

## IMPLEMENTATION COMPLETION MEMORANDUM (ICM)

### A. BASIC TRUST FUND INFORMATION

TF Name: GEF MSP-Moldova: Renewable Energy From Agricultural Waste

TF Number: TF055292

Task Team Leader Name/TF Managing Unit: Sandra Broka, ECSSD

TF Amount: US\$ 972,920

Recipient of TF funds: Recipient - Consolidated Agricultural Project Management Unit (CAPMU)

Type of TF: Free-standing

Single/Multi Donor: Single

Donor(s) Name(s): Global Environmental Facility

TF Program Source Code:

Purpose of TF (*Co-financing/Investment financing/ Debt Service/ Advisory Activities-Bank/Advisory Activities-Recipient, etc*):

TF Approval/IBTF Clearance Date: June 15, 2005

TF Activation Date: July 5, 2005

TF Closing Date(s): May 31, 2008

Date of ICM Submission to TFO: June 30, 2008

Cost and Financing Table (US\$):

<b>Cofinancier</b>	<b>Original</b>	<b>Actual</b>
GEF	972,920	972,920
Financial Intermediaries	219,388	61,071 <sup>1</sup>
Recipient	1,434,950	783,230 <sup>2</sup>
<b>Total</b>	<b>2,627,258</b>	<b>1,817,221</b>

### Rating Summary

<b>Category</b>	<b>Rating</b>
Overall TF Outcome	Satisfactory
Overall Risk to Development Outcome	Moderate
Bank Performance	Satisfactory
Recipient Performance	Satisfactory

### B. TRUST FUND DEVELOPMENT OBJECTIVES AND DESIGN

#### 1. Original (and Revised) Trust Fund Development Objectives

The objective of the Project, as stated in the GEF Project Brief was to “overcome barriers in updating its primary agricultural wastes (biomass) technologies by providing examples

<sup>1</sup> Investments in the baling machines through financial intermediaries.

<sup>2</sup> Includes tax exemptions by the Central Government; boiler room renovations and straw purchases over a period of 6 years by Local Authorities.

of best practice (demonstration plants) in the use of biomass fuelled energy systems as a viable alternative to fossil fuels and as a sustainable means of addressing the energy supply problems facing rural communities and agro-enterprises.”

In practical terms, the Project was to pilot the use of biomass-fuelled boilers in 8 – 10 selected sites as a viable alternative to gas, oil and coal, and as a sustainable means of addressing the energy supply problems faced by the country. The use of this technology was also to improve energy efficiency in heating systems, reduce greenhouse gas emissions by replacing fossil fuels, and decrease environmental pollution from unwanted biomass otherwise being burnt in the fields.

The Project objectives were not changed during implementation.

## **2. Original (and Revised) Trust Fund Activities/Components**

The project consisted of the following components:

### Part A: Biomass Energy Demonstration Units

(i) Provision of technical assistance to prepare technical specifications for the installation of demonstration sites through stakeholder consultation; (ii) supply and installation of boilers plants on a turn key basis; and (iii) training and capacity building in the operation and maintenance of equipment.

### Part B: Biomass production and Fuel Cycle Support

(i) Provision of technical assistance to prepare technical specifications for biomass bale production equipment purchase and establishment of adequate storage facility; (ii) provision of co-financing grants to enterprises willing to invest into biomass bale supply system; and (iii) provision of technical assistance and capacity building for all engaged stakeholders in developing sustainable biomass supply systems, including contracting arrangements, technical specifications, quality insurance, and training.

### Part C: Public Awareness, Outreach and Dissemination, and Information Barriers Removal

Provision of technical assistance to launch an intensive public information campaign in order to increase awareness of the rural population regarding usage of renewable energy and biomass in the country by using the local mass-media, regional and site workshops, seminars, panel discussions and providing a telephone hotline for this purpose.

### Part D: Project Management, Monitoring and Evaluation, and Audit

The project components were not changed during implementation.

## **3. Outcome Indicators**

- a) Demonstrated social and economic benefits from use of renewable energy, including decreased operating costs:

- (i) at least 30% lower fuel costs per unit of thermal energy generated for demonstration units;
  - (ii) service hours in the demonstration units maintained over the entire heating season (approx. 2,250 full load hours);
  - (iii) demonstrated operational efficiency of biomass boilers of 80% compared to less than 50% efficiency of existing coal boilers.
- b) Encouraged development of straw bale market by engaging additional 10 agro-enterprises in production, storage, and sale of straw bales by end of project.
- c) Improved global and local air quality by achieving annual emission reductions of 4258 tons of CO<sub>2e</sub> through greater efficiency and fuel switching from coal to straw biomass.

#### **4. Other Significant Changes in Trust Fund Design**

Project Extension and Reallocation of the Proceeds. Following a request from the Recipient, in September 2007 the grant closing date was extended until May 31, 2008, and a reallocation was made in the total amount of US\$22,469 from Category (2) "Consultants' services, including training and audit" to Category (1) "Goods". The need for extension of the closing date stemmed from the initial slow installation of the biomass boilers, when, as a result, only two such boilers operated the full heating season 2006-2007. Four more boilers were installed during spring 2007, and five more (including four small pilot boilers with the capacity of about 80kW) were installed in spring 2008. The extension of the grant allowed the boilers to operate a full heating season 2007-2008, providing additional information and a full data set for the benefit and impact evaluation purposes. The reallocation of proceeds stemmed from the need to design and pilot a boiler cleaning mechanism, to speed up the boiler cleaning in order to reduce the heating losses.

The Project progressed well, and there were no covenant-related issues and no outstanding audits for the project.

### **C. OUTCOME**

#### **1. Relevance of TF Objectives, Design and Implementation**

**Bank - High:** The Project provides a valuable contribution to the current debate on Climate Change, which is one of the most important priorities for the Bank not just in ECA Region, but also globally. The Project was designed at the outset of the Climate Change debate in the Bank, thus providing an innovative, easily replicable tool for emission reductions and slowing of Climate Change globally.

**Country - High:** In the ECA Region, Moldova is at the forefront of Climate Change debate, and it is also one of the poorest countries. Therefore, the introduction of new technologies by demonstration of carbon-neutral heating systems, which allows for operating cost savings, in particular for the public sector, and reduction of the carbon emissions, was a very important Project for Moldova.

The Project was prepared together with a CDCF-financed project, which attempted to mainstream the use of biomass boilers in public buildings (schools, kindergartens, medical offices, libraries, etc.) in rural areas. While the GEF pilot project has indeed generated lots of interest both from the public and private sector, installation of boilers is very slow, mainly due to the fairly high initial investment costs, which are prohibitively high for the public sector. With the availability of grant funding, the number of expected cases of fuel switch (coal to biomass, in particular), is high. The private sector has already started the adoption of boilers, and the adoption rate is expected to increase.

## **2. Achievement of TF Development Objective**

### **Achievement of Project Outcomes: Satisfactory**

The project piloted innovative carbon-neutral heating systems and created pre-conditions for mainstreaming these technologies on a much broader scale. By the end of the Project, it was able to set up and pilot the whole system of using biomass as alternative energy, including piloting of biomass boilers, standardization of boilers for use in Moldova, building the linkages between straw suppliers and boiler users, helping the straw suppliers to acquire the necessary baling equipment, as well as implementing a public awareness and PR campaign to popularize use of biomass as an alternative fuel. In addition, valuable lessons learned were obtained during this pilot, which will be made available in the country to potential users and financiers of such biomass heating systems.

a) Demonstrated social and economic benefits of renewable energy, including decreased operating costs. Biomass fuelled installations, which were run throughout the heating seasons in the public buildings participating in the Project, enabled heat regimes in accordance with the full normative requirements and within the allocated budgets. This contrasts sharply with fossil fuelled installations, which, due to the lack of available budget to fund the greatly increased fossil fuel costs, were run at much-reduced levels, well below the stipulated norms.

(i) Seventy percent (70%) lower fuel costs per unit of thermal energy generated for demonstration units. During a full heating season, provided the heating is ensured at the level of 100% of the needs, the cost reduction achieved by using straw vs. coal is 69.5%<sup>3</sup>:

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<sup>3</sup> However, it should be noted that the real savings from use of biomass boilers were much less, as the local authorities prior to the project, due to budget constraints, had only been able to purchase only 46% of the coal needed for heating during the season, so the temperature in the schools and kindergartens throughout the winter was below par.

	Unit	Annual consumption	Unit price, MDL	Total, MDL
Coal	tons	260	1,500*	390,000
Straw	tons	350	340	119,000
Savings				271,000
* The assumption of MDL1,500 (US\$143/ton equivalent) per ton of coal is used taking into consideration the local budget constraints, which does not permit purchase of high quality coal (cost US\$200/ton).				

Availability of high quality heat ensured. In addition to the cost saving, a major benefit of the boilers is consistent high quality heat due to the increased heat conversion ratio. The heating output was consistently at the required level of +22°C indoors, even at very low outside temperatures.

Delivery of a full education program ensured. The availability of the consistent heating in the school permits the school to deliver a full program of instruction to its students (in the past, during very cold winters the lessons would last only 15 minutes instead of the required 45 minutes, for a total of only about 2 hours of instruction per day).

(ii) Full operations of the launched boilers ensured. The first boiler, installed in January 2006 has operated full service hours every heating season, as well as three of the six demonstration units installed before the 2007-2008 heating season. Thus, the Project demonstrated that properly installed, tested and operated biomass boilers are a very reliable heating system. The other three boilers experienced problems, not related to reliability of the boilers: in one site, the straw suppliers could not supply the straw at all due to very severe drought of the summer 2007; in the other two sites the school heating system refurbishment was not finished until May 2008. By the Project closing, all issues have been resolved and the boilers are expected to work at 100% of capacity. The remaining four boilers were installed and tested in March 2008, and ready for the upcoming heating season. The monitoring of this indicator will continue during the next heating season (2008 – 2009).

(iii) Demonstrated operational efficiency of biomass boilers of 80% compared to less than 50% efficiency of existing coal boilers. As envisaged at appraisal, the data obtained from the demonstration units confirmed that the energy efficiency of the biomass boilers was 80 – 81%, compared to 40 - 50% efficiency of the coal operated boilers.

b) Eight agro-enterprises engaged in contractual relationships with the beneficiary local authorities. As expected at the project outset, the Project kick-started development of the straw market, and the participating agricultural enterprises received increased incomes from agricultural activity by selling the straw to the project beneficiaries on average at US\$ 30 per ton. By the Project closing, it had contributed to the production of about 1,500 metric tones of baled straw. Instead of being burnt on the fields, as happened

traditionally, baled straw is becoming a tradable commodity in the Project areas. The eight agro-enterprises signed the contracts with the local authorities in which the pilot boilers were located, ensuring long-term supply of straw in each pilot locality.

c) Emission reduction amounting to 1,561 tons of CO<sub>2</sub> achieved at the Project sites, mostly due to the slower than expected boiler installation rate. However, it is also expected that with the increased adoption rate the biomass-fuelled heating systems in Moldova, the resulting emission reductions will be significant.

### **Achievement of Component Outputs**

**Part A: Biomass Energy Demonstration Units** (Component Costs US\$ 826,801, of which GEF US\$ 587,365, and Government Co-financing of US\$ 239,435)

(i) Eleven biomass boilers (ranging from 80 kW to 600kW) with a total capacity of 2,720 kW were supplied and installed in public buildings (mostly schools and kindergartens) in selected rural communities on a turn-key basis. At the time of project preparation, it was expected that biomass boilers with a total capacity of 3,000 kW would be installed. At project closing, the total capacity of the boilers installed amounts to 91% of the expected, largely due to the decision made during project implementation to pilot a number of smaller boilers (up to 100 kW), which would be of particular interest to farmers and other private sector users for business and personal (housing) heating use. The work related to the supply and turn-key installation of the boilers included the following tasks: (a) dismantling the existing systems; (b) site and boiler design works; (c) construction works: preparation of the boiler rooms, and the connection of the building with the heating system; (d) upgrading of the heating systems for compatibility with biomass based system; and (e) supplying and installing of the new boiler plants.

(ii) Two local producers of biomass heating systems were identified and received manufacturing licenses, and the boilers were licensed for use in Moldova. Whereas the first boiler was procured in Ukraine from a company licensed by a Danish heating system maker, two local producers of biomass boilers had been identified through a tender process by the end of the Project. Both makers have been licensed by the Danish companies to manufacture a broad range of biomass boilers. As expected at the time of the project design, local production reduced the manufacturing costs - by about 20%. Since the project was the first to import straw-fueled boilers, it had to ensure standardization and licensing of the boilers for use in Moldova. A review of the legal framework (laws, regulations and standards) regulating the installation and operation of such boilers was carried out, the necessary amendments to the legislation were proposed, and all necessary licenses and permissions for the future application of the boilers (such as technical agreement, environmental review, etc.) were obtained for all boiler sizes.

(iii) Boiler cleaning mechanism designed. Although not originally envisaged under the project, with the installation of the first boilers it became clear that the cleaning of the boilers was prolonged - up to 20 minutes, resulting in significant loss of heat. A vacuum-based mechanism for boiler cleaning was designed under the project, which reduced the

boiler cleaning time to 3 – 5 minutes, depending on the size of the boiler. First three sites to install biomass boilers received the boiler cleaning mechanism; the other beneficiaries will obtain it from the local manufacturer at their own expense.

(iv) Demonstration unit staff is trained on maintenance and operation of the installations, and capacity created for providing follow-up training in future sites. All staff servicing the demonstration sites were trained in operation and maintenance of the boilers. For future purposes, the boiler manufacturers will provide the necessary instructions on boiler operation and maintenance.

**Part B: Biomass Production and Fuel Cycle Support** (Component Costs US\$ 646,232, of which GEF US\$ 120,132, and Government Co-financing of US\$ 526,100)

(i) Provided technical assistance in the preparation of a technical specification for biomass bale production equipment and grant funding for the purchase of the equipment. The project helped to ensure that all straw suppliers (agro-businesses) obtain adequate baling equipment. Where the agro-business decided to purchase new baling equipment, the project provided grant financing in the amount of 25% of the purchase price of the equipment. The project provided total grant funding in the amount of MDL191,000 (US\$18,190 equivalent) for purchase of six baling machines. Advice was provided to the local authorities, recipients of the boilers, on establishment of adequate storage facilities for the straw.

(ii) Provided technical assistance and capacity building for all engaged stakeholders in developing sustainable biomass supply systems, including contracting arrangements, technical specifications, quality insurance, and training. Under the Project long-term supply contracts (up to 7 years; the Project financed purchase of the straw for the first year) were signed between the local authorities where the boilers were installed and the straw suppliers. Both parties received technical assistance from the Project in forming these contractual relationships. In addition, the project offered a full integrated training program to the participating agro-enterprises on straw baling technologies: harvesting with minimal loss, storage and preservation, baling up and preparation for sale, etc.

**Part C: Public Awareness, Outreach and Dissemination, and Information Barriers Removal** (Component Costs US\$ 126,431, of which GEF US\$ 118,529, and Government Co-financing of US\$ 7,902)

The project has ensured a number of information dissemination and promotional activities:

- (i) Ran a series of seminars for local authority representatives and directors of schools, kindergartens and other public offices with a total outreach of about 350 persons;
- (ii) Produced and broadcasted four audio ads (2 social, on environment efficiency and 2 on economic efficiency in Romanian and Russian), four video ads (2 social, on

- environment efficiency and 2 on economic efficiency in Romanian and Russian), and a short documentary movie (15-20 min.);
- (iii) Designed and published information leaflets (20,000 copies) and promotional materials (calendars, handouts and brochures) for a wide dissemination;
  - (iv) Participated in several thematic exhibitions to disseminate the information about the biomass boilers.
  - (v) Developed and published 550 copies of a book “Biomass and Its Utilization for Energy Purposes” (in Romanian), which will be sent to local authorities, the National Agricultural Training and Consultancy Agency (ACSA), the Carbon Finance Unit (under the Ministry of Ecology), libraries and other organizations, which would be effective in disseminating the findings of the book to a broader audience;
  - (vi) Developed a website [www.biomass.md](http://www.biomass.md), which contains information on biomass boilers and use of biomass as an alternative fuel.

**Part D: Project Management, Monitoring and Evaluation and Audit** (Component Costs US\$ 156,687, of which GEF US\$ 146,894, and Government Co-financing of US\$ 9,793)

The Project Implementation Unit (CAPMU) ensured smooth implementation of the project activities, monitored achievement of the objectives and ascertained compliance with the Bank’s safeguard policies (financial management).

### **3. Efficiency**

All Trust Fund activities had been implemented by the end of the Project. Largely the activities were performed timely, with the exception of the identification and tender of the first local boiler maker, in order to start the manufacturing of the boilers locally and reduce the manufacturing costs. As a result the project experienced a delay of about 6 months between the import and installation of the first boiler and the start of manufacturing of the boilers locally. The Project did not exceed its overall costs. A small reallocation was required to finish the boiler installation works (contracted in local currency), mostly due to the weakening of the dollar. The key economic and financial benefits were achieved at the beneficiary level, and are significant, as described above in Section C, Part A, (iv)(a).

The Efficiency is rated **Satisfactory**, since the project has been fully, timely and efficiently implemented, with positive impact at the beneficiary level, while experiencing multiple changes in the project staff on both sides, as described below in Section E.

### **4. Development Impacts, including those that are Unintended/Unrelated to TF Objectives**

- (i) Increased awareness among the project stakeholders, local authorities, rural businesses and larger public of biomass heating systems through a range of dissemination measures as described above in Section C2. Although biomass heating systems are not



yet installed on any significant scale, the adoption rate is expected to increase. The installed boilers are often visited by interested private individuals, local authority and business representatives.

(ii) Increased expertise in the country in biomass heating systems. The Project worked with representatives of the scientific community, engineers, NGOs and public and private sector. As a result the knowledge and expertise in biomass-based heating systems has been disseminated.

(iii) Demonstrated that biomass is a sustainable, economical, and profitable fuel alternative to coal and gas. This is particularly important in the context of the country's fuel security. Being fully dependent on imports of gas and coal, the country is concerned about finding suitable fuel alternatives to reduce its dependence on external fuel resources.

(iv) Triggered interest of other donors in the positive social impacts in the communities where the biomass boilers were installed. Two donors, specifically, the Government of Japan and the Swedish International Development Agency (SIDA) are considering the possibilities to invest in biomass heating systems in rural communities.

(v) Banking sector increasingly looking for opportunities in the field of environment. With the increased awareness of Climate Change issues, environmentally friendly technologies and carbon benefits, the banking sector is increasingly seeking opportunities for involvement. For instance, one of the biomass boiler makers has arranged a loan and leasing product through one of the country's largest banks, to finance purchase of its boilers. The banking sector also financed the purchase of the boiler by the farmer, as mentioned above. As the banking sector becomes increasingly fluent with such products, financing of environmentally friendly technologies is expected to pick up (especially if the carbon benefit is applied).

(vi) Improved health of the rural population, resulting from higher quality and more consistent heating supply (in particular this refers to children attending the schools and kindergartens where the boilers were installed) and reduced pollution of air, as a result of switching from dirty fuel (coal) to the much cleaner biomass. Although to date the impact is not yet significant, it is expected to increase with the wider adoption of the biomass boilers.

## **5. Overall TF Outcome**

**Satisfactory (S):** The Grant achieved its development objectives, as discussed above. It demonstrated the social and economic benefits of renewable energy, including the decreased operating costs, identified local producers, which achieved production cost savings of 20% versus the imported boiler, commoditized straw into a tradable commodity, and improved the global and local air quality as a result of implementation of biomass demonstration systems by reducing the emissions by 1,561 tons of CO<sub>2e</sub> through greater efficiency and fuel switching from coal to straw biomass.

However, although the interest in the pilot results has been significant, the replication of these results to date has taken place on a very limited scale. The outlook for private sector investments in these heating systems, which have already started, is positive. The replicability for the public sector, where social benefits would also be achieved, is complicated by the high initial investment costs and financial restrictions placed on local authorities.

At the time of Project preparation, a results framework was not required. However, the project tracked a number of outcome indicators, as described in the Section C2 above. The baseline, which was not specifically provided in the Project preparation documents, in most cases was “zero” or “none”, since the Project focused on introduction of innovative technologies, which had not been used in the country before.

## **D. RISK TO DEVELOPMENT OUTCOME**

### **1. Follow-On Results and/or Investment Activities**

*Activity/Investment:*

\_\_\_\_\_ Recipient/Other Investment; \_\_\_\_\_ Grant Project/Program; \_\_\_\_\_ Bank Project;  
\_\_\_\_\_ IFC Financial Project/Activity, Other (explain)

The Project has not yet led to any follow-up activities stemming directly from the results of this pilot. However, the Project team has held discussions, and will continue to work on pursuing grant funding for scaling up the use of biomass boilers in the public buildings in rural communities (in the context of the on-going CDCF Project on Public Heating Systems in Moldova’s Rural Communities, which was prepared together with this MSP and scales up use of biomass boilers). Discussions have been held with the representatives of the Swedish International Development Agency (SIDA) and the Government of Japan, and this follow-up work will continue.

### **2. Replicability**

The Project results appear to be **Highly** Replicable. The Project piloted an innovative biomass-based alternative heating technology, which had not been previously used in the region. As already mentioned above, switching of the heating systems in the public sector buildings in Moldova is complicated due to the lack of funding from the central and/or local governments for these purposes (although the search for donor funding is continued). The private sector in Moldova has already started using these new technologies, and the rate of adoption is expected to increase. Similarly, these technologies are also increasingly used globally (for instance, in Mexico), even by very large businesses, thus the replicability of this technology is considered to be High. The lessons learned from the experience in Moldova are reflected in Section F below.

### 3. Overall Risk to Development Outcome

**Moderate:** As explained above, the sustainability aspect should be separated for private and public sectors. For the private sector, the expected sustainability is **High (H)**. Possibilities for use of such biomass boilers is wide – business purposes (heating of offices, greenhouses, etc), and also heating of residential buildings. With the increase in the boiler production volume and improved efficiency of the design achieved by one of the local boiler makers, the price of the boilers (in particular, the small boilers), is within reach of many potential private sector users.

For the public sector, where social benefits for local communities would also be achieved, as already mentioned above, the sustainability is burdened by the very high investment costs and financial restrictions placed on local authorities. Sustainability of the outcomes here depend on availability of grant funding (which the project team continues to seek), thus it is rated **Low (L)**. However, once the initial investment has been made through grant and/or some other available funding, the operation of the biomass boilers is cheaper, thus increasing the sustainability of this type of heating.

## E. PERFORMANCE

### 1. Bank

**Satisfactory:** The project's technical and institutional design, and the implementation arrangements, including those for procurement and financial management, were appropriate. The respective project requirements were outlined in the MSP Brief and Letter-Agreement in sufficient detail. During supervision, the project experienced three changes in TTLs, which explains some of the gaps in the filing of the supervision reports for the Project (although the second TTL was based in Moldova and followed up on project implementation on regular basis). Yet, the Project was implemented fully and required only one extension of five months. All implementation problems were identified and addressed timely and proactively. Advice to the Recipient and the follow-up on the agreed actions were adequate. The skill mix of the supervising team was adequate, as at all times it included an Environmental Expert. Financial Management supervision was performed regularly, and appropriate procurement-related advice was sought from the Procurement Staff. The Project complied with the applicable Bank's policies and procedures.

### 2. Recipient (for Recipient-executed TFs only)

**Satisfactory:** The Project was implemented by the Consolidated Agricultural Project Management Unit (CAPMU), which has gained solid experience and expertise through coordinating a number of World Bank projects. At all times CAPMU maintained the staff, skills and resources necessary to ensure successful implementation of the Project. The Project experienced one change in the Project Coordinator. The transfer took place

smoothly, as the Assistant to the Project Coordinator became the new Project Coordinator. The technical supervision, procurement and financial management capacity were ensured at all times and adequate.

## **F. LESSONS LEARNED / RECOMMENDATIONS**

The Lessons Learned and Recommendations below are mostly intended for the **Donors and Teams** considering similar follow-up operations:

(i) Careful selection of the Project sites. Site selection should be done carefully, as success of the project implementation largely hinges on the suitability of the selected sites. Use of experts (technical, social, environmental) is highly recommended. In order to become a participating local authority, in Moldova's project positive answers were to be obtained to the following key questions: whether the village was not expected to be fully connected to the gas pipeline during the next 3 – 5 years (there is an on-going gasification of the country); the readiness/enthusiasm of the community to participate in the Project; and whether the building was in satisfactory physical condition to retain heat and fully use the benefits of the higher quality heating. To become a straw supplier, the agro-enterprises had to meet the following criteria: have a stable production area of crops/cereals of minimum 300 Ha; have the necessary equipment or be willing to procure it (combine harvesters, tractors and baling equipment); interest in production and supply of biomass; and readiness to sign a long-term straw supply contract with local authorities.

(ii) Contractual arrangements between the local authority and the biomass supplier are critical. A well-constructed contract is needed to ensure a timely and predictable supply, and also to ensure that there are sufficient carry-over stocks. The 2007 drought constrained biomass availability (directly linked to wheat yields) in one of the Project sites. The contracts contained, in addition to the responsibilities and obligations of both parties, also mutual guarantees for both parties.

(iii) Finished heating system refurbishment in the premises/buildings where the boilers will be installed is a critical pre-condition in order to ensure efficient use of the boilers. In one of the project sites, the director of the school was overoptimistic about receiving the funding for the renovation of the building's heating system, and in the other case the organization refurbishing the heating system in the school did not implement the works according to the design, thus leading to losses of heat. The boilers were installed in these sites, but did not operate for one season due to the issues related to the building heating system refurbishment. The issues were only resolved towards the end of the Project.

(iv) Training/technical assistance to the contract signing parties is very important. Both parties benefit from a reminder on contract sanctity; training should be done for beneficiaries on straw storage, and on straw baling technologies: harvesting with minimal loss, storage and preservation, baling up and preparation for sale, etc, for the straw supplier. Also, the beneficiaries should be explained the impact of the climatic conditions on the quality of the straw (in particular, the moisture content, which makes the bales

lighter/heavier than specified), and the heat conversion ratios of the various types of biomass. Regarding the latter, the Project had the following findings:

Biomass	Top congestion temperature, MJ/kg dry mass
Lucerne stalks	18.4
Hazel nut shells	18.0
Sunflower seed hull	16.1
Sunflower stalks	21.8
Nut shells	21.1
Vegetable waste	12.6
Wheat straw	18.0
Wheat stalks	16.0
Corn cobs	17.4
Tobacco stalks (7% humidity)	16.4
Grapevine (7% humidity)	16.5

The following Lesson Learned/Recommendation is for **Governments/Recipients**:

(i) Benefits and incentives to the private and commercial sector need to be considered in order to stimulate investments in carbon-neutral technologies. Such incentives could include tax, carbon values and financing incentives to be available for this market so as to increase affordability and stimulate demand for such technologies.

## **G. ICM PROCESSING AND COMMENTS**

### 1. Preparation

TTL at Approval: Samir Suleymanov, ECSSD

TTL at Closing: Sandra Broka, ECSSD

Comment of TTL at Closing:

Prepared by (if other than TTL):

Date Submitted to Approving Manager: June 26, 2008

### 2. Approval

Manager:

Date Approved by Manager:

Manager's Comment:

### 3. TFO Evaluation of ICM Quality

TFO Reviewer:

TFO Rating on the Quality of ICM (*Satisfactory or Unsatisfactory*):

Comment and Justification for Rating Given by TFO: