Standardized Baseline for Institutional Cook Stoves in Uganda

Feasibility Report

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List of Acronyms

CARE2	Capital Access for Renewable Energy Enterprises.
CDM	Clean Development Mechanism.
CED	Cooking Energy Delivered.
CGE	Consultative Groups of Experts.
CIRCODU	Centre for Integrated Research and Community Development.
CREEC	Centre for Energy and Energy Conservation.
DNA	Designated National Authority.
DOE	Designated Operating Entities.
EB	Executive Board.
EF	Emission Factor.
ERT	Energy for Rural Transformation.
GHG	Green House Gases.
GIZ	The German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)
GVEP	Global Village Energy Partnership.
ICSEA	Improved Cook Stoves for East Africa.
ICR	International Care and Relief.
IICS	Improved Institutional Cook Stoves.
KPT	Kitchen Performance Test
LPG	Liquefied Petroleum Gas.
MEMD	Ministry of Energy and Mineral Development.
NAMA	National Appropriate Mitigation Action.
NCV	Net Caloric Value.
NTG	Net to Gross Adjustment Factor.
SBL	Standardized Baseline
SME	Small Medium Enterprise.
SSC	Small Scale.
PDD	Project Design Document.
PoA	Programme of Activities.
UBC	Uganda Carbon Bureau.
UBOS	Uganda Bureau of Statistics
UN	United Nations.
UNEP	United Nations Environmental Program.
UNFCCC	United Nations Framework Convention on Climate Change.
VER	Verification Emission Reduction.

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1. Introduction

The German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) through GIZ is supporting the development of a standardized baseline for institutional cook stoves in Uganda, in line with its core objective of strengthening the local carbon markets in Sub-Saharan Africa, especially in Least Developed Countries.

The Ministry of Energy and Mineral Development (MEMD) in Uganda has approved to undertake the "Promotion of improved institutional stoves" as prioritized nationally appropriate mitigation action (NAMA) for registration with UNFCCC. The ministry may wish to develop a Programme of Activities (PoA) on national scale for institutional cook stoves.

Development of a standardized baseline for institutional cook stoves in Uganda would provide crucial support in conceptualization of a PoA, and subsequently be proposed as a NAMA. Furthermore, this may also facilitate the development of CDM projects of institutional improved cook stoves (IICS) by independent investors. According to Gold Standard, all methodologies approved by the CDM Executive Board that meet their scope and specific eligibility criteria are accepted by Gold Standard (for both GS-CER and GS-VER.

This specific objective of developing the standardized baseline for institutional cook stoves also encompasses the overall objective of BMU to commission a right set of initiatives aimed at fostering Carbon Market activities in Uganda and strengthen the relevant stakeholder capacity in the country.

The Clean Development Mechanism & Standardised Baseline

All projects that aim to generate certified emission reductions (CERs) under the CDM rules must meet the same criteria and complete the same steps – a process referred to as project cycle. The initial step in the project cycle requires that the project proponent undertake an eligibility exercise, including the justification of the project additionality and identification of the baseline scenario. The baseline scenario determines the level of emissions that would have occurred in absence of the CDM project. Determination of the baseline and the justification of additionality have been criticized. AEA (2011)[1] have concluded from their assessments that the additionality test is subjective and unpredictable, there is lack of clarity in the guidance, loopholes in the role of the Designated Operational Entities (DOEs) and in the CDM Executive Board (EB) data gathering requirements. AEA further argues that the lengthy process requires costly data collection resulting in high bureaucratic costs. This and many other criticisms provided the rationale for the COP/CMP to request for the development of standardized baselines.

At the Climate Conference in Cancun, the parties to UNFCCC proposed that Standardized Baselines (SBs) be developed as one of the primary solutions to the challenges exposed by the existing CDM cycle. Under the SB framework, the baseline,

[1] http://ec.europa.eu/clima/policies/ets/linking/docs/additionality_baseline_en.pdf

additionality and related monitoring requirements may be pre-established for an entire sector, measure or technology. This ensures smoother facilitation of validations, and subsequently easier verifications. SBs thereby result in reduction of costs and at the same time enhances transparency, objectivity and predictability while ensuring environmental integrity.

The SBs continue to evolve, and to-date, 12 SBs have been proposed and the CDM Executive Board has approved four out of these 12 SBs. Uganda has one approved SB for charcoal projects[2], and one submitted for the GEF[3] that has just had a successful initial assessment. The development of SBs is driven by among others (i) proactive efforts by the UNFCCC to improve and expands standards; (ii) a shift in emission reduction markets to currently underrepresented project types and countries; (iii) the continuous expansion to new project types driven by project developers and; (iv) the possible need to expand standards to new instruments (e.g. NAMAs, sectoral crediting) for the post-2012 period.

Standardized baselines can be developed on the basis of an approved methodology, or an approved tool, together with a newly submitted methodology or using the SB guidelines. Once approved by the Executive Board (EB), the SBs help to reduce the CDM transaction cost by significantly reducing the time and effort spent on finalizing baseline scenario establishment, baseline emission (factor) calculation and (or) the demonstration of additionality.

2. Objective

The feasibility assessment of the SB is crucial step in carrying forward the SB development process. The objective is to ensure that the right choices are made through exhaustive analysis of available options for every step. The following steps listed below are analyzed.

- ✓ Level of aggregation and alternative technologies;
- ✓ Applicable CDM Methodologies;
- ✓ Additionality Concept;
- ✓ Existing baseline studies;
- ✓ Baseline Emission Factors;
- ✓ Suppressed Demand;
- ✓ Cost Benefit Analysis; and
- ✓ SBL and National GHG inventory

3. The Approach

The consultant has undertaken a desk-based research using publically available data on institutional cook stoves in Uganda as first priority. The UNFCCC website was consulted to determine the applicable methodologies, standards and guidelines for

[2] https://cdm.unfccc.int/methodologies/standard_base/EB73_repan04_ASB-0002.pdf

[3] https://cdm.unfccc.int/methodologies/standard_base/new/sb8_index.html

establishing the SBL in institutional cook stoves. The approach for SBL development in the context of institutional cook stoves could be either using:

- "Guidelines for the establishment of sector specific standardized baselines"; or
- A methodological approach contained in an approved baseline and monitoring methodology.

Thereafter, stakeholders were identified in consultation with GIZ. All the stakeholders were contacted via email and requested to share relevant information and data in their possession, specifically if it is related institutional cook stoves. The list of the identified stakeholders is contained in the Appendix 1.

The consultant with guidance from GIZ, approached stakeholders for meetings to request data and relevant information for development of SB. The stakeholders who were visited include: GIZ - Biomass Energy, Ministry of Energy and Mineral Development – Department of Renewable, UGASTOVE, Biomass Energy Efficiency Technology Association (BEETA), GVEP, CIRCODU, UNFCCC Regional Collaboration Centre and Uganda Bureau of Statistics (UBOS).

The Consultant undertook the feasibility assessment of SBL, in parallel with draft completion of Standardized Baseline Form to ensure that the analysis covers the important aspects of standardized baseline documentation.

The draft feasibility report was discussed with key stakeholders who provided inputs that have been incorporated during the finalization of feasibility report.

4. The Analysis

4.1 Institutional cooking practices in Uganda

As per the Uganda National Communication (National Communication, 2002), the energy sector is predominantly dependent on wood fuel, which accounts for up to 93% of the country's total energy needs. The high demand for fuel wood has resulted into depletion of forests leading to land degradation. The other sources of energy are petroleum and hydroelectricity accounting for 5% and 1.5% respectively (National Communication). The hydroelectricity will primarily cater to electricity requirements in country. The fuel combustion breakdown in the country establishes that approximately 88% of the fuel is used in transportation and residential sector, leaving marginal quantities of fuel to be used for commercial / institutional setups. A recent paper, mentions that biomass contributes 90% of the energy needs for institutional setups and commercial buildings (A Review of Energy Situation in Uganda, 2014). Thus it is evident that for cooking needs, biomass is the energy source, also for institutional setups.

> Institution is defined as a group of people sharing a common goal. Further defined by GIZ as a unit where 50 a more people are feed. A definition by UBOS literature indicates it as a unit using 300 liters and above. According to Uga-stove manufacturers, for a group of 15 and more people to prepare and eat together a bigger size stove is required. The institutions that can be included are - schools (primary, secondary and tertiary); hospitals, prisons and small-scale enterprises such as restaurants, hotels etc.

In most institutions in the country, such as schools, prisons, hospitals etc., firewood is used for cooking in an inefficient manner such as three stone fires or using traditional cooking techniques. The firewood used comes from mostly non-renewable sources and contributes to degradation and deforestation in Uganda. (National Biomass Energy Demand Strategy 2001 – 2010, 2001)

Use of non-renewable biomass can be demonstrated when there is a depletion of biomass stock in forests or a reduction of forest coverage, which means that there has been an unsustainable use of the biomass resources. In Uganda, during the period 1990 to 2010 the extent of forest decreased from 4.751 million hectares 2.988 million hectares. Also, the carbon stock in living forest biomass decreased from 171 million tons to 109 million tons (Global Forest Resources Assessment, 2010). Therefore, as per the published literature, the depletion of forests over the years indicates that biomass used is non-renewable.

The Ugandan cook stoves sector came to the fore in the 1980s due to concerns over deforestation and desertification. The then Ministry of Energy (MoE) initially set improved cook stove (ICS) adoption targets of 2.45m households, but technology limitations and a lack of resources prevented the government from achieving the target. Despite the challenges, the roll out of improved cook stoves at the household level increased steadily, starting with the foundation of UgaStove and the increased GIZ involvement in the 90s.

However only a few ICS businesses operate at scale today, the largest (UgaStove) produces approximately 4,000 stoves per month. Entrepreneurs and micro-businesses dominate the market, typically producing up to 100 stoves monthly. The entrepreneurs of improved cook stoves have formed themselves into an association – The Biomass Energy Efficiency Technology Association (BEETA).

The players in the improved cook stove sector in Uganda include:

Private Sector

- Ugastove
- Friends of Wealthy Environment (FOWE)
- Envirofit
- Ecozoom
- Paradigm Project
- BEETA Network
- The Private Sector Foundation of Uganda
- Uganda Energy Foundation
- Up Energy
- Wana Energy Solutions
- PEES
- PETSD
- AEESS
- Prime Equipment & Co
- KEAN Development Enterprises

Source: Global Alliance for Clean Cookstoves – Uganda Market Assessment - http://www.cleancookstoves.org/resources_files/uganda-market-assessment-mapping.pdf

The carbon market knowledge is at reasonable levels in the cook stove domain. UgaStove together with Impact Carbon has already achieved Gold Standard registration and is verifying and issuing credits. The Uganda Carbon Bureau (UBC) has registered a multi country Improved Cookstoves for East Africa (ICEA) PoA.

Most of the above advancements are in the domestic cook stoves sub-sector. There is little development in institutional improved cook stoves. Firewood is the common fuel used in most of the institutions. As a result, a large number of trees are consumed to provide firewood for these institutions. Efforts to reverse this effect started in the 1980s when the development agencies and some NGOs began to promote institutional improved cookstoves for institutions that were using biomass inefficiently. The early development of the IICS is attributed to Bellerive Foundation, an NGO that was based in Kenya. The Bellerive institutional stoves were designed in various sizes ranging from 12 to 200 litres with investment costs ranged from US$1,250 to US$ 1,500[4] (including installation costs, supplementary equipment, training of cooks and maintenance contracts). The Bellerive cookstoves installed in last 2 decades are not quite old and inefficient, as observed in survey conducted in schools by MEMD (Inspection and evaluation of institutional stoves adoption and performance in schools and institutions , 2011).

Overall, there is slow progress in the institutional cook stove development compared to the household improved cook stoves. The majority of improved cooking stoves built today are for domestic cooking, often used by households. However, institutions such as schools, colleges, universities, hospitals, prisons, army barracks, factories and, to a great extent large temporary settlements such as refugee camps or sites of religious festivals where a large number of people may need feeding at any one time require a larger size of the improved cook stove. Moreover, even in commercial centers, restaurants selling cooked food and serving a large number of people throughout the day similarly require larger sized improved cooking stoves. In these places the conventional domestic stove would not be suitable, even if several of them were used together - these would be too small to meet the demand. There are fewer types of the institutional stove on the market than domestic stove. The improved institutional stoves currently available in market include - Rocket stoves, Built- in institutional cook stoves, Barrel stoves.

[4] http://www.sustainergyweb.eu/wiki/improved-biomass-institutional-stoves/

According to a study conducted by GVEP in Wakiso District, rural schools spend about UGX 400,000 per month on firewood, with their urban counterparts spending twice as much (Improved Institutional Cookstoves in Wakiso District - Baseline Survey Report, 2012). The feedback from the schools that have adopted improved cook stoves indicate over 50% cost savings. In addition to saving money, the interviewed schools reported a considerable reduction in the amount of smoke in the kitchens and significant reduction of the time used for cooking. Despite of the reported benefits, the uptake of Improved Institutional Cook Stoves (IICS) remains low for several reasons, such as low awareness among schools of the IICS economic benefits arising from reduced firewood consumption; the cost of acquiring the stove and the inability of schools to raise the money; the lack of knowledge of available suppliers of IICS; and previous negative experience with IICS manufacturers who did not meet the market minimum quality standards.

Indeed, the development of a standardized baseline may help to address some of the barriers mentioned above if it can trigger the development of carbon projects that could result in additional revenue streams for either stove manufacturers or the implementers.

4.2 Level of aggregation

The SBL development starts with the first step of deciding the level of aggregation to include different technologies and measures. The key to choose right technological measures is striking a balance between level of aggregation in the sector specific technologies and objective of the standardized approach. In the context of institutional cook stoves, there could be fuel switch; or switch of technology with or without change of energy source (including energy efficiency improvement). In other word, for institutional cook stoves the measures may include switch from non-renewable biomass to renewable cooking source or efficiency improvement through the replacement of the existing in-efficient cook stove.

The elements to be standardized by the proposed standardized baseline are:

- Additionality demonstration;
- Baseline identification; and
- Baseline emission/removal estimation

In line with the objective of SBL, the various institutions that qualify to be considered for the standardized baseline have different biomass consumption patterns. The per capita consumption will vary depending on the nature of institution and the access to the firewood. The analysis, will try to encompass the variations and establish the standardization for these factors in conservative manner. The basic underlying principle of analysis being that daily human requirements of cooked food must be addressed irrespective of the nature of institution or setup. The basic minimum denominator will help in standardization of factors. In future, additional institutions can be included in the registered SBL consistent with section 6 of the *Procedure: Development, revision, clarification and update of standardized baselines,* Version 03.1.[5].

The risk for non-registration of the SBL is perceived due to lack of exhaustive data for institutional cook stoves in terms of type of stove, efficiency, fuel consumption etc. The

[5] http://cdm.unfccc.int/methodologies/standard_base/index.html

standardization of biomass consumption factor will present an additional challenge but the Consultant believes enough literature evidence may be gathered to conservatively propose standardized factors.

4.3 Applicable CDM Methodologies

As per the 'Proposed Standardized Baseline Submission Form', the Standardised Baselines can be developed using:

- ✓ The "*Guidelines for the establishment of sector specific standardized baselines*";
- ✓ A methodological approach contained in an approved baseline and monitoring methodology;
- ✓ A methodological approach contained in an approved methodological tool;
- ✓ Following new methodological approach

In case Section A - *proposed standardized baseline developed using the "guidelines for the establishment of sector specific standardized baselines"* of Proposed Standardized Baseline Submission Form is to be filled, the level of aggregation must be tabulated in detail as per examples in the Guidance for Submission of Standardized Baseline. The objective of this standardized baseline is clearly defined as developing a standardized baseline for institutional cook stoves.

Instead of using the guidelines for establishment of sector specific standardized baselines, a methodological approach is more appropriate in this context. This is on account of lesser data intensive requirements and several default factors being in place in the approved methodologies. Section B of proposed Standardized Baseline Submission Form offers a more streamlined approach. Thereby, the level of aggregation will be addressed via eligibility criteria in the approved SSC methodologies.

Once approved by the Executive Board (EB), the standardized baseline replaces the discussions on baseline scenario establishment, baseline emission (factor) calculation and the demonstration of additionality in corresponding methodologies.

There are two Small Scale CDM methodologies, which may potentially be used for standardization of the parameters required for institutional cookstoves.

- AMS-II.G. - Energy efficiency measures in thermal applications of non-renewable biomass
- AMS-I.E. - Switch from non-renewable biomass for thermal applications by the user.

Both methodologies being very similar when applied to cook stoves initiatives, their few differences could be taken care of as follows:

- Baseline factor for consumption of biomass for institutional cooking is established on per person per annum basis, to ensure that factor is applicable to both the methodologies in equivalent manner.
- The institutional stove projects may apply the standardization factors in either of the methodologies mentioned above.
- Monitoring will be differentiated between the two user groups so that the 90/10 or 95/5 precision is achieved for each group, and the quantity of renewable biomass used is monitored in the group of institutions switching to renewable biomass;

- General Guidance on Leakage in biomass project activities would be followed for the AMS-I.E-related component of the project;

4.4 Additionality Concept

A proposed CDM project activity should not only result in reduction of GHG, but in reductions beyond those that would have occurred in the absence of the CDM project activity. Arguably, even in the absence of CDM, an economy is likely to witness a move towards more efficient energy use and increased renewable energy use. These activities also result in GHG emissions reductions. Therefore, for a project to be eligible for CDM, the GHG reductions should be greater than or additional to the GHG reductions that are expected to occur in any case.

As per normative reference under small-scale methodologies, for additionality demonstration, "Guidelines on the demonstration of additionality of small-scale project activities", have to be followed. Clause 2 of the guideline declares that documentation of barriers is not required for the positive list of technologies and project activity types that are defined as automatically additional for project sizes up to and including the small-scale CDM thresholds (e.g. installed capacity up to 15 MW).

The institutional improved cooking stoves fall under the project category in clause 2 part c of this guideline stating that ``*Project activities solely composed of isolated units where the users of the technology/measure are households or communities or Small and Medium Enterprises (SMEs) and where the size of each unit is no larger than 5% of the small-scale CDM thresholds*``, and therefore do not need to provide documentation to demonstrate additionality.

Cook stoves are isolated units; the users in this specific case are institutions such as schools, prisons, hospitals etc. Institution is a structure or mechanism of social order that governs the behavior of a set of individuals within a given community.

A cookstove may be classified as institutional cookstove if:

- The stove is catering for more than 50 people; (GIZ PREEP)
- The stove is above 20L (GACC, 2012)

The above two definitions, are fairly similar as 0.5L stove size is considered per person;

Moreover, the size of each unit is less than 5% of the small-scale thresholds.

- For Type I: The small-scale threshold is not beyond 15 MWe (45 MW_{th}) per annum. The 5% limit for this type of projects is 2.25MW_{th}; and
- For Type II: The small-scale threshold for this type of projects is not to exceed the equivalent of 60 GWh (180GW_{th}) per annum. The 5% limit for this type of project is 9 GWh_{th}.

The tables below provide sample calculation of the population size per institution to breach the 5% threshold as defined above.

Table 1: Demonstration of the 5% rule for type I projects

Parameter	Unit	Value	Source
Fuelwood consumption per year per capita	Tons	0.589	

Number of persons per institution	Number	2008	Calcu-lated
Fuelwood consumption per year per Institution	Tons	1182.7	Calcu-lated
NCV of fuelwood	TJ/tonne	0.015	AMS-I.E
Energy consumption stove	MWh-th per year	4928	Calcu-lated
Maximum capacity (6 hr cooking per day)	MW-th	2.250	Calcu-lated
SSC CDM threshold for type I	MW-th	45	AMS-I.E
Max capacity of each CS as a percentage of SSC CDM threshold	%	5.000%	Calcu-lated

Table 2: Demonstration of the 5% rule for type II projects

Parameter	Unit	Value	Source
Fuelwood consumption per year per capita	Tons	0.589	
Number of persons per institution	Number	5258	Calculated
Fuelwood consumption per year per institution	Tons	3097	Calculated
Efficiency of traditional cookstove	Fraction	0.121	
Efficiency of ICS	Fraction	0.40	
NCV of fuelwood	TJ/tonne	0.015	AMS-II.G
Fuel savings per cookstove per year	Tons	2160.13	Calculated
Energy savings per cookstove per year	GWh-th	9.0000	Calculated
SSC CDM threshold for type II per year	GWh-th	180	AMS-II.G
Energy savings of each improved cookstove as a percentage of SSC CDM threshold	%	5.00%	Calculated

Table 3: Typical population size in institutional setup

Type of Institution	Population (attribute)	Source
Schools	< 2000	(Northern Uganda Energy Study, 2011) (Improved Institutional Cookstoves in Wakiso District - Baseline Survey Report, 2012) (page – viii) (Presentation for the use of efficient coosktoves, 2010) (page – 2) (Inspection and evaluation of institutional stoves adoption and performance in schools and institutions , 2011) (page – Raw Data)
Prisons	< 1000	(Statistical Return, 2009) (Page – 4)
Hospitals	< 1500 (bed capacity)	(Human Resources for Health Country Profile Uganda , 2009) (Table 2.4, 2.6)
Restaurants / Hotels (commercial eating business)	-	No data source available. The hotel and restaurants would cater to their guests at all three meals. However the customers to be catered by

		hotels and restaurants is expected to be lower than 1200.
Others such as Tea estates (with residential facilities)	-	The number of people employed will be catered by cookstoves at the facility. However the number of residents is expected to be lower than 1200.

In addition to above tables, the maximum size of cookstove is observed to support 600 litre cooking capacity. This means that population size that can be supported by single cookstove can approximately be 1200 (assuming 0.5litre per person) (Impact Carbon, 2012). The population size of institutions complies with additionality threshold for Type I and Type II projects.

The values in the above table indicate that Institutional cook stoves fulfill the requirements and thereby deemed additional. Further, to serve the indicated population size, multiple cook stoves are expected to be used. Therefore, institutional cookstove as a technology too are deemed additional and this will cover the additionality section in the SB documentation.

4.5 Baseline Emission Factor

From the methodological approach for the emission reduction, the parameters such as Net Caloric Value (NCV), Emission Factor (EF), have fixed default values, and for Uganda the value of f_{NRB}[6] (fraction of non-renewable biomass) is also available. For leakage the option of multiplying $B_{y,savings,i}$ by a net to gross adjustment factor of 0.95 is preferred to reduce the need for surveys.

The baseline emission factors are analysed for each of the methodologies. The parameters with available default values are summarised below:

Table 4: Default parameters for application of AMS-II.G

Baseline Factor Available	Value	Source
NCV: Net Calorific Value	0.015 TJ/tonne	IPCC default value for wood fuel
Emission Factor	81.6 t CO_2/TJ	Default value provided in AMS-II.G
Leakage Net to Gross Adjustment Factor	0.95	Default value provided in AMS-II.G
Fraction of non-renewable Biomass	82%	http://cdm.unfccc.int/DNA/fNRB/index.html

In order to calculate the emission reductions, $B_{y,savings,i}$ remains to be determined. The methodology provides three approaches of determining this parameter.

Option 1: Kitchen Performance Test (KPT)	$B_{y,savings,i,a} = B_{old,i} - B_{a=1,i,KPT} \times \Delta B_{y,i,a}$
Option 2: Water Boiling Test (WBT)	$B_{y,savings,i,a} = B_{old,i} \times (1 - \frac{\eta_{old}}{\eta_{new,i,a=1} \times \Delta\eta_{y,i,a}})$

[6]https://cdm.unfccc.int/DNA/fNRB/index.html

Option 3: Controlled Cooking Test (CCT) $B_{y,savings,i,a} = B_{old,i} \times (1 - \frac{SC_{new,i,a=1} \times \Delta SC_{y,i,a}}{SC_{old}})$

In the context of institutional cook stoves, with maintenance program in place the performance of cookstove is considered to be stable over time. Efficiency loss factors due to age of cook stoves have no impact on the calculations and the above equations can be represented as follows:

Option 1: Kitchen Performance Test (KPT) $B_{y,savings,i} = B_{old,i} - B_{i,KPT}$

Option 2: Water Boiling Test (WBT) $B_{y,savings,i} = B_{old,i} \times (1 - \frac{\eta_{old}}{\eta_{new,i}})$

Option 3: Controlled Cooking Test (CCT) $B_{y,savings,i} = B_{old,i} \times (1 - \frac{SC_{new,i}}{SC_{old}})$

Baseline Fuelwood consumption ($B_{old,i}$)

As per methodology, para 19, $B_{old,i}$ can be determined, in the following manner:

(a) Estimated as the annual consumption of woody biomass (tons/year) derived from historical data or a sample survey of local usage;
(b) Calculated from thermal energy generated.
(c) Default Value of 0.5 tonne per capita per year

To simplify the calculation approach, $B_{old,i}$ is determined on per capita basis. The woody biomass consumption pattern for cooking needs is assessed. Biomass accounts for 93% of the total energy consumption in the country, and cooking needs for both residential and institutional sectors (Ministry of Energy and Mineral Development, 2001).

Table 5: Consumption of Woody Biomass for cooking in various regions of Uganda

Woody biomass consumption (tons/person/annum)	Reference Region	Source
0.680	Uganda	(East African Community, 2008)
0.542	East Uganda – Soroti district	(Coping with Firewood Scarcity in Soroti District of Eastern Uganda, 2014)
0.692	West Uganda – Hoima district	(A system Approach to Fuelwood Status in Uganda: A Demand-Supply Nexus, 2008)
0.601	West Uganda – Kibale district	(Fuelwood Resources and Forest Regeneration on Fallow Land in Uganda, 2002) (8.4/5.1*365)
0.485	North Uganda – Uleppi district	(Biogas as an alternative to fuelwood for a household in Uleppi sub-county in Uganda , 2013) (1.33 X 365)
0.540	Uganda	(Disappearing forests of Uganda: The way forward , 2001)
0.582	Uganda	(Woodfuel Integrated Supply/Demand Overview Mapping (WISDOM) Methodology

		, 2005) (Page -64, Table - Summary table of total and per capita fuelwood and charcoal consumption and of map-adjusted values) 0.909 m^3 per person X 725 kg/m^3 = 0.582
0.589	**Average fuel wood consumption**	

Based on the cited literature, the average fuel wood consumption per person per annum in Uganda is 0.589 tons.

The value of $B_{old,i}$ for various institutions can be established on the basis of average consumption per person and the type of institution.

Table 6: Assessment of available data on institutions

Institution Type	Assessment
Boarding Schools	The boarding school setup is comparable to households. The schools are operational for only 236 to 250 days a year (Ministry of Education, 2014). Therefore, approximate consumption for schools is **0.381** (for 236 day consumption in a year). (0.589 * 236 / 365) As per 'Inspection and evaluation of institutional stoves adoption and performance in schools and institutions' report published by MEMD in October 2011, the fuel wood usage in schools with traditional cooking technology ranges from 0.1875 tonne to 0.45 tons. This range includes both boarding and non-boarding school setups. (Ministry of Energy and Mineral Development, 2011) Also it is understood that many schools in Uganda, do not have resources to serve meals. The students continue attending school while hungry. Thereby reported values for fuel wood consumption by schools are expected to be lower. (Breakfast, midday meals and academic achievement in rural primary schools in Uganda: implications for education and school health policy, 2012) This approach will also address the suppressed demand component of fuel consumption and requirement.
Day Schools	In continuation with approach adopted for boarding schools, the day schools will cater only one meal during the school day (in majority cases) and thereby use half the fuel quantity estimated for boarding schools.
Residential Institutions: Prisons, Plantation estates and Hospitals	The residential institutions cater to daily cooking needs of the residents on the premises. These institutes operate all around the year. Further the published news reports suggest that meal consumptions are inadequate in prisons indicating that the proposed value will address the suppressed demand aspect. (Uganda Prisons in shilling 21.2bn shortfall for food, 2014).
Commercial Institutions: Restaurants, Hotels, Eateries	The institutions preparing food for commercial purposes cater to food at all times during the day.

Efficiency of the baseline cookstove (η_{old})

The 90% of basic cooking needs in country are fulfilled using biomass resources in households, institutions and commercial building. In 2007, the adoption of institutional cookstoves in Uganda was reported at 450. As a part of 'Modern Energy Services Programme' the cumulative target for institutional stoves by 2012 was 1500 (The Renewable Energy Policy of Uganda). As per MEMD Annual Report for 2011, the ministry with support from GIZ / PREEEP has done the dissemination of both household and institutional cookstoves. A total of 77 institutions and SMEs were reached under this programme. Further, the report states that less than 5% of the schools surveyed have energy efficient stoves, while most of the schools use traditional cooking technologies. (Institutional stove survey and evaluation) (Annual Report, 2011). Less than 2000 improved institutional cookstoves have been disseminated in the country over the past 6 years (P J Turyareeba, 2010).

The institutions in Uganda such as schools, health centres, prisons, commercial buildings and restaurants, primarily rely on traditional cooking technologies such as three stone stoves, open fires etc. (National Biomass Energy Demand Strategy 2001 – 2010, 2001). Further the government of Uganda identifies implementation of improved cookstoves in households and institutions as a potential investment sector under 'Scaling up Renewable Energy in Low Income Countries Program (SREP)'. (Expression of interest to participate in SREP, 2014)

Paragraph 17, option b) of the methodology provides guidance on the establishment of the baseline efficiency. It states that "*a default value of 0.10 may be optionally used if the pre-project device is a three stone fire using firewood (not charcoal), or a conventional device with no improved combustion air supply or flue gas ventilation, that is without a grate or a chimney; for other types of devices, a default value of 0.2 may be optionally used. Use weighted average values (taking the amount of woody biomass consumed by each device as the weighting factor) if more than one type of device is being replaced*".

Assuming that any institutional cooking setup, which is currently used, could be replaced, the weighted average value needs to be calculated. For estimation of weighted average efficiency, the numbers of institutional and commercial kitchens (target sector) is compiled in Table 7. Subsequently the number of improved stove installations and corresponding efficiency is conservatively applied for calculation.

Table 7: Number of Institutions in Uganda

Type of institution	Numbers	Remark
Schools	25993	Includes pre-primary, primary, secondary, post-primary schools and Non-Formal Schools. (Uganda Bureau of Statistics, 2009)
Health Units	2545	(Africa Health Workforce Observatory, 2009)
Prisons	239	(International Centre for Prison Studies)
Commercial	-	For the lack of credible data sources, the number of commercial institutions is not cited. However, this is conservative in the given context of weighted average efficiency computation.

Table 8: Efficiency for Institutional Cookstoves

Description	Efficiency	Remark
Improved Institutional Cookstoves	0.40	The higher value in the range of efficiency suggested for improved institutional stoves is applied. (Practical Action)

Traditional Cooking technology	0.1	The efficiency of traditional cookstoves is as per the methodology AMS.II.G and AMS.I.E

Based on above factors, the weighted average efficiency of cookstoves in existing scenario can be established for institutional cookstoves.

4.6 Suppressed Demand and Institutional Cook Stoves

In developing countries, the energy service levels at times are insufficient to meet the needs and demands, mainly due to lack of financial means or inaccessibility to energy infrastructure. This situation can be termed as suppressed demand.

The institutions at times lack funds, thereby cooking activities are carried out only once a day and all three meals are cooked in one instance. This has been observed in prisons or some schools where they lack funds to buy enough fuel wood. In case these institutions have access to efficient means of cooking and sufficient funds are available, they would switch to three times a day cooking schedule.

For Schools (Breakfast, midday meals and academic achievement in rural primary schools in Uganda: implications for education and school health policy, 2012) and Prisons (Uganda Prisons in shilling 21.2bn shortfall for food, 2014), it is observed that the resources are not enough to cater to cooking needs of children and prisoners. In such scenario, an exhaustive baseline survey will only provide biomass consumption values, which are lower than required values of biomass consumption. In such case, the volume of thermal energy consumption in baseline scenario is not represented by pre-project scenario. A hypothetical scenario with satisfied demand level of thermal energy will represent the baseline scenario. The biomass consumption required for cooking needs in line with reasonable level of human development (or humanely acceptable benchmark) can only be established based on broader range of values or through controlled user surveys, same as already available data in Table 6.

The determination of baseline fuelwood consumption has accounted for the suppressed demand as explained in 4.5

4.7 Cost Benefit Analysis

The benefits of establishing a standardized baseline identified in previous sections were - decrease the project costs and simplifying the complicated process of CDM registration and issuance. The cost benefit analysis therefore is based on the accrued benefits as well as merits and shortcomings of the Clean Development Mechanism (CDM) in determining the baselines and demonstration of additionality.

Some benefits of establishing the standardized baseline cannot be easily quantified in monetary terms but have a positive impact on the overall implementation of the mechanism. The process of determining a baseline was not clearly defined from the start by the Kyoto Protocol but later emerged when confronted with the challenge of determining the emission reductions generated. Most of the evaluations are based on a hypothetical baseline, which cannot be observed. This could result in overestimated baselines that could lead to fake CERs being issued; undermining the integrity of the concept. This is because the hypothetical baseline introduces perverse incentives for project developers to keep it high in order to claim more CERs.

Moreover as stated by the World Bank, some methodologies underestimate the potential to reduce greenhouse gas (GHG) emissions. This is particularly true in less developed countries where emission baseline calculations do not take into account latent demand for energy that exists and are thus under estimated, diminishing the potential for GHG reductions. The Marrakesh Accords have recognized this issue of suppressed demand. They explicitly allow for baselines to account for emissions above current levels due to specific circumstances of host parties. The establishment of a standardized baseline overcomes this shortfall.

Once the standardized baseline is developed, all projects for institutional cook stoves developed within the boundary limitation and meeting the applicability conditions of the SB are free to use it, hence forth, the proposed project does not incur the costs of developing the baseline and demonstrating additionality.

On the other hand, in the absence of an established standardized baseline, each project will be required to develop its own baseline and demonstrate additionality. The cost of developing the baseline is met by each individual project, increased uncertainty, and faces subjectivity.

In Cancun the Parties to the Kyoto Protocol asked for increased standardization in the CDM, arguing for the points below:

- **Transaction costs** are lowered for project developers but developing standardized methodologies requires large amounts of reliable industry data and in-depth analysis. This is an expensive process and the fact that establishment of the SB does not exclude any project developer from using it, the issue arises of that bears the risks and costs for its establishment. Hence establishing the SB is a benefit to all the project developers that intend to use it;
- **Objectivity** is only increased at the stage of project evaluation;
- **Predictability** for project developers is increased because the application of a standardized baseline is straightforward;
- **Facilitating access to underrepresented project types and regions** may be possible in some cases but are not a given, because underrepresented regions usually lack data and capacity to develop standardized approaches; and
- **Scale up the abatement of greenhouse gas emissions, while ensuring environmental integrity.**

4.8 SBL establishment and National GHG Inventories

Uganda signed the UNFCCC on 13th June 1992 and ratified it on 8th September 1993 and as consequence is bound to undertake commitments under the convention. These commitments are included in article 4[7] of the convention.

According to the UN unpublished report[8], Uganda carried out a National Inventory of Sources and Sinks of Greenhouse gases in 1993 with funding from Global Environment Fund (GEF). The project was implemented by UNEP and coordinated by the Department of Meteorology (now Uganda National Meteorological Authority, UNMA). The created inventory was partly updated in 1995 with funding from the United States Government under the United States Country Studies programme. The inventory gives a comprehensive list of emissions of greenhouse gases by source and removals by sinks in Uganda. It also contains a number of recommendations, including enhancement of legal, regulatory and policy framework. The institutions that participated in this project gained some capacity on the methodologies for GHG emission estimation. The inventory is supposed to be updated annually but this has not been the case due to lack of funds and capacity in the collection and analysis of the required data. There is therefore need to strengthen the capacity of the concerned departments and organizations in data collection and analysis.

Uganda joined the Low-Emission Capacity-Building Project[9] (September 2011 – August 2014) to establish a GHG inventory management system, to formulate NAMAs and to design corresponding MRV systems to support identified NAMAs. The project activities under the LECBP are being carried out in parallel with the development of the Second National Communication and the National Climate Change Policy, with a view of aligning processes and outcomes. Under the programme, a number of training workshops specifically focused on the GHG inventory have been implemented, thus suggesting that there is effort to focus on GHG inventory for better management of the emissions and the mandatory reporting.

The data management system implemented in effect to the SB development may potentially contribute in establishment of GHG inventory institutional cook stove fuel consumption and estimation of emission reduction potential. There is little information on improved institutional cook stoves, the fuel consumption and the efficiencies of the installed cook stoves. The monitoring methodology applicable to project implementing institutional cookstove projects will contribute towards transparent and reliable source of data for estimation of emission reductions in institutional cookstove sector.

4.9 Existing Baseline Studies

The consultant has assessed the available studies in context of cook stoves, in particular with institutional cook stoves for Uganda. The available studies and the data contained therein have been discussed with the UNFCCC RCC and the Standards Setting Unit of the UNFCCC Secretariat to provide technical guidance.

Data availability is an important determinant for standardized baseline development. There are a handful of studies that have been conducted in regard to institutional cook

[7] http://unfccc.int/essential_background/convention/background/items/1362.php

[8] http://www.un.org/esa/sustdev/csd/casestudies/uganda.pdf

[9] http://www.lowemissiondevelopment.org/countries/uganda

stoves. The consultant had access to a study conducted by Ministry of Energy and Mineral development covering six districts in Western Uganda, GVEP study that focused on Wakiso District, and another study conducted by CREEC covering Northern Uganda.

Some of the data available include:

Case Study – Experiences of Rural Schools in Uganda with Institutional Biomass Cookstoves

Iganga High School, a mixed day and boarding "A" level secondary school has been steadily growing for the last 5 years. Presently, the students' enrolment stands at **1500**.

In the past, the School faced the following challenges with regard to meeting the meal requirements of its students:

- ✓ Ensuring a steady firewood supply;
- ✓ Rising students' enrolment which increased firewood needs;
- ✓ Occasional delays in serving meals due to firewood shortages; and
- ✓ Complaints by kitchen staff about smoke and heat of the traditional institutional stoves and three-stone fires.

Following the installation of an institutional biomass cookstove in early **2010**, the school realized a reduction in firewood consumption from **14-16 tonnes of firewood per month** to about **5 tonnes per Month.**

In another school – St. Stephen Budondo, two modern improved institutional biomass stoves were installed. According to the School, a decreased firewood Consumption was realised from an average **21- 24 tonnes** of firewood to **7-8 tonnes** per school term. Being a relatively young rural secondary school, the high rate of firewood consumption stretched the School's limited financial resources.

The above case study suggest that before the installation of improved cook stove, Iganga High School had a per capita firewood consumption of 0.03tons per annum (assuming the enrolment of 1500 and also bearing in mind that the school is both day and boarding. The case study does not indicate the proportion of day students to those of boarding students)

Below is a summary of the notes from the meetings and discussions with different stakeholders;

<u>Biomass Energy-GIZ (PREEP)</u>

According to GIZ, an institution is one that prepares meals for more than 50 people on a daily basis. This includes all schools at all levels, prisons, police, army, orphanages categorized as social institutions. There are commercial enterprises that deal in food categorized as SMEs, farming estates that provide meals for their workers, for instance Tea estates, Sugar factories, coffee plantations etc. these also qualify for institutions. Churches can also qualify as institutions. Indeed the above provides a list of potential institutions that would be good candidates for the SB.

Between 2003 and 2006, 250 stoves had been disseminated in schools, barracks, prisons and other institutions. According to GIZ, tests carried out showed that a wood saving between 50 to 60[10] % is realized.

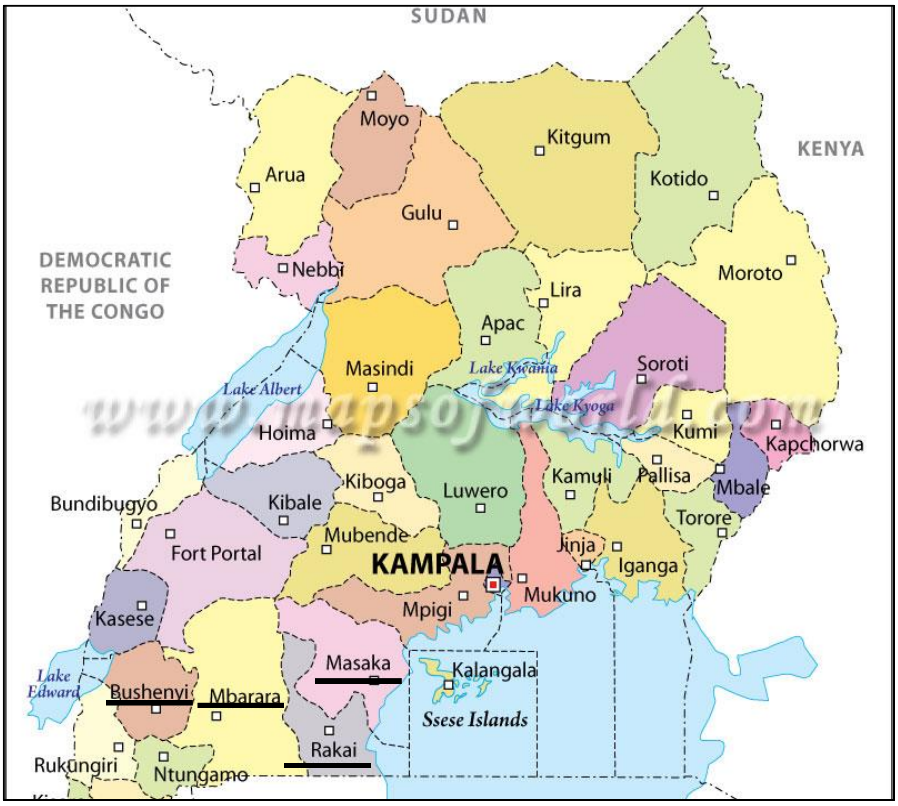
Table showing number of stoves distributed and institutions:

category	Number	Number of stoves supported by GIZ	Capacity of stove supported
Schools	163	586[11]	250litres
Prisons	129		

MINSTRY OF ENERGY AND MINERAL DEVELOPMENT – Modern Biomass for Rural Development - Inspection and evaluation of Institutional stoves adoption that fed into the 2011 annual report for the ministry.

Purpose: to establish the adoption rate, performance, constructional designs and structural strengths; ascertain qualities and value for money accruing to adopting institutions; and other relevant energy aspects prevailing at the institutions.

District Surveyed: Mbarara, Isingiro, Bushenyi, Masaka, Rakai and Lwengo districts[12]. These are indicated on the map below to give you orientation. However, the newer 2 districts of Isingiro and Lwengo are not indicated on the map. The two lie in the same region.



[10]Word of mouth from the project manager GIZ – no efficiency test results was seen.
[11]Some institutions bought/received more than one stove

[12] http://www.energyandminerals.go.ug/uploads/reports/MINISTRY%20OF%20ENERGY%20AND%20MINERAL%20DEVELOPMENT.pdf

Results:

- 65 schools in the districts were reported to have institutional cook stoves;
- 33 schools were visited, 23 had institutional stoves of the Bellerive design,
- Many of the Bellerive design stoves at schools were donated by International Care & Relief (ICR) between 2000 - 2005
- More than 50% of these stoves were in bad condition, with some like at St Cecilia Girls Sec. Secondary school Bushenyi, emitting too much smoke and heat in the kitchen ;
- Some schools used to cook with electric boilers before the 1979 e.g Ntare School, St. Henry's Kitovu. Some boilers are still functional but schools cannot afford the cost of power and therefore use firewood.

The highest per capita consumption recorded in the school that used the traditional three stone fires, and the rest fall within the range because the stoves they have are of different quality. The surveyed schools include: Secondary Schools, Primary Schools, Vocational Training Institutes and covered both day and boarding (schools that are both day and boarding can be assumed to be boarding). In some surveyed schools, the surveyors were unable to ascertain the amount of firewood used.

The findings reveal that the school using the three stone stove has a higher per capita consumption of 0.42tons per annum followed with those with broken improved stoves.

Improved Institutional Cookstoves in Wakiso District

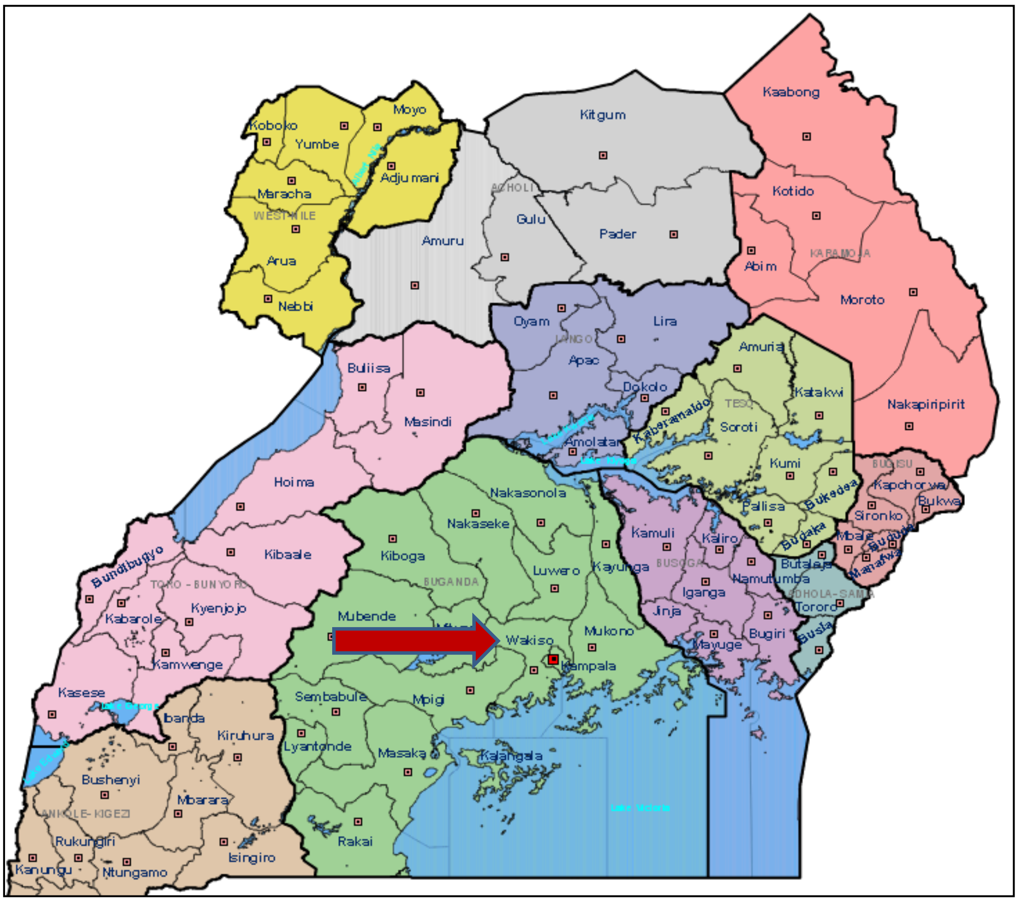
Who conducted the Survey: Global Village Energy Partnership (GVEP)

Purpose: The purpose of the baseline survey was to clearly understand the existing situation regarding cook stoves in Wakiso district and the elements that have hampered the adoption of improved cook stoves (IICS) by schools.

The survey concentrated on the improved cook stoves penetration rates. There is no information on the biomass consumption. It clearly concludes that there is higher penetration of ICSs in the urban and peri-urban schools than in rural ones. That there is a higher penetration in the secondary schools compared to primary schools because of a higher market zone and a number of stove artisans are located in the urban.

District Surveyed: Wakiso District – Central Uganda

Wakiso District is one of the twenty-four districts in central Uganda. It has a population of 1,291,600, and with 2,099 schools. It has the highest number of both private and government aided schools in the central region.



The Scope of the Baseline study:

The survey covered **four rural sub-counties** namely; Masuulita, Mende, Namayumba, Kasanje, **three peri-urban sub-counties** including Nabweru, Makindye Saabagabo, Nsangi and **three urban sub-counties** including Kiira Town council, Entebbe Municipality and Wakiso Town council.

A total of **51 schools** including **24 primary, 24 secondary and 3 vocational institutions out of a possible 2,099** were randomly selected to include government aided and privately owned schools. 58% of the respondents were day and boarding, 37% day schools and at least 4% were purely boarding schools.

The survey covered day schools, day and boarding schools and purely boarding schools.

Survey Design and Methods

This survey used a **convenient multi-stage sampling technique.** At the first stage, 10 sub-counties out of the 19 in Wakiso District, including a Municipality were selected using **Simple Random Sampling**. These were stratified into Urban; Entebbe Municipality, Kiira and Wakiso Town councils, Peri-Urban; Nabweru, Nsangi and Makindye Saabagabo and Rural; comprising of Kasanje, Masuliita, Namayumba and Mende sub counties.

Respondents were selected from each stratum of primary, secondary or vocational institutions. Day and boarding schools with various numbers of students were selected to include government funded or privately owned schools. A simple random sampling technique was used in each stratum where 18 urban, 14 Peri-Urban and 19 rural schools were selected. The selected schools included purely day, purely boarding and day & boarding schools. However in some analyses since purely boarding and day & boarding schools had almost similar characteristics, we categorized both of them as boarding schools.

Type and source of fuel used for cooking in schools

Various energy sources for cooking consisting of firewood, charcoal, kerosene, electricity, gas and biogas. Firewood predominantly used most by the schools, (86%) while charcoal was a distant second at 12% and gas at 1.7%

The 51 surveyed schools in all the localities used firewood for cooking. While 4 urban and 4 peri-urban schools used firewood as well as charcoal and only 2 rural schools used charcoal in addition to firewood for cooking.

Out of the 51 schools surveyed 27, (54%) of the schools used IICS. Of these 8, (16%) were single pot cook stoves while 19, (38%) were multiple pot cook stoves. 4, (8%) of the schools used surrounded fires while 19, (38%) used open fires/traditional stoves).

The high number of schools using IICS could be because most of Wakiso District is urbanized and there is a higher rate of usage of IICS in urban institutions compared to their rural counterpart. The figure should be interpreted bearing in mind the sample size, and therefore may not be representative of the actual situation on ground.

Sources of biomass:

The survey does not give the biomass consumption – to enable one to estimate the per capita consumption. But it provides the different sources of biomass and the overall cost.

Most schools in both urban and peri-urban areas often have large student numbers (700-1200) and therefore tend to purchase their firewood in bulk directly from forests while those that had a small population (400 and below) sourced their firewood mainly from the open bush and the markets.

According to the survey, 23, (46.2%) schools got their wood fuel from local markets and from vendors while 18, (34.6%), purchased it from forests and 10, (19.2%) purchased/got it from open bushes.

About 17 schools, (35%) of the schools which bought their firewood from forests spent up to **UGX 2,000,000 per school annually**, 24 (47%) of the schools that purchased firewood from the markets spent up to **UGX 1,000,000 annually**, while 10, (20%) of the schools that sourced their firewood from the open bush spent up to **UGX 300,000 per school**.. There is no linkage between the cost and tonnage, and therefore is rather difficult to estimate per capita consumption using this data.

Improved Institutional cook stove Efficiency;

The Center for Integrated Research and Community Development Uganda (CIRCODU) was contracted by GVEP to perform field-based assessments to determine the effect of improved cooking stoves on fuel consumption and emissions in schools. Between March and May 2014, CIRCODU selected multiple locations in Central Uganda to conduct kitchen surveys, kitchen performance tests, emissions tests and stove usage monitoring. The tests were conducted in schools that use improved wood stoves. For comparison purposes, the same tests were conducted in “control” schools that use mainly traditional 3-stone fires

Under the GVEP International’s CARE programme, 26 schools adopted improved institutional Cook stoves by March 10, 2014, CIRCODU targeted to conduct tests in only16 schools out of which 3 declined to take part in the tests

Kitchen Performance Tests (KPTs) were performed in 13 project schools and 13 control schools. Control schools were selected to match the key parameters of project schools mainly; the type of school (nursery/primary/secondary, boarding/day, mixed/single sex), and school population. A KPT protocol version 3.0 was used. The KPT was conducted over three full days, requiring daily school visits for four days. Fuel wood and, where applicable, charcoal, were weighed daily using large mass weighing scales. Wood moisture was measured daily in each school using Pocket moisture meters.

A KPT survey was also administered daily to record information about cooking stove and fuel usage, the number and type of meals prepared, and the number of people cooked for. The KPT was performed using a cross-sectional test where control schools were selected and marched with IICS.

The KPT was performed in the control schools “Before” the introduction of the improved wood stove (traditional wood stove phase) while the “After” KPT was performed in IICS.

According to the results, the Kitchen Surveys did not reveal any relevant seasonal variations regarding the number of people cooked for and the number of meals cooked per day.

School cooking details	**Number**
# people cooked for in dry season (average)	930
# people cooked for in rainy season (average)	930
# meals cooked in dry season (average)	4
# meals cooked in rainy season (average)	4

The results on fuel usage do correlate with the other studies indicating that 12 out of the 13 schools use firewood. Out of 13 schools, 12 purchased fuel while 1 collected their fuel. Prior to obtaining IICS, the average amount of money spent by a school on firewood was approximately 2,340,000UG shillings per term. The firewood cost and saving is captured in the table below.

Sub-group	N	Firewood purchased “before” purchase of IICS	Firewood purchased “after” purchase of IICS	Fuel Savings
Fuel (trucks/term)	12	6.4 trucks	3.9 trucks	2.5 trucks
Money (UGX/term)	12	2,340,000 UG shillings	1,274,000 UG shillings	1,066,000 UG shillings

The measure of firewood consumption is the number of trucks and the cost (money). This proxy can be used to determine the biomass consumption in tons.

The study summarized the wood and charcoal consumption values (and standard deviations) of the 3-day KPT in the project and “baseline” scenarios, in units of kilograms per institution-day (kg/institution-day), kilograms per person-day (kg/person-day)[13] and kilograms per standard adult-meal (kg/std.adult-meal)[14]. All wood and charcoal masses are reported in terms of wet mass. The average wood moisture content was measured as 19.9% (std dev. 5.1%).

	Baseline Scenario		**Project Scenario**	
	Average use	**Std. dev.**	**Average use**	**Std. dev.**
kg/Inst.-day	118.12	57.49	139.97	134.2
kg/person-day	0.32	0.21	0.15	0.06
kg/std.adult-meal	0.35	0.23	0.12	0.06

Using the above results, the per capita consumption is 0.12tons/annum. The value obtained in this survey is in the same range as the earlier established, but with the difference resulting from the fact that the schools considered in this study primarily used an improved cook stove.

Uganda Bureau of Statistics (UBOS)

The Uganda Bureau of Statistics conducted a rural electrification survey in 2012. The report of the study was released in 2014. The report covered 112 districts of Uganda. The RE Survey 2012 comprised of four modules namely: the Household, Business, Education and Health institutions. It generally shows the extent of access levels of energy sources in the four sectors and various uses of the energy sources in meeting the end use energy demand.

According to the report, the sample for primary and secondary schools was drawn using the list from the Ministry Of Education and Sports (MOES). The sample for Education was further broken down between Pre-primary, Vocational and Higher Education institutions. The census done by the MOES, there are about 20,000 Primary and Secondary schools in the country. A sample of 637 schools was drawn 508 were Primary while 92 were Secondary schools. In addition, a sample of 37 Pre-primary, vocational and Higher Institutions was drawn from the Census of Business Establishment (COBE) register.

According to the report results, firewood energy fuel was used most in schools. 93% of urban schools use firewood (ERT, 2012). At the national level, the most common source of energy used in Education Institutions was firewood. 98.6% of the Institutions in the country use firewood as the predominant source of energy, followed by Grid Electricity used in 56.3 percent of Education Institutions. The report further indicates the fuel usage per region with Central, Eastern and Northern regions respectively had 98.9, 99.5 and 98.8% of the education institutions using firewood as the most common source of energy, while Western region had 97.9% of the education institutions using firewood as the predominant energy source. In Kampala region, 87.4% of the education institutions reported using firewood as their most common source of energy.

[13] The fuel consumption in kg/person-day was calculated by dividing the daily average fuel use per institution by the number of people living in the institution

[14] Standard adult conversions were performed using FAO weights for children below 14 yrs (0.5), adult females above 14 yrs (0.8), males between 15-59 yrs (1.0), and males over 59 yrs (0.8)

The knowledge on use of improved energy methods was very limited, a large number of schools were not aware of improved cook stoves. Only 17.8% of education institutions have received training on energy efficient technologies, and only 46.8% of those who received the training adopted these technologies.

From different research resources that are listed in the reference, wood energy fuel was identified as the commonly used energy fuel by 90% of the population.

5. Data availability assessment (Data Gaps)

At the time of start of this assignment, the methodologies didn't include the default values for the biomass consumption for cookstove projects. It was only during course of this feasibility study, that this default biomass consumption value (0.5 tons/ person / year) was established. The Consultant has taken a cue from this standardization and approached the standardized baseline establishment with a more pragmatic view. It is understood that the data available on per capita firewood consumption is not exhaustive and dis-integrated for various regions. However, enough research is available over the past few years to suggest that biomass is the key source of energy for cooking needs and consumption levels have relatively remained unchanged because there has been only a marginal improvement in baseline cooking techniques.

Further in the context of adoption of water boiling test (WBT), efficiency of the cooking systems in baseline scenario has not been studied or surveyed exhaustively by any available research. However, it is evident that the government is pursuing to get international funding for institutional cookstoves adoption projects, indicating non-availability of any modern cooking technology for various institutions.

6. Conclusion

The aim of this assignment was to assess the feasibility to establish the additionality argument, standardize the baseline emission factors related to biomass consumption and efficiency for institutional cookstoves.

The institutions included are schools, police, prisons, health institutions, restaurants etc. The cooking requirements at these institutions depend on (a) Type of institution i.e. if these are day schools they will only cook one meal and in case these are residential institutions they must cater to all day cooking requirements. (b) Type of cooking technology that is currently in use and it is observed that majority institutions have not adopted institutional stoves.

An exhaustive survey of institutional cooking practices and firewood requirements would provide an insight into the exact firewood consumption patterns and baseline efficiencies but is deemed to be only marginally beneficial for the following reasons:

- As observed the cooking practices at majority institutions is the traditional 3 stone stoves or open fires, which means that exhaustive survey may only reveal the number of institutions which adopted institutional stoves and are still using these cookstoves. As a conservative alternative it may be assumed that all the institutional stoves distributed / sold are working at design conditions to calculate efficiency of baseline cooking systems.
- The biomass consumption levels at various institutions depend on availability of firewood and their ability to buy or collect the firewood. Understanding the shortage of money (in prisons and government schools) and sometime shortage of firewood the countrywide institutional survey will provide the actual biomass consumption values and will not account for suppressed demand component. On the other hand, extrapolation of existing ‘control user’ surveys provide a range of firewood consumption pattern across the country.

Therefore an exhaustive countrywide survey increase the accuracy of available data and trends only by marginal factor and is thereby not a cost-effective option. Thereby the Consultant has proceeded to prepare the standardized baseline based on the available information and data combined in this feasibility study.

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Appendix 1

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