Sawdust 2000 - Project Implementation

Guidelines for Monitoring Plan

Version 4 – 2005 01 05

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Abbreviation

Annex B countries	Emssion capped industrialised countries and economies in transition listed in Annex B - Kyoto Protocol.
Annex I countries	Industrialised countries and economies in transition listed in Annex I of the UNFCC.
AIJ	Activities Implemented Jointly. In the first UNFCC Conference of Parties (COP 1) in Berlin 1995 a pilot phase for bilateral GHG mitigation projects was created with the name Activities Implemented Jointly. During the AIJ phase experience shall be established, but without allowing carbon credit transfer between countries.
AAU	Assigned Amount Unit is tradable units of the Assigned Amount of an Annex B country as issued pursuant to the rules of article 17 of the Kyoto Protocol, expressed as one metric ton of CO2.
ARCE	Romanian Agency for Energy Conservation
Baseline	A description of the most likely future development in the considered GHG emission or sequestrating system without the JI or CDM project.
BAU	Buisness As Usual. The BAU scenario describes the future development of the existing fossil fuel based district heating sytem if it was continued to be in operation.
BS	Baseline Study
CDE	Carbon Dioxide Equivalent
CDM	Clean Development Mechanism
CEECs	Central and East European Countries
CER	Certified Emission Reduction
CH_4	Methane
CO_2	Carbon Dioxide
DEPA	Danish Evironmental Protection Agency
DH	District Heating
EPA	Enviromental Protection Agency located in each county
ERU	Emission Reduction Unit describes the technical term for GHG emission reduction output of JI - Project according to the Kyoto Protocol.
EUR	Euro (currency European Union)
Gcal	Giga-calorie (1.0 Gcal = 4.187 GJ)
GES	Gross Energy Supply (total energy demand of DH system including losses boiler system, distribution pipe network, under buildings and in buildings).
GHG	Greenhouse Gasses
GJ	Giga Joule (1.0 GJ = 277.78 kWh)
GWP	Global Warming Potential
Host Contry	Country in which the JI or CDM project is implemented
IPCC	Intergovernmetal Panel on Climate Change
JI	Joint implementation Porject according to Article 6 - Kyoto Protocol.
kWh	Kilowatt hour (1.0 KWh = 3,600,000 Joule)
Leakage	The net change of anthropogeni GHG emission which occur outside the project boundary.
L/S	Litre per second
MDP	Romanian Ministry of Development and Prognosis
MOU	Memorandum of Understanding between countries
MP	Monitoring Plan
MWh	Megawatt hour (1.0 MWh = 3,600,000,000 Joule)
N_2O	Nitrous Oxide
NED	Net Energy Demand (energy demand in buildings, excluding losses in basements).
PCF	Prototype Carbon Fund of the World Bank
PDD	Project Design Document
QA	Quality Assurance
QC	Quality Control
ROL	Romanian Lei (currency)
RMWEP	Romanian Ministry of Waters and Environmental Protection
SINK	A procees, activity or mechanism, which removes anthropogenic GHG from the atmosphere.
UNFCC	United Nations Framework Convention on Climate Change

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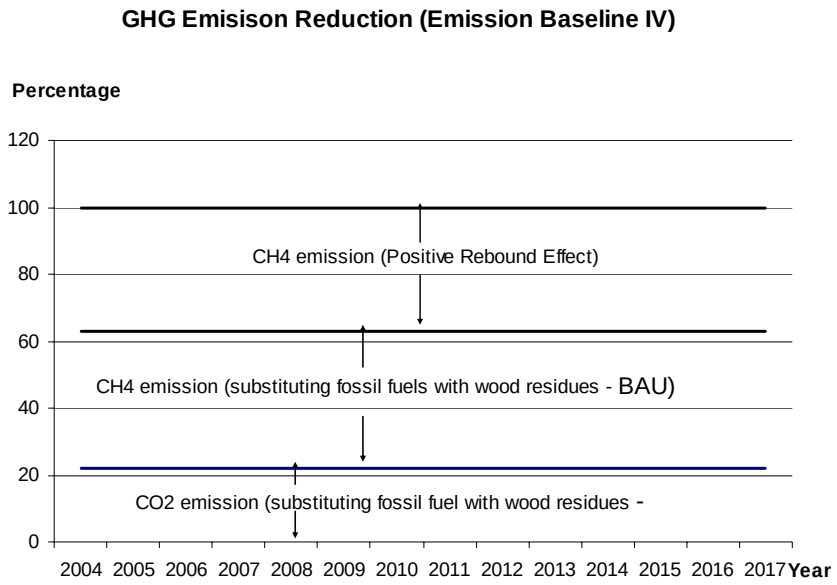
1. Monitoring Requirements

1.1 Objective of the Monitoring Plan

The objective of the MP is to provide a practical framework for collection and management of performance data in order to monitor and verify the GHG emission reduction generated by the Joint Implementation Project, Sawdust 2000. The project comprises establishment of new biomass based DH systems in the five Romanian towns Vlahita, Gheorgheni, Huedin, Vatra Dornei and Intorsura Buzaului. The MP shall after its validation act as an integrated part of the contractual agreement for selling of GHG between the Romanian government and the Danish government.

The MP provides methodologies for monitoring and estimation of GHG emission reduction within CO_2 emission reduction and CH_4 emission reduction referring to baseline IV in the Baseline Study – Version 3 – 2005 01 05.



The MP comprises two monitoring methodologies to be followed by the organisations responsible for execution of the monitoring. The two methodologies are briefly described below.

Methodology One: Methodology One comprises calculation of the annual CO_2 emission reduction originating from substituting fossil fuels with wood residues. For each site the annual CO_2 emission reduction will be equal to the annual quantity of CO_2 emission estimated in the BAU scenario (see emission baseline IV in the Baseline Study). Methodology one shall be used for the entire monitoring period, which is ten years.

Methodology Two: Methodology Two comprises calculation of CH_4 emission reduction originating from reducing the quantities of stockpiles of wood residues in the nature. CH_4 emission reduction generated by the project shall be divided into CH_4 emission reduction connected to the BAU scenario and CH_4 emission reduction generated by increasing the comfort level in buildings. In the Baseline study it is foreseen that the comfort level in buildings in all the five towns involved will reach the same level as what has been mapped in the buildings in the biomass project in Tasca (commissioned in 1999).

This means the CH_4 emission reduction generated by the BAU scenario is known today providing the assumptions presented in the Baseline Study will not be changed. CH_4 emission reduction generated by increasing comfort level in buildings will be estimated according to meter readings and subsequent calculations. The CH_4 emission will be converted into a quantity of equivalent CO_2 using a GWP factor of 21.

The monitoring results shall be filled in the forms in the Annexes for the entire monitoring period of ten years. The proposed monitoring methodologies, data collection, data management and guidelines can only be changed after agreement with the Romanian Government, the Danish Government or the Verifier.

1.2 Requirements for the Monitoring Activities

1. Monitoring of the GHG emission reduction generated by the project shall be performed by data collection at site in the five Romanian towns Vlahita, Gheorgheni, Huedin, Vatra Dornei and Intorsura Buzaului.

2. Monitoring reports including the actual GHG emission reduction shall be issued on annual basis in the entire crediting period of ten years.

3. The monitoring reports shall include the GHG emission generated by operation of standby boilers.

4. Persons trained in the monitoring procedures shall conduct monitoring of the GHG emission reduction generated by the new biomass boiler system and standby boilers.

5. Based on monitoring results the GHG emission reduction shall be calculated and submitted for verification as approves ERUs.

6. A QA system shall be implemented to secure accurate and transparent monitoring of GHG emission reduction.

7. The governing language is English when speaking about monitoring reports.

8. The outcome of the MP shall make it possible for a legal entity to accredit the ERUs generated by the project according to requirements of the Joint Implementation Supervisory Committee.

9. The monitoring procedures shall be based on the guidelines in the Project Manual - Joint Implementation - May 2003 publicised by the Danish Energy Authority.

10. Draft version of the annual monitoring report shall be submitted to the Romanian government and Danish government or theirs representative before issuing the final version. For a time period of ten (10) years the Romanian government, Danish government and verifier shall annually received the reports presented below.

Receiver of annual reports	**Draft version monitoring report**	**Final version monitoring report**
Romanian Government	Two (2) copies	Two (2) copies
Danish Government	Two (2) copies	Two (2) copies
Verifier		Two (2) copies

Table 1:

1.3 Operation- and Monitoring Obligation

This paragraph describes requirements for collection of the key performance parameters necessary to achieve verifiable emission reduction data. This will call for certain operational obligations and data collection obligations to be fulfilled by the utility.

The utility shall take all reasonable actions to optimise the operation of the new biomass boiler system even this in fact will minimise the GHG emission reduction.

1. The utility shall ensure collection and transported of wood residues from the suppliers to the new storage facilities and biomass boiler plant.

2. The utility shall as a minimum fulfil the obligations concerning monitoring- and data management which are described in this document, this shall act as an integrated element in the day-to-day management system for the DH system.

3. The utility operating the new DH system shall notify the Romanian government and the Danish government if the new DH system is stopped, or if combustion of wood residues have dropped significantly or supply of wood residues are stopped.

4. The utility operating the new DH system shall notify the Romanian government and the Danish government if implementation of new directives or legislation will affect the operation and the corresponding GHG emission reduction generated by the Sawdust 2000 – Project.

1.4 Monitoring reports Frequency of Monitoring and Verification Procedures

The overall time period for the monitoring procedures is defined in the Baseline Study – Version 3 – 2004 01 05 after agreement between the Romanian government and the Danish government. The time schedule for monitoring- and verification surveying will as starting point have the same frequency.

Time period and frequency	Monitoring	Verification
MP time period	14 years	14 years
First year for monitoring	December year 2003 to December to year 2004	December year 2004
Last year for monitoring	December year 2017	December year 2017

Table 2: Time Period for monitoring- and verification procedures.

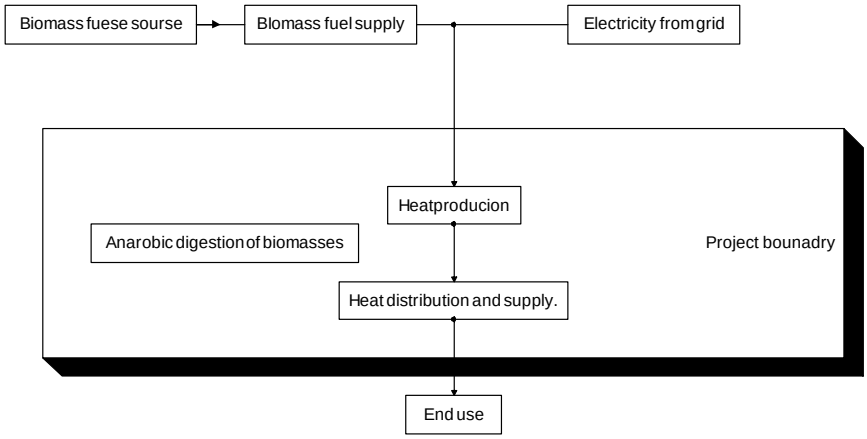
1.5 Baseline Reference

1.5.1 Baseline Study

The Baseline Study to which the MP is referring is:

Sawdust 2000 - Project Implementation Baseline Study Version 3 – 2005 01 05

1.5.2 Project Boundaries



1.5.3 Key elements of the baseline IV

- The annual GES in all five towns is presumed to be the same every year for a time period of ten years if the BAU would prevail.

- Baseline IV is addressing CO_2 emission reduction originating from substituting fossil fuels with biomasses and CH_4 emission reduction originating from reducing the number of wood waste stockpiles in the nature.

  In baseline IV it is assumed that the fossil fuel consumption substituted with biomasses will be equal to the average fuel consumption mapped in the five towns in the time period year 1997 to 2001 (the BAU scenario).

- As 78 % of the GHG emission reduction is related to reduced methane (CH_4) emission originating from reduced anaerobic digestion of wood waste stockpiles the project is considered as a **Methane Emission Reduction Project**. GHG emission reduction caused by substituting fossil fuels with wood residues is equal to approx. 22 % of the total GHG emission reduction.

- The precondition for implementation of this project is that sawmills and wood processing companies mapped as suppliers of sawdust and other wood residues will continue to produce the necessary quantities during the entire monitoring period. Wood residues which today typically not are used, but instead dumped in stockpiles in nature where anaerobic digestion is causing emission of CH_4.

2. Verification and Basic Assumptions

The MP provides a practical approach and describes the methodologies how to quantify the project performance in terms of the GHG emission reduction. The precondition is that baseline IV described in the Baseline Study is accepted as the model for this project. Monitoring of the GHG emission reduction shall be based on transparent data management and calculation methods.

One of the key assumptions is that the wood residues substituting fossil fuels like oil and natural gas is CO_2 neutral and the quantities of available wood residues from wood processing industries located near the town will be sufficient to meet the fuel demands of the new DH system. The available quantity of wood residues has been mapped by the local EPA, who is in charge of different monitoring environmental aspects like for instance wood residues produced by wood processing industries (sawmills etc.) and forestry.

The new DH system shall be proper operated and maintained to secure the highest possible heat production for a time period of minimum ten years.

The MP does not estimate the N_2O emission reduction because it has not been possible to identify a reliable method to for measuring N_2O emission from decomposition of wood stockpiles. In this respect it is worth remembering that the GWP factor of N_2O is 310 times higher that CO_2.

The monitoring plan for the GHG emission reductions generated by the project has been divided into CO_2 emission reductions from substitution of fossil fuels with wood residues and methane emission from anaerobic digestion of wood stockpiles. The principles are described in the paragraphs below.

2.1 CO_2 Emission from Substitution of Fossil Fuels

2.1.1 Basic Assumptions

The MP is based on the basic assumption that the direct CO_2 emission reduction generated by emission baseline IV is equal to the BAU scenario and that this will prevail during the entire monitoring period. This means that for each site the annual CO_2 emission reduction will be equal to the annual CO_2 emission estimated in the BAU scenario.

2.1.2 Methodology

The steps presented below describe the methodologies used calculating the CO_2 emission reduction generated by substituting fossil fuels with wood residues:

Step I: The specific type of fossil fuel, the calorific value of the oil (MWh/ton) and natural gas (MWh/Nm^3) used shall be described. The utility shall contact the relevant supplier of oil and natural gas to obtain precise and reliable data.

Step II: CO_2 emission factor for oil (ton CO_2/MWh) and natural gas (ton CO_2/MWh) from the relevant supplier of oil - and natural gas.

Step III: The energy value (MWh) of the fuel loaded into the boiler systems in the BAU is presented below.

Town	Unit	Annual quantity of energy of fuel entering the boiler system in the BAU
Vlahita	MWh/year	8,112.27
Gheorgheni	MWh/year	10,648.00
Huedin	MWh/year	3,744.44
Intorsura Buzaului	MWh/year	8,393.33
Vatra Dornei	MWh/year	11,734.44

Table 3: Annual quantity of fuel entering the boiler system

Step IV: The forms in paragraph 4 (Annexes) for registration of performance data shall be filled in and signed by the utility in charge.

2.2 Methane Emission from Anaerobic Digestion of Wood Stockpiles

2.2.1 Basic Assumptions

This paragraph describes the GHG emission reduction caused by avoiding CH_4 emission from anaerobic digestion of wood stockpiles, and the method to convert CH_4 into equivalent CO_2.

The CH_4 emission reduction generated by the operation of the new biomass boiler system shall be divided into CH_4 emission reduction related to the BAU scenario (see emission baseline IV in the Baseline Study) and CH_4 emission reduction from the increased comfort level in buildings according to experience from similar projects in Romania. This means the CH_4 emission reduction generated by the BAU is known today providing the assumptions presented in the Baseline Study will prevail. CH_4 emission reduction generated by increasing comfort level in buildings will be mapped by meter readings and consecutive calculations.

A basic assumption is that the owner and operator of the new DH system will seek to optimise the collection and combustion of wood residues produced by sawmills and wood processing companies, aiming to decrease the quantity of wood residues dumped in wood stockpiles.

2.2.2 Methodology

The following steps describe how to calculate the CH_4 emission avoided by combustion of wood residues which otherwise would create wood stockpiles in the nature are presented:

Step I: Information about the wood residues loaded into the new biomass boiler system like type of wood specie (spruce, beech, pine etc.) shall be obtained.

Step II: Identify the water content of the wood residues combusted in the new biomass boiler system. The water content of the wood residues shall be measured one time every day in each of the five towns during the entire monitoring period.

Monitoring of water content:

The place for taking samples of wood residues will be where sawdust from the sawdust silo (storage) is falling into the screw conveyor transporting the wood residues from the sawdust silo to the biomass boiler system see paragraph 4 (Annexes).

The weight of the wet sample shall be measured and dried. After the sample has been fully dried the weight of the dried sample shall be established.

The water content in percentage can be calculated.

$$\text{Water Content of Sample (\%)} = \frac{100 \text{ x (weight of wet sample – weight of dry sample)}}{\text{Weight of wet sample}}$$

Step III: Identify the calorific value of the wood residue entering the new biomass boiler system according to wood specie and water content by using the tables in paragraph 4 (Annex V).

Step IV: Record the useful heat produced by the biomass boiler system (MWh) over an interval of one (1) week or one (1) month. The total annual quantity of useful heat production from the biomass boiler system to the district heating distribution pipe network shall be recorded daily. Useful heat will be metered by ultrasonic heat flow meters with visual displays.

Step V: The heat production efficiency of the new biomass boiler system (ration of heat value in fuels entering the boiler system and becoming useful heat). The actual efficiency factor shall be the one stated in the taking over documents issued after successfully commissioning of the new biomass boiler plant.

Step VI: Convert the recorded quantity of useful heat production (MWh) generated by the new biomass boiler system into a quantity of heat energy entering the new biomass boiler system (MWh).

$$\text{Energy entering boiler system (MWh)} = \frac{\text{Useful heat production (MWh)}}{\text{0.85 (heat efficiency of new biomass boiler system)}}$$

Step VII: Convert the energy entering the new biomass boiler system into a quantity of biomasses combusted.

$$\text{Biomasses loaded into the boiler system (tons)} = \frac{\text{Energy entering boiler system in MWh (Step VI)}}{\text{Calorific value of wood residue per ton (Step III)}}$$

Step VIII: Convert the quantity of wood residues (tons/year) loaded into the new biomass boiler into CH_4 emitted from anaerobic decomposition of wood residues.

- The quantity of wood residues (tons) loaded into the new biomass boiler system for a period of 12 months shall be cumulated.
- The cumulated quantity of wood residues (tons/year) shall be filled in the template (hard copy) or spreadsheet model included in see paragraph 4 (Annex III).

The quantity of wood residues to be combusted in the new biomass boiler system in the BAU scenario is known today (existing heat demand) and will not be changed during the monitoring time period. The remaining biomass consumption is the consumption necessary to reach a higher comfort level, probably like in Tasca.

Step IX: The forms for registration of performance data in paragraph 4 (Annexes) shall be filled in and signed by the responsible staff member.

2.3 Operation of Standby Boilers

2.3.1 Basic Assumptions

The MP is based on the basic assumption that standby boilers only will operate if the new biomass boiler systems will break down etc. In Vlahita (natural gas) and Intorsura Buzaului (oil) existing boilers are available as standby boilers, while new standby boilers will be installed in Gheorgheni (oil) and Vatra Dornei (oil).

The biomass boilers will not need any kind of oil or gas burners under start-up and during operation. The biomass boilers will be in continues operation during the entire year with only short and planned stops for service and overhaul. Such stops will be planned in advance to take place outside the heating season. Emergency repairs may occur and in such cases the standby boiler may be called in and the fuel consumption need to be mapped.

2.3.2 Methodology

The number of operation hours and fuel consumption of standby boilers shall be mapped and recorded as stated in the guidelines presented in paragraph 4 (Annexes). CO_2 emission calculations will follow the principles presented in paragraph 2.1.2.

2.4 Environmental and Social Impacts

2.4.1 Basic Assumptions

The MP and the corresponding Baseline Study is based on the assumption that the project will remove wood residues, that else would have been illegally dumped in the nature and the reduced environmental impacts shall be recorded to monitor that the expected environmental benefits are achieved.

Another basic assumption is that the project would introduce social impacts like improved comfort level (space heating and hot potable water) in the buildings connected, development of new jobs and new business areas, which could be an important side effect introduced when this project is implemented. In this respect monitoring and verification of the social impacts will be needed during crediting time period.

Local stakeholder can at any time submit comments to the project's environmental- or social impact and important comments and their solution will be included in the annual monitoring report.

2.4.2 Methodology

The environmental and social impacts caused by the project will be recorded by the local EPA and described in EPA inspection reports and guidelines presented in paragraph 3.2.2 and 3.2.5.

3. Management of the Monitoring Plan

Management of the MP shall ensure registration of performance data for verification of the GHG emission, which shall executed by an independent entity.

3.1 Responsibilities

The management and operation of the new DH system is as mentioned earlier the responsibility of the local utility operating the new DH system. The utility shall ensure environmental credibility through systematic and accurate performance of monitoring procedures during the entire crediting lifetime of the MP.

3.2 Management

The utility is responsible for implementation of the management system according to the guidelines for the MP. The management system shall be based on the guidelines mentioned in paragraph 3.2.2, 3.2.4, 3.2.5, 3.2.6 and the forms included in the Annexes (paragraph 4).

3.2.1 Data handling

Data handling shall be conducted in a transparent way to secure high quality data recording and data filing. The forms included in the MP shall be used as a protocol for data handling, which as a minimum comprise written recording of monitoring data.

Data and information obtained from third party concerning e.g. on fossil fuels used before implementation of the project shall be in writing and confirmed with the stamps and signatures necessary.

Uncertainty related to data handling shall be recorded by the utility and the verifier shall be noticed about this, and if necessary monitoring procedures shall be modified according to agreement with the verifier.

Data recorded in the first three (3) months of the first year of the monitoring period shall be forwarded to the verifier immediately after this three-month period has passed for identification of possible mistakes or irregularities.

3.2.2 Quality Assurance System

The quality assurance system shall secure that monitoring procedures and requirements are followed. The QA system will **not** be according to any ISO 9000 or similar standards.

The QA system comprises inspection of the monitoring procedure by an independent third party. It is recommended that the local EPA will be responsible for this party activity, but now formal agreement has been made. The EPA is operating as branch offices under the Ministry of Agriculture, Forest, Waters and Environment in Bucharest. The EPA is holding an extensive experience in inspection of forestry and the wood processing industry.

The QA-system will in general focus on the procedures presented below and the QA system shall be in force during the entire crediting period.

QA – Procedure		Time for inspection	Inspection
1.0	**Calibration of ultrasonic heat meters.**	One (1) time every sixth year.	Utility
2.0	**Identification of calorific value of fossil fuels used before implementation of new biomass based DH system.**	One (1) time, when commissioning the new biomass based DH system.	Utility
2.1	Description of chemical composition and heat value.		
2.2	Suppliers (name, official company registration number, address phone and fax number).		
4.0	**Identification of calorific value of wood residues entering the new biomass boiler system.**	Four (4) times per year.	Local EPA
4.1	Identification of the biomass supplier.		
4.2	Description of wood species used (most prevailing)		
4.3	Samples taking of wood residue used		
4.4	Establishing the water content of sample wood residue (weight, drying, weight and calculation)		
5.0	**Reading of Heat Meter**	Weekly.	Utility
6.0	**Calculation of CO_2 and equivalent CO_2 emission**	One (1) time per year.	Local EPA
6.1	Calculate the quantity of CO_2 emission using the forms in the annexes.		
7.0	**Operation of standby boiler**	According to operation	Local EPA
7.1	Fossil fuel used (tons or Nm^3)		
8.0	**Environmental and social impact**	One (1) time per year.	Utility and local EPA
8.1	Environment impacts (degree of improvements, air quality, sustainability of impact, etc.)		
8.2	Social impact (comfort level in buildings, number of jobs created, new business areas)		
8.3	Wood residue used (weight, quantity)		

QA – Procedure		Time for inspection	Inspection
9.0	**Observations and comments**	Four (4) times per year.	Local EPA
9.1	Wood residue used (weight, quantity)		
9.2	Calorific value wood residue (measuring method)		
9.3	Staff conducting monitoring (errors, correctness etc.)		
9.4	Sundries		
10,0	**Training of staff members**	Before commissioning of new DH system and hereafter after one (1) time per year.	Utility
10.1	Monitoring procedures		

The QA system can be changed according to request from the Verifier.

3.2.3 Weighbridges

A weighbridge is located near the new biomass boiler plant, which shall be used to estimate the effectiveness of the new biomass boiler system and the calorific value of the wood residues. Batch firing will be used for estimations of the different parameters. In the MP it is assumed that a weighbridge is used every month but on request from the Verifier the frequency will be changed.

Town	Number of Weighbridge	Distance from weighbridge to boiler plant (km)
Intorsura Buzaului	1	2
Huedin	1	1
Vatra Dornei	1	2
Gheorgheni	1	2
Vlahita	3	2 – 4

Table 4: weighbridge

3.2.4 Training of operational staff

Training of operational staff members shall be conducted before commissioning of the project. Training shall be replicated when the boiler and district heating system is put into operation to secure full understanding of the monitoring procedures and to secure the highest possible reliability of the monitoring results.

It is the responsibility of the utility to ensure that the operational staff members receive the necessary training enabling them to fulfil the requirements as specified in the MP. The training described in this document may be changed according to request from the verifier, the Romanian government or the Danish government.

Training Procedures (guidelines)

Training Procedures		**Time for training and responsibility**
1.0	**Review of MP (before commissioning of new DH system)**	
1.1	Objectives of MP Requirements of MP Monitoring methods to be used Data handling and elaboration of annual emission reduction report QA – system The role of local EPA and Verifier	Timing Before the new DH system is commissioned. Responsibility: The utility and project developer will be responsible for training
2.0	**Characteristics of fossil fuels used before new DH system**	Timing
2.1	Characteristics of existing fossil fuels used	Before the new DH system is commissioned. Responsibility: The utility and the project developer will be responsible for training
3.0	**Monitoring CO_2 emission reduction**	Timing
3.1	Quantity of wood residues combusted	Before the new DH system is commissioned.
3.2	Calorific value of wood residues combusted	Responsibility:
3.3	Filling in forms and calculating CO_2 emission reduction	The utility and project developer will be responsible for training

Training Procedures		**Time for training and responsibility**
4.0	**Monitoring CH_4 emission reduction**	Timing: Before the new DH system is commissioned. Responsibility: The utility and project developer will be responsible for training
4.1	Quantity of wood residues combusted	
4.2	Calorific value of wood residues combusted	
4.3	Filling in forms and calculating CH_4 emission reduction	
5.0	Changes in Monitoring Procedures	Timing: Before the new DH system is commissioned. Responsibility: The utility and project developer will be responsible for training
6.0	Operation of standby boilers	
7.0	Instruction of EPA in QA system	

3.2.5 Instruction of EPA

As part of the QA – system the local EPA will frequently conduct inspection of the monitoring procedures described in this document. The local EPA is a public authority under the Romanian Ministry of Agriculture, Forest, Waters and Environment responsible for environmental issues related to the local society (county level) like inspection of the wood processing industry, forestry, air quality and wastewater quality.

In this respect the EPA seems qualified to act as a third party to secure that monitoring procedures are respected within the issues listed in paragraph 3.2.2. Besides the EPA as a branch office under the Ministry of Agriculture, Forest, Waters and Environment in direct contact with Romanian Counterpart in this project when speaking about emission reduction trading. The local utility and the project developer will instruct the EPA in the procedures to be conducted by them.

The EPA is expected to conduct inspection four (4) times every year during the entire crediting period and in this way secure that the monitoring procedures will be based on the forms presented in paragraph 4 (Annexes) and the guidelines for EPA inspection report is described below.

EPA Inspection Report (headlines)

Paragraph (issues)		Language
1.0	**Basis information**	Romanian/English
1.1	Name Inspection Report	
	Name of EPA elaborating the inspection report	
	Name of utility and town	
	Name/address/phone utility	
	Time for inspection	
	Name/address/phone inspector	
2.0	**Quantity of wood residue used**	
3.0	**Reading of Heat Meter**	
4.0	**Calculation of CO_2 and equivalent CO_2 emission**	
5.0	**Operation of standby boiler**	
6.0	**Environmental and social impact**	
7.0	**Observations and comments**	

3.2.6 Monitoring Report

The utility shall every year during the entire crediting period elaborate the monitoring reports mentioned in paragraph 1.2 (Table 1) with the content following the guidelines presented below. The number of monitoring reports per year can be changed according to request of the verifier, the Romanian government or the Danish government.

Contents of annual monitoring reports (guidelines)

Paragraph (issues)		**Language**
1.0	**Basis information**	English
1.1	Name Monitoring Report Name of utility elaborating the monitoring report Name of utility and town Name/address/phone operator Time period for monitoring Name/address/phone verifier	English
2.0	**Description of DH system Performance**	English
2.1	Overall description of performance of DH-system during the respective heat season from September (year X) to September (year X +1).	English
2.2	Description of performance new biomass boiler system	English
2.3	Description of biomass consumption	English
2.4	Description of biomass suppliers (text)	English
2.5	Description and presentation of fossil fuels used before the implementation of the Sawdust 2000 – Project.	English
3.0	**Monitoring Procedures**	English
3.1	Description of monitoring methods	English
3.2	Description of adjustments of monitoring methods	English
3.3	Description of errors	English
3.4	Filled in forms (see Annexes)	English
4.0	**Changes in Monitoring Procedures**	English
4.1	Description of changes in operation of the new DH – system	English
4.2	Description of changes in the supply of wood residues.	English
4.3	Description of changes conducted according to agreement with verifier.	English

3.2.7 Instruction of operational staff

The utility is responsible for necessary instruction of the operational staff members enabling them to carry out monitoring procedures according to this document. The instruction shall be performed before the beginning of the heating season to secure highest possible quality of monitoring activities.

The utility shall conduct an instruction meeting minimum one (1) month before the beginning of the heating season and the first monitoring period starts.

3.2.8 Verification

Verification of the management procedures and monitoring procedures for carrying out a satisfactory MP must be approved before the project can begin generating ERUs.

The summary aims to highlight the key elements and responsibilities of the management of the MP.

4. Annexes

Annex I Fossil fuels used in existing boiler system

Name District Heating Company :	
Denumirea companiei de termoficare	
Address District Heating Company :	
Adresa companiei de termoficare:	
Name of Operator :	
Numele Operatorului	

Monitoring Plan No.:

Plan de monitorizare nr. :

Monitoring Period:

Perioada de monitorizare:

A	B	C	D	E	F	G
	Year/month/day *Anul/luna/ziua*	Operator's Initials	Oil or Natural gas *Comb. lich. sau gaz*	MWh/kg or MWh/Nm3	kg CO2/MWh	

Name and address of supplier of fossil fuel *Numele şi adresa furnizorului de combustibili fosili*	Date information of existing fossil fuel *Data informatiilor privind combustibilii fosili*	*Inițialele Operatorului*	Type of fossil fuel *Tipul de comb. fosil*	Calorific Value of fossil fuel *Valoarea calorifică a comb. fosil*	CO2 emission factor *Factor de emisii CO2*	Comments *Observații*

Representative Utility Company	Name:	Signature	Date
Reprezentantul Companiei de utilitate publică	*Nume*	*Semnatura*	*Data*

Annex II Methodology I - CO_2 emission reduction

Name District Heating Company :	
Denumirea companiei de termoficare	
Address District Heating Company :	
Adresa companiei de termoficare	
Name of Operator :	
Numele Operatorului	
From Year to Year :	
De la an la an	

Monitoring Plan No.:

Plan de montiorizare nr.:

Monitoring Period:

Perioada de monitorizare:

A	B	C	D	E = D x 3.6	F	G	H = (E x F) / 1000
	Year/month/day *Anul/luna/ziua*		MWh	GJ	kg CO2/GJ fuel used *kg CO2/GJ de combustibil utilizat*	kg CO2/GJ fuel used *kg CO2/GJ de combustibil utilizat*	Ton CO2

Month *Luna*	Date for supply of wood residues *Data livrării reziduurilor de lemn*	Operator's Initials (performing monitoring) *Inițialele Operatorului (care face monitorizarea)*	Energy entering the new biomass boiler sytem *Energia intrată în noul sistem pe biomasă*	Energy entering the new biomass boiler sytem *Energia intrată în noul sistem pe biomasă*	CO2 emission factor liquid oil *Factor de emisii CO2 pentru comb. lichid*	CO2 emission factor natural gas *Factor de emisii CO2 pentru gaze naturale*	CO2 emission caused by using liquid oil *Emisii de CO2 generate de BAU din combustibil lichid*
January			-	-	77,30	56,06	
February			-	-	77,30	56,06	
March			-	-	77,30	56,06	
April			-	-	77,30	56,06	
May			-	-	77,30	56,06	
June			-	-	77,30	56,06	
July			-	-	77,30	56,06	
August			-	-	77,30	56,06	
September			-	-	77,30	56,06	
October			-	-	77,30	56,06	
November			-	-	77,30	56,06	
December			-	-	77,30	56,06	
		Total	**-**	**-**			**-**

Representative Utility Company	Name:	Signature	Date
Reprezentantul Companiei de utilitate publică	*Nume*	*Semnatura*	*Data*

Annex III Methodology II – CH_4 emission reduction (equivalent CO_2)

Name District Heating Company	:
Denumirea companiei de termoficare	
Address District Heating Company	:
Adresa companiei de termoficare	
Name of Operator	:
Numele Operatorului	
From Year to Year	
De la an la an	:

A	B	C	D	E	F	G	H	I = G / (H / 100)	J = (3.6 x I) / F
	Year/month/day		Specie	%	GJ/ton	MWh	%	MWh	Ton
	Anul/luna/ziua		*Specia*						

Month	Date for supply of wood residues	Operator's Initials (performing monitoring)	Type of wood specie	Average water content of wood residue	Average heat value of wood residue	Useful heat from meter reading	Heat production efficiency of of biomass boiler system	Energy entering the new biomass boiler system	Quantity of wood residue entering the biomass boiler system
Luna	*Data funizării reziduurilor de lemn*	*Inițialele Operatorului (care face monitorizarea)*	*Tipul de specie de lemn*	*Conținutul de apă al reziduurilor de lemn*	*Valoarea energetică a reziduurilor de lemn*	*Energie termică utilă contorizată*	*Eficiența producției de energie termică a sistemului pe biomasă*	*Energia intordusă în noul sistem pe biomasă*	*Cantitatea de reziduuri de lemn intordusă în sistemul pe biomasă*
January					-	-	85,0	-	
February					-	-	85,0	-	
March					-	-	85,0	-	
April					-	-	85,0	-	
May					-	-	85,0	-	
June					-	-	85,0	-	
July					-	-	85,0	-	
August					-	-	85,0	-	
September					-	-	85,0	-	
October					-	-	85,0	-	
November					-	-	85,0	-	
December					-	-	85,0	-	
							Total	**-**	**-**

Representative Utility Company	Name:	Signature	Date
Reprezentantul Companiei de utilitate publică	*Nume*	*Semnatura*	*Data*

Calculation of CO_2-equivalent emission reduction from biomass prevented from stockpiling or taken from stockpiles

General input data		
Conversion factor organic carbon to biogas (a)	1,87	m^3 biogas/kg carbon
GWP CH_4	21	
Density methane	0,7	kg/m^3
Methane concentration biogas	60%	
Half-life biomass (tau)	5,1	year
Decomposition constant (k)	0,136	$year^{-1}$
Generation factor (zeta)	0,77	
Methane oxidation factor	0,10	
Percentage of the stockpile under aerobic conditions	10%	

LEGEND

db = dry basis
wb = wet basis
yellow cells = unprotected cells
red marks = comment field included

Biomass specific input data	Biomass from stockpile	Fresh	
Organic carbon content (db)	53,6%	53,6%	db
Moisture content	0%	50%	wb
Organic carbon content (wb)	53,6%	26,8%	wb
Lignin fraction of C	0,25	0,286	

Month	Fresh biomass prevented from stockpiling or taken from stockpile			Month												
	Biomass from stockpile (ton_w)	Age of biomass (years)	Fresh (ton_w)	1 ton CO2-eq	2	3	4	5	6	7	8	9	10	11	12	Total
1	0	0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0
2	0	0	0,00		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0
3	0	0	0,00			0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0
4	0	0	0,00				0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0
5	0	0	0,00					0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0
6	0	0	0,00						0,00	0,00	0,00	0,00	0,00	0,00	0,00	0
7	0	0	0,00							0,00	0,00	0,00	0,00	0,00	0,00	0
8	0	0	0,00								0,00	0,00	0,00	0,00	0,00	0
9	0	0	0,00									0,00	0,00	0,00	0,00	0
10	0	0	0,00										0,00	0,00	0,00	0
11	0	0	0,00											0,00	0,00	0
12	0	0	0,00												0,00	0
Total	0		0,00													
	Total emission prevention			0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	tonne CO_2-eq/yr
	Cumulative total emission prevention			0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	tonne CO_2-eq/project

Annex IV Changes in operation of new biomass boiler system

Name District Heating Company :	
Denumirea companiei de termoficare	
Address District Heating Company :	
Adresa companiei de termoficare	
Name of Operator :	
Numele operatorului	
From Year to Year :	
De la an la an	

Monitoring Plan No.:	
Plan de monitorizare nr.:	
Monitoring Period:	
Perioada de monitorizare:	

A	B	C	D	E
Description irregularity *Descrierea problemelor*	Year/month/day *Anul/luna/ziua*		Description (where, what and why) Descriere (când, ce, de ce)	Year/month/day *Anul/luna/ziua*

Irregularity new DH System *Probleme în noul sistem de termoficare*	Date for occurence of irregularity *Data la care a survenit problema*	Operator's Initials (performing monitoring) *Inițialele Operatorului (care face monitorizarea)*	Changes to be implemented Modificări de aplicat	Date for implementing change *Data aplicării modificării*

Representative Utility Company	Name:	Signature	Date
Reprezentantul Companiei de utilitate publică	Name:	Semnătura	Data

Annex V EPA - Recordings

Name of EPI office	:
Inspectaratul pentru Protecția Mediului	
Name EPI Inspector	:
Numele Inpsectorului IPM	
Time for inspection	:
Data inspecției	
Name District Heating Company	:
Denumirea companiei de termoficare	
Address District Heating Company	:
Adresa companiei de termoficare	
Name of Operator	:
Numele Operatorului	

Monitoring Plan No.:

Plan de monitorizare nr.:

Monitoring Period:

Perioada de monitorizare:

A	B	C	D	E	F = D x E	G	H = (F x G) / 1000	I	J
Description of time period for inspection	Year/month/day	MWh	Tons	MWh/kg or MWh/Nm3	MWh	kg CO2/MWh	Tons	MWh	Year/month/day
Descrierea perioadei de inspecție	*Anul/luna/ziua*	MWh	Tone	MWh/kg sau MWh/Nm3	MWh	kg CO2/MWh	Tone	MWh	*Anul/luna/ziua*

Time Period	Beginning and ending of time period	Reding of heat meter	Quantity of wood residues used	Calorific Value of wood residue	Energy value of wood residue entering the new boiler system	CO2 emission factor	CO2 and equivalent CO2 emission	Operation of standby boiler	Description of environment and social impacts
Perioada	Începutul şi sfârşitul perioadei	Citirea contorului de energie termică	Cantitatea de reziduuri de lemn utilizate	Valoarea calorifică a reziduurilor de lemn	Valoarea energetică a reziduurilor de lemn intrate în noul sistem	Factor de emisii CO2	Emisii de CO2 şi echivalent CO2	Funcționarea sistemului de rezervă	Descrierea impactului social şi de mediu

Representative EPI	Name:	Signature	Date
Reprezentanatul IPM	*Nume*	*Semnatura*	*Data*

Annex VI Operation of standby boilers

Name District Heating Company :	
Denumirea companiei de termoficare	
Address District Heating Company :	
Adresa companiei de termoficare	
Name of Operator :	
Numele Operatorului	

Monitoring Plan No.:

Plan de monitorizare nr.:

Monitoring Period:

Perioada de monitorizare:

A	B	C	D	E	F	G	H = (F X G) / 1000
	Year/month/day *Anul/luna/ziua*		Oil or Natural gas *Comb. lichid sau gaz*	MWh/kg or MWh/Nm3	MWh	kg CO2/MWh	Tons CO2

Name of town where standby boiler system is located *Oraşul în care este amplasat noul sistem de rezervă*	Date information of existing fossil fuel *Data informațiilor privind cmbustibilii fosili*	Operator's Initials *Inițialele Operatorului*	Type of fossil fuel *Tipul de combustibil lichid*	Calorific Value of fossil fuel *Valoarea calorifică a combustibilului fosil*	Fuel consumption *Consum de combustibil*	CO2 emission factor *Factor de emisii CO2*	CO2 emission *Emisii de CO2*
				Total	-		-

Representative Utility Company — Name: — Signature — Date

Reprezentantul Companiei de utilitate publică — Nume: — Semnătura — Date

Annex VII Calorific values of fuels

Monitoring Plan No.:
Plan de monitorizare nr.:
Monitoring Period:
Perioada de monitorizare:

A	B	C	D = C / 3.6	E	F
	%	GJ/ton	MWh/ton	MWh/ton	MWh/1000 Nm3
Name of fuel	Water Content *Conținutul de apă*	Heat Value of wood residue *Valoarea energetică a reziduurilor*	Heat Value of wood residue *Valoarea energetică a reziduurilor*	Heat Value of wood residue *Valoarea energetică a reziduurilor*	Heat Value of wood residue *Valoarea energetică a reziduurilor*
Woodchips from forest (storage)	40,00	10,40	2,89		
Woodchips from forest (fresh)	55,00	7,20	2,00		
Woodchips from sawmill (wet)	40,00	10,50	2,92		
Woodchips form sawmill (dry)	20,00	15,20	4,22		
Bark from spruce	50,00	7,70	2,14		
Sawdust	50,00	8,27	2,30		
Fire wood - beech	20,00	14,70	4,08		
Fire wood - beech	45,00	9,40	2,61		
Liquid oil (sulphur content approx. 2.0 %)				11,11	
Natural Gas					9,17

Annex VIII Emission Factors

Monitoring Plan No.:
Plan de monitorizare nr.:
Monitoring Period:
Perioada de monitorizare:

A	B	C = B x 3,6	D	E
	kg CO2/GJ	kg CO2/MWh		
Name of fuel	CO2 emission factor *Factor de emisii CO2*	CO2 emission factor *Factor de emisii CO2*		
Oil	77,30	278,28		
Natural Gas	56,06	201,82		