



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

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SECTION A. Identification of methodology

A.1. Title of the proposed methodology:

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Monitoring methodology for biodiesel production and switching fossil fuels from petro-diesel to biodiesel in transport sector

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

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This methodology is directly applicable to fuel switch activities that switch vehicle fuel use from petro-diesel, HFO, LDO etc. to biodiesel. The methodology may be applied to activities that switch gasoline or motor spirit to ethanol with minor modifications.

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

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This monitoring methodology is applicable to fuel switch activities that switch petro-diesel to biodiesel and

- a) that partially or fully substitute petro-diesel with biodiesel in mobile combustion for road and rail transport
- b) that include biodiesel production plant within the activity and the biodiesel plant developer owns CERs since emission reductions are generated solely by the initiative of the project developer. This happens when the biodiesel production plant is first of its kind or one of the first few cases. Project proponents shall enter into agreement with biodiesel consumers such that consumers will not claim CERs for the biodiesel consumed and additional revenues from the sale of certified emission reductions by project proponents will be passed on to biodiesel consumers as subsidy on the sale price of biodiesel. This arrangement will avoid duplication of ownership of emission reductions and double counting. The technology used in the biodiesel production plant shall be esterification or transesterification using ethanol or methanol.
- c) that use various feedstocks such as edible / non-edible oils derived from oil bearing seeds such as pongamia pinnata, jatropha curcas, soyabean, sunflower etc., waste oils, fatty acids, etc. which are otherwise neglected or dumped.
- d) that do not claim emission reductions from chemical fertiliser replacement with oil cake or any other non-biodiesel related emission reductions.
- e) where no regulations exist in host countries on biodiesel use

Further the methodology is applicable to all proposed CDM project activities under the above mentioned category in regions where a specific engine types and engine technologies can not be identified and biodiesel consumption is anticipated across a wide range of vehicle types and technologies.



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

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The strength of the methodology is related to the accuracy of data items and stringent quality control measures proposed. All necessary data items are included in the monitoring methodology to ensure completeness. So far no methodology has been proposed for similar project activities.

The weakness in the methodology is related to the use of emission factors specified by IPCC where national data is not available. Another weakness of the methodology is that it has a very limited applicability across the similar project activities.

SECTION B. Proposed new monitoring methodology

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B.1. Brief description of the new methodology:

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The accompanying baseline methodology considered the baseline that represents continuation of existing practice of using petro-diesel in transport sector including rail. Hence, the baseline emissions are the emissions caused due to the combustion of petro-diesel. As described in the accompanying baseline methodology, actual baseline emissions depend on many parameters such as technology level, fuel consumed, emission controls, operating characteristics, age of engines etc. Further, biodiesel utilization is anticipated across a wide range of vehicles that differ in age and technology level. Monitoring of these emissions is very difficult and complex. Hence, a common emission factor based on the national data or IPCC emission factors is developed in the baseline methodology and baseline emissions are related to the common emission factor and the quantity of petro-diesel substituted. Accordingly this monitoring methodology requires monitoring of emission factors and the petro-diesel substituted to ascertain the baseline emissions. As described in the baseline methodology, biodiesel consumed may be monitored in place of petro-diesel substituted.

Similarly, the accompanying baseline methodology considers various project emissions and leakage emissions that occur during the production of biodiesel. Monitoring of these emissions is necessary for ascertaining the emission reductions from the project activity. Hence, this monitoring methodology includes monitoring of parameters such as electricity consumed during the production of biodiesel, the build and operating margin according to ACM0002, fossil fuel use by the biodiesel plant, transport distance for transport of feedstock and other materials and area cleared for plantations.

In summary, the monitoring methodology requires monitoring of the following data to ascertain the emission reductions from the project activity.

Baseline emissions

- Emission factors for each greenhouse gas as applicable
- Oxidisation factor
- Quantity of biodiesel consumed
- Efficiency multiplier



Project emissions

- Electricity consumed by the biodiesel production plant during plant operation
- Grid emission factor
- Fossil fuels consumed by the biodiesel production plant during plant operation
- Fossil fuel emission factor
- Petro-diesel consumed for off-site transport of raw materials, by products and biodiesel to filling stations
- Vegetation clearance for new plantation and harvest of plantation
- Fuel use for plantation operation
- Carbon sequestration in plantation

Leakage

- Emissions associated with manufacture of methanol for biodiesel production

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 (Please use numbers to ease cross-referencing to table B.7)	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
1	Electricity consumed by project and oil extraction activities	Bills from electric utility	kWh	m	Monthly	100%	paper	This data item is used for estimating project induced emissions due to usage of electricity for plant operation
2	Grid emission factor	Official statistics	tCO ₂ /MWh	e	Yearly	100%	paper	To be estimated as combined margin emission factor as described in the approved consolidated methodology ACM0002 for grid connected renewable electricity generation projects or another appropriate baseline methodology.
3	Petro-diesel	Fuel bills	t	c	Monthly	100%	paper	Transportation of biodiesel, raw

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	consumed for off-site transport	of transport providers						materials and byproducts will be contracted to outside parties and delivery notes submitted by outside parties will be used to calculate emissions from off-site transport
4	Quantity of fossil fuels used on-site	Fuel bills	t	m	Monthly	100%	paper	Fossil fuel delivery documents by suppliers and purchase bills will be used for verification.
5	Emission factors for fossil fuels used on-site for CO ₂ , CH ₄ and N ₂ O and oxidation factor	National data / IPCC emission factors	g/kg	e	Annual	100%	paper	Emission factors are either obtained from national data or based on IPCC emission factors. First choice is for national data and only where national data is not available then IPCC emission factors may be used.
6	Emission factor for vegetation clearance	National forest inventory or publicly available sources	tCO ₂ /ha	e	Annual	100%	paper	
7	Vegetation clearance for new plantations / harvesting of old plantations	Cadastre	ha	e	Annual	100%	paper	
8	Fossil fuel use in plantations	Fuel bills	kl	e	Annual	100%	paper	
9	Emission factors for fossil fuels used in plantations	National data / IPCC emission factors	g/kg of fuel	e	Annual	100%	paper	Emission factors are either obtained from national data or based on IPCC emission factors. First choice is for national data and only where national data is not available then IPCC emission factors may be used.



10	Sequestration in plantations	Publicly available sources	tCO ₂ /ha	e	Annual	100%	paper	Average rates for the vegetation type planted.
11	Area of plantation	Cadastre	ha	e	Annual	100%	paper	

B.2.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.):

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Emissions from electricity consumption :

$$\begin{array}{lclcl} \text{Emissions from electricity} & = & \text{electricity consumed} & \times & \text{grid emission factor} \\ \text{tCO}_2/\text{yr} & & \text{MWh / yr} & & \text{tCO}_2/\text{MWh} \end{array}$$

Emissions from fossil fuel consumption

$$\begin{array}{lclcl} \text{Emissions from Fossil fuel Consumption} & = & \text{Fossil fuel consumed} & \times & \text{Fuel specific Emission factor} \\ \text{tCO}_2/\text{yr} & & \text{t} & & \text{tCO}_2\text{e/t} \end{array}$$

Off-site transport emissions:

$$\begin{array}{lclcl} \text{Transport emissions} & = & \text{Petro-diesel consumed} & \times & \text{Emission factor} \\ (\text{tCO}_2\text{e / yr}) & & (\text{t / yr}) & & (\text{tCO}_2\text{e / t fuel}) \end{array}$$

Emissions from preparation of lands for new plantations and plantation operations

Emissions from preparation of lands for new plantations and plantation operations are to be estimated as follows.

$$\begin{array}{lclclclcl} \text{Emissions From plantation} & = & \text{Vegetation clearance} & \times & \text{Land area cleared} & + & \text{fuel use} & \times & \text{fuel emission factor} & - & \text{sequestration in plantation} & \times & \text{area of plantation} \\ \text{tCO}_2/\text{yr} & & (\text{tCO}_2/\text{ha}) & & (\text{ha}) & & (\text{kl}) & & (\text{tCO}_2/\text{kl}) & & (\text{tCO}_2/\text{ha}) & & (\text{ha}) \end{array}$$



B.2.3. Relevant data necessary for determining the <u>baseline</u> of anthropogenic emissions by sources of greenhouse gases (GHG) within the project boundary and how such data will be collected and archived:								
ID number (Please use numbers to ease cross-referencing to table B.7)	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
1	Quantity of Biodiesel produced	Project operation records	tons	m	Daily	100%	Paper	Quantity of the biodiesel produced is considered same as the petro-diesel substituted.
2	Quantity of biodiesel consumed	Sales records submitted by retail outlets	t	m	Monthly	100%	paper	Biodiesel sales data submitted by retail outlets will be used to estimate the biodiesel consumed.
3	CO ₂ e emission factor for petro-diesel	National data / IPCC emission factors	g/kg of fuel	e	Annual	100%	Paper	CO ₂ emission factor is either obtained from the national data or estimated based on carbon content or the lowest IPCC emission factors for diesel vehicles is taken..
4	Oxidisation factor for petro-diesel	Publicly available sources	%	e	Annual	100%	Paper	
5	Efficiency multiplier of petro-diesel	Publicly available sources	%	e	Annual	100%	Paper	Publicly available sources for the efficiency of motors using biodiesel compared to motors using petro-diesel under traffic conditions similar to those of host country.

**B.2.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.):**

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The following formula to be used for estimation of baseline emissions (consistent with the formulae provided in section D.6 of baseline methodology).

$$\begin{array}{ccccccc} \text{Baseline} & & \text{Biodiesel} & & \text{CO}_2\text{e Emission} & & \text{Efficiency multiplier of} \\ \text{emissions} & = & \text{consumed} & \times & \text{factor} & \times & \text{petro-diesel (\%, bio-diesel motor /} \\ (\text{tCO}_2\text{e / yr}) & & (\text{t / yr}) & & (\text{tCO}_2\text{e / t fuel}) & & \text{petro-diesel motor}) \end{array}$$

Where national CO₂e emission factor for petro-diesel is available, the following formula applies:

$$\begin{array}{ccccccc} \text{Baseline CO}_2 & = & \text{Carbon} & \times & \text{Oxidisation} & \times & \text{Conversion} \\ \text{Emissions} & & \text{content in} & & \text{factor} & & \text{factor} \\ & & \text{petro-diesel} & & & & \\ t\text{CO}_2 / t\text{fuel} & & t\text{C} / t\text{fuel} & & \% & & t\text{CO}_2 / t\text{C} \end{array}$$

Otherwise the lowest IPCC default factor for diesel vehicles is used as provided in the baseline methodology.

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

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Option 2 is not selected for the project activity. Hence, this is not applicable.

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 (Please use numbers to ease cross-referencing to table B.7)	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

**B.3.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.):**

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

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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 (Please use numbers to ease cross-referencing to table B.7)	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
1	Methanol consumed	Plant operation records	T	m	monthly	100%	paper	This data item will be used for estimating project induced emissions for methanol production outside the project boundary.

B.4.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.):

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The following formula to be used for estimation of leakage emissions that are occurring outside the project boundary due to the project.

$$\begin{array}{lcl} \text{Methane} & & \text{Methanol} \\ \text{Emissions} & = & \text{consumed} \\ & & \text{by project} \\ tCO_2e / yr & & t/yr \end{array} \quad \times \quad 0.002 \quad \times \quad 21$$

More description on the above formula is furnished in section D.8 of the baseline methodology.

B.5. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.):

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The emission reductions by the project activity during a given year are calculated as under.

$$\text{Emission Reductions} = \text{Baseline Emissions} - \text{Project Emissions} - \text{Leakage}$$

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

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The monitoring methodology suggests using conservative emission factors specified by IPCC for developed countries. This is suggested assuming that these emission factors are conservative than those of developing countries. However, these emission factors are suggested only where host country emission factors are not available. For small project emission items such as electricity use from oil extraction, estimates will be used as costs to collect the actual data would be prohibitive.

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.
B.2.1.1	Low	This data item is required for estimating the project emissions from electricity consumption. The electricity consumed will be monitored by the electricity supplier using calibrated tamper proof electricity meter installed within the project premises. Bills of the electricity supplier will be verified. Electricity meters will be periodically calibrated according to the industry standards or as recommended by the electricity supplier.
B.2.1.2	Low	This data item is obtained from national statistics. Hence, QA/QC of this data item is not in the control of project proponents.
B.2.1.3	Medium	This data item is required for estimating the project emissions due to off-site transport distance. Project proponents shall maintain the records of the petro-diesel purchased for transport vehicles. Bills and the amount paid for the petro-diesel shall be verified.
B.2.1.4.	Low	This data item is required for estimating the project emissions due to on-site fossil fuels use. Project proponents shall maintain the records of the fuel deliveries. Bills and the amount paid for fuel shall be verified.
B.2.1.5	Low	Data come from national statistics or IPCC good practice guidance
B.2.1.6	Medium	Data come from national statistics or external sources whose credibility needs to be checked.
B.2.1.7	Medium	Feedstock / oil providers are required to provide information on new plantation area
B.2.1.8	Low	Feedstock / oil providers are required to provide fuel bills
B.2.1.9	Low	Data come from national statistics or IPCC good practice guidance
B.2.1.10	Medium	Data come from external sources whose credibility needs to be checked.
B.2.1.11	Medium	Feedstock / oil providers are required to provide information on overall plantation area
B.2.3.1	Low	Two numbers of tamper proof electronic flow meters will be installed at the final product outlet point to measure and record the flow of outlet biodiesel. Flow meters will be subjected to periodical calibration to industry standards. This data item shall be verified with the quantity of raw materials used and sales bills for biodiesel.
B.2.3.2	Medium	Quality control of this data item will not under the control of project participants. Hence, no QA / QC procedures are planned.

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B.2.3.3	Low	Quality control of this data item will not under the control of project participants. Hence, no QA / QC procedures are planned.
B.2.3.4	Medium	Data come from external sources whose credibility needs to be checked.
B.2.3.5	Medium	Data come from external sources whose credibility needs to be checked.
B.4.1.1	Medium	This data item will be used for estimation of project induced emissions from methanol consumption. Quantity of methanol consumed will be measured using electronic weighing scale installed at the entry of the project premises. Trucks carrying methanol will be weighed twice, once upon entry of loaded truck into the project premises and the second upon exit from the project premises. The difference of these two represents the methanol weight carried inside the project area. This data item will be further verified using purchase bills of the methanol, daily opening stock and closing stock records of the inventory. Electronic weighing scales will be subjected to regular calibration according to the industry standards.

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

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This methodology has not been applied elsewhere, but, parts of it, say monitoring of emissions / activities in biodiesel production might be applied in most of the existing biodiesel production plants.
