VESTERGAARD FRANDSEN

DISEASE CONTROL TEXTILES

GS0086 Sustainable Deployment of the LifeStraw Family in Rural Kenya
Verification Report - Verification 1 – June 1, 2011 to November 30, 2011

SUBM ITTED January 16, 2012
FINAL REVISED February 13, 2012

Introduction

This report presents the project proponent, Vestergaard Frandsen's, monitored parameters and Gold Standard Voluntary Emission Reduction (VER) calculations for GS0086, "Sustainable Deployment of the LifeStraw Family in Rural Kenya".

This report includes six sections:

1. Background on project deployment
2. Forward actions required by the Gold Standard Technical Advisory Committee
3. Forward actions required by validation Designated Operational Entity DNV
4. Monitored parameters outlined in the approved and registered PDD
5. Resultant VER calculations
6. Monitored parameters outlined in the approved and registered Gold Standard Passport

Additionally, the monitoring report package includes referenced documentation, the survey reports and raw data used, and the VER calculation sheets.

There are three surveys that form the data set used in this monitoring report. They are:

1. Survey conducted in July and August 2011 by Vestergaard Frandsen of 19,430 households across the project region. This survey is the primary data set for several monitoring parameters and is referred to hereafter as "**VF-MR1-Survey**". This data is produced by the Vestergaard Frandsen Project Database and stored in VF-MR1-rawdata.csv.

2. Survey conducted in by EXP Agency of 108 households, conducted in July and September 2011. The purpose was to address the validation DOE FAR 2 and FAR 3, and it is the primary data source for these FARs, and was also the primary data source for the Xboil parameter. Simple random sampling was used by EXP Agency to select 18 households in 6 districts with representation from each of the 4 counties. The sample size

of at least 100 households was requested in the FAR. This survey is hereafter referred to as "**EXP-MR1-FAR-Survey**".

3. Survey conducted by EXP Agency in November, 2011 of 101 households. The purpose was to address the Gold Standard FAR, as well as provide spot-checked quality control and quality assurance of the VF-MR1-Survey. The sample size for this survey was selected randomly from the sample contained in **VF-MR1-Survey**. This survey was a primary data source for some parameters, and secondary, comparison data source for several others, and is hereafter referred to as **"EXP-MR1-QAQC-Survey".** Note that the results of this survey are compared to the same values from the raw data contained in the **VF-MR1-Survey** for the particular sub-set sampled by EXP. Therefore, the "database" values that EXP compares their results to are a sub-set of the **VF-MR1-Survey** results.

This report was prepared by Manna Energy Limited under contract to Vestergaard Frandsen, and contains reporting information provided by Vestergaard Frandsen, Manna Energy Limited, and EXP Agency of Nairobi, Kenya.

1. Project Background

Vestergaard Frandsen is a European-based company specializing in disease control products and operating under a unique Humanitarian Entrepreneurship business model. The company's strategy is focused on strong support of the MDGs, particularly improving maternal health, reducing child mortality, combating HIV/AIDS, malaria, and reducing the number of people without access to safe drinking water. The company focuses on innovating technologies, building health service delivery models and identifying innovative financing mechanisms to support sustainable and scalable solutions for the developing countries.

The LifeStraw® Family is a point-of-use microbial water treatment system intended for routine use in low-income settings. The system can filter up to 18,000 liters of water, enough to supply a family of five with microbiologically clean drinking water for three years. This removes the need for repeat intervention. The system requires no electricity nor additional consumables beyond the unit itself. LifeStraw® Family complies with the US Environmental Protection Agency's "Guide Standard and Protocol for Testing Microbiological Water Purifiers," and meets WHO testing guidelines to be considered "Highly Protective", providing treated water that is as-good or better than boiling for microbiological contamination.

In April and May, 2011, 877,505 LifeStraw® Family water filters were distributed to approximately 91% of all households in the Western Province of Kenya. The distribution program, called "Carbon for Water," has provided more than four million residents with quick access to safe drinking water at the household level.

The program was solely funded by Vestergaard Frandsen and implemented in partnership with the Kenyan Ministry of Public Health and Sanitation and through collaborations with the Ministry of Education and the National Environment Management Authority.

In September 2011, four months after the original distribution, a campaign and health education campaign was implemented. Campaign activities used approximately 2,000 community health workers and more than 4,000 local employees to go door-to-door to more than 90% of all households that had received a LifeStraw family filter.

The company is opening 32 district-level, maintenance and education facilities, staffed by more than 44 Kenyans, accessible by each recipient to ensure on-going program success. In addition to offering free replacement and repair services for the LifeStraw filters, program strategy is built on effective community engagement. Extensive social mobilization and community education initiatives are being implemented in schools, in collaboration with the Ministry of Education, among community groups in collaboration with village chiefs, women's groups, and other opinion leaders, and integrated into health services. Health impact and sustainability studies are being developed to further build the evidence base around this large scale initiative. There are few other water treatment programs that can demonstrate this level of commitment to sustainability and success.

2. Gold Standard Technical Advisory Committee FARs

In the "Sustainable Deployment of the LifeStraw Family in rural Kenya GS0086 8-week registration review period" final report of February 2, 2011, the Gold Standard Technical Advisory Committee outlined one forward action. The FAR text states:

Following the telephone call on 2 February 2011 between Gold Standard and PP, the PDD was revised to clarify that parameters Lbl,i,y and Lpj,i,y will be determined by Kitchen Tests that are conducted over a period of 3 days in sample households, before first verification.

These two parameters as described as directed by the GS Technical Advisory Committee on January 10, 2012:

$L_{bl,i,y}$ - Raw water treated with the water treatment technology
$L_{pj,i,y}$ - Treated water that is still boiled

To address this FAR, Vestergaard Frandsen contracted with social mobilization firm EXP Agency to conduct this survey, **EXP-MR1-QAQC-Survey.** These results are reported in **EXP-MR1-QAQC-Survey_Findings11.12.11.docx** and the raw data is available in **EXP-MR1-QAQC-Survey_rawdata11.12.11.xlsm.** Over the course of three days, as required by the FAR, EXP surveyed these two parameters in 101 households selected randomly from the database selection composed of the **VF-MR1-Survey** results.

Their results, as reported, indicate:

$L_{bl,i,y}$ - Liters of treated water in the baseline – the average of three days of "Average Filtered liters of water per person" = **3.45 liters per person per day** ('3 day Analysis' tab, line 191, in **EXP-MR1-QAQC-Survey_rawdata11.12.11.xlsm).**

This value is higher than the **VF-MR1-Survey** results which are used in this MR for this parameter. Therefore, the **VF-MR1-Survey** results are used as they are more conservative.

$L_{pj,i,y}$ - Liters of treated water still boiled in the project activity - The EXP-MR1-QAQC-Survey studied this parameter. In total, across 101 households over three days, only 20 liters of water were boiled, combined. This 20 liters was recorded in one household. EXP clarified with the household owner than this 20 liters is NOT filtered water.

Therefore, this value is recorded as "0" liters of treated water still boiled in the project activity.

3. Validation Designated Operational Entity DNV FARs

Three forward action requests (FARs) were provided by the validation DOE, DNV. They are presented below, direct from the validation report, along with the requested response.

FAR 1 The PP should submit all 68 letters from division officers to Gold standard prior the 1st Verification.

Please see enclosed letters from all division officers in the Western Province of Kenya.

FAR 2 The PP used the services of a third party agency "EXP agency" to conduct a survey to estimate the alternative treatment options that are being used and that would be used if suitable supplies were made available. The sample size of the survey conducted included 17 households. The sample size is used for the survey is insufficient to provide a true representation of the alternative treatment options used and would be used. The PP has to conduct the survey using a larger sample size (Step 1.5, section 4.1) from methodology should be followed to assess the number of households that would boil water. This survey has to be completed prior to the 1st verification. The results of the survey should be taken into account in the baseline.

To address this FAR, Vestergaard Frandsen contracted with social mobilization firm EXP Agency to conduct **EXP-MR1-FAR-Survey**. Their report for **EXP-MR1-FAR-Survey** "LSF additional survey July/September 2011" provides the required data input. The sample size was 108 households, which exceeds the sample size of 100 required by the methodology. The results are presented on slide 25, and indicate that 79.6% of households would choose to boil their drinking water if they had all necessary resources, prior to receiving the LifeStraw Family. Therefore, this impacts the baseline parameter X_{boil}. Based on these results, $X_{boil} = 0.796$.

FAR 3 The PP used the services of a third party agency "EXP agency" to conduct a survey to estimate the below listed parameters:
  1. *Stoves used for boiling water*
  2. *Biomass used for boiling water*
  3. *Types of biomass used for boiling*
The sample size of the survey conducted included 30 households. The sample size is used for the survey is insufficient to provide a true representation for the total population of Western Kenya. The PP has to conduct the survey using a larger sample size (Step 1.5, section 4.1) from methodology should be followed to assess the below parameters. This survey has to be completed

prior to the 1st verification. The results of the survey should be taken into account in the baseline emission estimation.

To address this FAR, Vestergaard Frandsen contracted with social mobilization firm EXP Agency to conduct **EXP-MR1-FAR-Survey**. Their report for **EXP-MR1-FAR-Survey** "LSF additional survey July/September 2011" provides the required data input. The sample size was 108 households, which exceeds the sample size of 100 required by the methodology.

The results for the type of stove used are shown on slide 16, where 97% of the respondents frequently use three-stone fires, 2% use charcoal stoves, and 1% use paraffin stoves.

For the second and third parameters, these are combined into a single question – type of biomass used in household cookstoves. These results are presented on slide 18, and indicate that 69% wood mixed with other biomass, 24% use wood mixed with twigs and branches, 2% use wood only, 1% use crop residues only, and 5% do not use biomass. This indicates an overall woody biomass use of 95%. On slide 16 of this report, it is shown that 97% of stoves predominately used are 3-stone fires (woody biomass, other biomass and other fuels) and 2% are charcoal stoves and 1% are paraffin stoves.

Therefore, it is conservatively assumed that 95% of stoves used to boil water are woody biomass stoves, and 2% are charcoal stoves. As previously stated in the PDD, the charcoal emissions are subsumed by biomass emissions. Therefore, the PP has reduced the biomass consumption by 3% to account for fuel use other than woody biomass or charcoal. This is reflected in the VER calculations.

4. Monitored parameters in PDD

The sections below present the monitoring parameter tables from the PDD, as revised and updated to reflect the resultant data values, sources, and justifications.

The "VF-MR1-Survey-Processed.xlsx" document presents the transparent processing steps for several of the parameters. The processing steps are listed below:

Table 1: VF-MR1-Survey-Processed.xlsx processing steps

Step	Action	Where Applied
1	Removed Households less than 1 and greater than 20	Column C
2	Removed all non-LifeStraw users	Column G
3	Removed "do not filter water"	Column I
4	Removed "0" liters of water per day	Column H
5	Calculate Uy as ratio of households after step 3 over households after step 1	Results
6	Calculated liters per person per day at household level	Column L

7	Reduced liters per person per day by non-creditable volumes (reference EXP-MR1-QAQC-Survey- final updated 23.11.2011 - NonCreditableCalc.xlsm)	Column M
8	Cap liters per person per day at household level to 6.0	Column N
9	Calculate overall average liters per person per day after cap	Results
10	Calculate average people in household - Py	Results
11	Calculated lower 90% confidence interval for mean values for Py and Lbl	http://easycalculation.com/statistics/confidence-limits-mean.php

In order to address a concern raised by the DOE in response to a question of how much of the LifeStraw treated water is used for non-creditable purposes, the following additional processing was applied.

The VF-MR1-Survey asked the question: "How many liters of water do you filter each day using LifeStraw?" (MR1), while, over three days, the EXP-MR1-QAQC survey asked the question: "Filtered liters of water used for drinking, washing hands and washing fruits and vegetables".

Therefore the EXP-MR1-QAQC question specifically identifies creditable sources versus total water filtered. Therefore, the difference between these values can be attributed to non-creditable sources.

This parameter is analyzed in "EXP-MR1-QAQC-Survey- final updated 23.11.2011 - NonCreditableCalc.xlsm" using the following steps:

Table 2: EXP-MR1-QAQC-Survey- final updated 23.11.2011 - NonCreditableCalc.xlsm processing steps

1	Created pivot table comparing LPPD from EXP-MR1-QAQC Survey against VF-MR1-Survey	Column C and D
2	Did not consider households where data was unavailable from VF-MR1-Survey	Column F and H
3	Did not consider LSF0000232384, a reported non-LifeStraw user	Column F and H
4	Calculated ratio of EXP-MR1-QAQC to VF-MR1	Column J
5	Removed consideration where Column J is greater than 2.5. This is consistent with observations that reporting can vary day-by-day,	Column K
6	Calculated average ratio	0.862
7	**Calculated non-creditable percentage**	**13.790%**

However, the DOE observed during the site visit a higher non-creditable water percentage of 16.4%. Therefore, for this monitoring period, the Project Proponent will apply this more conservative value to Lbl.

Data / Parameter:	$X_{nrb,bl,y}$
Data unit:	Fraction
Description:	Non-renewability of woody biomass fuel in year y in baseline scenario
Source of data:	C4EcoSolutions independent report "Calculation of the Non-Renewable Biomass usage for project areas in accordance with the Gold Standard methodology (Version 02)," as adapted and presented in Annex A: Updated Non-Renewable Biomass fraction parameter for GS0086 "Sustainable Deployment of the LifeStraw Family in Rural Kenya".
Value Applied	**0.93**
Description of measurement methods and procedures applied:	**Reference Annex A of this monitoring report.**
QA/QC procedures applied:	3rd party study and report
Any comment:	No less than biennial monitoring frequency

Data / Parameter:	$X_{nrb,pj,y}$
Data unit:	Fraction
Description:	Non-renewability of woody biomass fuel in year y in project scenario
Source of data:	C4EcoSolutions independent report "Calculation of the Non-Renewable Biomass usage for project areas in accordance with the Gold Standard methodology (Version 02)," as adapted and presented in Annex A: Updated Non-Renewable Biomass fraction parameter for GS0086 "Sustainable Deployment of the LifeStraw Family in Rural Kenya".
Value Applied	**0.93**
Description of measurement methods and procedures applied:	**Reference Annex A of this monitoring report.**
QA/QC procedures applied:	3rd party study and report
Any comment:	No less than biennial monitoring frequency

Data / Parameter:	i_y
Data unit:	Units/year
Description:	Number of LifeStraw® units distributed
Source of data:	Stockroom Counts
Value Applied	**877,505**
Description of measurement methods and procedures applied:	A detailed stockroom count was kept of all LifeStraw Family distributions during the distribution campaign in May, 2011. The resultant count recorded that the number of LifeStraw Family units listed above were distributed to households in Western Province, Kenya.

QA/QC procedures applied:	Cross check of stockroom counts by Vestergaard supervisors during the campaign deployment.
Any comment:	

Data / Parameter:	$LE_{,y}$
Data unit:	tCO2e/y
Description:	Leakage; potential GHG emissions outside project boundary caused by project activity
Source of data:	Calculated based on methods presented in PDD and data collected from total sales record of LifeStraw® Family units produced and distributed.
Value Applied	**316**
Description of measurement methods and procedures applied:	The distribution stock count (equivalent to total sales record), parameter i_y, is used in combination with the calculations presented in section B.6.1 of the registered PDD for this project, "Leakage to determine the ex-post leakage emissions". The approved calculation estimates a conservative leakage of 736 tonnes of CO2 per year for 1,024,000 LifeStraw Family units. The actual distribution was 877,505, or 85.69% of the estimate. Therefore, the Leakage estimate is scaled by the same amount – 736 * 0.8569 = 631 tones of CO2. This verification period covers 6 months, therefore the Leakage for this period is – 631 * (6/12) = 316 tones of CO2.
QA/QC procedures applied:	S Cross check of stockroom counts by Vestergaard supervisors during the campaign deployment.
Any comment:	Leakage will be applied ex-post as the Total Sales Record is updated, and applied prior to each verification. The calculation methodology described will be reviewed with biennial monitoring frequency.

Data / Parameter:	$B_{bl,i,y}$
Data unit:	Tbiomass/y
Description:	Mass of woody biomass combusted in the baseline in year y
Source of data:	Calculation
Value Applied	Please reference "**VF_VERCalculation1stVerification**"
Description of measurement methods and procedures applied:	Calculated per the methodology (page 35) as shown in section B.6 of the registered PDD for this project.
QA/QC procedures applied:	Calculation
Any comment:	No less than biennial monitoring frequency

Data / Parameter:	$B_{pj,i,y}$
Data unit:	Tbiomass/y
Description:	Mass of woody biomass combusted in the project in year y
Source of data:	Calculation
Value Applied	Please reference "**VF_VERCalculation1stVerification**"
Description of measurement methods and procedures applied:	Calculated per the methodology (page 35) as shown in section B.6.

QA/QC procedures applied:	Calculation
Any comment:	No less than biennial monitoring frequency

Data / Parameter:	U_y
Data unit:	Percentage
Description:	Usage of water treatment units in place
Source of data:	**VF-MR1-Survey**
Value Applied	**91.126%**
Description of measurement methods and procedures applied:	An extensive survey was conducted in the summer of 2011 of LifeStraw® Family users, in which they were be asked about their usage of the LifeStraw Family. These results are presented in the **VF-MR1-Survey-Processed.xlsx,** wherein the U_y parameter is determined as a percentage of those respondents who reported using their LifeStraw Family. This data was processed as described in Table 1, above.
QA/QC procedures applied:	Spot checks by 3rd party, EXP Agency as presented in **EXP-MR1-QAQC-final updated 23.11.2011.xlsm,** under "summary" tab, line 100. These results show that the QA/QC results indicate 98.02% usage of the households surveyed. Therefore, the **VF-MR1-Survey** is more conservative, and is used as the calculation parameter in this report. In any difference observed between EXP-MR1-QAQC Survey and VF-MR1-Survey, the more conservative value is applied.
Any comment:	No less than biennial monitoring frequency

Data / Parameter:	W_i
Data unit:	Kg/L
Description:	New stove performance and existing stove performance
Source of data:	Baseline Water Boiling Test (BWBT) Kitchen Test
Value Applied	0.36 - Determined via baseline water boiling tests (see Annex 3 of the registered PDD).
Description of measurement methods and procedures applied:	Reference Annex 3 of the registered PDD, Baseline Information, Baseline Water Boiling Test (BWBT)
QA/QC procedures applied:	Reference Annex 3 of the registered PDD, Baseline Information, Baseline Water Boiling Test (BWBT)
Any comment:	Will be conducted only if the Kitchen Test reveals that the baseline water boiling conditions have changed, necessitating a new BWBT. During the **EXP-MR1-FAR-Survey** , no material change was observed in the baseline water boiling conditions that would necessitate a new BWBT during this verification period.

Data / Parameter:	$L_{bl,i,y}$
Data unit:	L/p/d – Liters per person per day
Description:	Raw water treated with the water treatment technology
Source of data:	**VF-MR1-Survey**
Value Applied	**2.958**
Description of measurement methods and procedures applied:	An extensive survey was conducted in the summer of 2011 of LifeStraw® Family users, in which they were be asked how many liters of LifeStraw Family filtered water is used per day.

These results are presented in the **VF-MR1-Survey-Processed.xlsx,** wherein the $L_{bl,i,y}$ parameter is determined described in Table 1, above.

This mean value is applied for the emission reduction calculations. While the registered PDD states using the revised EXP survey **EXP-MR1-QAQC-Survey** as the new baseline value to comply with the Gold Standard FAR, this requirement is made obsolete by the updated value provided as part of this Monitoring Report, as this is a monitored value in addition to a baseline value. |
| QA/QC procedures applied: | Spot checks by 3rd party, EXP Agency as presented in **EXP-MR1-QAQC-Survey.** These results, shown on page 1 of "EXP-MR1-QAQC-Survey_Findings11.12.11", show that the QA/QC results indicate an average of 3.82 liters per person per day of treated water consumed.

Therefore, the **VF-MR1-Survey** is more conservative, and is used as the calculation parameter in this report. |
| Any comment: | No less than biennial monitoring frequency.

This value will be capped at 6.0, per direction from the Gold Standard Technical Advisory Committee dated January 10, 2012. |

Data / Parameter:	$L_{pj,i,y}$
Data unit:	L/p/d – liters per person per day
Description:	Treated water that is still boiled
Source of data:	**EXP-MR1-QAQC-Survey**
Value Applied	0
Description of measurement methods and procedures applied:	These results are reported in **EXP-MR1-QAQC-Survey_Findings11.12.11.docx** and the raw data is available in **EXP-MR1-QAQC-Survey_rawdata11.12.11.xlsm.** Over the course of three days, as required by the FAR, EXP surveyed these two parameters in 101 households selected randomly from the database selection composed of the **VF-MR1-Survey** results.

The EXP-MR1-QAQC-Survey studied this parameter. In total, across 101 households over three days, only 20 liters of water were boiled, combined. This 20 liters was recorded in one household. EXP clarified with the household owner than this 20 liters is NOT filtered water. |

	Therefore, this value is recorded as "0" liters of treated water still boiled in the project activity.
QA/QC procedures applied:	EXP Agency reported to the Project Proponent that their survey coordinator reviewed all of the EXP-MR1-FAR-Survey results and took the following quality control and assurance steps: The survey coordinator reconfirmed and clarified results that were ambiguous or seemingly contradictory, or outliers from the rest of the data set. The survey coordinator also randomly selected several households from the survey to re-visit in person or call to re-confirm reported results.
Any comment:	No less than biennial monitoring frequency.

Data / Parameter:	$P_{i,y}$
Data unit:	p/h
Description:	Average people per LifeStraw® Family unit
Source of data:	**VF-MR1-Survey**
Value Applied	**5.415**
Description of measurement methods and procedures applied:	During the **VF-MR1-Survey** residents were asked how many people are in their household, served by the LifeStraw Family. These results are presented in the **VF-MR1-Survey-Processed.xlsx,** wherein the $L_{bl,i,y}$ parameter is determined described in Table 1, above.
QA/QC procedures applied:	Spot checks by 3rd party, EXP Agency as presented in **EXP-MR1-QAQC-Survey.** These results, shown on page 1 of "EXP-MR1-QAQC-Survey_Findings11.12.11", show that the QA/QC results indicate an average of 5.59 people per household. Therefore, the **VF-MR1-Survey** is more conservative, and is used as the calculation parameter in this report. EXP Agency reported to the Project Proponent that their survey coordinator reviewed all of the EXP-MR1-FAR-Survey results and took the following quality control and assurance steps: The survey coordinator reconfirmed and clarified results that were ambiguous or seemingly contradictory, or outliers from the rest of the data set. The survey coordinator also randomly selected several households from the survey to re-visit in person or call to re-confirm reported results.
Any comment:	No less than annual survey.

Data / Parameter:	X_{boil}
Data unit:	Fraction

Description:	Percentage of users that would boil water as a form of water treatment
Source of data:	**EXP-MR1-FAR-Survey**
Value Applied	**0.796**
Description of measurement methods and procedures applied:	See above section, "Validation Designated Operational Entity DNV FARs".
QA/QC procedures applied:	EXP Agency reported to the Project Proponent that their survey coordinator reviewed all of the EXP-MR1-FAR-Survey results and took the following quality control and assurance steps: The survey coordinator reconfirmed and clarified results that were ambiguous or seemingly contradictory, or outliers from the rest of the data set. The survey coordinator also randomly selected several households from the survey to re-visit in person or call to re-confirm reported results.
Any comment:	No less than biennial monitoring frequency.

Data / Parameter:	$AF_{pj,i,y}$
Data unit:	Tfuel/year
Description:	Alternative fuel consumed in the project
Source of data used:	Monitoring Survey and Study – Not applicable for this Monitoring Report
Value of data applied Value Applied	0
Description of measurement methods and procedures applied:	This parameter was not surveyed for this verification period.
QA/QC procedures applied:	Spot checks by 3rd party.
Any comment:	No less than biennial monitoring frequency.

5. Voluntary Emission Reduction Calculations

Per the PDD, the baseline emission are calculated as follows.

Approach 1 per the methodology is used to estimate baseline emissions.

$$BE_y = [B_{bl,y} \times i \times X_{boil}] \times [X_{nrb,bl,y} \times EF_{bl,bio,co2} + EF_{bl,bio,ch4} + EF_{bl,bio,n2o}]\ldots\ldots\ldots \textbf{Eqn B.1a (modified)}$$

Where

BE_y = baseline emissions in year y (in tonnes CO_2e per year)

$X_{nrb,bl,y}$ = the non-renewable fraction of the woody biomass harvested in the project collection area in year y in the baseline scenario

$B_{bl,y}$ = the mass of woody biomass consumed during boiling in the baseline in year y (tonnes/year).

i = Number of water treatment units in place

X_{boil} = fraction of users that boil water as a form of water treatment (additional parameter not identified in the methodology)

$EF_{bl,bio,co2,net}$ = the CO_2 emission factor for use of the biomass fuel in the baseline scenario in tonnes CO_2 per tonne fuel (tonnes/TJ)

NCV = Net calorific value of biomass used (woodfuel) (TJ/tonne)

$EF_{bl,bio,co2}$ = $EF_{bl,bio,co2,net}$ × NCV = CO2 emission factor for wood (tonnes CO2/tonne woodfuel)

$EF_{bl,bio,ch4,net}$ = the CH4 emission factor for use of the biomass fuel in the baseline scenario in tonnes CO_2 per tonne fuel (tonnes CH4/tonne biomass)

GWP_{CH4} = The global warming potential for CH4

$EF_{bl,bio,ch4}$ = $EF_{bl,bio,ch4,net}$ × GWP_{CH4} = the CH4 emission factor for use of the biomass fuel in the baseline scenario in tonnes CO_2 per tonne fuel (tonnes CO2/tonne biomass)

$EF_{bl,bio,n2o,net}$ = the N2O emission factor for use of the biomass fuel in the baseline scenario in tonnes CO_2 per tonne fuel (tonnes N2O/tonne biomass)

GWP_{N2O} = The global warming potential for N2O

$EF_{bl,bio,n2o}$ = $EF_{bl,bio,n2o,net}$ × GWP_{N2O} = the N2O emission factor for use of the biomass fuel in the baseline scenario in tonnes CO_2 per tonne fuel (tonnes CO2/tonne biomass)

In accordance with Annex 3, $B_{bl,y}$ is calculated as follows:

$B_{bl,y}$ = $L_{bl,y}$ × W × 365 days × P_y … for **Eqn B1, B2**

Where,

$L_{bl,y}$ = the total amount of treated water for consumption per person per day (in liters).

W = amount of wood-fuel or fossil fuel (in tonnes) required to boil 1L of water on a three-stone stove to be safe for consumption

P_y = members per household in year y

Note: $AF_{bl,i,y}$ = The mass of alternative fuel i in the baseline in year y in accordance with trends projected throughout the project period, in tonnes. This mass can be set to zero in cases where the KT is appropriately designed to subsume alternative fuels (approach 3). Therefore this parameter is not included in this project activity emissions calculation.

Per the PDD, the project emission are calculated as follows.

Approach 1 is applies values of mass for each fuel in the mix:

$$PE_y = [B_{pj,y} \times i \times X_{boil}] \times [X_{nrb,pj,y} \times EF_{bl,bio,co2} + EF_{bl,bio,ch4} + EF_{bl,bio,n2o}]\ldots\ldots\ldots \textbf{Eqn P.1a (modified)}$$

Where (noting that parameters common to baseline equations are not repeated):

PE_y = project emissions in year y (in tonnes CO2e per year)

$X_{nrb,pj,y}$ = the non-renewable fraction of the woody biomass harvested in the project collection area in year y in the project scenario

$B_{pj,y}$ = the mass of woody biomass consumed during boiling of water in the project each year (in tonnes/year).

In accordance with Annex 3, $B_{p,y}$ is calculated as follows:

$$B_{pj,y} = [W \times 365\ days \times P_y] \times [[L_{pj,y} \times U_y] + [[1 - U_y] \times L_{bl,y}]] \ldots \text{for } \textbf{Eqn P1}$$

Where,

$L_{pj,y}$ = the total amount of water still boiled per person per day (in liters). This is equal to the amount of treated water still boiled for creditable purposes..

W = amount of wood-fuel or fossil fuel (in tonnes) required to boil 1L of water on a three-stone stove to be safe for consumption

P_y = members per household in year y

Baseline Emissions estimate for 12 month period

Description	Parameter	Value
Number of Lifestraws distributed	i	877505
Adjustment for % alternative water treatment	X_{boil}	79.6%
Nonrenewable Biomass %	X_{nrb}	93%
Treated water per person/day (l/day)	L_{bl}	2.958
Wood used to boil 1 liter water (kg/l)	W_i	0.36
Members per LifeStraw®	Py	5.415
Adjustment for alternative fuels %		0.970
Biomass consumption per year (t/yr)	B_{bl}	2.041567
CO2 emission factor for wood (tonnes/TJ)	$EF_{bl,bio,co2,net}$	112
Net Calorific Value (NCV) of wood (TJ/t)	NCV	0.0156
CO2 emission factor for wood (tonnes/t)	$EF_{bl,bio,co2}$	1.7472
CH4 emission factor for wood (tonnes/TJ)	$EF_{bl,bio,ch4,net}$	1.224
GWP CH4	GWP_{CH4}	21
CH4 emission factor for wood (tonnes/t)	$EF_{bl,bio,ch4}$	0.4009824
N2O emission factor for wood (t/TJ)	$EF_{bl,bio,n2o,net}$	0.01125
GWP N2O	GWP_{N2O}	310
N2O emission factor for wood (tonnes/TJ)	$EF_{bl,bio,n2o}$	0.054405
Baseline emissions (tCO2e/yr)	BE	2,966,531

Project Emissions estimate for 12 month period

Description	Parameter	Value
Number of Lifestraws distributed	i	877505
Adjustment for % alternative water treatment	X_{boil}	79.6%
Usage of water treatment systems in place	U_y	91.1263%
Nonrenewable Biomass %	X_{nrb}	93%
Treated water per person/day (l/day)	L_{bl}	2.9580
Liters of water still boiled (l/day)	L_{pj}	0.00
Wood used to boil 1 liter water (kg/l)	W_i	0.36
Members per LifeStraw®	P_y	5.415
Adjustment for alternative fuels %		0.970
Project biomass consumption per year (t/yr)	B_{pj}	0.181163
CO2 emission factor for wood (tonnes/TJ)	$EF_{bl,bio,co2,net}$	112
Net Calorific Value (NCV) of wood (TJ/t)	NCV	0.0156
CO2 emission factor for wood (tonnes/t)	$EF_{bl,bio,co2}$	1.7472
CH4 emission factor for wood (tonnes/TJ)	$EF_{bl,bio,ch4,net}$	1.224
GWP CH4	GWP_{CH4}	21
CH4 emission factor for wood (tonnes/t)	$EF_{bl,bio,ch4}$	0.4009824
N2O emission factor for wood (tonnes/TJ)	$EF_{bl,bio,n2o,net}$	0.01125
GWP N2O	GWP_{N2O}	310
N2O emission factor for wood (tonnes/t)	$EF_{bl,bio,n2o}$	0.054405
Project emissions (tCO2e/yr)	**PE**	263,241

Monitoring Report Period Emissions Reductions

In the following table, 121 LifeStraw Family units are adjusted to a start date of June 6 to account for late distributions of those units. All other LifeStraws have a start date of June 1, 2011.

Parameter	Value
Number of units installed June 1 - June 5	877,384
Days of crediting June 1 - June 5	5
Number of units June 6 - November 30	877,505
Days of crediting June 6 - November 30	178
Estimation of baseline emissions (tCO2e) per unit per day	0.009262035
Estimation of Project Activity Emissions (tCO2e) per unit per day	0.000821885
Estimation of leakage (tCO2e) per unit per day	0.000000987
Estimation of overall emission reductions (tCO2e) per unit per day	0.008439164
Emission Reductions June 1 - June 5	37,022
Emission Reductions June 6 - November 30	1,318,163
Total (tonnes of tCO2e) June 1, 2011 - November 30, 2011	1,355,185

These emission reduction estimates exceed the baseline estimates presented in the registered PDD. There are two primary factors that have driven this increase. The increase in the NRB fraction from 65% to 93% based on recent literature, and the increase from a baseline adoption rate of 83% to over 91% as a testament to the education campaigns the project proponent has conducted. There was also an increase in the average family size from to more than 5.41 from 4, and in X_{boil} from 71% to over 79%. However, L_{bl}, a significant parameter, is lower in this MR than in the PDD, going from 4.11 to 2.958.

6. Monitored parameters in Gold Standard Passport

The sections below present the sustainable development parameters that are monitored from the registered Gold Standard Passport for this project, the resultant data values, sources, and justifications.

No	1
Indicator	**Air Quality**
Mitigation measure	NA

Results: This parameter was not studied for this verification period, as it is required annually. It will be reported in the next verification period.

No	2
Indicator	**Water Quality and Quantity**
Mitigation measure	NA
Repeat for each parameter	
Chosen parameter	Number of people served with a satisfactory quality of potable water according to the EPA microbiological standard.
Current situation of parameter	Only 57 percent of households in Kenya have access to potable water, which is the cause of many waterborne diseases[1]. The LifeStraw® Family unit high quality ultra-filtration mechanism has been proven to be 99.99% effective in reduction of protozoa, bacteria and viruses and comply with U.S. Environmental Protection Agency guidelines for microbiological water quality[2].
Estimation of baseline situation of parameter	See above
Future target for parameter	An estimated 1 million households will have improved water quality as a result of clean water from LifeStraw® Family units.

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[1] UNDP Kenya Millennium Development Goals: http://www.ke.undp.org/mdgs/18

[2] Vestergaard Frandsen LifeStraw® Family Overview Presentation, 2010

		During distribution of the LifeStraw Family water treatment units, and during subsequent monitoring, education, maintenance and repair activities, the recipient residents will be taught proper operation and maintenance of the LifeStraw Family. Additionally, pictorial printed documentation describing proper operation and maintenance will be provided to the residents. This documentation and in-person instruction includes identification of how to monitor filter effectiveness and blockage, through flowrate changes, and how to respond to such degraded performance through filter "backwashing", repair and replacement when needed.
Way of monitoring	How	Surveys and records for number of households/people served with the LifeSraw® Family units
	When	Quarterly
	By who	Project proponent

Results: The stockroom distribution database indicates that 877,505 LifeStraw Family units were distributed to households in June, 2011. As reported by **VF-MR1-Survey,** with an average family size of more than 5.445 this indicates that 4,778,014 people now have access to a LifeStraw Family. **VF-MR1-Survey** indicates that 91.1% of those families use the LifeStraw Family on a regular basis. Therefore, there are now 4,352,771 people with regular access and usage of clean drinking water in the Western Province of Kenya, as a direct result of this project.

Therefore, the project proponent assigns a positive (+) score for this project on this indicator.

No		4
Indicator		**Other Pollutants**
Mitigation measure		The LifeStraw Family water filters will be replaced and disposed of every three years. The prevailing practice for disposal in Kenya is landfill, and the project proponent will ensure that, if any units are disposed of, it will be by landfill and not by incineration.
Repeat for each parameter		
Chosen parameter		Number of LifeStraw Family water treatment units collected by the PP and disposed of in landfill.
Current situation of parameter		The prevailing practice for disposal in Kenya is landfill.
Estimation of baseline situation of parameter		The prevailing practice for disposal in Kenya is landfill.
Future target for parameter		Disposal of all spent LifeStraw Family units in landfill.
Way of monitoring	How	Replacement and disposal records kept by PP.
	When	Annual reporting, but records maintain constantly
	By who	Project Proponent

Results: There have been a total of 1,361 LifeStraw units replaced since the initial distribution as of October 1, 2011. The replaced units have been retained by Vestergaard Frandsen for later re-use or recycling, or ultimately safe disposal.

Therefore, the project proponent assigns a neutral score for this project on this indicator.

No		7
Indicator		**Livelihood of the Poor**
Mitigation measure		NA
Repeat for each parameter		
Chosen parameter		1) Fuel savings from reduced boiling with firewood and charcoal 2) Money saved from reduced fuel consumption and; 3) Time saved by users from reduced gathering of firewood and charcoal.
Current situation of parameter		Dwindling resources lead to an additional workload for women and children, as they have to spend more time collecting firewood and/or spending money on firewood or charcoal. Families can use these saved resources to meet other basic household needs, more productive works, education and better child care. Fuel saving, time saving and better health due to improved water quality and decreased level of indoor air pollution are indicators for better livelihood.
Estimation of baseline situation of parameter		See above
Future target for parameter		Decreased firewood and charcoal consumption for cooking (or boiling water) will save time and money for end users[3].
Way of monitoring	How	Kitchen Survey and relevant academic reports or literature; Fuel savings from kitchen performance tests multiplied by current market price for charcoal and wood (if purchased). During Kitchen Surveys, residents will be asked if, during the period since receiving the LifeStraw Family, the cost or effort spent gathering fuelwood has been reduced.
	When	Annually
	By who	Project proponent

To address this indicator, the project proponent contracted with EXP Agency in November, 2011 to conduct a survey of 101 households. The sample size for this survey was selected randomly

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[3] Djédjé et al. Results Assessment: Survey on Impacts of the Stove Project in Transmara, Western and Central Cluster of Kenya; http://www.gtz.de/de/dokumente/en-kenya-results-assessment-stoves-2009.pdf

from the sample contained in **VF-MR1-Survey**. This survey was a secondary, comparison data source for several parameters, and is hereafter referred to as **"EXP-MR1-QAQC-Survey".**

Their results of this survey are shown on page 9 and 10 of **EXP-MR1-QAQC-Survey_Findings11.12.11,** and indicate that on average families have saved both wood fuel directly, and time and money to procure wood fuel since the project started, six months ago.

Therefore, the project proponent assigns a positive (+) score for this project on this indicator.

No		8
Indicator		**Access to affordable and clean energy services**
Mitigation measure		NA
Repeat for each parameter		
Chosen parameter		Number of households served with LifeStraw® Family units
Current situation of parameter		Targeted end users are currently boiling water using firewood and charcoal inefficiently.
Estimation of baseline situation of parameter		See above
Future target for parameter		An estimated 1 million households served with LifeStraw® Family unit will have access to clean water which is more affordable and efficient than boiling water by the traditional method of using firewood[4].
Way of monitoring	How	Kitchen Surveys
	When	Annually
	By who	Project Proponent

Results: The stockroom distribution database indicates that 877,505 LifeStraw Family units were distributed to households in June, 2011. As reported by **VF-MR1-Survey,** with an average family size of more than 5.445 this indicates that 4,778,014 people now have access to a LifeStraw Family. **VF-MR1-Survey** indicates that 91.1% of those families use the LifeStraw Family on a regular basis. Therefore, there are now 4,352,771 people with regular access and usage of clean drinking water in the Western Province of Kenya, as a direct result of this project.

Therefore, the project proponent assigns a positive (+) score for this project on this indicator.

No	10
Indicator	**Quantitative employment and income generation**
Mitigation measure	NA
Repeat for each parameter	
Chosen parameter	Number of new jobs created as a result of the project activity.

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[4] Vestergaard Frandsen Project Design Document, Sustainable Deployment of the LifeStraw® Family in rural Kenya, August 2010.

Current situation of parameter		None yet employed
Estimation of baseline situation of parameter		None yet employed
Future target for parameter		The project will generate thousands of jobs during the project distribution, monitoring and replacement phases.
Way of monitoring	How	Employment records
	When	Annual reporting, but records maintain constantly
	By who	Project Proponent

This project has employed thousands of Kenyan staff during the initial distribution, and following education campaigns. Therefore, the project proponent assigns a positive (+) score for this project on this indicator. These results are shown in the table below:

Campaign 1	Number employed
i. Distributors	3,400
ii. Supervisors	329
iii. Store clerks	208
iv. EXP - Forums	70
v. EXP - Road shows	8
vi. EXP Supervisors	37
vii. Area coordinators	12
viii. IT Team	4
ix. Motorbike drivers under subcontract	3,830
x. Drivers (Phiaton contract)	53
xi. Security team	424
Campaign 2	
i. Educators	1,945
ii. QC's	40
iii. Coordinators	40
iv. Motorbike drivers	2,025
v. Drivers	20
vi. EXP - surveys	7
vii. EXP - Forums	17
viii. EXP - Roadshows	8
ix. Security team	8
c. On-going	
i. Area Coordinators	5
ii. LSF Coordinators	40
iii. EXP - School activations	13

Based on the above evidence, the scoring for these parameters has been updated below:

Indicator	Mitigation measure	Preliminary score in registered Passport	Monitoring Period 1 Score
Air quality	NA	+	(not updated)
Water quality and quantity	NA	+	+
Other pollutants	Monitoring of collected LifeStraw Family units	0	0
Livelihood of the poor	NA	+	+
Access to affordable and clean energy services	NA	+	+
Quantitative employment and income generation	NA	+	+

Annex A:

Updated Non-Renewable Biomass fraction parameter for
GS0086 "Sustainable Deployment of the LifeStraw Family in Rural Kenya"

Introduction

Manna Energy Limited and CO2Balance commissioned a third party study through C4EcoSolutions to determine the fraction of Non-Renewable Biomass in project areas in Kenya for the purpose of providing an updated value of the NRB fraction presented in the Vestergaard Frandsen project, GS0086, "Sustainable Deployment of the LifeStraw® Family in Rural Kenya."

This report is entitled, "Calculation of the Non-Renewable Biomass usage for project areas in accordance with the Gold Standard methodology (Version 02)". The report was commissioned for CO2Balance's cookstove program in Kenya, but was commissioned by Manna Energy Limited and CO2Balance to be equally relevant for Vestergaard Frandsen's program. Parts of the report highlight CO2Balance's program as they were the primary contact for C4EcoSolutions. The report uses newly available data and follows the Gold Standard NRB methodology. This report studies six regions across Kenya, and establishes NRB fractions for each. This memorandum interprets these results and applies them to GS0086.

There are several motivations and justifications for this update:

1. X_NRB is a monitored parameter in GS0086, to allow for evolving baseline and project conditions.
2. There is recently new data available that provides greater insight, accuracy and currency into the NRB conditions in Kenya. Therefore, this new data is a more appropriate reflection of the project activity.

Methodology

The NRB fractions presented in the C4EcoSolutions report are as follows:

Project Area	NRB (m^3 yr^{-1})		NRB fraction (xNRB)	
			Total	Accessible
Aberdares	138,842	177,923	0.74	**0.95**
Kisumu	11,203,358	11,380,728	0.96	**0.97**
Maungu/Kasigau	12,759	45,999	0.21	**0.77**
Meru	461,308	504,945	0.86	**0.94**
Mombasa	3,740,468	3,890,611	0.95	**0.99**
Shimoni	12,218	13,863	0.85	**0.96**

As is shown, there is a varying NRB value across Kenya. This is reflected in the following map provided by, "Drigo,R. (2006) *WISDOM - East Africa: Spatial fuelwood production and consumption analysis of selected Africancountries*. FAO: Rome, Italy.88 pp." and modified in the C3EcoSolutions report:
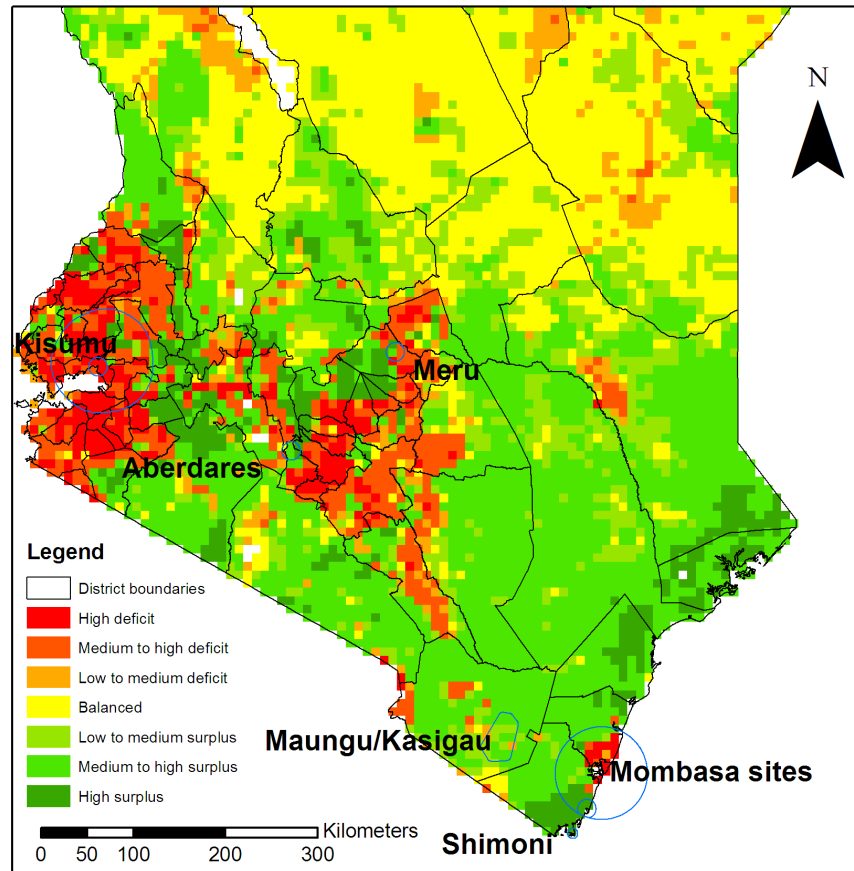
The ratio of fuelwood supply to demand estimated by the WISDOM study. This study assumes all demand is local, and that there are no other consumptive uses of woody biomass.

These results are now applied to the GS0086 project, which covers all of the western province of Kenya, which is illustrated below. Kisumu is located at the edge of the Western Province of Kenya, and is approximately 50 km from Kakamega, the provincial capital. As is illustrated in the above map, the NRB fraction in Kisumu is generally representative across western Kenya, inclusive of the western province of Kenya. Therefore, it would be reasonable to propose that the Kisumu NRB fraction be applied to all of the western province.

However, in order to be conservative the Project Proponent has instead conservatively calculated an average NRB fraction across the representative regions of Kenya. This is presented below:

Project area	Accessible NRB fraction (xNRB)
Aberdares	**0.95**
Kisumu	**0.97**
Maungu/Kasigau	**0.77**
Meru	**0.94**
Mombasa	**0.99**
Shimoni	**0.96**
Average	**0.93**

Conclusion

Therefore, the Project Proponent is submitting a revised NRB fraction to apply to GS0086 of:

$$X_{nrb,b,y} = X_{nrb,pj,y} = 0.93$$

This is applicable across the Western Province, as supported by the Kenya Forest Service:

KENYA FOREST SERVICE

Telephone: 0202315979

When replying please quote
Ref: NO.2/8/2/Vol. II/ ()

Email:zmkakamega@kenyaforestservice.org

ZONAL MANAGER
KAKAMEGA ZONE
P.O. BOX 1233
KAKAMEGA

Date: 23rd, November 2011

To whom it may Concern

RE: Biomass Fuel Deficit in Western Province, Kenya

I am the Kenya Forest Service Assistant Director of Forests for Kakamega, Kenya and I have worked in Kenya Forest Service for 16 years, including more than three years across the Western Province. I am trained as an environmental scientist and natural resource manager.

Kenya Forest Service is a State Corporation established in February 2007 under the Forest Act 2005 to conserve, develop and sustainably manage forest resources for Kenya's social-economic development.

The KFS management structure comprises 10 conservancies that are ecologically demarcated, 76 Zonal Forest Offices, 150 forest Stations, and 250 divisional forest extension offices located countrywide, and critical in forest management and surveillance.

The map below was provided to me by the project developers. This map shows a region within 50 km of Kisumu, Kenya that has been studied for biomass fuel availability.

Detailed studies are not currently available for biomass fuel availability across the Western Province. However, in my expert opinion, the access to household fuel and resulting biomass fuel deficit in the remaining areas of Western Province are similar or more severe than the area studied around Kisumu.

MWAI MURAGURI
Assistant Director of Forests

ZONAL MANAGER
KENYA FOREST SERVICE KAKAMEGA
24 NOV 2011
P. O. Box 1233 – 50100,
KAKAMEGA

1