



**Monitoring report form  
(Version 04.0)**

*Complete this form in accordance with the Attachment "Instructions for filling out the monitoring report form" at the end of this form.*

**MONITORING REPORT**

<b>Title of the project activity</b>	<b>Efficient Fuel Wood Cooking Stoves Project in Foothills and Plains of Central Region of Nepal</b>
<b>Reference number of the project activity</b>	756
<b>Version number of the monitoring report</b>	1
<b>Completion date of the monitoring report</b>	30/06/2015
<b>Registration date of the project activity</b>	06/02/2012
<b>Monitoring period number and duration of this monitoring period</b>	Monitoring period number: 1 Duration of this monitoring period: 01/05/2011–30/04/2014.
<b>Project participant(s)</b>	Centre for Rural Technology, Nepal – Host country Egluro – Annex I country
<b>Host Party(ies)</b>	NEPAL
<b>Sectoral scope and selected methodology(ies), and where applicable, applied standardized baseline(s)</b>	Sectoral scope: 3 : Energy demand Applied methodology: AMS-II.G ver.2 – Energy efficiency measures in thermal applications on non-renewable biomass
<b>Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD</b>	83,219tCO <sub>2</sub> e
<b>Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period</b>	39,672 tCO <sub>2</sub> e
<b>Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period up to 31 December 2012(if applicable)</b>	12,619 tCO <sub>2</sub> e
<b>Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period from 1 January 2013 onwards (if applicable).</b>	27,053 tCO <sub>2</sub> e
<b>Year wise GHG emission reductions:</b>	

01/05/2011 to 31/12/2011	1663.00 tCO <sub>2</sub> e
01/01/2012 to 31/12/2012	10956.00 tCO <sub>2</sub> e
01/01/2013 to 31/12/2013	20267.00 tCO <sub>2</sub> e
01/01/2014 to 30/04/2014	6786.00 tCO <sub>2</sub> e
<b>Total</b>	<b>39,672.00 tCO<sub>2</sub>e</b>

## SECTION A. Description of project activity

### A.1. Purpose and general description of project activity

The purpose of the proposed project is to reduce fuel consumption by introducing fuel efficient cooking stoves in six Terai districts namely: Parsa, Bara, Rautahat, Sarlahi, Mahottari, and Dhanusa of Central Development Region of Nepal. It is expected that the project will contribute towards checking deforestation and degradation of forests in the Terai region through wider and voluntary participation of the people in adopting fuel efficient stoves. This will also contribute to improvement in quality of lives of the targeted people through reduction of drudgery, time and money spent on fuel wood collection and through improvement of indoor environment. Globally, the project will contribute by reducing emission of GHG in the atmosphere.

The project activity has disseminated basically two models of fuel efficient cooking stoves. The first one is the built-on-site model mud stove and the second one is prefabricated metal rocket stove.

**(i) Built-on-site model:** This is the two pot hole mud-brick stove with chimney which is built on site inside the kitchen of the user household. The choice of the type and size (dimension) of stove depends on the use and family size of the house. The model to be promoted is the improved version of the similar model being promoted in the mid-hill areas by the Biomass Energy component of Energy Sector Assistance Programme under the Alternative Energy Promotion Centre and other projects. The improvement in this model is addition of better insulation and heat retaining device in the combustion chamber, decreased mass of the stove and reduced chimney height. The improvement provides better heat transfer to the cooking pots and reduces overall cooking time. The improvement also provides consistency in design and dimension. The two pot hole model provides two items of cooking at a time and reduces overall cooking time.

The ranges of dimensions of the ICS are given in the table below.

Type	Dimension range in inches						
	Φ 1 <sup>st</sup> PH	Φ 2 <sup>nd</sup> PH	Length	Breadth	Height	Fire gate	Chimney
2 PH raised ICS	8-10	6-8	25-31	14-18	10-12	6-8	20-24
2 PH plain ICS	8-10	6-8	25-31	14-18	10-12	6-8	20-24

There is some demand for 1 and 3 pothole stoves but significant demand is not expected. The experiences from the national ICS programme of AEPC and Chitawan ICS Carbon Project show that users in general prefer 2 pothole stoves. Nonetheless, in order to maximize benefits of the project, technical support will be extended to construct 1 and 3 pothole stoves but there will be no financial support for them, and hence they will not be taken into account in calculating emission reductions.

**(ii) Prefabricated model:** The project also promote few pre-fabricated model, a modified version of mud/metal rocket stove to suit the local cooking practices, needs and preferences of different ethnic groups and communities in the project districts.

Both these stoves models serve all the requirements like cooking, heating, frying, baking bread and boiling water as in the traditional stoves. These stoves have been improved recently by CRT/N

to meet the requirements of the people living in the Terai region of Nepal. If well maintained the life of the stove is 3-5 years. However, to avoid any reduction in efficiency, the users will replace the stoves with new ones after using for 3 years and will be recorded and monitored by the project staffs.

A fuel efficient stove saves fuel wood in the range of 30-50% as compared to the traditional stoves and hence reduces the greenhouse gas emissions through the reduced amount of fuel wood use from the non renewable biomass.

**A.2. Location of project activity**

Host Party: NEPAL

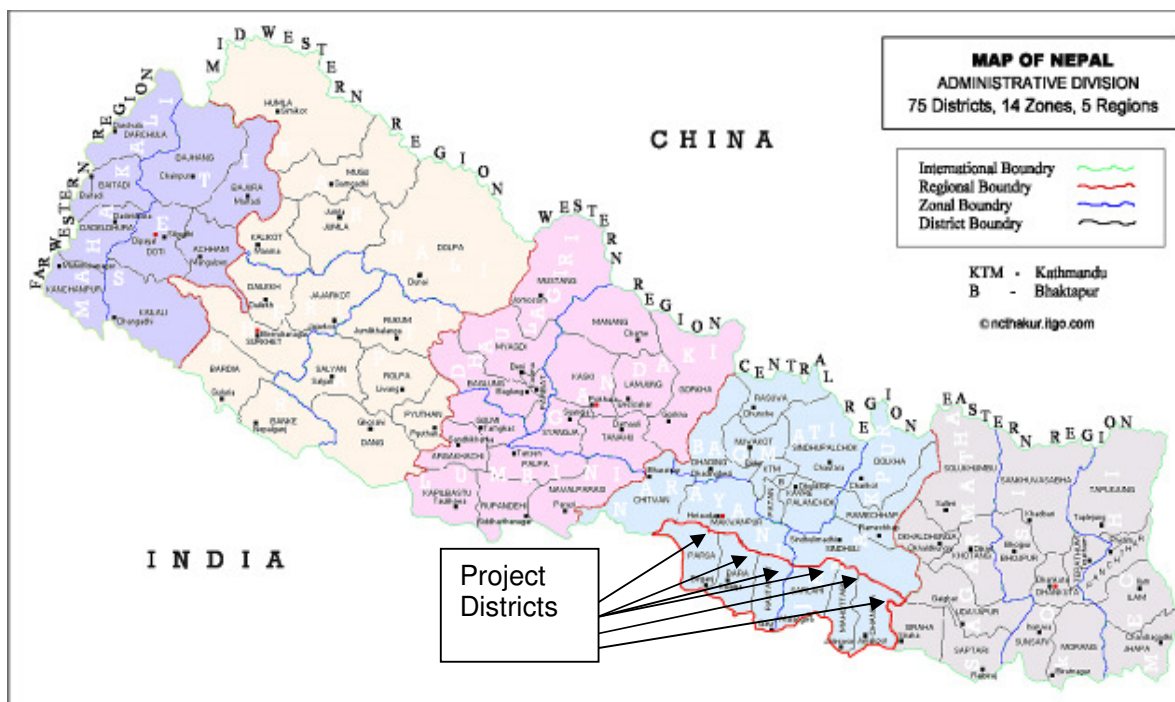
Project Location: The project is located in the foothills and plain areas in the Central Development Region of Nepal. The project area includes six districts, namely: Bara, Parsa, Rautahat, Sarlahi, Mahottari and Dhanusa lying within 26038'00"-27030'00" north latitude and 84022'00"-86014'00" east longitude.

City/Town/Community: The project has been implemented in 120 Village Development Committees (VDCs) 7 of the six districts mentioned above. This includes rural communities as well as semi urban areas in the VDCs.

The project is located in central region of Nepal and the districts included are: Parsa, Bara, Rautahat, Sarlahi, Mahottari and Dhanusha.

The project communities are located within 20 Village Development Committees (VDCs) of each of the mentioned districts. Generally, the project VDCs are located in the northern part of the districts along the east-west highway.

Physical/Geographic Location:



**A.3. Parties and project participant(s)**

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Party A NEPAL (host)	Private entity A Centre for Rural Technology, Nepal	No
Party B (UNITED KINGDOM)	Private entity B Egluro Limited ( Project Investor)	No
...	...	

**A.4. Reference of applied methodology and standardized baseline**

Sectoral scope: 3 : Energy demand

Type II – Energy efficiency improvement projects

Applied methodology: AMS-II.G ver.2 – Energy efficiency measures in thermal applications on non-renewable biomass

Tools: UNFCCC Additionality Tool (Version 05.2, EB 39)

Standardized Baseline: Refer to the UNFCCC CDM website

**A.5. Crediting period of project activity**

Type of crediting period: Fixed crediting period

Start date of the crediting period: 01/05/2011

Length of crediting period corresponding to this monitoring period: 10 years

**A.6. Contact information of responsible persons/ entities**

Organization:	Centre for Rural Technology, Nepal
Street/P.O.Box:	P.O.Box 3628
Building:	N/A
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State/Region:	Kathmandu
Postfix/ZIP:	N/A
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E-Mail:	<a href="mailto:info@crtnepal.org">info@crtnepal.org</a>
URL:	<a href="http://www.crtnepal.org">www.crtnepal.org</a>
Represented by:	Ganesh Ram Shrestha
Title:	Executive Director
Salutation:	Mr.

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State/Region:	Hertfordshire
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## SECTION B. Implementation of project activity

### B.1. Description of implemented registered project activity

The project activity involves fabrication of ceramic combustion chambers by local potters and fabrication of mud bricks and installation of stoves at the user households by promoters.

The project activity began from October 2010 but the stoves were installed/sold from March 2011 and the ER calculation started only from 01/05/2011 as mentioned in the UNFCCC website.

Till 30/04/2014, a total of 14,872stoves have been installed. The month-wise installation of stoves is as given below.

Month	Number of households having installed the stoves
Apr-11	357
May-11	407
June-11	428
Jul-11	326
Aug-11	372
Sep-11	384
Oct-11	446

Nov-11	707
Dec-11	774
Jan-12	414
Feb-12	526
Mar-12	549
Apr-12	629
May-12	1151
June-12	792
Jul-12	275
Aug-12	467
Sep-12	1188
Oct-12	1581
Nov-12	1237
Dec-12	1361
Jan-13	431
Feb-13	0
Mar-13	13
April-13	5
May -13	6
June-13	46
Total	14,872

The project activities have been implemented in 112 Village Development Committees in the six project districts by 30 April 2014.

It has been reported that 100% of the stoves (APTEC Survey Report 2012) and 97% stoves installed so far are in continued operation (APTEC Survey Report 2014).

As per PDD, once the stoves implemented by the project are installed, the users are expected to dismantle the old traditional stoves. As per 2012 survey out of the total samples of 70 households with fuel efficient stoves, 55 households (78.6%) dismantled traditional stoves and 15 households (21.4%) have not dismantled old stoves. As per 2014 survey 45 households (66.1%) dismantled old traditional stoves and 23 households surveyed (33.9%) have not dismantled the traditional stoves. Some of the surveyed households kept the old stoves intact but they do not use it. The reasons for keeping the old stoves were mainly to use these stoves once in a while in special occasions like when they felt like cooking Roti (bread) for farm labourers sometimes or for cooking animal feed using agricultural residues that they have or during festivals. (APTEC Survey 2012 and 2014). This implies all the installed stoves are in operation

As per the PDD, the project can promote two types of stoves. They are:

**(i) Built-on-site model:** This is the two pot hole mud-brick stove with chimney which is built on site inside the kitchen of the user household. The choice of the type and size (dimension) of stove depends on the use and family size of the house; and

**(ii) Prefabricated model:** This is a modified version of mud/metal rocket stove to suit the local cooking practices, needs and preferences of different ethnic groups and communities in the project districts.

During the monitoring period (01/05/2011 – 30/04/2014), the project has promoted mainly the built-on-site model and only 38 pre-fabricated model.

During the monitoring period (01/05/2011 – 30/04/2014), the total GHG emission reductions achieved is **39,672 tCO<sub>2</sub>e** which also accounts leakage.

## **B.2. Post registration changes**

### **B.2.1. Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline**

>> As per the registered PDD Section B.7.1 (Data and parameters monitored) a monitoring survey of the Efficiency of the fuel efficient appliance ( $\eta_{new}$ ) has to be conducted annually for a sample of 68 cook stoves. The registered PDD further states in the same Section B.7.1, that the Parameters *Type of stove displaced/dismantled ( $D_n$ )* and *Percent of user households who are continuously using the stoves ( $U_Y$ )* are to be monitored during this survey, i.e. also annually. Accordingly, the monitoring survey should have been conducted during the period of 2011-2012, 2012-2013, 2013-2014. However for reasons mentioned below, the first field testing activity was conducted in September 2012 and the second field testing activity was conducted in June 2014. This implies that the parameters Efficiency of the fuel efficient appliance ( $\eta_{new}$ ), stove emission and Percent of user households who are continuously using the stoves ( $U_Y$ ) and cross checking for Type of stove displaced/dismantled ( $D_n$ ), has been less than annual.

The first field testing activity was conducted in September 2012 and the second field testing activity was conducted in June 2014. In consequence, the monitoring frequency for the parameters *Efficiency of the fuel efficient appliance ( $\eta_{new}$ )*, *Type of stove displaced/dismantled ( $D_n$ )* and *Percent of user households who are continuously using the stoves ( $U_Y$ )* has been less than annual.

#### Justification

The temporary deviation from the monitoring plan is necessary to the following reasons that are outside the project proponent's control:

First, the project proponent responsible for the implementation of the project continuously faced the challenges of smooth stove dissemination due to the ethnic issues visibly surfaced in the aftermath of the Constituency Assembly election. The post Constituency Assembly election phase also saw some underground outfits causing sporadic violence and threats in the project districts which led to delays in the efficient stove dissemination and sales. So the project proponent decided to wait until June 2012 to hire external consultant for monitoring instead of doing it in April/May 2012 so that by that time there is a sizeable quantity of stoves disseminated. However with the onset of monsoon that started in mid-June the external monitoring had to be postponed until the end of monsoon that is September 2012. Normally during monsoon period field activities are not undertaken by external consultants because of heavy rainfall and the difficulty in field travel.

Secondly, there are very few trained people/ organisation/ consultants available with trained people to deliver technical testing of stoves which has been a constraint for timely monitoring. This is evident from the fact that the Project proponent hired Dept. of Mechanical Engineering of Kathmandu University to perform the stove testing as well as emission testing (CO and PM 2.5) as per the PDD. Please note that the parameter *Stove Emissions (CO and PM 2.5)* is necessary to satisfy the parallel Gold Standard certification only, therefore no approval for a temporary deviation is sought for this parameter here. Yet, the stove emissions test did have a profound impact on the general monitoring schedule as it requires specific, calibrated and portable equipment that was not available in Nepal. The consultant could not get appropriate instruments for emission testing and eventually abandoned the emission testing, and only submitted the stove test report in October 2012. This emission testing activity was carried out by another consultant only in September 2013.

So, one of the monitoring parameter that was planned to be carried out in September 2012 was possible doing only one year after that is September 2013. The second year monitoring that should have been carried out in April/May 2013 was carried out in June 2014 only, because the project proponent in the mean time was in the process of getting emission testing equipment from Approvecho Research Centre US with the support from Global Alliance for Clean Cookstoves for another project. The project proponent waited until September and the instrument arrived in early September and the earlier backlog of emission testing was performed.

Lastly, the project proponent was faced with further, extraordinary difficulties to carry out the 2013 field testing activities on time. A testing event to monitor the required sample of 68 stoves takes about 6 weeks, as each test requires almost a full working day, including the time to travel to the project sites. The road infrastructure in the project region is largely insufficient and access to the project sites is particularly difficult or even impossible during the monsoon season (June to September). Movement within the project areas can also be severely hampered by frequent, politically motivated strikes on a local, regional or national level called *bandh*. The situation deteriorated significantly in the months leading up to the Nepalese Constituency Assembly elections in November 2013. The level of insecurity for field activities for external consultants required to defer the planned stove testing activity in September/ October 2013. Eventually, the second monitoring campaign was carried out in June/July 2014.

Parameter  $\eta_{new}$  is directly related to the calculation of CERs. The values for the parameter measured during the monitoring survey are as follows:

Year	Stove efficiency ( $\eta_{new}$ )
September 2012	27.94%
June 2014	28.33%
Ex-ante value	28.72%

It is observed that the efficiency in June 2014 survey report conducted by APTEC Consultancy is higher than the efficiency in September 2012 survey conducted by Mechanical Department of KU. This is due to the following reasons:

- a) Sample households are different.
- b) The survey was conducted at different time of the year. The test in 2014 was conducted in the start of rainy season (mid June to mid July) where as the 2012 efficiency test was conducted in the end of the rainy season (end of August to mid of September).

Inline to the registered monitoring plan, the ex-post monitoring value of stove efficiency is to be compared with the ex-ante value and the conservative value is to be used for CER calculation. On the basis of conservativeness, ex-post monitoring value of 27.94% (September 2012 Survey) has been used for the CER calculation for the verification period of 01 May 2011 to 30 April 2014.

Year	Percentage of user households who are continuously using fuel efficient stoves ( $U_y$ )
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2012	100%
2014	97%

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r Percentage of user households who are continuously using fuel efficient stoves (Uy), those project activity households who used the stoves for 3 or less months in a year are discarded from calculation of emission reduction. Since the ex-post monitoring value is used, it is more likely to add conservativeness in ER calculation as it is assumed that as the stove approaches its effective lifetime, there is a bigger chance of stoves not being used. This is observed and concluded from the survey result:

Thus, for conservativeness, the total number of project activity stoves operating from October 2013 to March 2014 has been adjusted by the actual survey value of 97% for the emission reduction calculation. In addition 1% of the project stove has been considered as non-functioning stoves for the entire crediting period and has been deducted in the CER calculations.

Dn - type and number of stoves dismantled is not directly related to the calculation of CERs. The new efficient stoves are built or installed only after the traditional stoves are displaced or dismantled. This is evident from stove database 2012 as maintained by CRT/N and Monitoring Survey Report October 2012 and July 2014, APTEC Consultancy that 78.6% and 66.1% of households dismantled the old cook-stoves respectively whereas 21.4% and 33.9% households, though not dismantled old cook stoves, are only using them in special occasions (APTEC 2012, 2014). The dismantled old stoves cannot be reused or transferred as they are made of mud and stone or mud and bricks. Thus, there is no leakage due to transfer of old stoves to another location.

#### **B.2.2. Corrections**

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No correction has been requested.

#### **B.2.3. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline**

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No permanent changes in the monitoring plan or applied methodologies have been made.

#### **B.2.4. Changes to project design of registered project activity**

No change in project activity is proposed.

**B.2.5. Changes to start date of crediting period**

No change in start date of crediting period is proposed.

**B.2.6. Types of changes specific to afforestation or reforestation project activity**

Not applicable

**SECTION C. Description of monitoring system**

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The purpose of the monitoring plan is to ensure successful monitoring of the emission reductions of the proposed project during its crediting period. The overall monitoring is managed by the project implementer Centre for Rural Technology, Nepal (CRT/N).

The project implementation started in October 2010 after setting up of the Project Team and after the validation process. The Project Team identified local partner organisations (LPOs) and involved them in social mobilization. Together with the LPOs, the Technical Officer (TO) identified and trained stove builders (promoters) for the fixed type of stove. In the mean time, the TO together with LPOs identified manufacturer and retailers for the portable stove. Thus stove dissemination kicked off after the training of promoters and identification of fabricators of portable stoves. The trained promoters then installed the fuel efficient stoves in individual households in the project area based on demand from the users. Portable stoves are fabricated in the local workshops. The local workshops were initially trained by the project team for quality assurance of the product.

Demand for stoves is created through vigorous awareness, publicity campaign, promotion and marketing, orientation and demonstration through the existing local network of community based organizations and the network of promoters.

The monitoring which is a continuous inbuilt process in the project has monitoring plan implemented in full fledges after the stoves started to be disseminated in the project area. The Project Manager acts as a field CDM monitoring officer.

**Stove installations**

The information on installation of fixed type stoves is first reported by the promoters in monthly meeting at field level. The promoters use installation data format and is substantiated by ER transfer slip signed by the users.

The LPO staff and Technical Officer verify the data and compile monthly installation data which is passed on to the Project Manager or the Regional Manager based in Sarlahi district which is centrally located.

Computer data entry of all the fuel efficient stove installed/sold is made on monthly basis by the Project Manager or the Regional Manager. Besides, all monitored data and information are stored both on paper and electronically by the Project Manager (Regional Manager). A copy of the papers and the electronic database is sent to CRT/N central office in Kathmandu every month.

**Confirm dismantling of old stoves**

Fuel efficient stoves are installed/sold only when the existing traditional stoves are dismantled. Dismantling/scraping of old stoves as well as installation of new stoves were monitored by project team. Dismantling and scraping is also reflected in the Emission Reduction Transfer Slip (an agreement between household owner and CRT/N confirming stove installation and ER transfer). This is also spot checked during the regular monitoring visits by the project team and local Partner.

## CDM-MR-FORM

The physical spot check by the district-based project staff and LPO staff ( up to 50%), by the Regional Manager ( up to 10%) and by the CRT/N central staff ( up to 5%) will ensure quality of new stoves as well as the old stoves have been dismantled and not in use. Moreover, the LPO staff will be in regular contact/communication to ensure regular use of new stoves. The LPO staffs spot check the user households of portable stoves immediately as they are reported to have purchased the stoves. The old fixed type stoves are dismantled and old portable type stoves are collected and destroyed periodically. All the data and information of the stoves dismantled/scrapped will be recorded in the spreadsheet to ensure stoves are dismantled properly and replaced by new stove. In addition, sample survey by a third party will also verify non-use of old stoves. During this verification the number of stoves dismantled/scrapped shall be verified through monthly installation reports archived both in electronic and hard copy versions. The database of installation/sales also contains information on number and type of old stoves dismantled/scrapped. The stoves that replace the old stoves are the fuel efficient stoves which are disseminated under the project. This is verifiable as each new fuel efficient stove will have a unique 10-digit identification number tag which identifies district, VDC, promoter/retailer, and the user. The coding scheme is as below:

District	VDC	Promoter/Retailer	User Serial
1 to 6	01 to 20	001 to ...	0001 to ...

District code (single digit) ranges from 1 to 6. VDC code (two digits) in each district will range from 01 to 20. Promoter/retailer code (three digits) in each district begins from 001 and may reach up to 999. Users served by each promoter/retailer are assigned four digit number starting from 0001. A combination of all such components will generate a unique 10 digit code for each stove as shown in the sample code below:

District	VDC	Promoter/Retailer	User Serial
1	02	001	0015

The unique code is thus 1020010015. The letter 'F' and 'P' will be added at the end of the code to distinguish between fixed type or portable type stove. The same unique ID code number is maintained for the same user after replacement with the dismantling of the stove. There might be some cases where the users have migrated out of the village, in such case the new user provided with a new stove and same stove ID code of the previous stove user will be applied so that the total number of stoves will remain the same. Further, there may be some users not willing to install new stoves will be removed from the user data base and their stove ID will be used for new users.

### Sample size and determination of sample households

As under the CDM only emission reductions that are monitored and verified can be claimed, therefore, the independent survey applying systematic sampling process will be carried out before each verification (See sampling plan Annex3F and monitoring information Annex 4). This will incorporate monitoring parameters like the survey for sample households to cross check the performance of stoves installed, percentage of stoves in use, measurement for CO and PM<sub>2.5</sub>, percentage of stoves in use. The survey will also ensure that stoves are all operating at the specified efficiency and where replacements are made the efficiency of the replaced stoves is similar to the stove being replaced.

With the estimated total number of households of 22920 having fuel efficient stoves and every household shall have one stove only (either fixed type or portable type stove); the statistically appropriate sample required for survey will be 68 for the confidence level of 90% and a confidence interval of +/-10%. Since variance of the parameter is not known a priori, the preferred formula is that used for estimating sample size for proportions given below:

$$n = \frac{Z^2 pq}{e^2}$$

where,

$n$  ~ sample size

$Z$  ~ is the corresponding abscissa of the normal curve for 90% confidence level (1.645)

$p$  and  $q$  ~ estimated proportion of attribute, conservative value of 0.5, 0.5 has been taken.

$e$  ~ desired level of precision, 10%

The sample size may differ for the survey conducted later on as variance value from the first survey could be used to estimate sample size. Please refer Sampling Plan Documentation Annex 3F. The monitoring data and information is archived for at least 2 years after the end of actual crediting period or the last issuance of CERs for the project activity whichever comes later.

The sample survey is conducted once a year. The sample households will be selected following systematic sampling approach. The stove user households will be arranged by corresponding LPOs then by year of installation then by promoter. This will ensure selection of user households served by all LPOs, possibly all promoters and having stoves of different age.

### **Efficiency tests, equipments and measurements**

The efficiency test of stoves is done every year to determine mean efficiency of the stoves in use. Technical testing is done following stove testing protocol developed by University of California, Berkeley and The Shell Foundation. Only the digital thermometer and digital weighing machine will be used to take the measurements. These equipments are calibrated by the manufacturer. If the equipments in use require maintenance/calibration they will be replaced by new similar equipments.

Likewise in order to determine mean emission level during winter and summer seasons, measurement of stove emissions (CO and  $PM_{2.5}$ ) will be taken on six monthly basis. Measurement will be taken using HOBO and UCB Particle Monitor or the equivalent instrument available following standard guidelines of the manufacturer. These equipments are calibrated by the manufacturer. If equipments need calibration, they will be sent to the manufacturer. Since the calibrated HOBO and UCB Particle Monitor or the equivalent instrument was not available the emission measurement was carried out on annual basis only when the instruments were available. The earlier tests performed by Energy Sector Assistance Programme has reported that there is negligible seasonal variation.

### **Quality Assurance**

CRT/N central office cross checks the database through its Carbon Analyst and Technical Expert to ensure compliance with the CDM project monitoring plan. The central office team will visit the project area on quarterly basis to have random spot checks of up to 5% of stoves in the database entry. The Project (Regional) Manager makes spot checks of up to 10% of the stoves and will take appropriate corrective actions for any inconsistencies. Altogether up to 50% of the efficient stove installed/sold is spot-checked by the project and partner staff including promoter to ensure the quality and if required necessary corrective measures are taken during the visit. The spot check by LPOs/TO will also see whether the dismantled/scrapped stoves are being used outside the project area. At the end of every month, the TO sends the physical progress of stove installation/ sales or replacement to the Project (Regional) Manager along with the users' ER transfer slip.

CRT/N central office employs independent third party for sample survey as part of the monitoring plan. The activities of independent third party include:

- Identification of the households that are randomly selected based on the sampling plan.
- Ex-post collection of data on Fuel efficient stoves disseminated, fuel efficient stove replaced biomass use in project area and outside the project area, stoves in operation and use and the efficiency of stove.<sup>1</sup>

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<sup>1</sup> Please refer Annex 3G for sampling plan

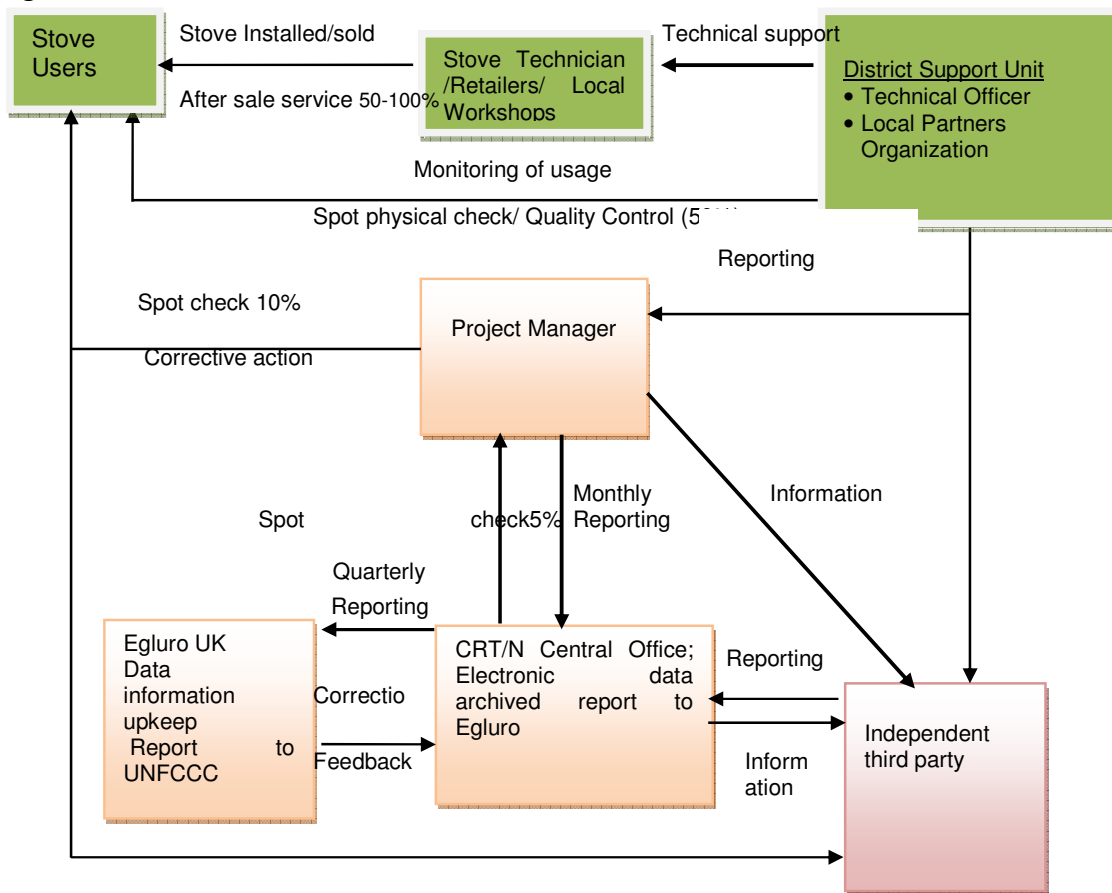
CRT/N produces quarterly report and annual monitoring report and submits to Egluro. Egluro assists CRT/N in implementation and monitoring of the project and coordinates with Designated Operational Entity (DOE) and the UNFCCC.

**Data archiving**

All data monitored and required for verification and issuance will be stored for 2 years after the end of the actual crediting period or the last issuance of CERs for the project activity, whichever comes later.

**The organization of the project monitoring is as follows:**

**Fig: IV**



Sample survey and stove test for stove /biomass usage and check for leakage

## SECTION D. Data and parameters

### D.1. Data and parameters fixed ex ante or at renewal of crediting period

(Copy this table for each piece of data and parameter.)

<b>Data / Parameter:</b>	$B_y$
Unit:	Tonnes/year
Description:	Quantity of woody biomass used in the absence of project activity per household (in tonnes)
Source of data:	Baseline Survey Final Report,, October 2009 (See Annex 3A, 3B of PDD) The sample size of 477 households(n) was determined on the basis of 90/10 precision along with the margin of error 5% and the formulae used was $n=Z^2 \times S^2/d^2$ where n is sample size, s is standard deviation, z is corresponding abscissa of the normal curve for 90% confidence level and d is margin of error. The values for s and d were taken from the baseline survey conducted by Winrock International for Chitawan ICS Carbon project. The total number of households in the 6 project districts covering a total of 120 VDCs is 188291.
Value(s) applied:	2.7 tonnes/year
Purpose of data:	As per AMS-II.G ver2, the data is directly used to estimate emission reductions for the project activity.
Additional comment:	The quantity of biomass used per month will be obtained by dividing the biomass used per year by 12.

<b>Data / Parameter:</b>	$\eta_{old}$
Unit:	Fraction
Description:	Efficiency of the system being replaced
Source of data:	1) UNFCCC default value from Methodology II.G/ Version 02 'Energy Efficiency Measures in Thermal Application of Non-Renewable Biomass, EB 51 Annex 04 December 2009.
Value(s) applied:	0.10
Purpose of data:	As per AMS-II.G ver2, the data is directly used to estimate emission reductions for the project activity.
Additional comment:	2) Douglas F. Barnes, Kirk R. Smith et al (1994), What Makes People Cook with Improved Biomass Stoves, World Bank Technical Paper No 242. <a href="http://ehs.sph.berkeley.edu/krsmith/publications/94_barnes_1.pdf">http://ehs.sph.berkeley.edu/krsmith/publications/94_barnes_1.pdf</a> (p.4) 3) K.M Sulpiya, "Stoves used for cooking, water heating and space heating in Nepal used in Nepal, Boiling Point Issue 38 (1997). The efficiency of the traditional stove measured from the water boiling and cooking test conducted in Jumla was reported as 8.9% <a href="http://www.hedon.info/StovesUsedForCookingWaterHeatingAndSpaceHeatingAtHighAltitudeInNepal">http://www.hedon.info/StovesUsedForCookingWaterHeatingAndSpaceHeatingAtHighAltitudeInNepal</a> (efficiency table)

<b>Data / Parameter:</b>	$H_{\text{new}}$
Unit:	Fraction
Description:	Efficiency of the system being deployed as part of the project activity
Source of data:	Water Boiling Test carried out by professionals from Kathmandu University part of third party monitoring.
Value(s) applied:	0.2794
Purpose of data:	As per AMS-II.G ver2, the data is directly used to estimate emission reductions for the project activity.
Additional comment:	

<b>Data / Parameter:</b>	$f_{\text{NRB}}$
Unit:	Fraction
Description:	Fraction of non-renewable woody biomass saved by the project
Source of data:	<ul style="list-style-type: none"> <li>• Baseline Survey Final Report, October 2009 (See Annex 3A, 3B)</li> <li>• Forest Cover Change Analysis of the Terai District (1990/91 - 2000/01), Department of Forest, May 2005, Table 1, p. 6</li> <li>• Forest Resources of Nepal (1987-1998)</li> <li>• Master Plan for the Forestry Sector Nepal:</li> </ul>
Value(s) applied:	0.807
Purpose of data:	As per AMS-II.G ver2, the data is directly used to estimate emission reductions for the project activity.
Additional comment:	Proposed project area is in the central region of Terai.

<b>Data / Parameter:</b>	$NCV_{\text{biomass}}$
Unit:	TJ/t
Description:	Net calorific value of non-renewable woody biomass that is substituted
Source of data:	IPCC default value for fuel wood
Value(s) applied:	0.015 TJ/tonne
Purpose of data:	As per AMS-II.G ver2, the data is directly used to estimate emission reductions for the project activity.
Additional comment:	

<b>Data / Parameter:</b>	EF <sub>projected fossil fuel</sub>
Unit:	t CO <sub>2</sub> /TJ
Description:	Emission factor for the substitution of non-renewable biomass by similar consumers
Source of data:	IPCC default value for Kerosene
Value(s) applied:	71.5 t CO <sub>2</sub> /TJ
Purpose of data:	As per AMS-II.G ver2, the data is directly used to estimate emission reductions for the project activity.
Additional comment:	

<b>Data / Parameter:</b>	L <sub>y</sub>
Unit:	Fraction
Description:	Leakage Discount Factor
Source of data:	Taken from assessment of leakage
Value(s) applied:	5%
Purpose of data:	As per AMS-II.G ver2, the data is directly used to estimate emission reductions for the project activity.
Additional comment:	

## D.2. Data and parameters monitored

(Copy this table for each piece of data and parameter.)

<b>Data / Parameter:</b>	V <sub>n</sub>
Unit:	Number
Description:	Project villages/ village development committee (VDC)
Measured/ Calculated / Default:	Measured
Source of data:	VDCs mentioned in the users data form
Value(s) of monitored parameter:	112 VDCs have been covered by project activities as of 30/04/2014
Monitoring equipment:	Not applicable
Measuring/ Reading/ Recording frequency:	Monthly
Calculation method (if applicable):	Not applicable
QA/QC procedures:	VDC wise fuel efficient stove installation/sales data has been maintained.
Purpose of data:	As per AMS-II.G ver2, the data is directly used to estimate emission reductions for the project activity.
Additional comment:	The number of VDCs where fuel efficient stoves to be disseminated will be up to 20 in each district.

<b>Data / Parameter:</b>	D <sub>n</sub>
Unit:	Number and type
Description:	Type of stove displaced/dismantled

Measured/ Calculated / Default:	Measured
Source of data:	Monthly efficient stove installation/sales data reported by the promoter and LPO through technical officer and Project Manager.
Value(s) of monitored parameter:	12,418 old stoves have been dismantled as of 30/04/2014
Monitoring equipment:	Not applicable
Measuring/ Reading/ Recording frequency:	Not applicable
Calculation method (if applicable):	Not applicable
QA/QC procedures:	The data will be randomly checked by independent third party consultant during annual sample survey as part of monitoring.
Purpose of data:	As per AMS-II.G ver2, the data is directly used to estimate emission reductions for the project activity.
Additional comment:	None

<b>Data / Parameter:</b>	$N_y$
Unit:	Number
Description:	Total number of efficient operational stoves.
Measured/ Calculated / Default:	Measured
Source of data:	Monthly efficient stove installation/sales data reported by the promoter and LPO through technical officer and Project Manager.
Value(s) of monitored parameter:	14,872 efficient stoves have been installed as of 30/04/2014
Monitoring equipment:	Not applicable
Measuring/ Reading/ Recording frequency:	Monthly
Calculation method (if applicable):	Not applicable
QA/QC procedures:	Computer data entry of the fuel efficient stove installed/sold is made on monthly basis by the Project Manager. A copy of the stove installation/sale is sent to CRT/N central office in Kathmandu every month which is cross checked by the carbon analyst and technical expert. The central office team will visit the project area on quarterly basis to have random spot checks of 5% of stoves in the database entry. The Project Manager makes spot checks of 10% of the stoves and will take appropriate corrective actions for any inconsistencies. Altogether 50% of the efficient stove installed/sold is spot-checked by the project and partner staff including promoters to ensure the quality and if required necessary corrective measures are taken during the visit.
Purpose of data:	As per AMS-II.G ver2, the data is directly used to estimate emission reductions for the project activity.
Additional comment:	The serial number of stove will be marked on each of the stove installed/ sold.

<b>Data / Parameter:</b>	$\eta_{new}$
Unit:	% heat utilized

Description:	Efficiency of the Fuel Efficient appliance replaced
Measured/ Calculated / Default:	Measured
Source of data:	Ex-ante value from Laboratory Test carried out by CRT/N in 2009; Water Boiling Test for sample of operational stove (see KU test report 2012); Field measurement of the emissions for existing traditional stoves and Fuel efficient stoves by project team (see APTEC Survey Report 2014)
Value(s) of monitored parameter:	Ex- ante: 28.72 2012 Field testing :27.94 2014 Field testing: 28.33 The most conservative value of 27.94 has been considered for ex-post emission reduction calculation.
Monitoring equipment:	
Measuring/ Reading/ Recording frequency:	Yearly
Calculation method (if applicable):	Not applicable
QA/QC procedures:	The test was carried out by KU in 2012 involving experts in stove testing as an integral part of the sample survey to be conducted by the independent third party (external consultant) every year as per monitoring plan. Results from the test (ex post monitored value) will be compared to the values adopted for baseline emission calculations and the conservative value shall be considered for ex post emission reduction calculation.
Purpose of data:	As per AMS-II.G ver2, the data is directly used to estimate emission reductions for the project activity.
Additional comment:	The ex post monitored value of efficiency has been used for ex post emission reduction calculation.

<b>Data / Parameter:</b>	Stove Emissions (CO and PM <sub>2.5</sub> )
Unit:	ppm and µg/m <sup>3</sup>
Description:	Carbon Monoxide (CO) and fine particulate matter (PM <sub>2.5</sub> ) emission from burning the fuel wood in fuel efficient stoves.
Measured/ Calculated / Default:	Measured
Source of data:	Field measurement of the emissions for existing traditional stoves and Fuel efficient stoves by project team (see APTEC report)
Value(s) of monitored parameter:	CO – 7.66 ppm PM <sub>2.5</sub> – 692.9 µg/m <sup>3</sup>
Monitoring equipment:	
Measuring/ Reading/ Recording frequency:	Yearly
Calculation method (if applicable):	Not applicable
QA/QC procedures:	The measurement has been taken by using standard instruments used to measure indoor air pollution in rural areas like IAP meter 5000 series manufactured by Approvecho Research Centre, USA.
Purpose of data:	As per AMS-II.G ver2, the data is directly used to estimate emission reductions for the project activity.
Additional comment:	None

<b>Data / Parameter:</b>	$U_y$
Unit:	%
Description:	Percent of user households who are continuously using the stoves. Those who used the stoves 3 or less months in a year will be discarded from further calculation of emission reductions.
Measured/ Calculated / Default:	Calculated
Source of data:	Sample survey (see APTEC Consultancy report 2012)
Value(s) of monitored parameter:	100%(October 2012); 97%(July 2014)
Monitoring equipment:	Not applicable
Measuring/ Reading/ Recording frequency:	Yearly
Calculation method (if applicable):	
QA/QC procedures:	APTEC Consultancy Sample Survey Reports (October 2012 and July 2014)
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks
Additional comment:	None

<b>Data / Parameter:</b>	$t_y$
Unit:	Months
Description:	Operation time of the fuel efficient stoves
Measured/ Calculated / Default:	Measured
Source of data:	CRT/N data base records; sample survey of APTEC Consultancy Pvt Ltd. Report July 2014
Value(s) of monitored parameter:	12
Monitoring equipment:	Not applicable
Measuring/ Reading/ Recording frequency:	Yearly
Calculation method (if applicable):	Not applicable
QA/QC procedures:	The stove users' database entries are made in the Project Manager's office in the project area and the copy (paper and electronic) of the database is also maintained at CRT/N central office in Kathmandu on monthly basis. The database entries are shared with Egluro, UK on quarterly basis. CRT/N central office cross checks the database entries and take corrective measures for any errors. Egluro suggests on appropriate corrective measures if needed.
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks
Additional comment:	None

<b>Data / Parameter:</b>	$L_y$
Unit:	Tonnes/year
Description:	Quantity of woody biomass used by non user households (in tonnes)
Measured/ Calculated / Default:	Measured
Source of data:	APTEC Consultancy Sample Survey Reports (October 2012 and July 2014)
Value(s) of monitored parameter:	2.590 Tonnes/year
Monitoring equipment:	Not applicable
Measuring/ Reading/ Recording frequency:	Yearly
Calculation method (if applicable):	Not applicable
QA/QC procedures:	Qualified third party will be hired to conduct the survey independently.
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks
Additional comment:	None

<b>Data / Parameter:</b>	$P_n$
Unit:	Number
Description:	Number of local people (LPO staff, ICS promoters, rocket stove manufacturers, ceramic manufacturers) trained. The number can be segregated by gender. This parameter gives information on quantitative employment and income generation in the community.
Measured/ Calculated / Default:	Measured
Source of data:	Training reports which are generated after every training event
Value(s) of monitored parameter:	By 30/04/2014 following number of people have been trained on related topics: Promoters training: Female – 231, Male – 139, Total – 370 LPO staff training: Female – 1, Male – 7, Total - 8 Ceramic chamber fabrication training: Female – 1, Male – 17, Total – 18
Monitoring equipment:	Not applicable
Measuring/ Reading/ Recording frequency:	Yearly
Calculation method (if applicable):	Not applicable
QA/QC procedures:	The ICS promoters trained were selected by local communities in close coordination with LPO/project staff and following a selection guideline.
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks
Additional comment:	None

<b>Data / Parameter:</b>	T <sub>n</sub>
<b>Unit:</b>	Number
<b>Description:</b>	Number of technical training activities targeted to local people (LPO staff, ICS promoters, rocket stove manufacturers, ceramic manufacturers). This parameter gives information on quality of employment and technology transfer and technological self reliance.
<b>Measured/ Calculated / Default:</b>	Measured
<b>Source of data:</b>	Training reports which are generated after every training event
<b>Value(s) of monitored parameter:</b>	By 30/04/2014 following number of training events have been conducted on related topics: Promoters training: 25 LPO staff training: 1 Ceramic chamber fabrication training: 2
<b>Monitoring equipment:</b>	Ex post monitored value.
<b>Measuring/ Reading/ Recording frequency:</b>	Yearly
<b>Calculation method (if applicable):</b>	Not applicable
<b>QA/QC procedures:</b>	The training will be conducted following standard procedures and guidelines developed by CRT/N and other concerned agencies.
<b>Purpose of data:</b>	Calculation of project emissions or actual net GHG removals by sinks
<b>Additional comment:</b>	None

### D.3. Implementation of sampling plan

>>

#### Sample size and determination of sample households

As under the CDM only emission reductions that are monitored and verified can be claimed, therefore, the independent survey applying systematic sampling process will be carried out before each verification (See sampling plan Annex3F and monitoring information Annex 4). This will incorporate monitoring parameters like the survey for sample households to cross check the performance of stoves installed, percentage of stoves in use, measurement for CO and PM<sub>2.5</sub>, percentage of stoves in use. The survey will also ensure that stoves are all operating at the specified efficiency and where replacements are made the efficiency of the replaced stoves is similar to the stove being replaced.

With the total estimated number of households of 22920 having fuel efficient stoves and every household shall have one stove only (either fixed type or portable type stove); the statistically appropriate sample required for survey will be 68 for the confidence level of 90% and a confidence interval of +/-10%. Since variance of the parameter is not known a priori, the preferred formula is that used for estimating sample size for proportions given below:

$$n = \frac{Z^2 pq}{e^2}$$

where,

n ~ sample size

Z ~ is the corresponding abscissa of the normal curve for 90% confidence level (1.645)

p and q ~ estimated proportion of attribute, conservative value of 0.5, 0.5 has been taken.

e ~ desired level of precision, 10%

The sample size may differ for the survey conducted later on as variance value from the first survey could be used to estimate sample size. Please refer Sampling Plan Documentation Annex 3F. The monitoring data and information is archived for at least 2 years after the end of actual crediting period or the last issuance of CERs for the project activity whichever comes later.

The sample survey will be conducted once a year. The sample households will be selected following systematic sampling approach. The stove user households will be arranged by corresponding LPOs then by year of installation then by promoter. This will ensure selection of user households served by all LPOs, possibly all promoters and having stoves of different age.

## SECTION E. Calculation of emission reductions or GHG removals by sinks

### E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

>>

As per the applied methodology, direct calculation of emission reductions as been made as below:

$$ER_m = B_{m\text{savings},i} * f_{NRB} * NCV_{\text{biomass}} * EF_{\text{projected fossil fuel}} \quad (ii)$$

Where:

$ER_y$	Emission reductions during the year in t CO <sub>2</sub> e
$ER_{m,i}$	Emission reductions in the following month after the efficient cooking systems are deployed, in tonne CO <sub>2</sub> e
$B_{m\text{savings},i}$	Quantity of woody biomass that is saved in tonnes per month
$f_{NRB}$	Fraction of woody biomass saved by the project activity, established as non renewable biomass using survey methods and government data source
$NCV_{\text{biomass}}$	Net calorific value of non-renewable woody biomass that is substituted (IPCC) default value for fuel wood 0,015 TJ/tonne, i.e. 15 MJ/kg wood)
$EF_{\text{projected fossil fuel}}$	Emission factor for the substitution of non-renewable woody biomass by similar consumers

#### Biomass Savings:

$$B_{m\text{ savings}, i} = B_y / 12 * (1 - \eta_{old} / \eta_{new})$$

Where:

$B_y$	Quantity of woody biomass used in the absence of the project activity (tonnes/year)
$\eta_{old}$	Efficiency of the system being replaced, measured using representative sampling methods and/or based on referenced literature values (fraction)
$\eta_{new}$	Efficiency of the system being deployed as part of the project activity (fraction)

Emission Reductions Calculations (tCO <sub>2</sub> )		
Activity Data	Value	Source of Data
By-Quantity of woody biomass used in the absence of the project activity (tonnes/year)	2.7	Registered PDD
$f_{NRB}$	0.807	Registered PDD
$NCV_{biomass}$	0.015	From AMS-II.G ver 2 methodology
$EF_{projected\ fossil\ fuel}$	71.5	From AMS-II.G ver 2 methodology
$\eta_{new}$	27.94%	Ex-post monitored value (Field study conducted by KU)
$\eta_{old}$	10%	Registered PDD
ERy (tCO <sub>2</sub> ) for the monitoring period	39,672 tCO <sub>e</sub>	Calculated based on the AMS-II.G ver 2 methodology

## E.2. Calculation of project emissions or actual net GHG removals by sinks

>>

There is no project emission reductions calculation as per the applied methodology. It is as per calculations made above under E.1.

## E.3. Calculation of leakage

>>

As per the registered PDD, "a conservative value of 5% leakage has been applied to calculate emission reductions which is a fixed ex ante value that shall be deducted every year".

## E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Item	Baseline emissions or baseline net GHG removals by sinks (t CO <sub>2</sub> e)	Project emissions or actual net GHG removals by sinks (t CO <sub>2</sub> e)	Leakage (t CO <sub>2</sub> e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO <sub>2</sub> e)
<b>Total</b>	41,760	0	2,088	39,672

## E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO <sub>2</sub> e)	72,162	39,672

## E.6. Remarks on difference from estimated value in registered PDD

>>

Actual emission reductions achieved is less than estimated emission reductions shown in the PDD. The main reasons for this difference are:

The installation rate of stoves was slower than expected as it took time for communities to trust the new efficient stove. Particularly, the behavioural change that a new efficient stove calls for was not as anticipated.

#### E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO <sub>2</sub> e)	12,619	27,053

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#### Document information

Version	Date	Description
04.0	25 June 2014	Revisions to: <ul style="list-style-type: none"> <li>• Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0));</li> <li>• Include provisions related to standardized baselines;</li> <li>• Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1;</li> <li>• Change the reference number from <i>F-CDM-MR</i> to <i>CDM-MR-FORM</i>;</li> <li>• Editorial improvement.</li> </ul>
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.
Decision Class: Regulatory Document Type: Form Business Function: Issuance Keywords: monitoring report		