project	*Project*	tonnes	*M*	*continuous*	*100%*	electronic/ paper	
BIOB	Biomass generation in baseline	*Project*	tonne	*M*	*continuous*	*100%*	electronic/ paper	
BIOP	Biomass generation in project	*Project*	tonne	*M*	*continuous*	*100%*	electronic/ paper	

B.2.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of greenhouse gases (GHG) within the project boundary and how such data will be collected and archived:

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
SBIOB	steam generated using biomass energy in baseline	*Project*	tonnes	*m*	*continuous*	*100%*	electronic/ paper	
SBIOP	steam generated using biomass energy in project	*Project*	Tonnes	*M*	*continuous*	*100%*	electronic/ paper	
Enth_ SBIOB	Enthalpy of steam generated using biomass energy in baseline	*Project*	kcal/tonne	*E*	*continuous*	*100%*	electronic/ paper	
Enth_ SBIOP	Enthalpy of steam generated using biomass energy in project	*Project*	kcal/tonne	*E*	*continuous*	*100%*	electronic/ paper	
BIOB	Biomass generation in baseline	*Project*	Tonne	*M*	*continuous*	*100%*	electronic/ paper	
BIOP	Biomass generation in project	*Project*	tonne	*M*	*continuous*	*100%*	electronic/ paper	

B.2.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

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In the baseline the emissions are on account of energy generation using fossil fuel. The baseline emissions are calculated as follows :

The baseline emissions in any year 'Y' are computed as:

BEy = (EP / Eff) / FF_CV *C% * 44/12 *(1/1000) (1)

Where,

EP= the extra energy generated by the project using BIOMASS as fuel (kcal)
Eff= Efficiency of CFBs generating steam (%) monitored periodically;
FF_CV= Average calorific value of fossil fuel (kcal/kg) monitored in the plant;
C% = Percentage of Carbon in Fossil fuel used (%);
44/12 = conversion of tC to tCO2 equivalent
1/1000 = conversion from kg to tonnes

Where,
EP = EP_bio + EP_proc+EP_util (2)

EP_bio= Energy generated from additional BIOMASS available from the project (kcal);
EP_proc= Energy saved due to efficiency improvements in BIOMASS processing (kcal); and
EP_util= Energy saved due to efficiency improvements in biomass utilization for energy generation (kcal).

Each of the above parameters has been calculated individually to arrive at the baseline emissions.

Step 1: Compute EP_bio

EP_bio = (increase in enthalpy of steam generated in project over baseline per unit of BIOMASS generated)*(incremental BIOMASS generated due to the project at baseline levels of production)

EP_bio = ((SBIOP* Enth_ SBIOP)/BIOP - (SBIOB* Enth_ SBIOB)/BIOB)*((BIOP/PP- BIOB/PB) * (PB)) (3)

Where,
SBIOB = steam generated using BIOMASS in baseline (tonnes)
SBIOP = steam generated using BIOMASS energy in project (tonnes)
Enth_ SBIOB = Enthalpy of steam generated using BIOMASS in baseline (kcal/tonne)

Enth_ SBIOP = Enthalpy of steam generated using BIOMASS in project (kcal/tonne)
PB = Blown pulp attributable to waste BIOMASS source in baseline (tonne)
PP = Blown pulp attributable to waste BIOMASS source in project (tonne)
BIOB = BIOMASS generation in baseline (tonne)
BIOP = BIOMASS generation in project (tonne)

Step 2 : Compute EP_proc

EP_proc = (incremental specific steam economy in project over baseline)*(biomass generated in baseline)
EP_proc = ((EN_B* Enth_ ENB/BIOB) – (EN_P* Enth_ ENP/BIOP))*BIOB (4)

Where,

EN_B = steam consumed to process biomass in baseline (tonnes)
EN_P = steam consumed to process biomass in project (tonnes)
Enth_ ENB = Enthalpy of steam used to process biomass baseline (kcal/tonne)
Enth_ ENP = Enthalpy of steam used to process biomass project (kcal/tonne)
BIOB = Biomass generation in baseline (tonne)
BIOP = Biomass generation in project (tonne)

Step 3 : Compute EP_util

EP_util = ((SBIOP* Enth_ SBIOP)/BIOP -(SBIOB* Enth_ SBIOB)/BIOB)*BIOB (5)

Where,

SBIOB = steam generated using biomass energy in baseline (tonnes)
SBIOP = steam generated using biomass energy in project (tonnes)
Enth_ SBIOB = Enthalpy of steam generated using biomass energy in baseline (kcal/tonne)
Enth_ SBIOP = Enthalpy of steam generated using biomass energy in project (kcal/tonne)
BIOB = Biomass generation in baseline (tonne)
BIOP = Biomass generation in project (tonne)

B.3. Option 2: Direct monitoring of emission reductions from the project activity:

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NOT APPLICABLE AS OPTION 1 HAS BEEN SELECTED

B.3.1. Data to be collected or used in order to monitor emissions from the project activity, and how this data will be archived:								
ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

NOT APPLICABLE

B.3.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

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Annual Emission Reductions ($\mathbf{ER_Y}$) from the project activity:

ERy = BEy – PEy – Leakage if any (Ley) (9)

B.4. Treatment of leakage in the monitoring plan:

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Leakage to the project would be on account for additional chemical and reagent usage and due to intermittent storage of biomass beyond a certain period. However in case of biomass storage this methdodology is not applicable. If it can be shown that leakage reductions on account of the project are significantly higher than any leakage caused by the project due to additional chemical or reagent use, only then can the estimation of these leakage be avoided.

B.4.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity:								
ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording Frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

B.4.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

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NOT APPLICABLE

B.5. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

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B.6. Assumptions used in elaborating the new methodology:

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Following points has been assumed while designing this methodology:

- all the parameters in the project as well as in baseline can be monitored and recorded;
- parameters are applicable to different project activities/ industry sector to which the methodology can be applied;
- all parameters measured and estimated based on given basis of calculation are practicable and applicable in any given condition.

B.7. Please indicate whether quality control (QC) and quality assurance (QA) procedures are being undertaken for the items monitored:

Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
All data related to project and baseline	*Low*	*All data on the project and baseline should be regularly monitored and recorded at mentioned intervals. Further all meters reading the critical parameters should be calibrated at regular intervals at least once in a year.*

B.8. Has the methodology been applied successfully elsewhere and, if so, in which circumstances?

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Methodology has been specifically designed for proposed project activity. However same can be applied to the various industry types as described in proposed new baseline methodology section.

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