Community Development Carbon Fund

Moldova Biomass Heating in Rural Communities Project

Project Design Document No. 2

November 24, 2005

CONTENTS

Acronyms and Abbreviations

BSL	Baseline
CDM	Clean Development Mechanism
CDM EB	Clean Development Mechanism Executive Board
CDCF	Community Development Carbon Fund
CER	Certified Emission Reductions
CO_2	Carbon Dioxide
LHS	Local heating system
ER	Emissions Reduction
ERPA	Emission Reduction Purchase Agreement
GHG	Greenhouse Gas
IPCC	Intergovernmental Panel on Climate Change
IRR	Internal Rate of Return
NG	Natural gas
NPV	Net Present Value
PA	Project Activity
PAs	Project Activities
UNFCCC	United Nations Framework Convention on Climate Change
WB	The World Bank

Units of Measure

GJ	gigajoule (10^9 joules)
GW	gigawatt (10^9 watts)
GWh	gigawatt hour (10^9 watt hours)
kg	kilogram (1000 grams)
kW	kilowatt (1000 watts)
kWh	kilowatt hour (1000 watt hours)
MJ	mega-joule (10^6 joules)
Leu (*pl. Lei*)	national currency of the Rep. of Moldova (1 USD = 12.6 Lei in 2005)
MW	megawatt (1 million watts)

MWh	megawatt hour (1 million watt hours)
Nm^3	normal cubic meter
t	metric tonne (1000 kilograms)
tCO_2	tonnes of carbon dioxide
USD	US dollars

A. General description of the small-scale project activity

A.1 Title of the small-scale project: "Moldova Biomass Heating in Rural Communities Project"

A.2 Description of the small-scale project activity:

(Please include in the description
- the purpose of the project activity
- the view of the project participants on the contribution of the project activity to sustainable development (max. one page).)

Purpose of the project activities

The goal of the present project is to generate an added value to Moldova Social Investment Fund (SIF) II Project, under implementation in Moldova, through gained GHG emissions reduction benefits, directed towards SIF project participants, thus creating incentives for further implementation of GHG mitigation measures. The use of carbon values will serve as catalyst for implementing heat production clean technologies in rural areas by using renewable biomass-energy.

Project activities contribution to sustainable development

The Article 12.2 of the Kyoto Protocol states that "the purpose of the clean development mechanism is to assist countries not included in Annex 1 in achieving sustainable development...".

This implies that within the project activities boundaries, the pillars of sustainable development would be upheld. For the current energy project, designed to address rehabilitation and upgrade of the deteriorated heating systems of public buildings, these pillars include economic efficiency, social equity, environmental and technological sustainability.

- Economic: the project leads to a decrease in the cost a heat unit production.
- Social: the project allows to decrease payment burden for consumed energy resources and increase local employment; Besides it, the project will improve the living and activity conditions within the considered public buildings:
  - Increase availability of heating service for considered buildings;
  - the room heating temperature normalization;
  - the increased duration of heating period;
  - it will make available and affordable hot water in such buildings like schools, orphanages etc.
- Environmental: Conventional coal-burning boiler houses create massive pollution; they represent one of the largest source of air pollution and greenhouse gas emissions. Heat and power production is responsible for large amounts of carbon dioxide (CO2), sulfur dioxide (SO2), nitrogen oxides (NOx), and mercury emissions (Hg). These four pollutants are the major cause of our worst environmental

problems, including acid rain, smog, respiratory illness, mercury contamination, and global warming. In this project coal will be substantially substituted by natural gas and biomass.

– Technological: Project implies more advanced technologies for heat production based on the use of biomass.

A.3 Project participants:

(Please list Party(ies) and private and/or public entities involved in the project activity and provide contact information in annex 1 of this document.)(Please designate one of the above as the official contact for the CDM project activity.)

Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Moldova (host country)	Carbon Finance Unit Moldova	No
The Netherlands	International Bank for Reconstruction and Development (Public Entity) as the Trustee of the Community Development Carbon Fund	Yes

The preliminary list of localities, as potential beneficiaries of SIF infrastructure projects, is determined on a region-by-region basis. The SIF fund allocations by regions are based on the rural population criterion.

For the given total investment and the estimated average project value of $50,000 results the total number of 400 project activities will be financed and that might also imply that the same number of communities might be involved. Based on previous experience (Phase I) and on preliminary assessments it is indicated that out of the total number of SIF project activities 250 to 300 will be energy related projects for public buildings - schools, kindergartens, orphanages, community halls, health centres, other public buildings. The project activity selection process will start in the second half of 2005, and will continue throughout the SIF II project implementation.

- ***Project manager*** – the Head of the Carbon Finance Unit.
- ***PA-owner*** - the beneficiary of the SIF II Project.
- ***PA-operator*** - the person legally designated by the PA-owner, responsible for PA local heating system operation and maintenance.
- ***Project monitor*** - the person designated by the Carbon Finance Unit, responsible for data collection, archiving and reporting.

The present carbon project bundles 120 SIF energy project activities (public buildings). The owners of all public buildings to be involved in the project - local public authorities, are the beneficiaries of this CDCF project, referred as PA-owners. Taking into account a need for a consolidated ERPA due to prohibitive transaction costs (hundreds of small PA-owners) and that here is no a capacity in the country currently in any agency that is sustainable, Carbon Finance Unit (CFU) was created under the Ministry of Ecology and Natural Resources (Fig. 1). CFU has the status of an independent legal entity and is empowered to enter into the Emission Reduction Purchase Agreement (ERPA). The CFU will serve as the CDCF counterpart and provide support for the implementation. In this respect, the CFU will have the following main duties: (a) on behalf of the PAs negotiate with the CDCF the Emission Reduction Purchase Agreements (ERPA) and sign them; (b) sign the subsidiary agreement with PAs (Emissions Reduction Owners (EROs) for each of the CDCF Projects), that stipulates the CFU and PAs rights and responsibilities; (c) receive the carbon payments from the CDCF and transfer this money to the PAs, pro rata, according their actual ERs; and, (d) be responsible for the projects Monitoring Plans. CFU will as well provide technical assistance for institutional and human capacity building in the area of Kyoto Protocol and CDM activities, as well as the financial assistance to the potential project beneficiaries. CFU serves as counterpart for other CDCF projects in the country.

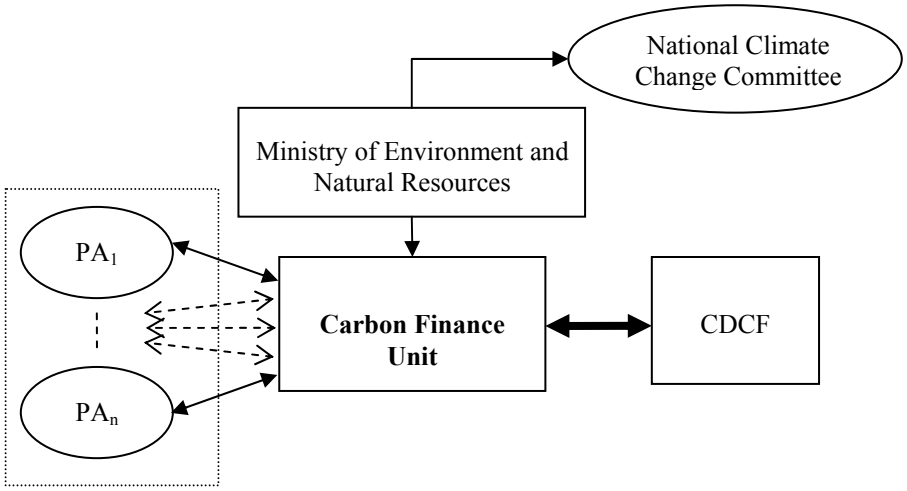

Figure 1. Principle of project bundling

Identification of a project activity for a given community includes the following steps:

1. A general meeting is held, where the investment type is decided;
2. A Project Committee is elected, responsible for the organization and implementation of the investment project;

3. Decisions are taken on the list of specific energy conservation measures to be carried out for the given public building (renewal/enforcement of roofs, windows, doors and sanitation systems), as well as the list of works to be done for heating system upgrading (boiler, pipes and insulation replacement, etc.).

This project represents a bundle of CDM small-scale project activities and refers to installation of new heating systems for a series of public buildings in rural area as well as rehabilitation measures related to the respective buildings.

The main feature of this project is the use of biomass (straw) as fuel for heat production.

The considered project activities (PA) are technologically independent, stand-alone, and spread out all over the country.

As it was said earlier, the SIF II project finances activities which are completely demand driven and are initiated and owned by the local communities. In this regard, it is relatively difficult to determine all the project activities with exact community location. For the reference purposes , the list of geographical location of potential beneficiaries is presented in Annex 3.

Thus, the project participants are:

- Carbon Finance Unit
- Local public authorities

A.4 Technical description of the small-scale project activity:

A.4.1 Location of the small-scale project activity:

A.4.1.1 Host country Party(ies): Republic of Moldova

A.4.1.2 Region/State/Province etc.: Republic of Moldova

A.4.1.3 City/Town/Community etc: Communities in rural area (Annex 3)

A.4.1.4 Detailed description of the physical location, including information allowing the identification of this small-scale project activity(ies) *(max one page)*:

The preliminary list of localities, as potential beneficiaries of SIF infrastructure projects, is determined on a region-by-region basis. The SIF fund allocations by regions are based on the rural population criterion.

A.4.2 Type and category(ies) and technology of the small-scale project activity

(Please specify the type and category of the project activity using the categorization of appendix B to the simplified M&P for small-scale CDM project activities, hereafter referred to as appendix B. Note that appendix B may be revised over time and that the most recent version will be available on the UNFCCC CDM web site.
In this section you shall justify how the proposed project activity conforms with the project type and category selected (for simplicity, the rest of this document refers to "project category" rather than "project type and category").
If your project activity does not fit any of the project categories in appendix B, you may propose additional project categories for consideration by the Executive Board, in accordance with paragraphs 15 and 16 of the simplified M&P for small-scale CDM project activities. The final SSC-PDD project design document shall, however, only be submitted to the Executive Board for consideration after the Board has amended appendix B as necessary.)
(This section should include a description of how environmentally safe and sound technology and know-how is transferred to the host Party, if such a transfer is part of the project.)

Project type and category

All considered project activities fall into **three predefined categories** (see the textbox below).

Description of project categories relevant to the considered activities

(EXCERPT from Appendix B to the Simplified Modalities and Procedures for small-scale CDM Project Activities)

I.C. Thermal energy for the user
Para. 15. This category comprises renewable energy technologies that supply individual households or users with thermal energy that displaces fossil fuel or non-renewable sources of biomass. Examples include solar thermal water heaters and dryers, solar cookers, energy derived from biomass for water heating, space heating, or drying, and other technologies that provide thermal energy that displaces fossil fuel.

II.E. Energy efficiency and fuel switching measures for buildings
Para. 64. This category comprises any energy efficiency and fuel switching measure implemented at a single building, such as a commercial, institutional or residential building, or group of similar buildings, such as a school, district or university. This category covers project activities aimed primarily at energy efficiency; a project activity that involves primarily fuel switching falls into category III.B. Examples include technical energy efficiency measures (such as efficient appliances, better insulation and optimal arrangement of equipment) and fuel switching measures (such as switching from oil to gas).

III. B. Switching fossil fuels
Para. 72. This category comprises fossil fuel switching in existing industrial, residential, commercial, institutional or electricity generation applications. Fuel switching may change efficiency as well. If the project activity primarily aims at reducing emissions through fuel switching, it falls into this category. If fuel switching is part of a project activity focused primarily on energy efficiency, the project activity falls in category II.D or II.E.

Rules applied for PAs distribution per three identified project categories:

1. All PAs out of those 120 considered here, which are biomass-fired, fall clearly into category *I.C. Thermal energy for the user*;
2. Other PAs which do not imply fuel switching and biomass, clearly fall into category *II.E. Energy efficiency and fuel switching measures for buildings*;

3. The remainder is project activities including fuel switching and as other - buildings' energy conservation measures and for these emerges the necessity for additional clarifications: the point is that according to CDM description of categories *II.E.* and *III.B.* (see the textbox below) there is no explicitly defined criterion for PAs distribution among these two categories (the term used '*activities aimed primarily at*' is enough vague/fuzzy).

The carried out analysis shows that there could be used a numerical/quantitative characteristic for a more explicit definition of the term mentioned above. For instance, a building of A-type, implying fuel switching from coal to natural gas, generates an ER = 99.2 tCO2/year, out of which 39.0 tCO2 are due to energy conservation measures and the rest - 60.2 tCO2/year - due to fuel switching (inclusively boiler efficiency increase) measure. Thus, there where fuel switching is present this measure definitively prevails over the building's energy conservation measures and by this all project activities including fuel switching measures univocally fall into category *III. B. Switching fossil fuels*.

Following the rules presented above, those 120 PAs considered in this project, are distributed per considered three project categories as shown in table 1. The carried out numerical analysis, based on the elaborated Excel model, demonstrates that those three project categories meet their threshold requirements.

Table 1. PAs distribution per categories and verification of the small-scale project eligibility

CDM small-scale project categories	Threshold	**Expected Project contribution**	No. of buildings (PAs)
I.C Thermal energy for the user For all PAs of this category, their aggregate generation capacity specified by the manufacturer shall be less than 15 MW.	15 MW	**13.5 MW**	53
II.E Energy efficiency and fuel switching measures for buildings For this category the aggregate energy savings may not exceed the equivalent of 15 GWh per year.	15 GWh	**9.3 GWh**	38
III.B Switching fossil fuels For all PAs of this category the project measures shall both reduce anthropogenic emissions by sources and directly emit less than 15 kilotonnes of carbon dioxide equivalent annually.	15 ktonnes	**4.6 ktonnes**	29

Based on carried out analysis and study, the data was derived shown in above table. It is confirmed that these bundle of PAs meet the eligibility criteria, thus qualifying for a small-scale CDM project.

All considered project activities fall into **three predefined categories**. The installed capacity of the project does not exceed 15 MW thresholds. In the event the total amount of installed capacity exceeds 15MW, CERs will only be issued up to the maximum value.

Technology to be employed by project activities

Most of public buildings included in this project are presently supplied with heat from physically old, technologically outdated boilers via an extremely deteriorated heat distribution network with a high level of losses, having an overall average system efficiency ranging between 40 - 60%.

The new technologies to be employed by project activities are aimed to increase the overall efficiency of the systems up to 80-90% and simultaneously considerably reduce the GHG emissions, by implementing energy efficiency and fuel switching measures at a single building or group of buildings. An important feature of this project is the use of biomass for heat production, for up to 30% of the total PAs.

The state-of-the-art technologies will either replace the existing equipment or will be installed in new facilities. According to the project, Moldova will import most modern heat production equipment and materials, related to the reconstruction of the existing-obsolete heating systems of considered public buildings, namely:

- biomass fired modern boiler systems, with a high efficiency (up to 81%);
- heat production equipment replacement with fuel switching in most cases;
- improvement of insulation of internal and external distribution pipelines, installation of thermostatic valves and heat and hot water metering equipment;
- replacement of old windows and doors by new energy saving ones, improvement of insulation of the building envelope by applying thermo-resistant materials.

It is expected that for up to 30% of the buildings wheat straw will be used as fuel. The straw will be compressed to bales as the cheapest processing option.

A.4.3 Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed small-scale project activity, including why the emission reductions would not occur in the absence of the proposed small-scale project activity, taking into account national and/or sectoral policies and circumstances:

(*Please state briefly how anthropogenic greenhouse gas (GHG) emission reductions are to be achieved (detail to be provided in section B.) and provide the estimate of total anticipated reductions in tonnes of CO_2 equivalent as determined in section E. Max. length one page.)*

The anthropogenic greenhouse gas (GHG) emission reductions in this project are to be achieved as a result of

- fuel switching from existing fossil fuels - coal to natural gas, coal to biomass and natural gas to biomass, and
- energy efficiency improvements of local heating systems (low-efficiency boilers replacement by modern ones; strengthening the insulation of external and internal heat and hot water distribution pipelines), as well as
- implementation of energy conservation measures in buildings (additional insulation of building envelops, windows and doors replacement).

The expected annual GHG emissions reduction is 19 026 tonnes of CO_2 and total over the crediting period – 178 885 tonnes. In the absence of project activity, due to prevailing practice of coal in the country, the project would continue to use fossil fuels and would not have attracted investment for switch to biomass. There are no sectoral or national policies that would require use of biomass or other cleaner fuels. Also there are no policies that would provide incentives to use biomass as a fuel.

A.4.3.1 Estimated amount of emission reductions over the chosen crediting period: *(Please indicate the chosen crediting period and provide the total estimation of emission reductions as well as annual estimates for the chosen crediting period. Information on the emission reductions shall be in indicated using the following tabular format. For type (iii) small-scale projects the estimation of project emissions is also required.)*

Table 2. Estimated annual emission reductions

Number of years	Years	Annual estimation of emission reductions in tonnes of CO2 e
1	**2008**	7650
2	**2009**	19026
3	**2010**	19026
4	**2011**	19026
5	**2012**	19026
6	**2013**	19026
7	**2014**	19026
8	**2015**	19026
9	**2016**	19026
10.	**2017**	19026
Total estimated reductions (tonnes of CO2 e)		**178884**
Total number of crediting years		**10**
Annual average over the crediting period of estimated reductions (tonnes of CO2 e)		**17888.4**

A.4.4 Public funding of the small-scale project activity:

(In case public funding from Parties included in Annex I to the Convention is involved, please provide in annex 2 information on sources of public funding for the project activity from Parties included in Annex I which shall provide an affirmation that such funding does not result in a diversion of official development assistance and is separate from and is not counted towards the financial obligations of those Parties.
Note: When the CDM-SSC-PDD is filled in support of a proposed new simplified methodology, it is to be indicated whether public funding from Parties included in Annex I is likely to be involved indicating the Party(ies) the extent possible.)

The project will be implemented through an IDA Moldova SIF II credit at the level of US $19.02 million, from which the Government of Moldova will provide US $1.2 million; IDA – US $15.68 million; and local communities – US $2.13 million. The Project was approved in June 2004 and is currently under implementation, it provides funding to a wide array of community investments. It is planned that in the SIF 2 the integrated approach will be taken toward financing sub-projects based on the community action plans that prioritize community investment. Each sub-project would also be required to be comprehensive and in addition to the "hardware" (infrastructure) component contain a "software" (institutional building, training and TA, programs etc.) component. Within the project, PAs promotion scheme implies a compulsory contribution/participation (investment share) of the beneficiaries to activities financing, which for the last represents a real burden. The local communities have to contribute toward project investment cost (15%) and local governments had to contribute to the recurrent costs.

A.4.5 Confirmation that the small-scale project activity is not a debundled component of a larger project activity:

(Please refer to appendix C to the simplified M&P for the small-scale CDM project activities for guidance on how to determine whether the proposed project activity is not a debundled component of a larger project activity.)

The current project represents a bundle of small-scale project activities, technologically fully independent and geographically spread out all over the country. The minimal distance between two PAs boundaries is expected to be more than one kilometre, while the maximal distance - about 400 km.

Each project activity, included in this project, will be represented by an owner/beneficiary of the Moldova SIF-II Project, which are the authorities of rural communities.

*Debundling i*s defined as the fragmentation of a large project activity into smaller parts. According to Appendix C (paragraph 2) of the Simplified M&P for Small-Scale CDM project activities, the current project cannot be deemed to be a debundled component of a larger project activity because by the moment of registration of this project proposal there is none registered small-scale CDM project activity or an application to register another small-scale CDM project activity with the same project participants; in the same project category and technology/measure; and registered within the previous 2 years; and whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

B. Baseline methodology

B.1 Title and reference of the project category applicable to the project activity:

(Please refer to the UNFCCC CDM web site for the most recent list of the small-scale CDM project activity categories contained in appendix B of the simplified M&P for small-scale CDM project activities.)

Type of the project activity:

Type II – Energy efficiency improvement projects;

Type II – Energy efficiency improvement projects;

Type III – Other project activities.

Category of the project activity:

I. C "Thermal energy for the user"

II.E "Energy efficiency and fuel switching measures for buildings";

III.B "Switching fossil fuels".

B.2 Project category applicable to the small-scale project activity:

(Justify the choice of the applicable baseline calculation for the project category as provided for in appendix B of the simplified M&P for small-scale CDM project activities, by showing that the proposed project activity meets the applicability conditions. Describe how the methodology is applied in the context of the project activity: Please explain the basic assumptions of the baseline methodology in the context of the project activity. Provide the key information and data used to determine the baseline scenario (variables, parameters, data sources etc.) in table form.)

The present project aims at replacing the existing obsolete coal- and natural gas-fired heating systems by new, modern ones fired on coal, natural gas and biomass (straw). Since the baseline CO_2 emissions are concerned, which result from the conventional fuel type and amount burned in the existing boiler, the first will primarily depend on the existing implied technology (boiler and network efficiency) and public building's heat demand. Total emissions for the baseline scenario, in its turn, will take into account the number of project activities per type of fuel used - coal and natural gas.

For the given project, the baseline approach chosen is based on the existing actual emissions for considered public buildings, since it is the single relevant approach. Given the fact that no specific project activity list is available yet, for the purpose of this project were selected three types of public buildings based on their load level (75, 150 and 262.5 kW), which in their turn determine the buildings' heat demand. Therefore, having in baseline scenario two types of used fuels and three types of buildings, there can be identified six (6) types of project activities for which the baseline emissions need to be calculated. Similarly, in project scenario, while having three types of fuels and three types of buildings – the emissions will be estimated for nine (9) types of project activities.

Table 3. Fuel types used at the PA's sources and considered in BSL Study[1]

	Type of fuel	Low Heat Value		Emission factor	
1.	Coal	5.556 kWh/kg	20 MJ/kg	0.340 t/MWh	0.095 t/GJ
2.	Natural Gas	9.306 kWh/Nm3	33.5 MJ/Nm3	0.200 t/MWh	0.056 t/GJ

Basic assumptions made in elaborating the baseline:

- The number of PAs to be implemented during 2005-2007 equals to 120;
- The PAs commissioning time-table will be respected;
- The annual heating period (average over the crediting period) will be constant and not exceeding six months, and the hot water supply service will correspond to existing standards;
- The public building's heat demand and annual heat consumption are constant over the crediting period;
- The project average building's heat demand will be at the projected level (157.5 kW);
- For baseline scenario the existent fuel option for each PA will remain unchanged during the future period;
- For project scenario the chosen fuel type will not change during crediting period;
- Heating systems efficiencies will remain unchanged during the future period in both scenarios;
- For each building to be included in the project, energy conservation measures will be implemented with an overall annual energy savings outcome not less than 20% out of building's heat consumption.

The developed emissions reduction calculation model is based on the mentioned above assumptions.

Principle of service equivalence

A common heat consumption strategy for a given building has to lay at the foundation of the baseline and project scenarios development. It implies that for both scenarios it has to be considered: the same heating period in terms of heating schedule (working days, weekend, holidays) and duration, the same service quality and, finally the same building heat consumption.

B.3 Description of how the anthropogenic GHG emissions by sources are reduced below those that would have occurred in the absence of the proposed small-scale project activity

(Justify that the proposed project activity qualifies to use simplified methodologies and is additional using attachment A to appendix B of the simplified M&P for small-scale CDM project activities. National policies and circumstances relevant to the baseline of the proposed project activity shall be summarized here as well.)

The *baseline methodology* is defined as a way (or an algorithm, method, procedure, technique) that provides the possibility finally to determine the baseline scenario, characterized by a series of parameters, inclusively by the relevant emissions and their dynamics for considered future period. The baseline methodology is based on the selected *baseline approach*.

In accordance with Art. 12 of the Annex II to Decision 21/CP.8, *to use simplified modalities and procedures for*

[1] Technology Needs Assessment and Development Priorities. Report elaborated under the UNFCCC, UNDP Moldova, MinEcology, Chisinau, Moldova, 2002 (Annex 1.11, Pag. 149).

small-scale CDM project activities, a proposed project activity shall:

(a) Meet the eligibility criteria for small-scale CDM project activities set out in paragraph 6 (c) of decision 17/CP.7;
(b) Conform to one of the project categories in appendix B to this annex;
(c) Not be a debundled component of a larger project activity, as determined through appendix C to this annex.

The proposed CDM project complies with all mentioned-above requirements, thereby is eligible to use simplified modalities and procedures for small-scale CDM project activities.

For the selected PA types and categories (table 1) the CDM EB offers an indicative baseline methodology (see the textbox below):

INDICATIVE BASELINE METHODOLOGIES for selected project categories

(EXCERPT from Appendix B to the Simplified Modalities and Procedures for small-scale CDM Project Activities)

TYPE I - RENEWABLE ENERGY PROJECTS
Category I.C. ***Thermal energy for the user***

Para. 18. For renewable energy technologies that displace technologies using fossil fuels, the simplified baseline is the fuel consumption of the technologies that would have been used in the absence of the project activity times an emission coefficient for the fossil fuel displaced. IPCC default values for emission coefficients may be used.

TYPE II - ENERGY EFFICIENCY IMPROVEMENT PROJECTS
Category II.E. **Energy *efficiency and fuel switching measures for buildings***

Para. 66. The energy baseline consists of the energy use of the existing equipment that is replaced in the case of retrofit measures and of the facility that would otherwise be built in the case of a new facility.

Para 67. Each energy form in the emission baseline is multiplied by an emission coefficient. For fossil fuels, the IPCC default values for emission coefficients may be used.

TYPE III - OTHER PROJECT ACTIVITIES
Category III.C. ***Switching fossil fuels***

Para. 74. The emission baseline is the current emissions of the facility expressed as emissions per unit of output (e.g., kg CO2equ/kWh). Emission coefficients for the fuel used by the generating unit before and after the fuel switch are also needed. IPCC default values for emission coefficients may be used.

The analysis of these three indicative methodologies shows that they are very similar. All of them imply the final emissions determination as the product of fuel consumption and emission coefficient for the type of fuel used.

Additionality of the project activity

It should be noted that Moldova SIF II Project has been approved and is currently under implementation. It provides funding to a wide array of community driven investments, which could be of any type (water supply, social investments). Within SIF II project the communities approach the SIF Project Management Unit with a request to co-finance an investment that has been identified and approved by the community.

However, communities have to demonstrate the commitment and ownership by as well as contributing 15% towards the costs of the requested investment. This requirement for contribution represents a real financial burden for project beneficiaries, as it ties up limited financial resources which may otherwise be used for other social or environmental programs undertaken by the project beneficiaries.

The subject CDCF project basically provides financial incentives for communities to (i) either select energy system rehabilitation or efficiency measures as community priorities; or (ii) conversion to renewable energy systems for local public building (fuelled by straw biomass) as such priority. As was clearly identified during project preparation, the availability of the carbon revenues for energy system rehabilitation or efficiency measures is a financial incentive for the communities to elect these types of investments from wide array of community priorities. Without the revenue generated by selling the emission reductions, the project benefit is negative of approximately minus $25,000 (see Annex 4).

In addition, as biomass technology is also new and more costly in terms of up-front investments, communities would not opt for requesting SIF II to fund biomass energy system installation without the promise of carbon revenues. The carbon revenues for biomass activities under the project are obviously higher than under a standard energy rehabilitation investment because the replace fossil fuels with renewable energy sources. This is natural as a financial incentive to switch to renewable energy and incur higher investment costs in the first place has to be higher that for standard energy related investments. The total project benefit for all PAs with the revenue from emission reductions is positive $97,400, making it possible for the project beneficiaries to undertake the PAs. The money received from the selling the emission reductions to the CDCF will be used for social and environmental purposes, thereby freeing up resources to enable the project beneficiaries both repay the loans and undertake much needed community development projects.

It shall also be noted that the CDCF project in this cases addresses specific financial barrier for energy efficiency and conversion to renewable energy. This activity is one integral part of a larger effort in the country to enhance the use of renewable energy in general. Thus, the technical constraints for introduction of the biomass energy, such as availability of biomass boilers, maintenance and operational capacity, are being addressed separately from this project, with assistance of a renewable energy from agricultural waste initiative supported by Consolidate Agricultural Projects management unit (CAPMU). In addition, information and awareness constraints focusing on building confidence amongst rural population on feasibility of using renewable energy sources is also being addressed jointly by the SIF II Management Unit, CFU, and CAPMU as part of the overall public awareness programs of these entities.

B.4 Description of the project boundary for the project activity:

(Define the project boundary for the project activity using the guidance specified in the applicable project category for small-

scale CDM project activities contained in appendix B of the simplified M&P for small-scale CDM project activities.)

The Marrakesh Accords specify that the project boundary shall encompass all anthropogenic emissions by sources of greenhouse gases under the control of the project participants that are significant and reasonably attributable to the CDM project activity.

For the current project, which aims at retrofitting of heating systems for a large number of selected public buildings in rural area of the country, the project boundaries were established as those which represent the physical, geographical site of the technologies generating the thermal energy and the equipment that uses the thermal energy produced delineates the project boundary of the rehabilitated local heating system (fig. 2).

For each PA included in the project, it is foreseen to install a new heating source (GHG emission source), located either in the project building or in its immediate neighbourhood. Thus, (i) the project participants will fully control the local heating systems, inclusively their sources; (ii) all GHG emissions are encompassed by the project boundary and will be determined and attributed to the project; (iii) such a situation complies with the Marrakesh Accords definition of the *principle of control*.

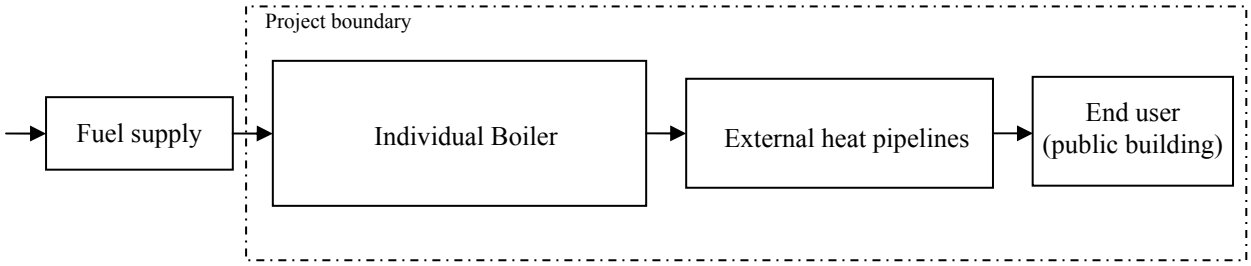

Figure 2. Energy chart and project boundary for PAs

According to *Appendix B of the simplified M&P for small-scale CDM project activities* in case of project activities using biomass, leakage shall be considered (Para 8). At the same time according to Para 21 of the same document if *the renewable energy technology is equipment* transferred from another activity, leakage calculation is required. In this context it has to be mentioned that:

- first, in the concerned project no *equipment* transferred from another activity is used, or no any used/replaced equipment is transferred to another activity;
- second, there is an enormous potential of straw, which is burned in the fields. Within the scope of this project it is foreseen to use only a small part of this biomass (straw) – less than 10%. In respect to these, use of biomass within the scope of this project will not cause leakage due to crowding out of straw from alternative use.

With regard to emissions leakage due to straw transportation to heat production plants a numerical analysis has been conducted (Emissions Reduction Study, Annex) showing that this generates a very

small emission (0.3% of the gained emissions reduction due to coal substitution by biomass) and consequently the *emissions leakage can be neglected*.

B.5 Details of the baseline and its development:

B.5.1 Specify the baseline for the proposed project activity using a methodology specified in the applicable project category for small-scale CDM project activities contained in appendix B of the simplified M&P for small-scale CDM project activities:

Baseline methodology

Baseline scenario is characterized mainly by the following parameters:

- Public building's heat demand (P_b) and consumption (Q_{csm});
- Fuel consumption ($V_{fuel,BSL}$) and embedded heat ($Q_{fuel,BSL}$); and finally
- CO_2 emissions (Em_{BSL}).

and their dynamics over the crediting period.

At this stage we will consider that the heat demand and heat consumption are constant over the crediting period. Thereby the expected future annual emissions will be constant as well. To be mentioned that at the project operational phase the mentioned parameters may little vary year by year.

The analysis of the situation has shown that there is no reason for considering other alternative baseline scenarios besides the one mentioned above.

The similarity of PAs, encompassed in this project, allows to apply a common baseline methodology to all project activities regardless their category. This methodology implies the calculation of the basic parameters mentioned above - Q_{csm}, $Q_{fuel,BSL}$, Em_{BSL}.

The baselines for all project activities, included in this project, have been developed on the basis of the modelled fuel structure and fuel consumption. This approach assumes that the "business as usual" scenario would have continued in the future in the absence of any interventions that would change the foreseen scenario.

Basic steps for baseline methodology application for the years of the study period (Fig. 3):

1. Public building's heat consumption (Q_{csm}) calculation;
2. Fuel embedded heat ($Q_{fuel,BSL,t}$) calculation;
3. CO_2 emissions ($Em_{BSL,t}$) calculation.

The fig. 3 illustrates the basic steps and the calculation scheme for the most important baseline

parameters.

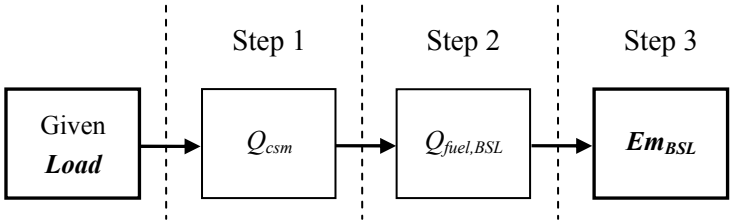

Figure 3. Basic steps towards baseline emissions calculation

The specific algorithms for heat consumption, fuel consumption and its embedded heat, and finally for the baseline emissions calculation are presented in Baseline Study, Para 2.2-2.3.

The transparency of the baseline methodology is proved through:

- explicit description of the applied algorithm, based on the heat flow chart (Fig. 4);
- project input data were selected from the reference sources and verified;
- elaborated and attached calculation sheets offer the possibility for crosschecking.

Baseline parameters calculation tool

A Microsoft Excel user-friendly workbook has been developed, which allows in a flexible way, regarding the input/initial variables, to determine the basic baseline parameters as well as a series of other different intermediary parameters.

Heat and fuel consumption for baseline and project scenarios

Heat consumption

a) For a given building

For the given type of public buildings thermal energy consumption Q_{csm} includes two components – (i) building's heating Q_{heat} and (ii) hot water supply Q_{hw}.

Building's heating

The energy consumption for heating Q_{heat} is determined by the heated volume and particularly by the heated area S and the duration of the heating period T_{heat}.

$$Q_{heat} = Load_{heat} \cdot T_{m,heat},$$

where the $Load_{heat}$ represents the maximum heating load of the building, in kW

$$Load_{heat} = S \cdot q_{heat}$$

q_{heat} is the specific heating load, in kW/m^2 (in Moldova it equals to 120 W/m^2);

$T_{m,heat}$ is so called equivalent duration of the maximum heating load (product of heating period and load factor) -

$$T_{m,heat} = T_{heat} \cdot k_{\text{var}.heat},$$

$k_{\text{var}.heat}$ is a coefficient taking into consideration the heating load variation –

$$k_{\text{var}.heat} = \frac{t_{in} - t_{out.av}}{t_{in} - t_{out.\min}} = \frac{18 - 0.2}{18 - (-16)} = 0.52,$$

t_{in} is the average rated temperature of the air in the considered building;

$t_{out.av}$ is the average rated air temperature outside the building;

$t_{out.\min}$ is the minimal rated air temperature outside the building during the heating period.

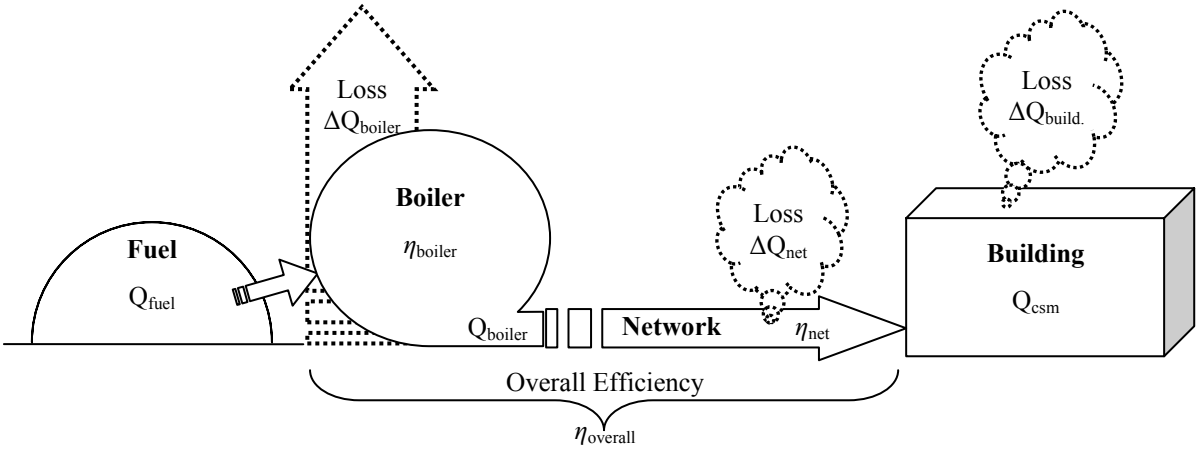

Figure 4. Heat flow chart

For the rated average heating period duration of 177 days (T_{heat} = 4248 h) the $T_{m,heat}$ = 2209 hours per year.

Hot water supply

For the purpose of this study it is assumed that the thermal load for hot water supply $Load_{hw}$ equals to 20% of the heating load $Load_{heat}$. Thus, the energy consumption for hot water supply Q_{hw} is

$$Q_{hw} = Load_{hw} \cdot T_{m,hw} = 0.2 Load_{heat} \cdot T_{m,hw},$$

$T_{m,hw}$ is the equivalent duration of the maximum hot water load,

$$T_{m,hw} = T_{hw} \cdot k_{\text{var}.hw},$$

T_{hw} represents the duration of the hot water supply period and equals to 8760 hours per year;

$k_{\text{var}.hw} = 0.15$ is a coefficient taking into consideration the hot water load variation (up to 4 of 24 hours hot water supply).

For the given T_{hw} and $k_{\text{var},hw} = 0.15$, results the $T_{m,hw}$ = 1314 hours per year.

Total building's heat consumption

The total building's heat load and annual consumption will be

$$Load_b = Load_{heat} + Load_{hw} \approx 1.2 Load_{heat} \quad (1)$$

and $$Q_{csm} = Q_{heat} + Q_{hw} = Load_b \cdot T_m \ , \quad (2)$$

where T_m represents the equivalent duration of the maximum building's load which will result from the equations above -

$$T_m = \frac{Load_{heat}}{Load_b} \cdot T_{m,heat} \ + \ \frac{Load_{hw}}{Load_b} \cdot T_{m,hw} \quad (3)$$

The considered assumptions lead to

$$T_m = 0.83 \cdot T_{m,heat} \ + \ 0.17 \cdot T_{m,hw} \ \approx \ 2057 \ \text{hours per year.} \quad (4)$$

b) For the whole project

For all buildings included in the project the total heat consumption can be calculated as:

$$Q_{csm} = \sum_{b=1}^{N_{PA}} Q_{csm,b} \ .$$

Information regarding the climate in Moldova and parameters used for heating system design:

The climate of the Republic of Moldova is temperate continental. Winters are mild and short, summers are hot and long. The average annual air temperature throughout the territory of the Republic is above zero (+8°C in the north, +9°C in the central parts of the country, and +10°C in the south). The length of the heating season is 158 days in the south, 167 days in the central parts (around Chisinau) and 177 days in the north of the country. The minimum temperature used for calculations in sizing of heating equipment is –16°C. Maximum and minimum temperatures in Moldova range between +40°C in the summer and –32°C in the winter, with temperatures during the coldest month (January) averaging around –5°C in central Moldova.

Fuel consumption for heat production

Generally, the fuel volume needed for heating is determined by the building's heat consumption Q_{csm}. In its turn, the heat consumption includes those two components – thermal energy for heating and for hot water supply.

a) For a given building

The fuel embedded heat, in MWh, of the given type of fuel *f*, for baseline (BSL) and project (PR) scenarios, can be calculated as

$$Q_{fuel,BSL,fb} = \frac{Q_{csm,b}}{\eta_{boiler,BSL,f} \cdot \eta_{net,BSL}} \quad \text{and} \quad Q_{fuel,PR,fb} = \frac{Q_{csm,b}}{\eta_{boiler,PR,f} \cdot \eta_{net,PR}} ,$$

where $Q_{fuel,BSL,fb}$ represents the fuel embedded heat, of the fuel used for heating and hot water supply of a given *b*-type of building, for the baseline scenario, MWh;

$Q_{fuel,PR,fb}$ - fuel embedded heat, of the fuel used for a given *b*-type of building, for the project scenario, MWh;

$Q_{csm,b}$ - PA's heat consumption for a given *b*-type of building, in MWh (see (2));

$\eta_{boiler,BSL,f}$ - efficiency of existing boiler;

$\eta_{boiler,BSL,f}$ - efficiency of boiler used in project scenario;

$\eta_{net,BSL}$ - efficiency of existing external network, including the building's energy losses, caused by its deterioration;

$\eta_{net,PR}$ - efficiency of project external network.

b) For the whole project

For all buildings included in the project the total energy content of the used fuel can be calculated as:

$$Q_{fuel,BSL} = \sum_{f,b} Q_{fuel,BSL,fb} \cdot N_{PA} \cdot \alpha_{BSL\,f} \cdot \beta_b \quad \text{and} \quad Q_{fuel,PR} = \sum_{f,b} Q_{fuel,PR,fb} \cdot N_{PA} \cdot \alpha_{PR\,f} \cdot \beta_b .$$

B.5.2 Date of completing the final draft of this baseline section *(DD/MM/YYYY)*:

The final draft of this baseline section was completed at 20/05/2005.

B.5.3 Name of person/entity determining the baseline:

(Please provide contact information and indicate if the person/entity is also a project participant listed in annex 1 of this

document.)

The current baseline was determined by Prof. Valentin Arion, Dr. hab, WB Expert, who is not a project participant.

Contact information:
Mail Address: 168 Stefan cel Mare bd., Technical University, MD-2004 Chisinau, Republic of Moldova.
Tel/Fax: +373 22 23 72 82; Email: valarion@cni.md

C. Duration of the project activity and crediting period

C.1 Duration of the project activity:

C.1.1 Starting date of the project activity:

(The starting date of a CDM project activity is the date on which the implementation or construction or real action of a project activity begins)(The starting date of a CDM project activity is the date on which the implementation or construction or real action of a project activity begins) Project activities starting between 1 January 2000 the date of the registration of a first clean development mechanism project, if the project activity is submitted for registration before 31 December 2005; have to provide documentation, at the time of registration, showing that the starting date fell within this period.)

Starting date of the current CDM project: 01 January 1, 2008.

C.1.2 Expected operational lifetime of the project activity:

(Please state the expected operational lifetime of the project activity in years and months.)

Expected operational lifetime of the project activities: 15 years.

C.2 Choice of the crediting period and related information:

(Please state whether the project activity will use a renewable or a fixed crediting period and complete C.2.1 or C.2.2 accordingly.) (Note that the crediting period may only start after the date of registration of the proposed activity as a CDM project activity. In exceptional cases (see instructions for section C.1.1. above), the starting date of the crediting period can be prior to the date of registration of the project activity as provided for in paragraphs 12 and 13 of decision 17/CP., paragraph 1 (c) of decision 18/CP.9 and in any guidance by the Executive Board, available on the UNFCCC CDM web site.)

For every project activity installation of a new local heating system is foreseen, which include boiler and local network with an expected operational lifetime of about 15 years.

According to Article 49, Decision 17/CP.7 M&P for a CDM, for this project a fixed crediting period of ten (10) years was selected for the proposed project activities with no option of renewal.

C.2.1 Renewable crediting period *(at most seven (7) years per crediting period)*

C.2.1.1 Starting date of the first crediting period *(DD/MM/YYYY)*:

C.2.1.2 Length of the first crediting period *(in years and months, e.g. two years and four months would be shown as: 2y-4m.)*:

C.2.2 Fixed crediting period *(at most ten (10) years)*:

C.2.2.1 Starting date: *01/01/2008*

C.2.2.2 Length (max 10 years): *(in years and months, e.g. two years and four months would be shown as: 2y-4m.)*

D. Monitoring methodology and plan

(The monitoring plan shall incorporate a monitoring methodology specified for the applicable project category for small-scale CDM project activities contained in appendix B of the simplified M&P for small-scale CDM project activities and represent good monitoring practice appropriate to the type of project activity.

The monitoring plan shall also provide information on the collection and archiving of the data specified in appendix B of the simplified M&P for small-scale CDM project activities to:
- Estimate or measure emissions occurring within the project boundary;
- Determine the baseline, as applicable;
- Estimate leakage, where this needs to be considered.

Project participants shall implement the registered monitoring plan and provide data, in accordance with the plan, through their monitoring reports.

Operational entities will verify that the monitoring methodology and plan have been implemented correctly and check the information in accordance with the provisions on verification. This section shall provide a detailed description of the monitoring plan, including an identification of the data to be collected, its quality with regard to accuracy, comparability, completeness and validity, taking into consideration any guidance contained in the methodology, and archiving of the data collected.

Please note that monitoring data required for verification and issuance are to be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

An overall monitoring plan that monitors performance of the constituent project activities on a sample basis may be proposed for bundled project activities. If bundled project activities are registered with an overall monitoring plan, this monitoring plan shall be implemented and each verification/certification of the emission reductions achieved shall cover all of the bundled project activities.)

D.1 Name and reference of approved methodology applied to the small-scale project activity:

(Please refer to the UNFCCC CDM web site for the most recent version of the indicative list of small-scale CDM project activities contained in appendix B of the simplified M&P for small-scale CDM project activities.)

(If a national or international monitoring standard has to be applied to monitor certain aspects of the project activity, please identify this standard and provide a reference to the source where a detailed description of the standard can be found.)

For the current project there are three project categories of PAs, see their description in the textbox below.

Description of project categories relevant to the considered activities

(EXCERPT from Appendix B to the Simplified Modalities and Procedures for small-scale CDM Project Activities)

I.C. Thermal energy for the user
Para. 15. This category comprises renewable energy technologies that supply individual households or users with thermal energy that displaces fossil fuel or non-renewable sources of biomass. Examples include solar thermal water heaters and dryers, solar cookers, energy derived from biomass for water heating, space heating, or drying, and other technologies that provide thermal energy that displaces fossil fuel.

II.E. Energy efficiency and fuel switching measures for buildings
Para. 64. This category comprises any energy efficiency and fuel switching measure implemented at a single building, such as a commercial, institutional or residential building, or group of similar buildings, such as a school, district or university. This category covers project activities aimed primarily at energy efficiency; a project activity that involves primarily fuel switching falls into category III.B. Examples include technical energy efficiency measures (such as efficient appliances, better insulation and optimal arrangement of equipment) and fuel switching measures (such as switching from oil to gas).

III. B. Switching fossil fuels
Para. 72. This category comprises fossil fuel switching in existing industrial, residential, commercial, institutional or electricity generation applications. Fuel switching may change efficiency as well. If the project activity primarily aims at reducing emissions through fuel switching, it falls into this category. If fuel switching is part of a project activity focused primarily on energy efficiency, the project activity falls in category II.D or II.E.

For the selected PA types and categories the CDM EB offers an indicative monitoring methodology (see the textbox below):

INDICATIVE MONITORING METHODOLOGIES for selected project categories

(EXCERPT from Appendix B to the Simplified Modalities and Procedures for small-scale CDM Project Activities)

TYPE I - RENEWABLE ENERGY PROJECTS, ***Category I.C. - Thermal energy for the user***

22. Monitoring shall consist of:

(a) Metering the energy produced by a sample of the systems where the simplified baseline is based on the energy produced multiplied by an emission coefficient; or

(b) Metering the thermal and electrical energy generated for co-generation projects; or

(c) If the emissions reduction per system is less than 5 tonnes of CO2 a year:

(i) Recording annually the number of systems operating (evidence of continuing operation, such as on-going rental/lease payments could be a substitute); and

(ii) Estimating the annual hours of operation of an average system, if necessary using survey methods. Annual hours of operation can be estimated from total output (e.g. tonnes of grain dried) and output per hour if an accurate value of output per hour is available.

TYPE II - ENERGY EFFICIENCY IMPROVEMENT PROJECTS, ***Category II.E.*** **- Energy** ***efficiency and fuel switching measures for buildings***

69. In the case of retrofit measures, monitoring shall consist of:

- In the case of retrofit measures, monitoring shall consist of:

  (a) Documenting the specifications of the equipment replaced;
  (b) Calculating the energy savings due to the measures installed.

- In the case of a new facility, monitoring shall consist of:

  (a) Metering the energy use *of the building(s);*
  (b) Calculating the energy savings *of the new building(s).*

Published values for technical transmission and distribution losses may be used. Alternatively technical transmission and distribution losses for the grid that supplies the building(s) may be monitored.

TYPE III - OTHER PROJECT ACTIVITIES, ***Category III.C. - Switching fossil fuels***

76. Monitoring shall involve:

(a) Monitoring of the fuel use and output *for an appropriate period (e.g., a few years, but records of fuel use may be used) prior to the fuel switch being implemented - e.g. coal use and heat output by a district heating plant, liquid fuel oil use and electricity generated by a generating unit (records of fuel used and output can be used in lieu of actual monitoring);*

(b) Monitoring *fuel use and output* after the fuel switch has been implemented - e.g. gas use and heat output by a district heating plant, gas use and electricity generated by a generating unit.

77. In the case of coal, the emission coefficient shall be based on test results for periodic samples of the coal purchased if such tests are part of the normal practice for coal purchases.

All PAs, falling into the mentioned above three categories, are very similar and consequently a common monitoring methodology are be applied to them.

D.2 Justification of the choice of the methodology and why it is applicable to the small-scale project activity:

(Justify the choice of the monitoring methodology applicable to the project category as provided for in appendix B.)

Taking into consideration the basic requirements of these three methodologies and good monitoring practices appropriate to the circumstances of the considered project activities it was identified the project specific monitoring methodology, which is illustrated in figure 5.

In order to calculate the emissions reduction in a reliable manner, there was chosen a project specific monitoring methodology, which is based on the need for *the boiler fuel consumption* monitoring via periodic measurements or fuel purchase documentation.

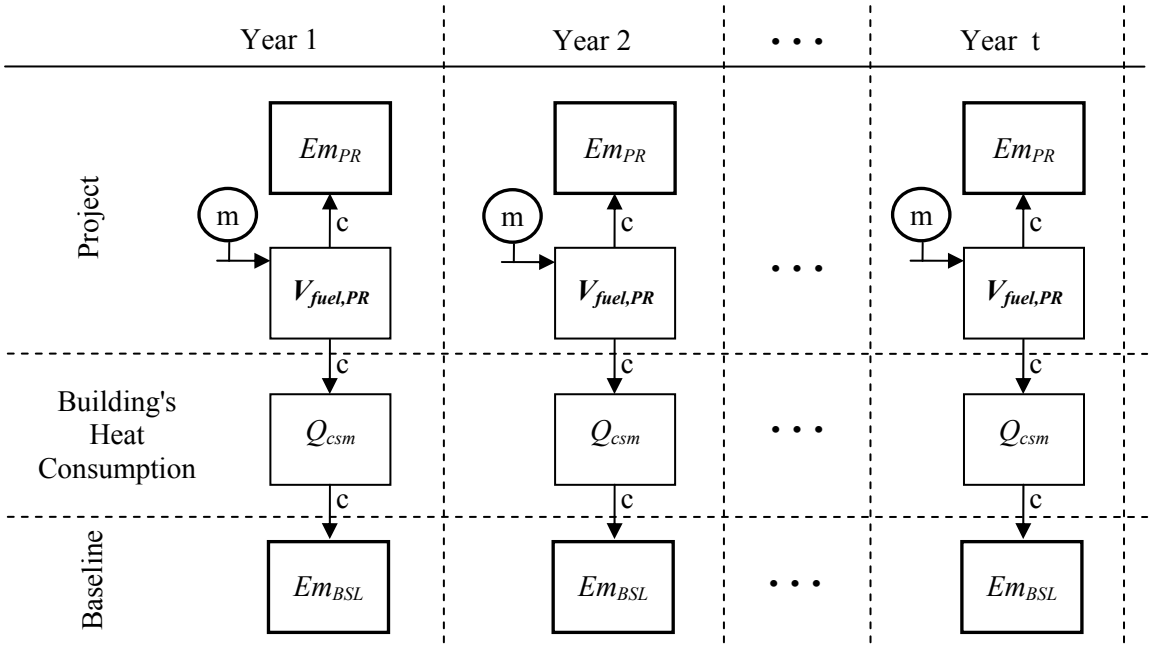

Figure 5. Emissions Monitoring: Basic info chart

The notations applied on the figure 5 are common for all studies related to the present project:

Em_{PR} - annual project emissions, tCO_2;

$V_{fuel,PR}$ - annual fuel volume used in the project scenario, ths. Nm^3 or tonnes (measured);

Q_{csm} - building's annual heat consumption, MWh;

Em_{BSL} - annual baseline emissions, tCO_2 .

Monitoring of Project Emissions

The present monitoring methodology gives the opportunity for real measurement or consumption documentation of the project fuel volumes, which will lead, via calculations, to building's heat

consumption and emissions reduction determination.

During the project implementation this monitoring plan can be reviewed (through DOE approvement), when necessary, in order to address properly all project aspects deemed necessary to monitor and report reliable emissions reduction.

The present monitoring plan provides a simple way for reliable and complete project emissions calculation over the crediting period.

The project emissions are totally determined by (i) the type of fuel used, (ii) fuel consumption and (iii) emission factor.

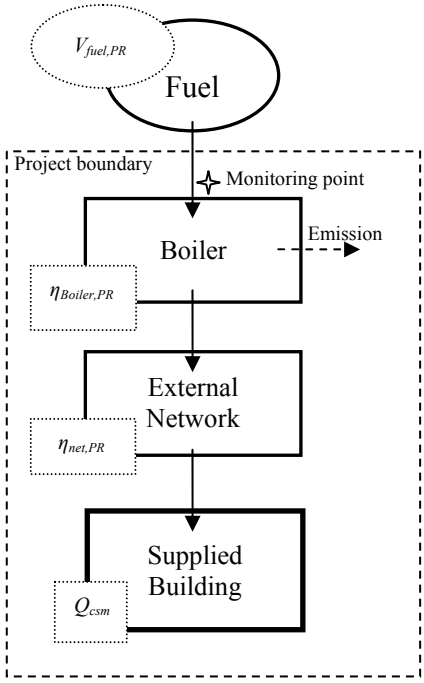

Figure 6. Project Monitoring Points

The type of fuel used will be known for each building included in the project - coal, natural gas, or straw. The emission factors for these three types of fuel are given and for emission calculations will be applied their officially published values.

As far as fuel consumption is concerned, it will be periodically, on a monthly basis, measured/documented and recorded at each site (see 'Monitoring point', fig. 6).

In paragraph D.3 are provided provisions for archiving project emissions data in order to ensure their future verification.

Monitoring of Baseline Emissions

The CO_2 baseline emissions at the project implementation stage are determined by the following factors:

- building's annual heat consumption, Q_{csm} , in MWh;
- emission factor, EF_{BSL} in tCO2/MWh.
- overall efficiency of the heating system in baseline scenario, $\eta_{overall,BSL}$ (estimated);

The building's heat consumption will be calculated on the basis of measured/documented fuel consumption for project scenario and given project's heating system overall efficiency as

$$Q_{csm,t} = V_{fuel,PR,t} \cdot LHV_{PR} \cdot \eta_{overall,PR} ,$$

where $\eta_{overall,PR}$ represents the overall efficiency of the project heating system which is the product of new boiler efficiency (75% for coal, 79% - straw and 92% - natural gas fired boiler) and project network efficiency (98%).

The calculation formulae of project and baseline emissions, and consequently the emissions reduction at the monitoring stage are presented in Para E.1.

D.3 Data to be monitored:

(The table below specifies the minimum information to be provided for monitored data. Please complete the table for the monitoring methodology chosen for the proposed project activity from the simplified monitoring methodologies for the applicable small-scale CDM project activity category contained in appendix B of the simplified M&P for small-scale CDM project activities.Please note that for some project categories it may be necessary to monitor the implementation of the project activity and/or activity levels for the calculation of emission reductions achieved. Please add rows or columns to the table below, as needed. The monitored data are use to calculate baseline, project or leakage emissions. Please include a comment in the 'Comments' column, identifying the use of each data (i.e. if used for baseline, project, leakage)

Table 4. Data to be collected and archived per PA

ID	Data type	Data variable	Data unit	Way of collecting*	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data to be kept?	Comment
1	*Coal consumption*	$V_{fuel,PR}$	*tonnes*	*e*	*monthly*	*100%*	*electronic*	*2 years*	*Documented by fuel purchasing invoices and monthly estimated*
2	*Coal net calorific value*	LHV_{PR}	*kcal/tonne*	*e*	*annually*	*100%*	*electronic*	*2 years*	*More frequently if change of supplier or origin*
3	*Coal emission factor*	EF_{PR}	*tCO2 / MWh*	*e*	*annually*	*100%*	*electronic*	*2 years*	*More frequently if change of supplier or origin*
4	*Natural gas consumption*	$V_{fuel,PR}$	*Nm3*	*m*	*monthly*	*100%*	*electronic*	*2 years*	*Recorded from fuel meters and documented by fuel payment invoices*
5	*Natural gas net calorific value*	LHV_{PR}	*kcal/Nm3*	*e*	*annually*	*100%*	*electronic*	*2 years*	-
6	*Natural gas emission factor*	EF_{PR}	*tCO2 /MWh*	*e*	*annually*	*100%*	*electronic*	*2 years*	-
7	*Straw consumption*	$V_{fuel,PR}$	*tonnes*	*e*	*monthly*	*100%*	*electronic*	*2 years*	*Documented by fuel purchasing records and monthly estimated*
8	*Straw net calorific value*	LHV_{PR}	*kcal/tonne*	*e*	*annually*	*100%*	*electronic*	*2 years*	-
9	*Straw emission factor*	EF_{PR}	*tCO2 / MWh*	*e*	*annually*	*100%*	*electronic*	*2 years*	-
10	*Coal emission factor*	EF_{BSL}	*tCO2 / MWh*	*e*	*annually*	*100%*	*electronic*	*2 years*	*Commonly used coal for heating in the neighborhood of the given PA*
11	*Natural Gas emission factor*	EF_{BSL}	*tCO2 / MWh*	*e*	*annually*	*100%*	*electronic*	*2 years*	-

* m – measured, c – calculated, e – estimated.

For each PA an Excel worksheet, attached to this document, is elaborated in order to record the annual fuel consumption.

A crediting year starts on January1 and ends on December 31.

D.4. Qualitative explanation of how quality control (QC) and quality assurance (QA) procedures undertaken:

Calibration of monitoring equipment

The volume of natural gas consumption will be registered by gas meter installed for all project activities. This monitoring equipment must be periodically verified and tested. According to the Moldovan regulations, the meters should be periodically verified and tested[2]. After meters verification and testing, for each meter, the authorized laboratory will submit a certificate of: (a) acceptance for operation, or (b) refusal for operation. In case any meter will be refused for operation, such one should be repaired and a certificate of reparation and calibration being submitted by an authorized entity. If the meter could not be repaired, a new meter should be purchased, receipt and technical passport being needed.

Procedures for monitoring, measurements and reporting

For most PAs activities with natural gas consumption, monitoring frequency should be in line with meter readings. Usually, natural gas meter readings will be taken by local gas supplier on a monthly basis. The reporting documents for this meter will be the monthly invoices, where metering period and meter registration are printed..

At the beginning of next reporting year the annual project emissions report should be worked out. The monitoring/reporting year should end on June 30 of each year. The annual emission reductions report should be printed and signed by the Project-monitor and Project-manager, as final responsible person. This report will be presented to DOE by the end of August of the next reporting year. The presented report will be archived to make it available for external audit and verification purposes.

The annual report should include: overall project performance, emissions reduction and comparison with Baseline Study estimations, comments concerning monitoring plan indicators, information on monitoring plan main assumptions, calculation methods and changes in the monitoring plan.

On the basis of elaborated annual reports the Project-manager will organize annual PA-owners meetings, with Minutes of Meeting issuance and their archiving.

Procedures for possible monitoring data adjustments and uncertainties

[2] Moldovan State Department of Standardization and Metrology Decision # 1445-M from January 4, 2004: The official list of the measuring equipment to be compulsory verified and tested. Official Journal, # 35-38/81 from February 27, 2004, Chisinau, Republic of Moldova.

The key parameter laid down to the project emissions calculation is the monthly metered/documented fuel consumption. In the real life, there could be situations when fuel meter readings are not available. In such cases estimated values will be applied. However CFU reserves the right to argue and come up with its own estimation on the basis of other existing cases.

Procedures for internal audits of GHG

Upon request of any PA-owner can be conducted an internal audit. For this reason the Project-manager will create a working team out of three members including the representative of the respective PA-owner.

All ERs generated by the Sub-Sub-Project until the Contracted ERs have been delivered, shall be subject to a periodic verification by an Independent Third Party selected in accordance with the ERPA ("Periodic Verification"). The CFU and the CDCF has the right to arrange for a Start-up Verification of the Sub-Sub-Project. It shall instruct the Designated Operational Entity to provide a copy of the Start-up Verification Report to the CDCF, CFU and the Sub-Sub-Project Entity.

PA-owners in conformity with the signed subsidiary agreements with CFU shall install, operate and maintain the facilities and equipment (data measurement and collection systems), and employ staff, necessary for gathering all such data as may be required by the Monitoring Plan (as it may be amended from time to time);
The CFU is responsible for data collection, archiving and reporting. Its specific responsibilities are to:

a) Contact Sub-Sub-Project entity and collect metered data as required by the monitoring methodology (the data collection is foreseen via e-mail, fax, phone or on site visiting);
b) Verify the collected data quality and integrity, enter the collected data in the emissions calculation workbook, including through regular on-site inspections;
c) Check that calculation of emission reductions are in line with the monitoring methodology requirements and assumptions and keep for each year of the crediting period a separate emissions calculation workbook;

D.5. Please describe briefly the operational and management structure that the project participant will implement in order to monitor emission reductions and any leakage effects generated by the project activity:

Description of the authority and responsibility of project management

Each project activity, to be included in this project, shall be represented by an owner/beneficiary of the SIF II Project, which is the local authority (hereinafter referred to as PA-owner*).*

PA-owner*'s specific responsibilities:*

- *handles project performances;*

- *insures the endowment of the monitoring points with appropriate measurement devices (natural gas meter) by the starting date of the project implementation;*
- *keeps the bills for fuel consumption or invoices for fuel purchase;*
- *annually provides copies of fuel bills or invoices for fuel purchase to Project-monitor;*
- *appoints the PA-operator.*

PA-owner legally designates a person responsible for PA local heating system operation and maintenance (hereinafter referred to as PA-operator*).*

PA-operator*'s specific responsibilities:*

- *reads meters offering the relevant data to PA-owner.*

Taking into consideration the similarity of energy conservation measures implemented for all considered PAs, the number of PAs, their geographical dispersion and the use of CDM *project participant* term, there will be established a *Carbon Finance Unit* for promoting the whole project to the investor.

In accordance with Appendix D of the CDM modalities and procedures, the decision on the distribution of CERs from a CDM project activity will be taken by project participants represented by the Carbon Finance Unit, which will communicate with the Executive Board, through the secretariat, in writing in accordance with the "modalities of communication" submitted together with the registration form. Thus, the project management will be under the responsibility of the Head of Carbon Finance Unit (hereinafter referred to as Project manager*).*

Project manager*'s specific responsibilities:*

- *represents PA-owners for the purposes of this project;*
- *appoints the Project-monitor;*
- *assures that the Project monitor is duly trained;*
- *submits annual monitoring report to DOE;*
- *takes decisions on the distribution of CERs per PAs.*

The Project manager shall designate a person responsible for data collection, archiving and reporting (hereinafter referred to as Project-monitor*).*

Project-monitor*'s specific responsibilities:*

- *contacts local PA-owners and monthly collects fuel consumption metered and documented data as required by the monitoring methodology (the data collection is foreseen via e-mail, fax, phone or on site visit);*
- *verifies the collected data quality and integrity, enters the collected data in the emissions calculation workbook;*
- *checks that calculation of emissions reduction are in line with the monitoring methodology requirements and assumptions;*

- *assures that data are stored and relevant measures are taken to avoid loss of information;*
- *elaborates annual monitoring report;*
- *informs PA-owners about their emissions reduction performances;*
- *submits annual monitoring report to Project-manager;*
- *keeps collected data and elaborated reports available for external audit and verification purposes at least for two years;*
- *annually, if required to make corrections on estimated parameters (table 1) in the emissions calculation workbook;*
- *keeps for each year of the crediting period a separate emissions calculation workbook;*
- *stores the saved files with annual emissions workbooks and annual reports on a local computer and CD;*
- *keeps e-mails and faxes concerning monitored data on printed paper;*
- *keeps good records of all mentioned files, reports and original reporting information for a period of two (2) years.*

- ***Project manager*** – the Head of the Carbon Finance Unit.
- ***PA-owner*** - the beneficiary of the SIF II Project.
- ***PA-operator*** - the person legally designated by the PA-owner, responsible for PA local heating system operation and maintenance.
- ***Project monitor*** - the person designated by the Carbon Finance Unit, responsible for data collection, archiving and reporting.

Emergency preparedness

All reasonable measures towards emergency preparedness are foreseen under the responsibilities of the Project-monitor and the Project-manager.

Leakage effects

There are no leakage effects foreseen under the project.

D.6 Name of person/entity determining the monitoring methodology:

(Please provide contact information and indicate if the person/entity is also a project participant listed in annex 1 of this document.)

The current monitoring methodology was determined by Prof. Valentin Arion, Dr. hab, WB Expert, who is not a project participant.

Contact information:

Mail Address: 168 Stefan cel Mare bd., Technical University, MD-2004 Chisinau, Republic of Moldova.

Tel/Fax: +373 22 23 72 82; Email: valarion@cni.md

E. Calculation of GHG emission reductions by sources

E.1 Formulae used:

(In E.1.1 please provide the formula used to calculate the GHG emission reductions by sources in accordance with the applicable project category of small-scale CDM project activities contained in appendix B of the simplified M&P for small-scale CDM project activities.

In case the applicable project category from appendix B does not indicate a specific formula to calculate the GHG emission reductions by sources, please complete section E.1.2 below.)

E.1.1 Selected formulae as provided in appendix B:

(Describe the calculation of GHG emission reductions in accordance with the formula specified for the applicable project category of small-scale CDM project activities contained in appendix B of the simplified M&P for small-scale CDM project activities.)

The calculation formulae of GHG emission reductions is not provided in Appendix B.

E.1.2 Description of formulae when not provided in appendix B:

E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary: *(for each gas, source, formulae/algorithm, emissions in units of CO_2 equivalent)*

Having PAs grouped by their annual heat consumption and fuel type, CO2 emissions can be easily determined.

For a given building

For a given PA project emissions are calculated as:

$$Em_{PR,fb} = Q_{fuel,PR,fb} \cdot EF_f \ , \qquad (5)$$

where $Em_{PR,fb}$ represents the project CO_2 emissions, for the *f*-type of fuel burned in a given *b*-type of building, tCO_2;

$Q_{fuel,PR,fb}$ - the project fuel embedded heat, for the *f*-type of fuel used in *b*-type of building, MWh;

EF_f - the emission factor for the *f*-type of fuel used, tCO_2/MWh.

There are three types of fuels considered in this project, namely – coal, natural gas and biomass (straw), for which the following emission factor values are used[3]:

Table 5. Fuel types used at heating sources and considered in baseline and project scenario

	Type of fuel	Low Heat Value		Emission factor	
1.	Coal	5.556 kWh/kg	20 MJ/kg	0.340 t/MWh	0.095 t/GJ

[3] Technology Needs Assessment and Development Priorities. Report elaborated under the United Nations Framework Convention on Climate Change, UNDP Moldova , MinEcology, Chisinau, Moldova, 2002 (Annex 1.11, Pag. 149).

2.	Natural Gas	9.306 kWh/m^3	33.5 MJ/m^3	0.200 t/MWh	0.056 t/GJ
3.	Straw	3.888 kWh/kg	14 MJ/kg	CO2 neutral	

Thus, for known $Q_{fuel,PR,fb}$ and given EF_f the project CO_2 emissions are easily determined by sources and years, according to formulae (5). It has to be mentioned that $Q_{fuel,PR,fb}$ is determined by taking into account the energy conservation measures (energy savings) foreseen for the given building.

For the whole project

Total project emissions for the whole project are calculated as -

$$Em_{PR} = \sum_{f,b} Em_{PR,fb} \cdot N_{PA} \cdot \alpha_{PR\,f} \cdot \beta_b \ , \qquad (6)$$

where N_{PA} is the total number of PAs (buildings) considered in the project;

$\alpha_{PR\,f}$ - the share of buildings (in the N_{PA}) supplied with the *f*-type of fuel;

β_b - the share of *b*-type of buildings in the N_{PA}.

Calculation of Project Emissions at operation/monitoring stage

Since only one type of fuel at each heating source is to be used, the annual project CO_2 emissions for each considered PA, at the monitoring stage, can be easily determined by applying the following formula

$$Em_{PR,t} = V_{fuel,PR,t} \cdot LHV_{PR} \cdot EF_{PR} \ ,$$

where $Em_{PR,t}$ represents the PA annual project emissions for a given year *t*, in tCO_2;

$V_{fuel,PR,t}$ - annual fuel volume burned at a given project activity site, in tones or 1000 Nm^3;

LHV_{PR} - low heat value of the fuel burned at a given project activity site, in kWh per tonne or or 1000Nm^3;

EF_{PR} - emission factor corresponding to the fuel burned at a given project activity site, in tCO_2/MWh.

For the measured $V_{fuel,PR}$, given LHV_{PR} and EF_{PR} the CO_2 emissions can be readily determined by sources on a yearly (or even monthly) basis, using a prepared sheet.

E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities *(for each gas, source, formulae/algorithm, emissions in units of CO_2 equivalent)*

According to project boundary and leakage definitions there is no leakage due to project activities.

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the project activity emissions:

Since there is no leakage due to project activities the result of E.1.2.1 will represent the project activity emissions.

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHG's in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities: (for each gas, source, formulae/algorithm, emissions in units of CO2 equivalent)

For a given PA the baseline emissions are calculated as:

$$Em_{BSL,fb} = Q_{fuel,BSL,fb} \cdot EF_f \quad (7)$$

where $Em_{BSL,fb}$ represents the baseline CO_2 emissions, for the *f*-type of fuel burned in a given *b*-type of building, tCO_2;

$Q_{fuel,BSL,fb}$ - the baseline fuel embedded heat, for the *f*-type of fuel used in *b*-type of building, MWh;

EF_f - the emission factor for the *f*-type of fuel used, tCO_2/MWh.

There are three types of fuels considered in this project, referring to the baseline scenario, namely – coal, and natural gas, for which the emission factor values are given in table 3.

Thus, for known $Q_{fuel,BSL,fb}$ and given EF_f the baseline CO_2 emissions are easily determined by sources and years, according to formula (7).

For the whole project total baseline emissions for the whole project are calculated as

$$Em_{BSL} = \sum_{f,b} Em_{BSL,fb} \cdot N_{PA} \cdot \alpha_{BSL\,f} \cdot \beta_b \quad (8)$$

where N_{PA} is the total number of PAs (buildings) considered in the project;

$\alpha_{BSL\,f}$ - the share of buildings (in the N_{PA}) supplied with the *f*-type of fuel.

Calculation of Baseline Emissions at operation/monitoring stage

As for baseline scenario, the annual emissions for each PA included in this project, can be determined by applying the formula:

$$Em_{BSL,t} = \frac{Q_{csm,t}}{\eta_{overall,BSL}} \cdot EF_{BSL} \ .$$

Total baseline emissions for a given year *t* will be calculated as the sum of emissions from all PAs included in the project.

The overall efficiency of the heating system in baseline scenario is estimated at 42% (0.6x0.7) for coal-fired and 62% (0.88x0.7) for gas-fired heating systems. These values will be considered for the whole crediting period. Such a low level of baseline heating systems' overall efficiencies is caused by high losses through dilapidated building's envelopes (external walls, roofs, floors, windows and doors' frames in bad condition).

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

At operation/monitoring stage, for a given *b*-type of building (A, B, C) and considered fuel switching option the emissions reduction is calculated as –

$$ER_{fb} = Em_{BSL,fb} - Em_{PR,fb} \ , \qquad (9)$$

while total project emissions reduction will be - $ER = Em_{BSL} - Em_{PR}$. (10)

Elaborated Excel model allows to determine baseline and project emissions, and consequently the total emissions reduction for any given set of initial data.

* * *

Generalized project emissions reduction factor

For the purpose of this project, at the PDD elaboration stage, the total expected emissions reduction, are determined according to formula -

$$ER = ERF_Q \cdot Q_{csm} \ ,$$

where ERF_Q represents so called *project emissions reduction factor*, in tCO2/MWh.

Below the procedure applied for ERF_Q calculation is set out[4]:

1. Let's consider four hypothetical cases where for all buildings, included in the project, is applied only one fuel-fuel option. Thereby, in the first case, for all buildings the coal-biomass option is applied. Consequently, for the second case - the coal-natural gas option, and so on.
   For each mentioned above case the emissions reduction factor has been determined on the basis of elaborated Excel simulation model as it follows -

   ***ERF_Q* = total project annual emissions reduction / total project heat annual consumption**.

[4] James T. Mc Clave, P George Benson. - Statistics for Business and Economics, Fifth edition, Dellen Publishing Company, San Francisco, 1991, 1230 pp.

The obtained results are presented in table 4.

Table 6. Emissions reduction factors for different fuel-fuel options
(hypothetical cases when project includes only a single given fuel-fuel option)

Parameter	Units	Fuel-fuel options			
		coal - biomass	coal - gas	coal - coal	gas - gas
ER per 1MWh of energy consumption	t/MWh	0.810	0.531	0.228	0.046

2. Let's consider five fuel-fuel structures (table 6), generated on the basis of the following constraints:

- the share of gas-gas option cannot exceed 20%, because such project activities are not attractive from GHG emissions mitigation point of view.

It means that up to 20% of considered buildings before and after rehabilitation keep the natural gas as heating option;

Table 7. Considered five project fuel-fuel structures

FF-Structures	Given probabilities (shares) for different fuel-fuel options				Total
	coal - biomass	coal - gas	coal - coal	gas - gas	
Structure 1	30%	30%	30%	10%	100%
Structure 2	20%	50%	10%	20%	100%
Structure 3	10%	50%	30%	10%	100%
Structure 4	20%	30%	30%	20%	100%
Structure 5	10%	40%	30%	20%	100%

- the coal-biomass option is the most preferable from GHG emissions mitigation point of view, but its share cannot exceed 30% of the total, because of lack of common practices in the country.

3. Emissions reduction factor for given fuel-fuel options, encompassed by the given *FF*-structures, are determined as the product of the emissions reduction factor (from table 4) and the relevant assigned probabilities (table 5). For instance, for coal-biomass option, structure 1, results –

$$ERF_{Q\ Coal\text{-}Bio} = 0.810\ \text{tCO2/MWh} \cdot 30\% = 0.243\ \text{tCO2/MWh}$$

and similarly for the remainder fuel-fuel options.

For structure 1 as a whole, including those four fuel-fuel options, results the following weighted average ERF_Q –

$$ERF_{Q\ Str\ 1} = 0.243 + 0.159 + 0.068 + 0.005 = 0.475\ \text{tCO2/MWh}\ .$$

Similarly for the remainder four *FF* -structures.

The obtained results are summarized in the table 8.

Table 8. Emissions reduction factors for considered *FF*-structures and for the whole project, in tCO2 / MWh (without energy conservation measures)

FF-Structures	ERF_Q for different fuel-fuel options within the frame of considered structures				Structure's ERF_Q	**Project's ERF_Q**
	coal - biomass	coal - gas	coal - coal	gas - gas		
Structure 1	0.243	0.159	0.068	0.005	0.475	
Structure 2	0.162	0.265	0.023	0.009	0.459	
Structure 3	0.081	0.265	0.068	0.005	0.419	**0.425**
Structure 4	0.162	0.159	0.068	0.009	0.399	
Structure 5	0.081	0.212	0.068	0.009	0.371	

Table 9. Emissions reduction factors for considered *FF*-structures and for the whole project, in tCO2 / MWh (with energy conservation measures implemented)

FF-Structures	ERF_Q for different fuel-fuel options within the frame of considered structures				Structure's ERF_Q	**Project's ERF_Q**
	coal - biomass	coal - gas	coal - coal	gas - gas		
Structure 1	0.243	0.176	0.104	0.010	0.534	
Structure 2	0.162	0.294	0.035	0.021	0.511	
Structure 3	0.081	0.294	0.104	0.010	0.489	**0.487**
Structure 4	0.162	0.176	0.104	0.021	0.463	
Structure 5	0.081	0.235	0.104	0.021	0.441	

4. The project emissions reduction factor is determined as weighted average ERF_Q per considered fuel-fuel options and structures. The used initial data yield a project ERF_Q of **0.487 tCO2/MWh** (table 7).

Table 10 reflects the case when project activities refer to both installing new heating systems and buildings' retrofitting.

Table 10. Calculation of project emissions reduction factors

Parameter	Units / FF-Structures	Fuel-fuel options				Total	Average
		Coal - Biomass	Coal - Gas	Coal - Coal	Gas - Gas		
INSTALLING NEW HEATING SYSTEMS AND BUILDINGS RETROFITTING							
Case when project includes a single fuel switching option							
ER per 1 kW installed capacity -	t/kW	**1.366**	0.992	0.585	**0.174**		
ER per 1MWh energy consum. -	t/MWh	**0.810**	0.588	0.347	**0.103**		
Real project includes 4 switching options							
Given probabilities (shares) for different fuel switching options	Structure 1	30%	30%	30%	10%	100%	
	Structure 2	20%	50%	10%	20%	100%	
	Structure 3	10%	50%	30%	10%	100%	
	Structure 4	20%	30%	30%	20%	100%	
	Structure 5	10%	40%	30%	20%	100%	
Calculation of the weighted average parameters						weighted average	

ER per 1 kW boiler installed capacity, t/kW	Structure 1	0.410	0.298	0.176	0.017	0.900	**0.823**
	Structure 2	0.273	0.496	0.059	0.035	0.862	
	Structure 3	0.137	0.496	0.176	0.017	0.825	
	Structure 4	0.273	0.298	0.176	0.035	0.781	
	Structure 5	0.137	0.397	0.176	0.035	0.744	
ER per 1MWh of energy consumption, **t/MWh**	Structure 1	0.243	0.176	0.104	0.010	0.534	**0.487**
	Structure 2	0.162	0.294	0.035	0.021	0.511	
	Structure 3	0.081	0.294	0.104	0.010	0.489	
	Structure 4	0.162	0.176	0.104	0.021	0.463	
	Structure 5	0.081	0.235	0.104	0.021	0.441	

E.2 Table providing values obtained when applying formulae above:

Table 11. Total annual project emissions reduction for the crediting period, in tonnes of CO_2

Years	**Unit**	**Crediting period**									
		2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Number of PAs (buildings) implem.	-	40%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Total Heat consumption, Q_{csm}	MWh	15 613	39 032	39 032	39 032	39 032	39 032	39 032	39 032	39 032	39 032
Emissions Reduction Factor for the whole project, ERF_Q	tCO2/ MWh	0.487	0.487	0.487	0.487	0.487	0.487	0.487	0.487	0.487	0.487
ER, $ER = ERF_Q \cdot Q_{csm}$	tCO2	**7 610**	**19 026**	**19 026**	**19 026**	**19 026**	**19 026**	**19 026**	**19 026**	**19 026**	**19 026**

Annual ER ranges between **7 610** and **19 026** tCO_2-equivalent.

Cumulative (non-discounted) savings:

For the crediting period of 10 years (2006-2015):	***178 845***	*tCO2-equivalent*
Up to and including 2012:	***83 715***	*tCO2-equivalent*
For the period 2008-2012:	***83 715***	*tCO2-equivalent*

The annual project total heat consumption and estimated emissions reductions factor can be checked using spreadsheets presented in the annexed file "Moldova biomass.xls", sheets "Qcsm" and "ER average".

F. Environmental impacts

F.1 If required by the host Party, documentation on the analysis of the environmental impacts of the project activity: *(if applicable, please provide a short summary and attach documentation)*

Conventional coal-burning boiler houses create massive pollution; they represent one of the largest source of air pollution and greenhouse gas emissions. Heat and power production is responsible for large

amounts of carbon dioxide (CO2), sulfur dioxide (SO2), nitrogen oxides (NOx), and mercury emissions (Hg). These four pollutants are the major cause of our worst environmental problems, including acid rain, smog, respiratory illness, mercury contamination, and global warming.

Due to the implemented measures within this project, coal will be substantially substituted by natural gas and biomass what will lead to an important environmental pollution reduction. Table 10 indicates the emissions reduction in case of switching from coal to straw for heat production. The indicative figure of emissions reduction for the considered bundle of PAs amounts to 5 840 tonnes/yr.

Table 12. Reduction of atmospheric pollutants emission

	Emissions, g/GJ at boiler output		REDUCTION	
	COAL	STRAW	absolute	relative
SO2	2 511.60	132.98	2 379	95%
NOx	193.25	92.06	101	65%
CxHy (C20H12)	0.000322	0.179012	-0.179	-41071%
CO	193.25	613.76	-421	-135%
PM	2 537.45	40.92	2 497	99%
CO2	172 807.77	135 802.47	37 005	42%
Total emission	**178 243.31**	**136 682.37**	**41 561**	**43%**

Some measures for straw-burning impact mitigation

Use of straw, in contrast to fossil fuels, leads to a series of benefits mentioned above, but meanwhile causes some negative effects. In this case, an increase of flying pollutants could be mitigated by planting of greenery in the neighbourhood areas.

Foolproof removal and temporal storage of straw ashes would decrease probable danger of dust pollution in settlements.

Removal of straw from fields causes loss of potential soil organic matter and takes away such nutritive elements as phosphorus, potassium, magnesium and removal of calcium may change sometimes PH of soil. The problem may be solved through use of ash for fertilizing and applying of other fertilizers. Additional expenses for that may be assessed as 7 USD per one tone of straw and not exceed 10 % of straw cost.

Problem of straw storage may be mitigated through contracts for gradual supply by straw using small depot to provide stability of supply.

G. Stakeholders comments

G.1 Brief description of the process by which comments by local stakeholders have been invited and compiled:

The project activities were not directly discussed with local communities, as the SIF II project finances various project activities at community level on demand basis, at the time of preparation of PDD there was not exact known communities or project activities. However, to get local stakeholders comments on the project and their support in the project implementation, the local specialists of Moldova Social Investment Fund (MSIF) were extensively interviewed. The MSIF has detailed knowledge of rural community performance and capacities as a result of completed social infrastructure projects (including SIF II). The local specialists as well have received limited training and potential benefits of GHG emission reductions and the project's scope and objectives, as well as the implementing arrangements were explained. During the preparation of the project, the World Bank specialists and locally hired consultants have gathered comments and views of the Ministries of Ecology and Natural Resources and Energy and other concerned members of the government.

An important number of environmental and agricultural NGOs have been involved in the debating and discussion of the project proposition. Moldovan Social Investment Fund, Union of Agricultural Producers, Rural Development Center, Biotica NGO, Agency for Consulting and Scholarship in Agriculture, Regional Environment Center of Moldova, Eco-Spectru NGO, Alliance for Cooperation in Agriculture, Pro-Rural-Invest NGO, Pro-Terra NGO, Consulting and Credit in Agriculture NGO, Agency for Consulting and Agricultural Information, etc., there are just a limited number of stakeholders' names involved into the project design identification and exchange of lessons and experience learned.

Specifically for introduction of biomass as a fuel sources thorough social and energy scanning assessments were undertaken through the MSIF, set up to improve the living conditions of the poor rural populations. The agricultural assessment was undertaken through the 2KR (agricultural mechanization fund) and the Union of Agricultural Producers (UAP), which have detailed knowledge of private agricultural enterprises competence as agricultural producers and managers.

The National Commission of Moldova on CDM consisting of all representatives of stakeholders from government agencies, NGO's and academia during June-July 2005 has reviewed the proposed project activities approved the approach and methodology. The whole review and approval process has taken 30 days, enough to study the project activities. The Decision of Commission taken on July 22, 2005 was favourable and welcoming, all members of the Commission have supported the project activities.

G.2 Summary of the comments received:

- Among the most important received comments are the following:
- The project is very welcomed and will provide additional benefits to the involved communities;
- The additional revenues from the CDCF as the result of emissions reduction sale would serve a good incentive in convincing local councils to implement projects with a emissions reduction potential;
- It would be advisable to use the possible CDCF revenues for similar activities that would generate new emissions reduction;
- Local authorities as well as thermal heating utilities do not have relevant capacity to implement Monitoring Plans and to do emissions reduction studies for what special training would be needed;
- As the CDCF revenues for the emissions reductions are supposed to be at the level of only several US$ thousand, the most preferable way to implement the project is as a bundle all subprojects and to identify an intermediary body, responsible for project implementation;
- As an implementing institution might be a special unit that could be created either under the auspice of Ministry of Energy or under the auspice of the Ministry of Ecology and Natural Resources (MENR). The most preferable solution is to have it under the Ministry of Ecology, as this institution might promote new Carbon Financed Projects not only in the energy sector, but also in other sectors, as forestry, waste water treatment, waste management, etc.

G.3 Report on how due account was taken of any comments received:

Most important comments, received from the local stakeholders were related to the capacity to implement the project monitoring plan as well as regarding the implementing arrangements. In this regard the project team and mentioned stakeholders agreed on the creation of a special unit to assume a consolidated management of this and of forthcoming new CDCF projects. The consolidation of the implementation mechanism for both projects would provide for synergy, economic and financial efficiencies. Furthermore, such a consolidated unit would also coordinate and promote other future carbon finance activities in the country, especially of small scale, and act as a knowledge bank for carbon finance related activities in general. It was also decided that such entity is best to be created under the MENR, a focal point for Kyoto Protocol related activities.

In order to establish and strengthen the capacity of a special unit that would manage the CDCF projects the MENR requested the WB to provide relevant assistance. The World Bank responded positively to this request and provides a PHRD grant in order to support creation of Carbon Finance Unit (CFU) within the

Ministry. The main objectives of the grant (signed in January, 2005) will build the capacity of the CDM CFU staff to implement carbon finance projects, to organize preparation of relevant baseline and monitoring/verification methodologies and legal/contracting issues and dissemination of best practice in this area. The CFU will serve simultaneously as the CDCF counterpart for the two on-going projects and provide support for their implementation. In this respect, the CFU has the following main duties: (a) be responsible for the projects Monitoring Plans; (b) sign the subsidiary agreement with the project participants (Emissions Reduction Owners (EROs) for each of the CDCF Projects), that stipulates the CFU and EROs rights and responsibilities; (c) on behalf of the EROs negotiate with the CDCF the Emission Reduction Purchase Agreements (ERPA) and sign them; and, (d) receive the carbon payments from the CDCF and transfer this money to the EROs, pro rata, according their actual ERs. The CFU also will provide relevant training to the project participants in conducting all measuring activities that are stipulated in the Monitoring plans for scopes, - emissions reduction studies and Community Benefits Plans.

It shall also be noted that the CDCF project in this cases addresses specific financial barrier for energy efficiency and conversion to renewable energy. This activity is one integral part of a larger effort in the country to enhance the use of renewable energy in general. Thus, the technical constraints for introduction of the biomass energy, such as availability of biomass boilers, maintenance and operational capacity, are being addressed separately from this project, with assistance of a renewable energy from agricultural waste initiative supported by Consolidate Agricultural Projects management unit (CAPMU). In addition, information and awareness constraints focusing on building confidence amongst rural population on feasibility of using renewable energy sources is also being addressed jointly by the SIF II Management Unit, CFU, and CAPMU as part of the overall public awareness programs of these entities.

PROJECT DOCUMENTS

-During the period of this project design the following documents have been elaborated and presented:

- CDCF (2005): Moldova Biomass Heating in Rural Communities Project - Carbon Finance Document.
- CDCF (2005): Moldova Biomass Heating in Rural Communities Project - Baseline Study;
- CDCF (2005): Moldova Biomass Heating in Rural Communities Project - Emission Reduction Study;
- CDCF (2005): Moldova Biomass Heating in Rural Communities Project - Monitoring Plan.

For validation and verification purposes any additional background information, work material, data collection would be available upon request from the team designed this project.

Annex 1

CONTACT INFORMATION FOR PARTICIPANTS IN THE PROJECT ACTIVITY

(Please repeat table as needed)

Organization:	Carbon Finance Unit
Street/P.O.Box:	9 Cosmonautilor str. Office 535 MD 2005
Building:	-
City:	Chisinau
State/Region:	-
Postcode/ZIP:	2012
Country:	Republic of Moldova
Telephone:	(+373 22) 22 68 60
FAX:	-
E-Mail:	-
URL:	-
Represented by:	
Title:	Administrator
Salutation:	Mrs.
Last Name:	Drucioc
Middle Name:	-
First Name:	Stela
Department:	-
Mobile:	-
Direct FAX:	-
Direct tel:	-
Personal E-Mail:	stela.drucioc@mediu.moldova.md

Organization:	World Bank Community Development Carbon Fund
Street/P.O.Box:	1818 H Street, NW
Building:	MC Building
City:	Washington
State/Region:	DC
Postfix/ZIP:	20043
Country:	United States of America
Telephone:	-
FAX:	-
E-Mail:	-
URL:	www.carbonfinance.org
Represented by:	
Title:	Fund Manager
Salutation:	Mr.
Last Name:	Knudsen
Middle Name:	-
First Name:	Odin
Department:	ENVCF

Mobile:	
Direct FAX:	+1-202-522 7432
Direct tel:	+1-202-458-9685
Personal E-Mail:	oknudsen@worldbank.org

Organization:	DNA of the Netherlands (VROM)
Street/P.O.Box:	Rijnstraat 8 30945
Building:	
City:	The Hague
State/Region:	
Postfix/ZIP:	2500 GX
Country:	The Netherlands
Telephone:	+310703393456
FAX:	+310703391306
E-Mail:	Ferry.vanhagen@minvrom.nl
URL:	
Represented by:	
Title:	Director for International Environmental Affairs
Salutation:	
Last Name:	De Boer
Middle Name:	
First Name:	Yvo
Department:	International Environmental Affairs
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	Ferry.vanhagen@minvrom.nl

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project will be implemented through an IDA Moldova SIF II credit at the level of US $19.02 million, from which the Government of Moldova will provide US $1.2 million; IDA – US $15.68 million; and local communities – US $2.13 million. The Project was approved in June 2004 and is currently under implementation, it provides funding to a wide array of community investments. None of these public funds committed to the underlying finance of the Energy II project, and none of the public funds contributed to the Community Development Carbon Fund to purchase emission reductions from the project, result in a diversion of official development assistance. All public funds are separate from and do not count towards financial obligations [in that respect][under the UNFCCC and Kyoto Protocol]."

Annex 3

THE LIST OF POTENTIAL PROJECT PARTICIPANTS

District Anenii Noi

District Basarabeasca

District Briceni

District Cahul

District Cantemir

District Călăraşi

District Căuşeni

District Cimişlia

District Criuleni

District Donduşeni

District Drochia

District Dubăsari

District Edineţ

District Făleşti

District Floreşti

District Glodeni

District Hînceşti

District Ialoveni

District Leova

District Nisporeni

District Ocniţa

District Orhei

District Rezina

District Rîşcani

District Sîngerei

District Soroca

District Străşeni

District Şoldăneşti

District Ştefan Vodă

District Taraclia

District Teleneşti

District Ungheni

UTA GĂGĂUZIA

Annex 4 PROJECT NPV CALCULATIONS

Fuel switching options	Building's type	Scenarios*	Total discounted (2007) cost over the crediting period, USD	Total annual costs, USD										Total PROJECT NET BENEFIT, in USD	
				2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	w/o CERs	with CERs
Coal - Gas	A	BSL	36,123	5557	5640	5725	5811	5898	5986	6076	6167	6260	6353	3,457	3,911
		PR	32,665	4749	4881	5020	5168	5324	5489	5664	5849	6045	6253		
	B	BSL	72,245	11113	11280	11449	11621	11795	11972	12152	12334	12519	12707	12,498	13,405
		PR	59,747	8603	8863	9138	9429	9738	10065	10411	10777	11165	11576		
	C	BSL	126,429	19448	19740	20036	20337	20642	20952	21266	21585	21909	22237	0	0
		PR	99,672	14273	14724	15203	15709	16246	16814	17416	18053	18729	19444		
Coal - Coal	A	BSL	36,123	5557	5640	5725	5811	5898	5986	6076	6167	6260	6353	-10,936	-10,668
		PR	47,058	6695	6919	7155	7406	7671	7952	8249	8564	8897	9250		
	B	BSL	72,245	11113	11280	11449	11621	11795	11972	12152	12334	12519	12707	-14,892	-14,357
		PR	87,137	12272	12715	13183	13680	14205	14762	15352	15976	16637	17338		
	C	BSL	126,429	19448	19740	20036	20337	20642	20952	21266	21585	21909	22237	0	0
		PR	145,161	20302	21072	21887	22751	23665	24635	25661	26749	27901	29122		
Coal - Biomass	A	BSL	36,123	5557	5640	5725	5811	5898	5986	6076	6167	6260	6353	-7,905	-7,281
		PR	44,028	6911	6975	7041	7108	7177	7248	7321	7396	7472	7551		
	B	BSL	72,245	11113	11280	11449	11621	11795	11972	12152	12334	12519	12707	940	2,189
		PR	71,305	11139	11256	11376	11499	11626	11756	11890	12027	12169	12314		
	C	BSL	126,429	19448	19740	20036	20337	20642	20952	21266	21585	21909	22237	11,416	13,602
		PR	115,013	17927	18126	18329	18539	18754	18975	19202	19436	19676	19922		
Gas - Gas	A	BSL	21,535	3313	3362	3413	3464	3516	3569	3622	3677	3732	3788	-11,131	-11,051
		PR	32,665	4749	4881	5020	5168	5324	5489	5664	5849	6045	6253		
	B	BSL	43,069	6625	6725	6826	6928	7032	7137	7244	7353	7463	7575	-16,678	-16,519
		PR	59,747	8603	8863	9138	9429	9738	10065	10411	10777	11165	11576		
	C	BSL	75,371	11594	11768	11945	12124	12306	12490	12678	12868	13061	13257	0	0
		PR	99,672	14273	14724	15203	15709	16246	16814	17416	18053	18729	19444		
For the whole project															

Total discounted baseline cost, USD	**8,158,362**	**547,976**	**1,390,490**	**1,411,347**	**1,432,517**	**1,454,005**	**1,475,815**	**1,497,952**	**1,520,422**	**1,543,228**	**1,566,376**	**-24,960**	**97,378****
Total discounted project cost, USD	**8,183,322**	**533,110**	**1,360,577**	**1,389,770**	**1,420,430**	**1,452,637**	**1,486,477**	**1,522,040**	**1,559,422**	**1,598,724**	**1,640,052**		

*BSL - Baseline scenario
*PR - Project scenario (taking into consideration conservation measures)
** The total discounted revenues which will be received from CDCF equal to S$ 122,338