



## Approved VCS Module VMD0012

Version 1.0

### REDD Methodological Module:

Estimation of emissions from displacement of fuelwood extraction (LK-DFW)

Sectoral Scope 14

#### I. SCOPE, APPLICABILITY AND PARAMETERS

##### Scope

This module allows for estimating GHG emissions caused by the activity-shifting leakage for projects avoiding degradation from fuelwood collection and charcoal production.

##### Applicability

The module is applicable for estimating the leakage emissions due to activity shifting for projects avoiding degradation from fuelwood collection and charcoal production.

Where fuelwood is collected or charcoal is produced for sale in regional or national market the market effects leakage must be considered using Module **LK-ME**.

##### Parameters

This module provides procedures to determine the following parameter:

Parameter	SI Unit	Description
$\Delta C_{LK-AS, degrad-FW/C}$	t-CO <sub>2</sub> -e	Net greenhouse gas emissions due to activity-shifting leakage for degradation caused by extraction of wood for fuel



## II. PROCEDURE

### Demonstrably renewable woody biomass (DRB)

Biomass<sup>1</sup> is “renewable” if one of the following five conditions applies:

1. The biomass is originating from land areas that are **forests**<sup>2</sup> where:
  - a. The land area remains a forest; and
  - b. Sustainable management practices are undertaken on these land areas to ensure, in particular, that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvest); and
  - c. Any national or regional forestry and nature conservation regulations are complied with.
2. The biomass is **woody biomass** and originates from **croplands and/or grasslands** where:
  - a. The land area remains cropland and/or grassland or is reverted to forest; and
  - b. Sustainable management practices are undertaken on these land areas to ensure, in particular, that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvest); and
  - c. Any national or regional forestry and nature conservation regulations are complied with.
3. The biomass is **non-woody biomass** and originates from **croplands and/or grasslands** where:
  - a. The land area remains cropland and/or grassland or is reverted to forest; and
  - b. Sustainable management practices are undertaken on these land areas to ensure, in particular, that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvest); and
  - c. Any national or regional forestry and nature conservation regulations are complied with.
4. The biomass is **biomass residue**<sup>3</sup> and the use of that biomass residue in the project activity does not involve a decrease of carbon pools, in particular dead wood, litter or soil organic carbon, on the land areas where the biomass residues are originating from.

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<sup>1</sup> This definition follows the CDM: EB 23, Annex 18

<sup>2</sup> Forests can include fuelwood plantations, where new plantations are installed they shall be included as a linked ARR VCS project

<sup>3</sup> Biomass residue is defined as biomass by-products, residues and waste streams from agriculture, forestry and related industries

For example, if bagasse from sugar production would in the absence of a project be dumped or left to decay and is used for energy generation under a REDD-project scenario, it can be assumed that the use of the bagasse does not affect the sugar cane cultivation practices and hence the carbon pools of the respective soils. In contrast, where a REDD project involves the collection of dead wood from a forest, which would not be collected in the absence of the REDD project activity, the extracted biomass cannot be regarded as renewable, since it would result in a decrease of carbon stocks.

5. The biomass is the non-fossil fraction of an industrial or municipal waste.

Otherwise, where none of these conditions applies, the biomass is considered as “**non-renewable biomass**” (NRB).

### **Calculation of Emissions due to Activity Shifting Leakage**

**Step 1:** For each monitoring period, estimate the average annual amount of demonstrably renewable biomass collected (in Mg) and the volume of fuelwood collected in the project area (if any). The baseline rate of fuelwood collection minus this with-project rate and the demonstrably renewable biomass gives an estimate of the non-renewable biomass harvested as a result of implementing the project activity. Estimates shall be obtained through a Participatory Rural Appraisal (PRA).

$$NRB_t = \sum_{i=1}^M \left( \frac{(FG_{BSL,i,t} - FG_{PA,i,t}) * D_{mn}}{0.9} \right) - DRB_t \quad (1)$$

Where:

$NRB_t$	Non-renewable biomass gathered for fuel and/or charcoal production as a result of project implementation at time $t$ ; t d.m.
$FG_{BSL,i,t}$	Average projected volume of wood gathered in the project area for fuel and/or charcoal production in the baseline scenario in stratum $i$ in year $t$ ; $m^3$ (from Module <b>BL-DFW</b> )
$FG_{PA,i,t}$	Volume of fuelwood gathered in the project area from stratum $i$ at time $t$ ; $m^3$
$DRB_t$	Demonstrably renewable biomass collected at time $t$ ; t d.m.
$D_{mn}$	Mean wood density of commercially harvested species; t d.m. $m^{-3}$
$CF$	Carbon fraction of dry matter; t C t. d.m. $^{-1}$
$i$	1, 2, 3 ... $M$ strata in the baseline scenario
$t$	1, 2, 3, ... $t^*$ years elapsed since the projected start of the REDD project activity

**Step 2:** Leakage of greenhouse gas emissions due to displacement of fuelwood collection shall be estimated as follows:

$$GHG_{LK,E,t} = NRB_b * GHG_{E,FACTOR} \quad (2)$$

$$GHG_{E,FACTOR} = \frac{GHG_{BSL,E}}{((FG_{BSL} * D_{mn})/0.9)} \quad (3)$$

$$FG_{BSL} = \sum_{t=1}^{t^*} \sum_{i=1}^M FG_{BSL,i,t} \quad (4)$$

Where:

$GHG_{LK,E,t}$	Greenhouse gas emissions as a result of the leakage of degradation activities; t CO <sub>2</sub> -e
$GHG_{E,FACTOR}$	Greenhouse gas emissions relative to biomass gathered as a result of leakage of degradation activities; t CO <sub>2</sub> -e/t d.m.
$GHG_{BSL,E}$	Greenhouse gas emissions as a result of degradation activities within the project boundary in the baseline; t CO <sub>2</sub> -e
$NRB_t$	Non-renewable biomass gathered for fuel and/or charcoal production as a result of project implementation at time $t$ ; t d.m.
$FG_{BSL}$	Summed projected volume of wood gathered in the project area for fuel and/or charcoal production in the baseline scenario; m <sup>3</sup>
$FG_{BSL,i,t}$	Average projected volume of wood gathered in the project area for fuel and/or charcoal production in the baseline scenario in stratum $i$ in year $t$ ; m <sup>3</sup> (from Module <b>BL-DFW</b> )
$D_{mn}$	Mean wood density of commercially harvested species; t d.m.m <sup>-3</sup>
$i$	1, 2, 3 ... $M$ strata in the baseline scenario
$t$	1, 2, 3, ... $t^*$ years elapsed since the projected start of the REDD project activity

**Step 3:** Leakage due to displacement of fuelwood collection shall be estimated as follows:

$$\Delta C_{LK-AS,degrad-FW/C} = \sum_{t=1}^{t^*} \left( \left( NRB_t * CF * \frac{44}{12} \right) + GHG_{LK,E,t} \right) \quad (5)$$

Where:

$\Delta C_{LK-AS,degrad-FW/C}$	Net greenhouse gas emissions due to activity shifting leakage for degradation caused by extraction of wood for fuel; t CO <sub>2</sub> -e
$NRB_t$	Non-renewable biomass gathered for fuel and/or charcoal production as a result of project implementation at time $t$ ; t d.m.

<i>CF</i>	Carbon fraction of dry matter; t C t d.m. <sup>-1</sup>
<i>GHG<sub>LK,E,t</sub></i>	Greenhouse gas emissions as a result of the leakage of degradation activities; t CO <sub>2</sub> -e
<i>t</i>	1, 2, 3, ... <i>t</i> <sup>*</sup> years elapsed since the projected start of the REDD project activity

### III. DATA AND PARAMETERS NOT MONITORED (DEFAULT OR MEASURED ONE TIME)

<b>Data / parameter:</b>	<i>CF</i>
Data unit:	t C t d.m. <sup>-1</sup>
Used in equations:	2
Description:	Carbon fraction of dry matter
Source of data:	Default value 0.47 t C t <sup>-1</sup> d.m. can be used, or species specific values from the literature (e.g. IPCC 2006 INV GLs AFOLU Chapter 4 Table 4.3)
Measurement procedures (if any):	
Any comment:	

<b>Data / parameter:</b>	<i>D<sub>mn</sub></i>
Data unit:	t d.m.m <sup>-3</sup>
Used in equations:	1, 3
Description:	Mean wood density of commercially harvested species
Source of data:	The source of data shall be chosen with priority from higher to lower preference as follows: (a) Averaged national and commercial species-specific (e.g. from National GHG inventory or site specific measurements); (b) Averaged commercial species-specific from neighboring countries with similar conditions. Sometimes (b) may be preferable to (a). (c) Averaged regional commercial species-specific (e.g. Table 4.13 IPCC National Guidance for Greenhouse Gas Inventories AFOLU Section). (d) Regional average (0.58 t d.m.m <sup>-3</sup> - tropical Africa; 0.60 t d.m.m <sup>-3</sup> - tropical America; 0.57 d.m.m <sup>-3</sup> - tropical Asia) from Brown, S. 1997. Estimating Biomass and Biomass Change of Tropical Forests: a Primer. For the Food and Agriculture Organization of the United Nations. Rome,

	1997. FAO Forestry Paper - 134. ISBN 92-5-103955-0.
Measurement procedures (if any):	
Any comment:	

#### IV. DATA AND PARAMETERS MONITORED

<b>Data / parameter:</b>	$DRB_t$
Data unit:	$Mg\ yr^{-1}$
Used in equations:	1
Description:	Demonstrably renewable biomass collected at time $t$
Source of data:	PRA
Measurement procedures (if any):	PRA shall be conducted through interviews and questionnaires
Monitoring frequency:	Must be monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
QA/QC procedures:	
Any comment:	<i>Ex-ante</i> a justifiable estimate shall be made of proportion of fuelwood that is demonstrably renewable

<b>Data / parameter:</b>	$FG_{PA,i,t}$
Data unit:	$m^3$
Used in equations:	1
Description:	Volume of fuel-wood gathered in stratum $i$ of the project area according to monitoring results at time $t$
Source of data:	Interviews / Participatory Rural Appraisals, field measurement and literature data. Monitoring should be conducted in communities within the project boundary and in communities outside the boundary but potentially collecting fuelwood or producing charcoal from within the boundaries
Measurement procedures (if any):	

Monitoring frequency:	Must be monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
QA/QC procedures:	
Any comment:	<i>Ex-ante</i> a justifiable estimate shall be made of fuelwood that can be sustainably harvested from the project area

## V. PARAMETERS ORIGINATING IN OTHER MODULES

<b>Data / parameter:</b>	$FG_{BSL,i,t}$
Data unit:	m <sup>3</sup>
Used in equations:	1, 4
Description:	Average projected volume of wood gathered in the project area for fuel and/or charcoal production in the baseline scenario in stratum <i>i</i> in year <i>t</i>
Module parameter originates in:	BL-DFW
Any comment:	Updated at every baseline renewal

<b>Data / parameter:</b>	$GHG_{BSL,E}$
Data unit:	t CO <sub>2</sub> -e
Used in equations:	3
Description:	Greenhouse gas emissions as a result of degradation activities within the project boundary in the baseline
Module parameter originates in:	BL-DFW
Any comment:	Updated at every baseline renewal