



FUEL-WOOD SAVING WITH IMPROVED COOK-STOVES IN CAMBODIA

MONITORING REPORT JAN 10TH -31 DEC 2008

SUMMARY

This monitoring report details the monitoring activities and their results for the period Jan 10th 2008- 31st December 2008. The emission reductions claimed for this period are 196,703 t/CO₂.

The monitoring activities consists of validating ex-ante assumption and collecting ex-post data as per the PDD and previous monitoring reports.

Ex-ante parameters:

- a. Fuel saving test (laboratory and actual testing);
- b. Wood to charcoal conversion;
- c. NCV of biomass;
- d. EFCO₂, biomass;

Ex-post parameters:

- a. Sales of New Lao Stoves to distributors;
- b. Stoves produced by respective producers;
- c. Stove lifespan (this was agreed during the first verification to be monitored as ex-post parameter) and
- d. Equipment ratio per family.

The outcomes of the monitoring activities are used to calculate emissions reductions as stipulated in the PDD. The table below summarizes the data collected, sources of data and the values used during verification. The table also details the values used during previous verifications. In this verification period only the number of stoves sold and the Stove Shelf Life differ from previous verification periods.

Table 1. Summary of ex-ante and ex-post data for NLS verification 2003-2008

	Data	Source	Verification 1 May 10th 2003- Jan 9th 2007		Verification 2 Jan 10th 2007- Jan 9th 2008		Verification 3 Jan 10th 2008- Dec 31st 2008	
Ex-post	Quantity of Stoves sold	Monthly Producer data	220,588		161,007		222,481	
Ex-Ante	Traditional Fuel Consumption	National User Surveys	Wood	Charcoal	Wood	Charcoal	Wood	Charcoal
			37.56 kg/month	32.12 kg/month	37.56 kg/month	32.12 kg/month	37.56 kg/month	32.12 kg/month
Ex-Ante	Wood to charcoal ration	IPCC	6	6	6	6	6	6
Ex-Ante	Fuel Saving	Household Cooking Test	Wood	Charcoal	Wood	Charcoal	Wood	Charcoal
			20.89	21.2	20.89	21.2	20.89	21.2
Ex-post	Equipment Ratio	User Survey	1.28		1.6		1.6	
Ex-post	Stove Shelf life	QC label survey	1 month		1 month		53.4 days	
Ex-post	Stove lifetime	User Survey	3 Years		2.5 years		2.5 years	
Ex-Ante	NCV biomass	IPCC	15.6		15.6		15.6	
Ex-Ante	EF Biomass	IPCC	112 t		112		112	
	Emission Reductions		182, 402 t /CO ₂		126,022 t/CO ₂		192,600t/CO ₂	

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SECTION A. PROJECT DESCRIPTION

At present the majority of the Cambodia population rely on fuelwood for cooking. This situation is forecast to continue for the foreseeable future (World Bank, 2007). The project has evolved from the Cambodian Fuelwood Saving Project (CFSP), which was created to protect forest resources in Cambodia by reducing woodfuel consumption. It is a service project that converts traditional stove makers to improved stove manufacturers. The improved stoves, called the New Lao Stove (NLS), are more expensive but individuals choose them because they last longer and reduce the amount of money spent on charcoal.

As a competitive advantage exists, a commercialized approach is used to disseminate the improved stoves, or New Lao Stove (NLS), through existing market channels. The user pays the full cost of the stove and the project does not introduce any market distortion such as subsidies or free distribution. Whilst at the producer/consumer level the stoves are commercially viable the project implements initiatives at sectoral level to transform the existing private sector towards a cleaner technology. These externalities, which include R&D, training, technical follow up, quality control, market development, structuring the supply chain with fair trade values, energy policy work and advertising, cannot be passed on to the consumer and are funded through carbon finance. The project has proceeded in three distinct phases. Phase I was primarily a set up phase which elaborated stove design, trained producers and developed distribution networks. Phase II focused on developing the commercialized distribution of the stove design. The project had been co-financed by the EU and, following the end of start-up funding, additional capital was sought in the form of carbon financing to not only complete the financing of the first two phases but also increase market penetration. The reduction in emissions of Greenhouse Gases (GHG), stemming from the replacement of inefficient stoves, combined with exceptionally high development dividends make the project an ideal candidate for carbon finance. The utilization of this long term funding stream will ensure that further strides are taken towards transforming the household energy sector in Cambodia. This monitoring report covers the period Jan 10th 2008- Dec 31st 2008. This is the third verification of the project activity.

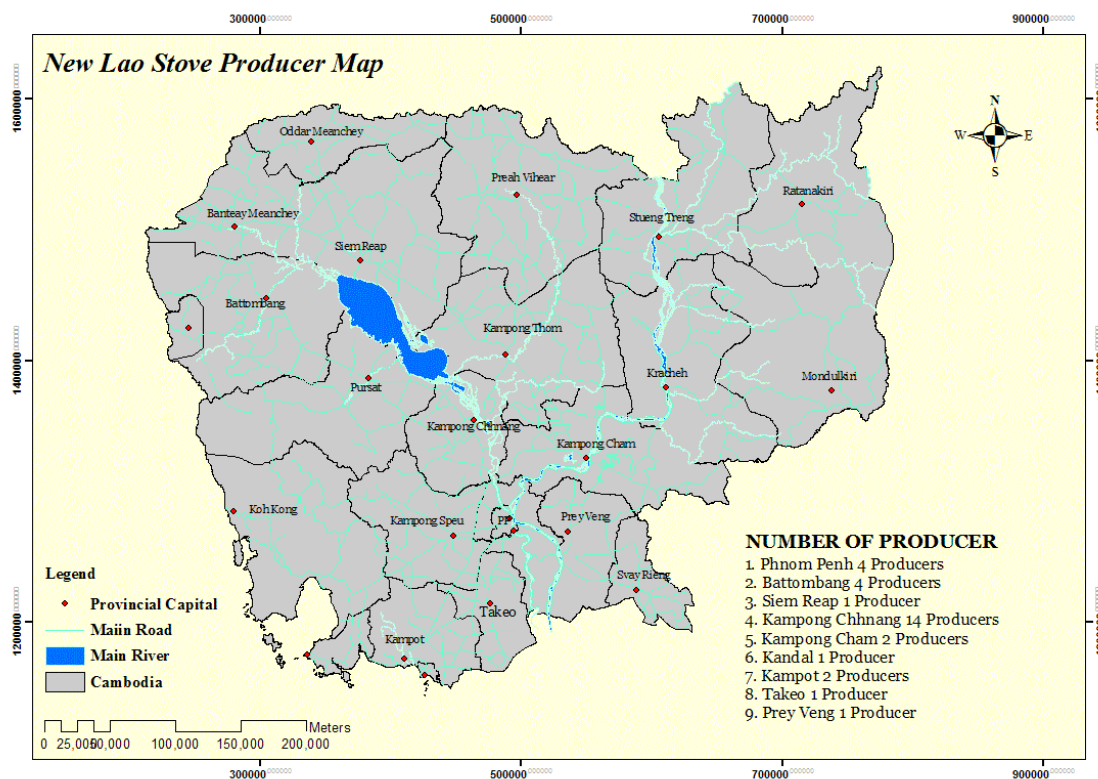
Summary of validation & verifications for NLS project

	Period Covered	Date Completed
Validation	2003- 2012	07/06/07
Verification	May 10th 2003- Jan 9th 2007	07/06/07
Verification	Jan 10th 2007 – Jan 9th 2008	18/09/08
Verification	Jan 10th 2008 – Dec 31st 2008	

SECTION B. CURRENT STATUS OF PROJECT

Monitoring of the project began in 2003 in 6 provinces. The success of the commercialized approach and stove design has meant that the project and monitoring activities have been extended to 9 different regions/states/provinces: Phnom Penh, Kandal, Kompong Speu, Prey Veng, Takeo, Siem Reap, Battambang, Kampong Cham and Kompong Chhnang.

B.1 Map of New Lao Stove Production in Cambodia



For the period 10th Jan 2008- 31 Dec 2008 222,481 units were sold by producers. The table below shows the stove sales for the period. The accumulated total of stoves in use is 422,492 . The number of stoves in use is adjusted to reflect the delay from Point of Sale (PoS) to use and the lifetime of individual stoves. The previous verification periods have used one month from Point of Sales (PoS). Monitoring activities for this period have revised the PoS time to 53.4 days (see section F.2 below) . The stove life time of two and a half years is retained

Table B.1: Sales of NLS 10th Jan 08 – 31st Dec 08

Date			No of units sold	Number of units in use
58	10-Jan-08	09-Feb-08	21399	284818
59	10-Feb-08	09-Mar-08	15978	296833
60	10-Mar-08	09-Apr-08	18105	312398
61	10-Apr-08	09-May-08	15396	323689
62	10-May-08	09-Jun-08	22226	335724
63	10-Jun-08	09-Jul-08	18750	346773
64	10-Jul-08	09-Aug-08	18588	361680
65	10-Aug-08	09-Sep-08	24086	374090
66	10-Sep-08	09-Oct-08	19697	386425
67	10-Oct-08	09-Nov-08	16230	402590
68	10-Nov-08	09-Dec-08	19197	413218
69	10-Dec-08	31-Dec-08	12829	422492

SECTION C SUSTAINABILITY ENVIRONMENTAL, ECONOMIC AND SOCIAL WELL BEING

C.1 SUSTAINABILITY OF PROJECT

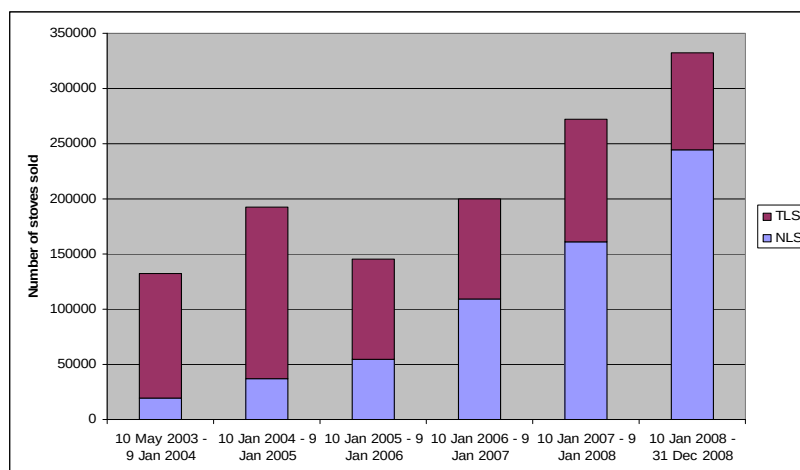
The emissions reductions from the project activities are permanent as the NLS has become established and is substituting traditional stoves in the market place. The national stove users survey, conducted in 2007, found that 31.3% of the urban population are now using NLS. Therefore, the project activity is sustainable because users do not switch back to inefficient stove technologies.

Market Share of NLS Stoves (National User Survey, 2007)

	Frequency	Percent
Yes	513	31.3
No	1,124	68.7
Total	1,637	100.0

Sales figures show that producers are shifting their production of New Lao Stoves to match demand.

Producer sales of New Lao Stoves 2003-2008



C.2 ENVIRONMENTAL

Aside from the environmental benefits of GHG mitigation (see below), the project activity directly contributes to efforts to reduce unsustainable fuel wood consumption. Charcoal savings from the dissemination of the NLS can be calculated using the results of Real Cooking Tests (RCT) which are used to compare the performance of different thermal technologies. The savings per stove can be extrapolated to estimate the total savings during the monitoring period. The project has saved the equivalent of 940 ha of forest¹.

Area of forest saved by NLS project Jan 2008- Dec 2008

Date	Number of units in use	Total Biomass Saving t/month	Total Biomass Saving M ³ /month	Total Biomass Saving ha/month
57 10-Jan-08 09-Feb-08	284818	8670.1	14453.1	62.8
58 10-Feb-08 09-Mar-08	296833	9035.8	15062.7	65.5
59 10-Mar-08 09-Apr-08	312398	9509.6	15852.5	68.9
60 10-Apr-08 09-May-08	323689	9853.3	16425.5	71.4
61 10-May-08 09-Jun-08	335724	10219.7	17036.2	74.1
62 10-Jun-08 09-Jul-08	346773	10556.0	17596.9	76.5

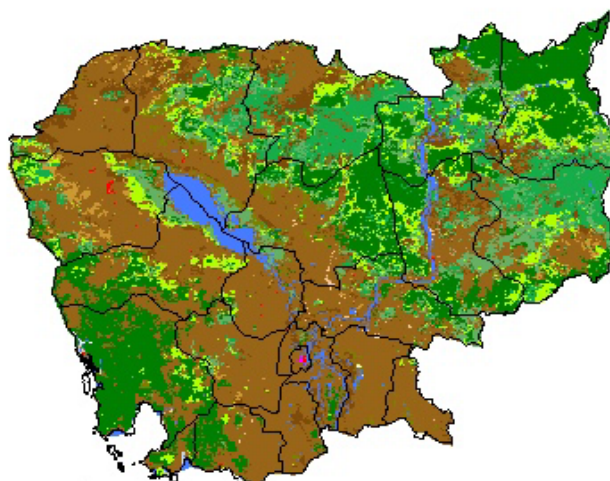
¹ 1 ton = 1.667 m³ 1 ha = 230 m³ (source GERES, 2005)

63	10-Jul-08	09-Aug-08	361680	11009.8	18353.3	79.8
64	10-Aug-08	09-Sep-08	374090	11387.5	18983.0	82.5
65	10-Sep-08	09-Oct-08	386425	11763.1	19609.1	85.3
66	10-Oct-08	09-Nov-08	402590	12255.1	20429.3	88.8
67	10-Nov-08	09-Dec-08	413218	12578.7	20968.7	91.2
68	10-Dec-08	31-Dec-08	422492	12861.0	21439.3	93.2
Total						940.0

C.2.1 NON-RENEWABILITY

Cambodia's forest resources are rapidly being depleted. Biomass is considered non-renewable as the current trend of regional use is unsustainable in the long term. The monitoring report summarizes accredited literature to demonstrate this. The main forested areas are located in the North and South of the country. The map below illustrates the density of forest cover; the populated corridor where urban centers are located can be clearly seen. The figure below goes somewhat towards illustrating the logistical difficulties of supplying urban centers with fuel wood. As the forest cover recedes so do the distances need to collect fuelwood and so to the associated costs of meeting energy requirements.

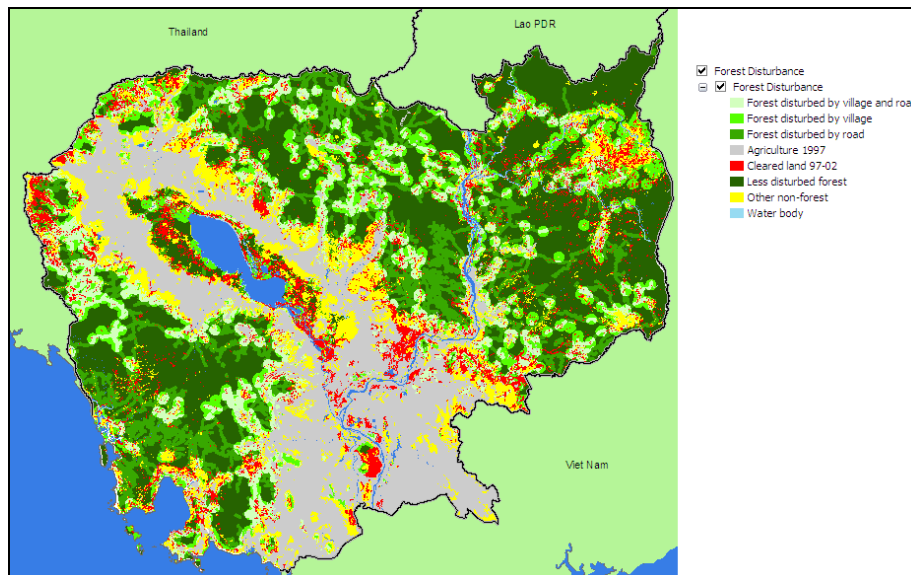
Distribution of forest cover in Cambodia. (source FAO, 2005)



Evidence of non-renewability can be found in Geographic Information System and remote sensing analysis of forestry in Cambodia². This allows the overlay of different themes of data and a spatially explicit representation of the "woodfuel frontier" i.e. where woodfuel is being produced, as well as deforestation and forest degradation areas and maps where the forest is being disturbed. The map below represents a GIS map of forest disturbance in Cambodia from 1997. The red colour on the map is the forest cleared over 1997-2002. It clearly and dramatically shows the fragmentation of primary and less disturbed forest by roads, logging, woodfuel production and land conversion to agriculture and human settlements.

Forest disturbance 1997-2002

² GERES Forestry Unit GIS analysis of Forestry in Cambodia.



Other recent evidence available for non-renewability of biomass resources is given by national forestry statistics. These show that between 2000 and 2005, the rate of forest change in Cambodia has been 1.90% per annum. In total, between 1990 and 2005, Cambodia lost 19.3% of its forest cover, or around 2,499,000 hectares. Cambodia lost approximately -444,000 hectares of its primary forest cover during that time. Measuring the total rate of habitat conversion (defined as change in forest area plus change in woodland area minus net plantation expansion) for the 1990-2005 interval, Cambodia lost 19.3% of its forest and woodland habitat. Between 2000 and 2005 alone, Cambodia lost nearly 30 percent of its primary forest cover, and deforestation rates continue to climb (Mongabay Forestry Statistics 20093, Cambodia Independent Forestry Sector Review Report - World Bank 20044).

The principle causes of deforestation in Cambodia are agriculture, shifting cultivation, fuelwood harvesting and logging. In particular logging in Cambodia has been a source of international concern. Rival factions in the civil war funded themselves through logging and the practice has continued largely unabated ever since.

"Despite public commitments to reform, Cambodia's shadow state has continued to generate money from the timber sector. Officials charged with implementing reforms have instead subverted them; with the result that illegal logging has continued in a variety of forms and is still causing severe damage to Cambodia's remaining forests" (Global Witness, 2008).

Domestic fuel use also adds pressure on environmental resources. Cambodia's increasing population relies heavily on fuel-wood as main energy source. Indeed, 95.3 % of the households use firewood and charcoal for cooking (National Institute of Statistics, 2005). For household and light industrial consumption, charcoal is produced illegally and unsustainably:

"Charcoal-making is not well managed, reflecting short term thinking without a long term planning horizon within an environment of highly insecure rights" (Cambodia Independent Forestry Sector Review Report, World Bank 2004).

"Charcoal production in the Kampong Speu Province west of Phnom Penh (its main supply area) is evidently causing deforestation, converting primary forests into low-productivity degraded shrub-land. Charcoal, produced in traditional earth mound kilns, is mostly obtained from wood collected from the natural forest owned by the government."(Van Mansvelt et al, IGES, CCCO 20066)

In 2006 GERES conducted a wood energy baseline study. The study found that the annual wood demand for Phnom Penh was 369,000 tones, or approximately 4,500 hectares per year. The study concluded that charcoal production is unsustainable as natural forest regeneration is too slow to produce enough fuelwood for demand. Harvesting the same yield sustainably would require the

³ <http://rainforests.mongabay.com/20cambodia.htm>

⁴ <http://www.cambodia-forest-sector.net/docs/mainreport.pdf>

⁵ <http://statsnis.org/index.htm>

⁶ Van Mansvelt et al. - Wood Energy Baseline Study For Clean Development Mechanism in Cambodia Household woodfuel use and supply in Phnom Penh – GERES, IGES, CCCO, 2006

maintenance of a tree plantation some 30,750 ha (Van Mansvelt et al, 2006³) – a proposition which is unfeasible in present day Cambodia.

An FAO study in 2001 explicitly linked fuelwood collection with localized deforestation:

“One may say that forest areas in the province could be totally lost as a result of illegal fuelwood collection, leaving the province and its neighbours affected by floods and/or droughts almost every year”(FAO,2001)

This observation remains pertinent because, as a result of population growth, fuelwood use is expected to increase in the short to medium term as shown.

Energy use in Cambodia 1994-2010 (Source RWEDP, 2001)

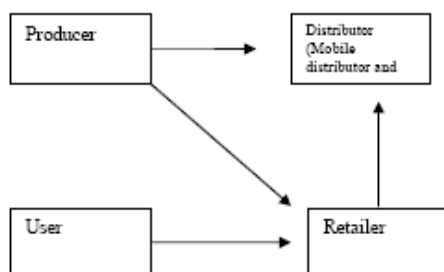
	1994	1995	2000	2005	2010
Households	81,530	81,395	93,819	108,240	110,508
Wood	77,329	77,329	88,985	102,546	104,730
Charcoal	935	935	1,050	1,179	1,135
Kerosene	1,046	879	1,263	1,468	1,512
LPG	35	57	222	416	546
Diesel	80	176	93	106	107
Electricity	352	378	607	967	1,229
Other	1,754	1,642	1,600	1,559	1,351
Service sector	918	989	1,420	2,104	3,189
Wood	23	23	10	5	3
Charcoal	149	149	142	152	165
Kerosene	278	233	415	614	918
LPG	69	113	199	313	504
Diesel	33	80	50	75	114
Electricity	367	391	605	945	1,486
Industry	405	405	681	1,096	1,764
Wood	370	370	622	1,001	1,611
Charcoal	13	13	22	36	58
Diesel	22	22	37	59	95
Fuel Oil	63	63	101	157	248
Electricity	58	57	96	154	247
Transport	11,174	11,674	17,988	26,712	36,188
Gasoline	6,002	6,089	10,765	15,288	20,284
Diesel	4,445	5,116	7,341	10,299	14,468
Jet Fuel	725	468	881	1,125	14,352
Fuel Oil	2	1	1	1	1

In sum, this evidence shows that woodfuel use in all sectors will increase over the medium term and it will continue to be used on an unsustainable basis.

C.3 ECONOMIC

An advantage of the commercialized dissemination of the NLS is that the project is able to offer economic benefits throughout the stove distribution network of producers, retailers and end users

Distribution Network



Source. Atukorala, 2006

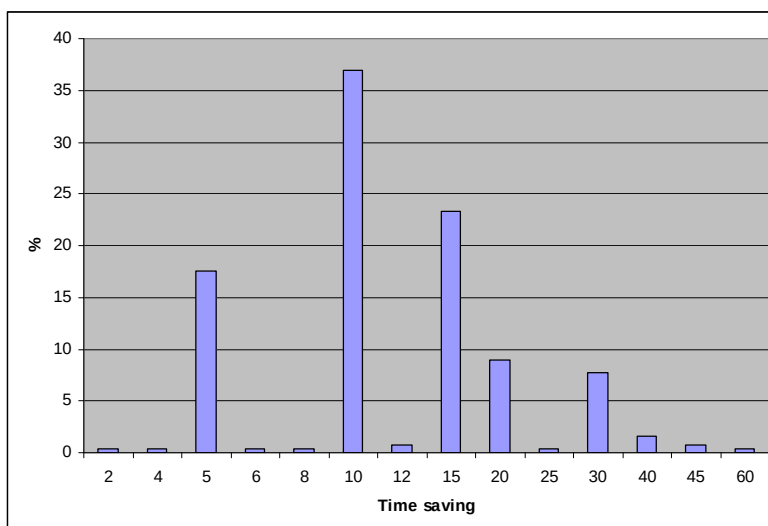
The stove producers and retailers make a profit of US\$0.50 from each NLS. This compares favorably with profit from traditional stoves which is approximately US\$0.12 per stove. The number of stoves sold throughout the crediting period is 244,102, the total number of stoves in use is 442,123. The producers made an additional \$92,759 over the course of the monitoring period and \$167,669 since the project began. The profits are provided by the end users, who pay more per

unit. However, reductions in charcoal use and the increased durability extend economic benefits of the stove to end users.

C.4 SOCIAL BENEFITS

New Lao Stoves do not fully alleviate the problems associated with the inhalation of cooking smoke. However, although the reduction in health damaging pollutants has not been directly monitored the greater combustion efficiency and reduced exposure time is expected to mitigate the health impacts of cooking with charcoal. 73% of NLS users reported that they saved time daily by using the New Lao Stove.

Time Saving using New Lao Stove (National User Survey 2007)



User surveys have indicated that around 40% of stove users cook outside, and 24% said they used the stove in a kitchen where the smoke could escape. There was a relatively high awareness of the detrimental health effects of smoke (over 60% said it is bad for health) and almost all respondents had someone in their household with respiratory ailments, with the women being primarily affected. However, as many NLS users, as well as non-users, cited respiratory problems, it is difficult at this point to establish a direct correlation between improved health and adoption of the NLS (Winrock International, 2006).

The spread of more efficient cook stoves reduces the gap between rising fuel wood demands and diminishing forest resources. In the wider context of energy use this means there is less competition for the same resources with the result that energy access and food security is improved, especially for the less wealthy in Cambodian society. The adoption of the NLS has been shown to reduce cost of meeting energy requirements and allow the savings to be spent elsewhere. To date these benefits are primarily confined to urban and semi-urban areas where charcoal is used in larger quantities. It is estimated that 75% of stoves are destined for urban and semi-urban areas (Autokorala, 2006). In rural areas fuel is often free to collect and home-made three stone fires are used to burn it.

Almost all stove users, 87.2%, are female, the adoption and use of NLS has strong gender implications. Whilst the time saving is not enough for users to engage in additional income generating activities it does free up time that can be used for other vital survival activities, such as water boiling, childcare and socializing. In addition, the cash savings, although relatively small, take place in an essential area of the family that is managed by women and deals with food nutrition and childcare. The money saved on charcoal purchases is mostly used to buy both durable and consumable goods such as food, for the household (Winrock, 2006). The production process also has a strong gender dimension as a significant number of women participate in the stove business. In case studies of the production process, there is only one task: insulation and cementing which is done solely by men and all other activities are done by both male and female. Skilled work like trimming is done mostly by women and two production centres have female employees in charge of finance (GERES, 2005).

In addition, the development of civil society is encouraged by a strong emphasis on the development of local capacity and expertise. A good example of this is the establishment of the Improved Cooking Stove Producers Distributors Association of Cambodia (ICOPRODAC) which is the professional association of stakeholders along the ICS supply chain. In the past stove producers have been reluctant to cooperate and share information which resulted in some unhealthy competition and a lack of accountability. In response ICOPRODAC was formed to facilitate sectoral development, quality assurance, and the long-term sustainability of ICS dissemination without external assistance. The association supports the producers with new data and coordinates

dissemination but also gives stakeholder ownership in the project process and a forum to raise issues. Initially DAT organized regular meetings between stove producers and stove distributors. In the meeting, voices from both supplier and distributors are heard. Jointly they have discussed pricing issues and shared information to produce better quality stoves. The quality control and assurance of the stoves is coordinated through ICOPRADAC who issue stickers to the NLS producers who qualify for the hallmark of quality. In return the stove producers provide 1% of the income from selling stoves per month to the ICOPRADAC. The money collected will be used for additional stove promotional activities.

SECTION D. PARAMETERS TO BE OBTAINED

The parameters are obtained through a combination of ex-post and ex-ante data

Data / Parameter:	Representative sample of mass of biomass used before and after installation of devices and efficiency measures.
Data unit:	Kg/ month / Family
Description:	Quantity of biomass saved as a result of the project activity.
Source of data to be used:	Household Fuel Consumption Test data (2008) National Stove Users Survey (2007) Stove Producer Sales data (2008)
Value of data	Emissions reductions from utilisation of the NLS
Description of measurement methods and procedures to be applied:	National Stove User Survey results demonstrate the average fuel mix and consumption per family. Data from Household Cooking Tests generates data on efficiency savings. Monthly sales data of stove producers to monitor mass of biomass used before and after installation of the efficiency devices.
QA/QC procedures to be applied:	Household Fuel Consumption Test Data (2008) follows an internationally recognized methodology and replicates previous studies. The data used is within acceptable standard deviation of the data series. National Stove Users Survey is conducted by GERES –Cambodia Policy and Study Unit. The results us statistical confidence levels to ensure results. Stove producers sales data is collected on a monthly basis. Internal verification procedures ensure data entry. Every three months samples taken from stove producers are tested using water boiling tests. These measures ensure the quality of stove production.
Any comment:	

Data / Parameter:	Representative samples of the moisture content of the biomass at the time it is burnt
Data unit:	Kg/month/family
Description:	Variations in the moisture content of the biomass affects fuel saving of improved cooking stoves
Source of data to be used:	Household Fuel Consumption Test data (2008)
Value of data	Accuracy of fuel savings
Description of measurement methods and procedures to be applied:	The fuel savings are calculated under field conditions using fuel purchased in the market. The tests are conducted in the wet season where combustion efficiency is lower.
QA/QC procedures to be applied:	Results are part of a series of test conducted since 2004. Data used will be within acceptable standard deviation of the data series.
Any comment:	

Data / Parameter:	Annual check of representative samples to ensure that they are still operating or replaced by an equivalent in service appliance or measure
Data unit:	No of stoves sales per month

Description:	Stove sales demonstrate that appliances are still in use or replaced by an equivalent appliance.
Source of data to be used:	Stove Producer Sales data (2008)
Value of data	Ensure accuracy of emissions reductions
Description of measurement methods and procedures to be applied:	The increasing market penetration is used as a proxy for ensuring that devices are operating or being replaced. 30 months after their sale the stoves are subtracted from the total number of units in use.
QA/QC procedures to be applied:	National Stove Users Survey (2007) demonstrates high level of user satisfaction with the NLS.
Any comment:	

Data / Parameter:	Monitoring shall include the efficiency of the appliances
Data unit:	%
Description:	Representative samples from stove producers to measure the efficiency of stoves constructed by producers.
Source of data to be used:	Water Boiling Test
Value of data	Quality control of stove production. Quality assurance for emissions reductions calculations.
Description of measurement methods and procedures to be applied:	Every three months each stove producer submits 3 stoves for quality control testing. This consists of checking dimensions of the samples and conducting water boiling tests. To ensure efficiency of stoves being produced by each NLS producer.
QA/QC procedures to be applied:	Training for technicians is provided and established methodology is used. Test are repeated frequently allowing results to be verified by the observable range of data
Any comment:	

Data / Parameter:	Ensure replaced low efficiency appliances are not used within the boundary
Data unit:	
Description:	Bi-annual survey data on user behaviour.
Source of data to be used:	National Users Survey (2007)
Value of data	Ensure the accuracy of emissions reductions calculations
Description of measurement methods and procedures to be applied:	User surveys will establish the percentage of stove users using traditional and NLS simultaneously.
QA/QC procedures to be applied:	Stove producer data (2008). Stove sales data demonstrates the increasing market share of the NLS over time.
Any comment:	

Data / Parameter:	Quantity of alternative fuels used by project participants and assessment of aggregate biomass renewability in the region.
Data unit:	Fuel mix Deforestation rate
Description:	The mix of fuels and saving from those fuels affects the emission reductions. Emissions reductions are dependent on the renewability of the biomass.
Source of data to be	National stove Users Survey (2007)

used:	Independent accredited literature
Value of data	Validity of emission reductions from non-renewable biomass
Description of measurement methods and procedures to be applied:	National users survey includes measurements of the proportions of agricultural waste, wood and charcoal used in biomass stoves. National users survey collects data of increasing price of charcoal and wood as a proxy for non-renewability.
QA/QC procedures to be applied:	National Stove Users Survey is conducted by GERES –Cambodia Policy and Study. The results use statistical confidence levels to ensure results. Peer reviewed published reports.
Any comment:	

Data / Parameter:	Greater use of non-renewable biomass outside the project boundary does not exist
Data unit:	N/A
Description:	N/A
Source of data to be used:	N/A
Value of data	N/A
Description of measurement methods and procedures to be applied:	N/A
QA/QC procedures to be applied:	N/A
Any comment:	N/A

Data / Parameter:	Wider social and economic impact of the projects will be monitored; on-going analysis will be made of its contribution positive or otherwise to sustainable development in the area.
Data unit:	N/A
Description:	Survey data designed to assess socio-economic impacts of the stove project. Furthermore the increasing market share is testament to the competitive advantages of the NLS and consequently the socio-economic benefits that are derived from them.
Source of data to be used:	National Stove Users Survey
Value of data	Sustainable development benefits of Project Activity.
Description of measurement methods and procedures to be applied:	Survey of stoves users. Market data
QA/QC procedures to be applied:	Peer review of literature.
Any comment:	

Data / Parameter:	Transport Emissions from monitoring activities
Data unit:	T/CO2e
Description:	Monitoring staff travel to producers and retailers to collect stove sales data. This is a source of project emissions
Source of data to be used:	Fuel receipts from monitoring staff
Value of data	Conversion from price to volume multiplied by emissions coefficient gives transport emissions
Description of	Submission of fuel expenditure receipts

measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	Auditing of accounts
Any comment:	

SECTION E. EMISSIONS REDUCTIONS

The emissions reductions are calculated as per the formula presented in proposed methodology CC-NRB-BSAS and detailed in the Project Design Document (PDD). The total emissions reductions over the monitoring period are 192,600 t/CO₂. The following table shows the monthly emissions reductions that occur as a result of the project activity. The table is abridged, the full table is reproduced in Appendix 2.

Emission reductions for the monitoring period 10th Jan 08 – Dec 31st 08

Date			No of units sold		Number of units in use	Total Biomass Saving t/month	ER t/CO ₂ e	Adjusted ER t/CO ₂ e	Yearly Totals ER t/CO ₂ e
58	10-Jan-08	09-Feb-08	21399	5039	284818	8670.1	15148	12,875	
59	10-Feb-08	09-Mar-08	15978	4509	296833	9035.8	15787	13,418	
60	10-Mar-08	09-Apr-08	18105	5207	312398	9509.6	16615	14,121	
61	10-Apr-08	09-May-08	15396	5408	323689	9853.3	17216	14,633	
62	10-May-08	09-Jun-08	22226	6016	335724	10219.7	17856	15,175	
63	10-Jun-08	09-Jul-08	18750	6469	346773	10556.0	18443	15,676	
64	10-Jul-08	09-Aug-08	18588	6301	361680	11009.8	19236	16,348	
65	10-Aug-08	09-Sep-08	24086	7596	374090	11387.5	19896	16,910	
66	10-Sep-08	09-Oct-08	19697	6849	386425	11763.1	20552	17,468	
67	10-Oct-08	09-Nov-08	16230	8221	402590	12255.1	21412	18,199	
68	10-Nov-08	09-Dec-08	19197	7681	413218	12578.7	21977	18,679	
69	10-Dec-08	31-Dec-08	12829	10771	422492	12861.0	22471	19,098	192,600

SECTION F. MEASURES TO ENSURE THE RESULTS

The results are ensured through a combination of ex-ante assumptions ex-post data. The validity of the ex-ante assumptions will be assured through continuous validation. For example bi-annual survey data or annual RCT results will be carried out. The results of the ex-post data are ensured through regular monitoring activities throughout the NLS supply chain. The data obtained consists of easily verifiable field measurements which can be used to accurately gauge emission reductions. Quality assurance measures are in place throughout the NLS supply chain consisting of producers, middlemen, retailers and end-users. Detailed information on monitoring activities is contained in the accompanying document: SAM-09Feb10_GERES monitoring activities 2008 v1.pdf

F.1 EX-ANTE PARAMETERS:

A. FUEL SAVING TEST (LABORATORY AND ACTUAL TESTING);

The household cooking tests are used to demonstrate fuel savings of using a New Lao Stove. The tests conducted during the second verification period returned fuel savings of 19.07% for charcoal and 20.1% for wood. These figures are conservative as they are drawn from tests conducted during the rainy season where the combustion efficiency is considered to be lower. Furthermore the fuel savings are far more conservative than the default values of 50% that are used in later CDM methodologies (see AMS II.G). The results are consistent with figures used in the PDD and first verification period. In the interests of maintaining conservativeness and consistency the validated figures used in the PDD will be used to calculate emissions reductions.

Comparison of fuel saving between verification period.

Fuel Type	Fuel Saving 2003-2007	Fuel Saving 2007-2008	Fuel savings in 2008-2009
Charcoal	21.2%	22.08%	19.07%
Fuelwood	20.89%	20.1%	20.1%

B. WOOD TO CHARCOAL CONVERSION

The PDD uses IPCC (2006) default value for wood to charcoal conversion

C. NCV OF BIOMASS;

PDD uses Net Calorific Value (NCV) stipulated in the IPCC guidelines 2006.

D. EFCO₂, BIOMASS;

PDD uses Emissions Factors stipulated in the IPCC guidelines 2006.

E. FUEL CONSUMPTION

The validated figures used in the PDD for traditional fuel consumption are 32.12kg and 37.56kg a month, for charcoal and firewood respectively. In 2007 a national user survey was conducted to analyze the fuel mix used in traditional stoves. The results show an average monthly use of 47kg of Charcoal and 34 kg of Fuelwood. The latest study is based on a sample size of 608 stove users compared with 256 in the initial study. The more conservative values as validated in the PDD are retained.

CHARCOAL

Stove Type	Number	KG/ Month	KG/ Day	Tonnes/month
TLBS	603	47.086894	1.546876	0.04709

WOOD

Stove Type	Number	Kg/Month	Kg/ Day	Tonnes /Month
TLBS	603	34.004963	1.117114	0.03400

F.2 EX-POST PARAMETERS:

F.2.1. STOVES PRODUCED BY RESPECTIVE PRODUCERS;

This amount is reported on a routine basis when the complete NLS is produced. The total quantity of each stove type (7 types) produced is summed-up on a monthly basis. This data is collected by the monitoring staff and in turn keyed into the spreadsheet for calculation. The following details are recorded.

- date on which the stoves were bought,
- amount and type of stoves bought,
- buying price
- from which production center or middleman the stoves were bought
- date on which the stoves were sold
- amount and kind of stoves sold
- selling price,
- to whom they were sold (middleman or individual).

GERES has undertaken to upgrade the data management procedures for ISO certification. An independent ISO lead auditor was contracted to review the procedures and protocols in place and make recommendations for improving data management systems and move towards compliance with ISO 9001:2000. Stoves sold by producers who do not comply with quality control procedures are excluded from emissions reductions calculations. The following list details producers included and excluded for the monitoring period.

Producer name	Code	Status
Yem Kouen	KCK	✓
Dul Sam Oun	SVKC	✓
Ris Sarath	RRKC	✓
Training Centre	TCD	✓
Sun Tha	SAKC/ STKC	✓
Khim Tin	KTKC	✓
Khin Pum	PBTB	✓
Nhek Sakun	KBTB	✓
Sor Hour	HBTB	✓
Sim Mom	SMKC	✓
Sim Sour	SSKC	✓
Sim Seth	SKC	✓
Bun Sun	BSPP	✓
Sem Kosal	ECX1	✓
Bun Tikear	HK2	Excluded – we stopped issuing labels due to lack of cooperation
Mak Samith	HK3	✓
Bin Theara	SKV1	Excluded – we stopped issuing labels due to lack of cooperation
Lim La	LBTB	Excluded – stopped producing
Mok Soy	MSPV	✓
Vong Siengleng	SRP	Excluded – no stoves when we visited them for re-testing
Meng Chhun	CKCM	✓
Sok Hoan	HKCM	Excluded – no stoves when we visited them for re-testing
Yong Sunhai	HKPT	✓
Pon Ratha	TKPT	Excluded – no stoves when we visited them for re-testing
Kong Sok	STKO	✓
Phon Somen	PMKC	Excluded – started late 2008 so QC started in 2009
Phon Sopha	PHKC	Excluded – started late 2008 so QC started in 2009

✓ – indicates inclusion in calculations

F.2.2. SALES OF NEW LAO STOVES TO USERS;

Emission reductions from this project activity are calculated through monitoring the monthly sales of stoves sold by producers. However, the NLS purchased by distributors are not necessarily immediately being sold to end users. It can be assumed that once the stoves reach the end users; they are utilized and emission reductions can accrue. However, emissions reductions will not accrue during the time that stoves take to reach the end user. Two points in the supply chain can affect the length of this period. Firstly, during distribution from producers to retailers, sometimes via middlemen. Secondly, the number of stove shelf days (SSD), the length of time stoves are held by the retailer before their eventual sale to the end user. To estimate the total time lapse between the moment of stove production and the point of sale GERES introduced a NLS labeling system. These labels serve as quality control but also contain a unique number. By recording the date the labels are obtained by the producers and by recording the date the stove is sold to the user, the period between the production and the usage of the NLS is determined, the Point of Sale Time (POST). During the monitoring period data was collected from 535 stove sales drawn from a total number of 244,102. This sample size returns a confidence level of 95,7%. During the second verification period the Point of Sales Time (POST), the time between stoves being sold by the producer and utilized by end users, was assumed 30 days. Using the figures of the QC labels the average POST is 53,4 days, a larger value. However, this is a very conservative estimate. First of all, the obtained POST includes the period between the QC label obtainment by the producers and the actual labeling of the NLSs which occurs in batch wise. The batch wise labeling is executed on a 1-2 weekly basis. Secondly, the results showed extreme POST values, reflecting a long time lapse

before the stoves are labeled. Finally, the average POST is not discounted for sales closer to the point of production. In the interest of maintaining a conservative estimate a period of 53,4 days is adopted for the third verification period. Please see accompanying document SAM-09Feb10_GERES monitoring activities 2008 v1.pdf for more information on calculation of stove lifetime.

F.2.3. STOVE LIFESPAN

The lifespan adopted is 2 ½ years or 30 months. Data collected during the national user survey showed that of stoves users who were no longer using their first stoves the average life time was 29 months. However of the 513 NLS user survey only 12% reported that they were no longer using their first stove. This indicates that the majority of stoves are still in operation and 30 months is a conservative estimate.

F.2.4 EQUIPMENT RATIO PER FAMILY.

Equipment ratio refers to the number of stoves used per family. Results from the national user survey in 2007 identified a higher equipment ratio from 1.28 to 1.6. As the higher ratio is the more conservative figure it has been adopted for the verification period

Number of stoves	Frequency	Total Stoves	Equipment Ratio
1	311	311.0	
2	116	232.0	
3	55	165.0	
more than 3	17	68.0	
Total	499	776.0	1.6

F.2.5. TRANSPORT EMISSIONS

Transportation emissions are generated from collecting producer and retailer data, quality control activities and conducting household fuel cooking tests. These emissions would not have occurred in the absence of the project activity. These emissions are calculated as project emissions and deducted from total emissions reductions. Transport emissions from monitoring activities are generated by

- monthly visits to producers and retailers
- quality control activities
- marketing and awareness building activities
- meetings of the improved cookstove producers association

The transport emissions are calculated by the consumption of fossil fuel associated with the monitoring activities multiplied by an emissions coefficient. The fuel consumption is derived from GERES accounting records for the period 10th Jan 2008- 31st Dec 2008. Receipts to cover travel expenses are submitted to the Accounting department of GERES Cambodia. In the period 10th January 2007 – 9th January 2008 19.75 t/CO₂e were emitted.

F.2.6. QUALITY ASSURANCE MEASURES

Samples of NLS are collected every three months from producers to check quality of stove production. The stoves are then tested to determine their efficiency. Water Boiling Tests (WBT) are conducted to determine the efficiency of the stoves, power input, burning rate and useful heat input. Performance should be within pre-determined thresholds. Based on these tests the quality of the stoves in terms of fuel savings and time to boil is analyzed. If the stoves performance is not within the threshold the monitoring team works with the producers to diagnose the reason and rectify it. The samples are also measured to ensure they conform to standardized stove dimensions. A system of labeling has been initiated for quality assurance of NLS. Producers whose construction standards have consistently met the required specifications are provided with labels to attach to the finished product. Quality control labels are issued on the basis of observed sales and only once the stock has been monitored.

To assure the strength of the QC and QA procedures, GERES Cambodia is in the process of double certification ISO 9001/14000.

The NLS project has been visited by independent external advisors to assess the quality of the project activity. The table below summarises external visits during the onitoring period.

Summary of external reviewers of the NLS Project in 2008

Name	Organisation	Description	Duration	Outputs
Robert Stevens	Vice President, JPMorgan ClimateCare	Due Diligence. Climate Care are a major buyer of credits from the NLS.	17-21st June 08. Field visit and interviews	http://www.jpmorganclimatecare.com/projects/countries/Cambodia-stoves
Chris Sherlock	Sustainable Development Manager, Co-operative Group	Due Diligence. Co-Operative Group buy credits through Climate Care.	17-21st June. Field visit and interviews	http://www.co-operative.coop/ethicsinaction/environment/carbonoffsetting/some-of-the-schemes-we-help-to-fund/
Douglas McLure	Consultant, EU	Ex-post evaluation by the EU	13th Oct 2008- 24 Oct 2008	MR-020256 04.pdf (available on request)
Tighe Geoghegan, Simon Anderson Ben Dixon	DFID	Opportunities to achieve poverty reduction and climate change benefits through low carbon energy access programmes	Desk Review and interview. Publication date April 2008	DFID_report.pdf (available on request)

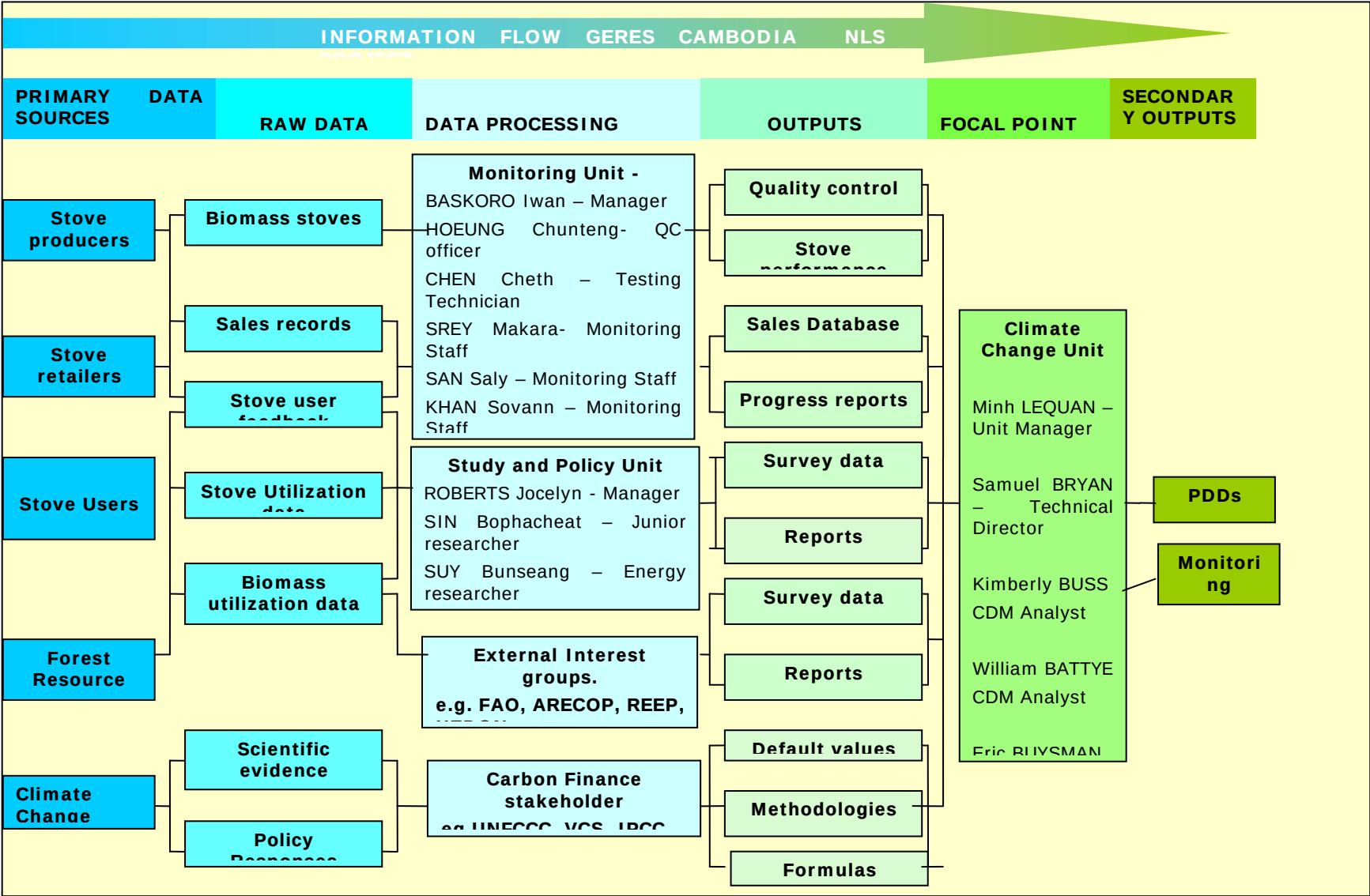
F.3 MONITORING INTERMEDIARIES

The intermediaries transport NLS and generally operate as a link between production and retail. Monitoring of middleman is not as extensive as with other stages in the supply chain as they are not involved with stove production or selling directly to the end-user. Nevertheless, it is important to ensure that only stoves constructed by trained producers are being sold. Therefore the details of their clients, recognized retailers, and work whereabouts are recorded.

F.4 CONSERVATIVENESS

- Emissions reductions from non-CO2 gases are not included in the emissions reductions calculations
- Emissions reductions from avoidance of charcoal production, mainly methane, are not included in the calculations.
- National stove user surveys indicate that fuel consumption is increasing lower values as validated in the PDD are used.

APPENDIX 1. INFORMATION FLOW GERES CAMBODIA NLS EMISSIONS REDUCTIONS PROJECT.



APPENDIX 2. EMISSIONS REDUCTIONS FROM NLS PROJECT JAN 10TH 2008 – 31ST DEC 2008.

Date			No of units sold		Number of units in use	Biomass wood t/month	Biomass charcoal t/month	Biomass saving wood t/month	Biomass saving charcoal t/month	Total Biomass Saving t/month	ER t/CO ₂ e	Leakage deduction [15%]	Transport Emissions tCO ₂ e	Adjusted ER t/CO ₂ e	Yearly Totals ER t/CO ₂ e
58	10-Jan-08	09-Feb-08	21399	5039	284818	6686.1	34308	1396.7	7273.3	8670.1	15148	2272	1.03	12,875	
59	10-Feb-08	09-Mar-08	15978	4509	296833	6968.1	35755	1455.6	7580.1	9035.8	15787	2368	0.95	13,418	
60	10-Mar-08	09-Apr-08	18105	5207	312398	7333.5	37630	1532.0	7977.6	9509.6	16615	2492	1.61	14,121	
61	10-Apr-08	09-May-08	15396	5408	323689	7598.6	38990	1587.3	8266.0	9853.3	17216	2582	0.68	14,633	
62	10-May-08	09-Jun-08	22226	6016	335724	7881.1	40440	1646.4	8573.3	10219.7	17856	2678	2.33	15,175	
63	10-Jun-08	09-Jul-08	18750	6469	346773	8140.5	41771	1700.5	8855.5	10556.0	18443	2767	1.01	15,676	
64	10-Jul-08	09-Aug-08	18588	6301	361680	8490.4	43567	1773.7	9236.1	11009.8	19236	2885	3.02	16,348	
65	10-Aug-08	09-Sep-08	24086	7596	374090	8781.8	45062	1834.5	9553.0	11387.5	19896	2984	1.74	16,910	
66	10-Sep-08	09-Oct-08	19697	6849	386425	9071.3	46547	1895.0	9868.1	11763.1	20552	3083	1.82	17,468	
67	10-Oct-08	09-Nov-08	16230	8221	402590	9450.8	48495	1974.3	10280.8	12255.1	21412	3212	1.65	18,199	
68	10-Nov-08	09-Dec-08	19197	7681	413218	9700.3	49775	2026.4	10552.3	12578.7	21977	3297	1.37	18,679	
69	10-Dec-08	31-Dec-08	12829	10771	422492	9918.0	50892	2071.9	10789.1	12861.0	22471	3371	2.54	19,098	192,600

