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NATIONALLY APPROPRIATE MITIGATION ACTION ON

INTEGRATED SUSTAINABLE ENERGY SOLUTIONS FOR SCHOOLS IN UGANDA

United Nations Development Programme

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UNDP LOW EMISSION CAPACITY BUILDING (LECB) PROGRAMME

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The UNDP Low Emission Capacity Building (LECB) Programme is a country-driven initiative that promotes essential cooperation between relevant institutions, engaging the public sector and industry in a concerted effort to design and implement approaches to low emission development that are consistent with national development priorities. National counterparts are supported to strengthen technical and institutional capacities to identify and formulate Nationally Appropriate Mitigation Actions (NAMAs) and Low Emission Development Strategies (LEDS) in the public and private sectors, and to strengthen the underlying greenhouse gas inventory management and Measurement, Reporting and Verification (MRV) systems.

The LECB Programme runs through 2016 and is active in 25 countries: Argentina, Bhutan, Chile, China, Colombia, Costa Rica, the Democratic Republic of Congo (DRC), Ecuador, Egypt, Ghana, Indonesia, Kenya, Lebanon, Malaysia, Mexico, Moldova, Morocco, Peru, Philippines, Tanzania, Thailand, Trinidad and Tobago, Uganda, Vietnam and Zambia.

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More information can be found at www.lowemissiondevelopment.org

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ABBREVIATIONS AND ACRONYMS

ASC	Annual Schools Census
BAU	Business as usual
BTVET	Business Technical Vocational Training
CAO	Chief Administration Officer
CapDev	Capacity Development
CDM	Clean Development Mechanism
CSR	Corporate Social Responsibility
COP	Conference of Parties
DEO	District Education Office
DIS	District Inspector of Schools
EE	Energy Efficiency
EMIS	Education Management Information System
GACC	Global Alliance on Clean Cookstoves
GCF	Green Climate Fund
GHG	Greenhouse Gas
GIZ	Gesellschaft für Internationale Zusammenarbeit
GoU	Government of Uganda
ICS	Improved Cookstove
IICS	Institutional Improved Cookstove
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
KCCA	Kampala Capital City Authority
LECBP	Low Emission Capacity-Building Programme
MDG	Millennium Development Goal
MEMD	Ministry of Energy and Mineral Development
MES	Ministry of Education and Sports
MRV	Measurement, Reporting and Verification
MWE	Ministry of Water and Environment
NA	NAMA Approver
NAMA	Nationally Appropriate Mitigation Action
NCA	NAMA Coordinating Authority
NCV	Net Calorific Value

NEE	NAMA Executing Entity
NIE	NAMA Implementing Entity
NEP	National Energy Policy
NFI	National Financing Institution
PCR	Pupil Classroom Ratio
PIU	Project Implementation Unit
PPE	Public Education Expenditure per Pupil
PSFU	Private Sector Foundation Uganda
PSR	Pupil Stance Ratio
PTR	Pupil Teacher Ratio
PV	Photovoltaic
PTC	Primary Teachers' College
QC	Quality Control
RE	Renewable Energy
REA	Rural Electricity Authority
RLF	Revolving Loan Fund
SB	Standardized Baseline
SD	Sustainable Development
SDG	Sustainable Development Goal
SE4All	Sustainable Energy for ALL
SCR	Student Classroom Ratio
STR	Student Teacher Ratio
SSR	Student Stance Ratio
UGX	Ugandan Shilling
UNACC	Uganda National Alliance on Clean Cooking
UBS	Uganda Bureau of Statistics
UNBS	Uganda Bureau of Standards
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework for Climate Change Convention
UPE	Universal Primary Education
USE	Universal Secondary Education

EXECUTIVE SUMMARY

The Government of Uganda is living up to its international commitments to combat climate change, and one of the actions taken is participation in the UNDP´s Low Emission Capacity- Building (LECB) project. The LECB project in Uganda focuses, among other things, on strengthening the country´s technical and institutional capacity in the development of Nationally Appropriate Mitigation Actions (NAMAs) and their associated measurement, reporting and verification (MRV) systems. The NAMA process under the LECP aimed at identifying the mitigation actions that are appropriate and well-aligned with the key Government policies and national priorities, as specified in the National Development Plan 2010/2014 and 2015/16-2020, and the National Climate Change Policy 2013, as well as the Uganda Vision 2040. Within four GHG-intensive sectors of agriculture, energy, transport, and waste, eight NAMA concepts have been developed within the LECB project. The Green School NAMA being one of them.

The solutions to the challenges identified in the education sector energy situation have been aligned with the country´s potential, capacities and commitment. The activities proposed by this NAMA are designed with aim of creating a programme for schools to disseminate clean energy solutions that will

- Unite and scale up various activities and initiatives of the Government and other stakeholders both in space (reaching the whole country), and time (long lifetime, expected until 2030);
- Create a financing vehicle for the planned large-scale rollout that is appropriate for the schools (Revolving Loan Fund), designing new business models for schools (to pay back the PV installation costs), and tapping various external financing sources (CSR, international donors, crowd-funding);
- Complement the technologies with a Life Skills Programme for youth and local communities;
- Complement the technical interventions with technical assistance and capacity- building for public l and private sector stakeholders to facilitate smooth implementation; and
- Streamline the roles and responsibilities of public and private sector stakeholders, strengthening market involvement in implementation, and strengthening planning, monitoring, oversight, and overall steering by the Government thus enabling transformational and sustainable change in the education sector, with positive impacts on the private sector and livelihoods.

The geographical scope of the NAMA covers the whole country of Uganda, targeting schools in urban, semi-urban and rural areas; in the long term, the NAMA should cover all types of schools and educational institutions in Uganda–government-aided and private, primary, secondary, and tertiary, as well as institutions with educational activities (not having the status of a school). This translates to more than 18,000 primary schools, almost 3,000 secondary schools, and about 50 tertiary schools. (MES, 2015). These numbers will be reached as follows:

- The NAMA will be implemented in bundles (groups of schools) in the same area, to simplify logistics;
- The NAMA will use a prioritizing tool to identify the "most needy", as well as the "most promising" areas for future roll-out.

The proposed technology interventions of the NAMA and their targets are:

- Improving cooking conditions of schools with improved institutional cookstoves (IICSs); targeting ca 22,000 schools, and a total of 55,000 IICSs with average capacity of 100 litres;
- Improving cooking and sanitation conditions of schools with IICS and bio-latrines; targeting 5 per cent of the schools, thus 1,100 bio-latrines to be installed, with an average volume of bio-digester of 20m^3; and
- Self-sufficient and clean supply of lighting and/or electricity with solar PV systems; targeting 30 per cent of the schools, 5,600 solar PV systems shall be installed, with average installed capacity of 1 kWp.

The energy needs of the schools differ widely, as do their capacities and capabilities to implement and use the various energy solutions. Similarly, the economic feasibility of the technologies differs. Therefore, implementation is to be adjusted to reflect the applicability and readiness of the technology:

- Institutional improved cookstoves (IICSs) are the primary focus, being widely applicable, and generating good returns on investment. IICSs will be disseminated after the NAMA is launched, the first batch financed by the Corporate Social Responsibility (CSR) contributions of the national private sector. A Revolving Loan Fund (RLF) will be established and capitalized for the full roll-out.
- Photovoltaic (PV) systems for light and electricity will require development of business models to identify ways to pay back the investment, and to be involved under the RLF scheme. This shall be done within technical assistance measure in the first year, in conjunction of piloting and testing the models. Financing shall be sought for this component.
- Gas cookstoves fed from biolatrines require a substantial grant component due to high investment but low payback potential. Therefore specific fundraising and marketing will be undertaken.

Non-technology measures complementing the technology interventions under the NAMA will include:

1. Establishment of a NAMA Implementing Entity (NIE), including capacity-building and technical assistance;
2. Technical assistance for creation of a database, redesign/adaptation of school monitoring tools and design of verification and reporting systems;
3. Developing and testing a business model for solar PV systems;
4. Capacity-building and awareness trainings for companies; and
5. A Life Skills Programme to support technical interventions for schools.

NAMA Financing is designed for individual technology interventions, combining traditional and innovative, national and international sources:

- A Revolving Loan Fund will be established and capitalized for the full roll out of the IICSs.
- A RLF fund will be used for financing the PV systems, with an optional subsidy scheme, as will be defined within technical assistance for development of a business model to identify ways and potential to pay back the investment.

- Donor grants, crowdfunding, CSR contributions, and national government contributions will be the source of financing for the biolatrines.

The NAMA Implementation structure will be designed for effective and efficient coordination, implementation, progress and quality monitoring:

- NIE will be established for everyday operation and management;
- Private sector-led implementation and maintenance; and
- Strong oversight, guidance, and verification by government.

1 INTRODUCTION TO NAMAS

The success of the Paris Agreement signals a significant step towards the future of climate action. This UNFCCC-led process involving over 190 parties led to an agreement in December 2015 that saw countries agree to cut emissions with the aim of limiting temperature increase. The agreement lays down several "building blocks" that can help the world collectively undertake climate actions and NAMAs are expected to play an important role in driving this transformation.

Nationally Appropriate Mitigation Actions (NAMAs) are voluntary, non-binding policy instruments that provide a framework for pursuing a country's socioeconomic and development goals, while contributing towards global greenhouse gas mitigation efforts. NAMAs were first introduced at the 13th Conference of Parties to the Kyoto Protocol (COP13) in Bali in 2007.

Many developing countries are taking steps to develop and implement NAMAs, which can help achieve their growth objectives and participate in the global climate change mitigation agenda. NAMAs help governments leverage national and international support to achieve appropriate, effective and transformational GHG mitigation and sustainable development targets for the country and within communities.

COP 19 in 2013 saw the introduction of Intended Nationally Determined Contributions (INDCs), which were to be submitted by all parties, developed and developing, to the UNFCCC. The INDCs formed the crucial basis for the discussions leading to the successful Paris Agreement (COP 21) and provide an indicative list of activities that a party is willing to undertake in the period following 2020.

Though not explicitly mentioned in the Paris Agreement, NAMAs are currently the only "framework for non-market approach to sustainable development" (as noted in the Paris Climate Agreement) and are expected to play an important role in helping developing countries plan and execute mitigation actions as elaborated in their INDCs. Moreover, the overall scope of a NAMA, i.e. mitigation action combined with sustainable development leading to sector transformation, makes it an ideal framework that can successfully balance national development priorities with global climate actions.

1.1 Green Schools NAMA –An Opportunity for Uganda

Uganda is a party to the UNFCCC process and is committed to tackling climate change, as indicated by its various policies and programmes. The Government of Uganda is living up to its international commitments to combat the climate change, and one of the actions taken is participation in the UNDP´s Low Emission Capacity-Building (LECB) project.

The LECB project in Uganda focuses, among other things, on strengthening the country´s technical and institutional capacity in the development of Nationally Appropriate Mitigation Actions (NAMAs) and their associated Measurement, Reporting and Verification (MRV) systems.

The NAMA process under the LECB aimed at identifying mitigation actions that would be appropriate and well aligned with the key Government policies and national priorities, as specified in the National Development Plan 2010/2014 and 2015/16-2020, the National Climate Change Policy 2013, as well as the Uganda Vision 2040. Within four GHG-intensive sectors of agriculture, energy, transport, and waste, eight NAMA concepts have been developed within the LECB project course. The Green School NAMA is one of them.

The NAMA will achieve:

- Multiple transformational effects, to the education sector in the form of provision of clean energy technologies to schools, to the private sector in the form of capacity- building and creation of growth potential, and to local communities in the form of life and micro enterprise skills building;
- Practical solutions for financing the technology interventions and non-technology measures of the NAMA, and ensuring the NAMA´s quality, credibility and transparency in order to be financeable by international and national donors;
- Social, socioeconomic and environmental co-benefits;
- Increased private sector involvement in the financing and implementation;
- Up-scaling emissions reduction by country-wide implementation over the lifetime of the NAMA.

2 BACKGROUND TO UGANDA

2.1 Country Topography

More than two-thirds of the country is a plateau, lying 1,000-2,500 m above sea level. Lakes, swamps and Protected Areas constitute 25 per cent of the land. More than 75 per cent of the country (over 18 million hectares) is available for both cultivation and pasture. Pastures and grazing land are estimated at over 16 million hectares, half of which is extensive grazing. Improved pastures are estimated to comprise only 1.8 million hectares.

Forty-three per cent of the cultivated soil has fair productivity; 22 per cent is of medium or high productivity and 35 per cent has low or negligible productivity.

The majority of the land area lies between 900-1,500 m (84 per cent); 9 per cent is below 900 m (mainly the lake areas); 5 percent is 1,500-2,000m; and 2 per cent is above 2,000 m (Rwenzori being the highest mountain range with several peaks in the west on the border with the Democratic Republic of Congo and Mount Elgon the second highest formation in the east on the border with Kenya). Agriculture is the backbone of Uganda's economy; 95 per cent of the population farms (both crops and livestock) on small farms for food and cash income. The southern parts of Uganda mainly cultivate perennial crops that include coffee and green bananas, while livestock farming is practised in the drier areas of northern and western Uganda.

Figure 1: Map of Uganda

Source: http://www.fao.org/ag/agp/agpc/doc/counprof/uganda.htm.

2.2 Country Administration

Uganda is a republic. The Government of Uganda is a democracy made up of three arms: Executive (president, vice president, prime minister, cabinet); Legislative; and Judiciary – Magistrates' Courts, the High Court, the Court of Appeals (Constitutional Court), and Supreme Court. The system is based on a democratic parliamentary system with universal suffrage for all citizens over 18 years. The Constitution is the supreme law of Uganda. The present Constitution was adopted on 8 October 1995. It is the fourth Constitution since independence from Britain in 1962. (Government of Uganda, 2016)

Uganda is divided into 111 districts and one city (the capital, Kampala), which are grouped into four administrative regions.

Figure 2: Administrative regions of Uganda

Source: http://gov.ug/about-uganda/sector/maps-regions.

As of the 2002 census, the Central region contained 27 per cent of the country's population, the Western region contained 26 per cent, the Eastern region 25 per cent, and the Northern region had 22 per cent.

Since 2005, the Ugandan government has been in the process of dividing districts into smaller units to prevent resources from being distributed primarily to chief towns and leaving the remainder of each district neglected. Each district is further divided into counties and municipalities, and each county is further divided into sub-counties.

2.3 Climate and Natural Conditions

Uganda lies astride the Equator with the temperatures ranging between 15o-30oC.

Rainfall: The distribution in southern Uganda is bimodal, to the north, the two rainy seasons gradually merge into one. Precipitation is fairly reliable, varying from 750 mm in Karamoja in the Northeast to 1,500 mm in the high rainfall areas on the shores of Lake Victoria, in the highlands around Mt. Elgon in the east, the Rwenzori mountains in the south-west and some parts of Masindi and Gulu. Seventy per cent of the land gets moderate rainfall of 1,000-1,750 mm per annum.

Forests: Satellite imaging data released by FAO indicate that the proportion of Uganda's land area covered by forest had fallen to 15 per cent in 2010, from 18 per cent in 2005 and 25 per cent in 1990. Even within protected areas, deforestation is occurring at an estimated rate of 1.9 per cent each year, driven by the demand for agricultural and grazing land, timber and fuel wood.

Environmental impacts: The main drivers of environmental change include poverty, rapid population growth, urbanization, agricultural expansion, informal settlement development, industrialization and the impacts of climate variability, as well as low levels of compliance with environmental legislation.

In response, the Government has created the Environment Police Protection Unit to enforce environmental laws and regulations, and stepped up strategies to reduce forest depletion and increase reforestation efforts, instituting a ban on tree cutting in 2012 and strengthening the regulation of log harvesting, charcoal burning and other forestry activities.

2.4 Demography

The population of Uganda is 37.78 million, and it also has one of the world's highest rates of population growth, of 3.2 per cent. The population has doubled in the past two decades, increasing pressure on the country's resources and leaving young people particularly vulnerable to poverty.

In 2002, approximately 3 million people, or 12 per cent of the country's population, lived in urban areas. The Central region contained 54 per cent of the urban population (mostly in the city of Kampala), the Northern region 17 per cent, the Western region 14 per cent, and the Eastern region 13 per cent.

The population density is 226 persons per km^2 in the Eastern region, 176 per km^2 in the Central region, 126/km^2 in the Western region, and 65/km^2 in the Northern region.

Uganda ranks 163th out of 188 countries in the UNDP Human Development Index (HDI), which measures development in terms of life expectancy, educational attainment and standards of living. More than 80 per cent of the population live in rural areas, and rural households rely on agriculture for most of their income. The rural economy, in turn, depends mainly on smallholder farming, which produces the majority of Uganda's agricultural output. (UNDP, 2015a)

Rural women are vulnerable as well; because they do not have equal access to social and economic assets, subsistence farming is the primary source of livelihood for most of them. Yet women and young people have great potential for contributing to economic development and social progress if they are able to fulfill their potential.

2.5 Socioeconomic Situation

Uganda is a member of the United Nations, the African Union, The East African Community and the Commonwealth.

The economy of Uganda has great potential, and is poised for rapid economic growth and development. The building and construction materials industries have a long history. As a landlocked country, Uganda relies on transport from Kenyan port of Mombasa, which is done mainly by roads. Uganda's predominant mineral reserves are gold, tungsten, tin, beryl, and tantalite in the south, tungsten, clay, and granite in the central region and gold, mica, copper, limestone, and iron in the north. In 2006, Uganda confirmed the existence of commercially viable petroleum reserves in the Western Rift Valley around Lake Albert (so far 6.5 billion barrels of oil and 500 million cubic feet of natural gas have been discovered in the Albertine rift).

Agriculture is the backbone of Uganda's economy. Agriculture contributes over 40 per cent of GDP and over 90 per cent of the country's foreign exchange earnings. It also contributes over 60 per cent of total Government revenue in addition to employing more than 80 per cent of the total labour force and providing over half of the total income for the bottom three-quarters of the population. Ninety-five per cent of the population farms (both crops and livestock) on small farms for food and cash income, and on fairly large farms (including ranches) of an average size of 1,200 ha and crop farms (5-20 ha).

The major livestock species in Uganda include cattle, sheep, goats, pigs, rabbits and poultry. Livestock production is an important sub-sector of agriculture, contributing about 7.5 per cent to total GDP. It is estimated that mixed farming small holders and pastoralists own over 90 per cent of the cattle herd and all of the small ruminants and non-ruminant stock. They produce the bulk of domestic milk and slaughter animals. From an economic point of view, cattle are the most important livestock with contributions, though to a lesser extent, from goats and sheep.

Uganda's wildlife (including more than 1,000 bird species and over half of the world's endangered mountain gorillas) attracts many visitors to the country's national parks and game reserves. Tourism is supported also by promotion of water sports on the White Nile River.

The future success of the economy depends largely on political stability, good governance, and curbing of corruption and patronage, which all promote the private sector's willingness to invest in the country. Population growth has also put a huge strain on Uganda's land and the environmental impact of

deforestation is already being felt. But with better protection of the environment and a reduction in corruption and mismanagement, Uganda's trading culture, many entrepreneurs and strong industry sectors should foster a favourable future.

Rural poverty in Uganda is also strongly linked to environmental concerns–especially poor water management, soil erosion, declining soil fertility and land degradation. Climate change, which is one of the major challenges facing the Ugandan economy, could undermine the resource base and contribute to declining agricultural yields.

3 BACKGROUND TO THE EDUCATION SECTOR

The Ugandan national census in 2014 (Government of Uganda, 2016) found that children under 18 years of age constitute 55 per cent of the population, which is one of the world's largest. This presents both a tremendous opportunity and the need for effort and investment for Uganda to educate young people and give them the opportunity to contribute to the economy.

The development of the education sector in Uganda over the past two decades is characterized by rapid growth after the introduction of free Universal Primary Education (UPE) in 1997, followed by free Universal Secondary Education (USE) in 2006. This resulted in rapid and enormous increases in enrolment, but brought serious implications in terms of capacities and quality, especially for the government schools.

The strategic objectives of the education sector (Ministry of Education and Sports, Education Planning Department, 2004) are as follows:

- Ensuring universal and equitable access to quality basic education for all children;
- Ensuring equal access by gender, district and special needs at all levels of education;
- Improving the quality of education; and
- Building the capacity of districts by helping education managers acquire and improve on their knowledge, skills and attitudes to be able to plan, monitor, account and perform managerial functions.

3.1 Institutional Framework, Governance and Management

The overall responsibility of development in the education sector lies with the Ministry of Education and Sports (MES). The mission of the MES is "to provide technical support, guide, coordinate, regulate and promote quality education, training and sports to all persons in Uganda for national integration, development and individual advancement."

The school sector is run by both public and private players (individual investors, communities, civil society organizations, international NGOs and faith-based organizations). Most of the private school operators run the schools under the Public Private Partnership (PPP) system based on a contract with Government, and receive funding from the Government for implementing so-called universal education programmes.

The Local Government Statute of 1993 which has decentralized the system of governance in Uganda, has shifted authority and resources to Local Governments (LGs) in the education sector. The management and provision of basic education (pre-primary, primary, and secondary) is now largely in the hands of LGs, while the MES remains responsible for tertiary education, and overall policy control and maintenance of standards through control of teacher education, the curriculum and examinations. This decentralization provides for a more accountable and responsive provision of basic services to the population, and enhances flexibility, transparency and accountability. It also allows local administrators to be creative in seeking solutions to problems that are unique to their localities.

An important tool for sector performance control is the Education Management Information System (EMIS), providing management information on all key aspects of education to facilitate evidence-based decision making. It enables the MES to collect, capture and process data to generate management information that could help in planning and evidence-based decision-making at all levels. Consequently, it will be necessary to maintain management data on the Key Performance Indicators of the sector, including data in institutions, teachers, pupils, infrastructure, finances and audit, and school inspection. It was conceptualized to be sector wide and decentralized to district level.

The data for EMIS is collected by the Annual Schools Census (ASC), which is a comprehensive collection of basic educational data for all levels of the education system:

- Administration and management of pre-primary centres (nurseries), primary and secondary schools lies with the LGs–The District Councils, although transfer of the competences for the secondary sub-sector is not fully realized (Kizito, 2016);
- District Councils have Education Committees, comprising a Chief Administrative Officer (CAO), who is the district accounting officer, a District Education officer (DEO), and a District Inspector of Schools (DIS); and
- The District Councils devolve the management to School Management Committees. At the school level the head teachers (school principals) are answerable to the Education Committees.

3.2 Financing of Uganda School System

Uganda's overall public education expenditure per pupil (PPE) in terms of percentage of GDP per capita is 8 per cent for primary education level. This is lower than the median PPE in primary for low income countries, which is 9 per cent. The PPE in primary level is lower than in secondary level, which is 21 per cent (Education Policy and Data Centre (EPDC), 2014). The government allocates over 30 per cent of the discretionary recurrent budget to education (IOB Impact Evaluation, 2008); of this 65 per cent is for primary education. In 2005, expenditures per pupil amounted to approximately UGX 60,000 (around US$ 18).

The 1995 Constitution posited education as a right, specifying that each child is entitled to basic education, which is a shared responsibility of the state and the child's parents. In 1997, the primary education (Universal Primary Education, UPE programme) was made obligatory, and available free of charge for four children per

family. UPE brought a remarkable change in the structure of school financing, such as the abolition of the compulsory parental contributions that had previously been a mainstay of school funding.

The free secondary education has been implemented since 2007, under the Universal Secondary Education (USE) programme.

Remittances from central government are all channelled through the District Education Offices (DEOs) to the schools in accordance with the guidelines developed by the MES (MES, 2007), and with the District Work Plan. The finances are sent to the bank account of the schools three times a year (in January, May, and August).

3.3 Structure of the Education System

Education in Uganda is provided within both the formal and non-formal education system. The non-formal educational programmes were initiated in regions which are hard to reach, in areas that are poverty stricken, with unstable home environments, and in rural areas where schools are inaccessible, to girls and those who perceive few benefits in attending formal school.

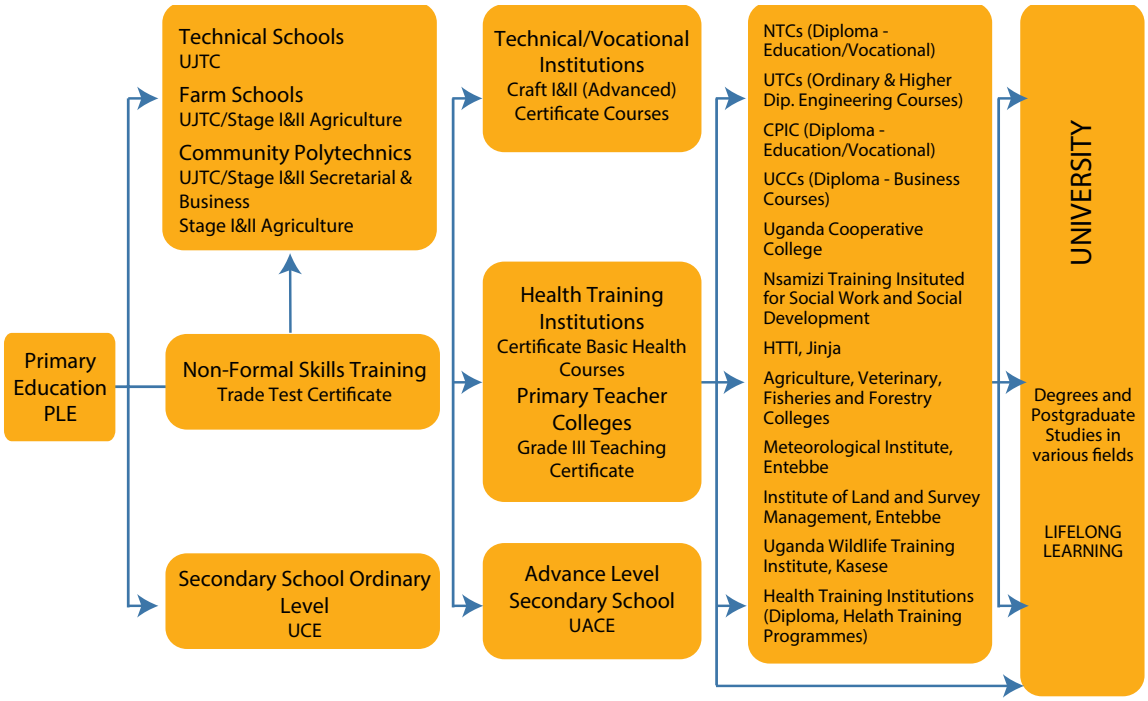
The formal educational system in Uganda consists of four levels of institutions, each followed by a national selection examination:

Table 1: Duration of education and official ages in individual education levels

Education level	Duration in years	Official ages of students
Pre-primary education	3 years	3-6
Primary education	7 years	6-12
Lower secondary education	4 years	12-16
Upper secondary education	2 years	16-18
Post-secondary (tertiary) education	3-5 years	18-21/23

Source: EDPC 2014.

Figure 3: Structure of Ugandan education



Source: MES http://www.education.go.ug/files/downloads/Poster.pdf.

3.3.1 Primary Education

Primary education has the largest numbers of pupils and takes the largest share of government spending on education in Uganda. The 1995 Constitution posited education as a right, specifying that each child is entitled to basic education, which is a shared responsibility of the state and the child's parents. The most important development was achieved by implementing the Universal Primary Education (UPE) programme in 1997. Under UPE, free primary education is provided to all children This has resulted in a rapid rise in the number of pupils (2 million in 1986, 6 million in 1999, 8.5 million in 2013). The management and administration of primary schools is greatly influenced by the founders. Despite most of the schools being founded by religious affiliations, 66.91 per cent are mainly funded by government.

The majority of the schools 16,519 (89.74 per cent) in 2013 operated as day schools, 1,779 schools (9.66 per cent) were partly boarding, and only 110 schools (0.6 per cent) had full boarding facilities (MES 2015). In terms of gender, 99.4 per cent are mixed (co-educational) schools.

Table 2: Overview of primary schools numbers

	Primary schools		
	Govt. aided	**Private**	**Total**
Day schools			16,519
Partly boarding			1,779
Fully boarding			110
Total no. of schools	**12,317**	**6,091**	**18,408**

Source: MES 2015.

In terms of location and distance to the nearest primary school, the majority of schools (93.4 per cent) are located less than 5 km away from the nearest primary school, enabling effective and continued communication and interaction amongst the schools. However there is still room for improvement, as many sub-counties, especially in the newly created districts, do not have any government-aided primary schools (MES,2013a).

Enrolment: primary education comprises 7 grades (classes) with the minimum age of entry to Grade 1 being 6 years and the maximum age of exit from Grade 7 being 12 years. The Education Abstract 2013 reported that 85.2 per cent of the total enrolment was aged between 6 to 12 years, 13.9 per cent of the enrolment was over age while 0.9 per cent was under age (MES, 2013b).

Table 3: Primary institutions and enrolment by sub-region (2013)

	Governmental	Private	Total	
Sub-region	**Enrolment (No. of pupils)**		**No. of Institutions (schools)**	**Enrolment (No. of pupils)**
Acholi	406,420	33,182	736	439,602
Ankole	518,144	130,074	1,926	648,218
Buganda	1,356,469	597,457	5,426	1,953,926
Bukedi	535,600	56,249	884	591,849
Bunyoro	343,158	88,722	1,120	431,880
Busoga	783,355	146,041	1,732	929,396
Elgon	455,705	48,245	881	503,950
Karamoja	122,754	16,906	286	139,660
Kigezi	324,187	46,254	981	370,441
Lango	558,923	36,822	825	595,745
Teso	512,563	42,472	942	555,035
Toro	477,758	90,469	1,290	568,227
West Nile	695,302	36,489	1,050	731,791
TOTAL	**7,090,338**	**1,369,382**	**18,079**	**8,459,720**

Source: MES 2015.

3.3.2 Post-Primary Education

Post primary education comprises Business Technical Vocational Training (BTVET), as well as Primary Teachers' Colleges (PTCs).

BTVET education is expected to promote job creation competencies, to stimulate the intellectual and technical skills of students, and to produce craftsmen, technicians and skilled manpower to meet the demands of the industrial sector. BTVET institutions range from community polytechnics, cooperatives, farm schools, health institutions, meteorological institutions, specialized institutions, survey & land institutions, technical institutions, technical schools, commercial colleges to vocational institutions/schools. PTC education ensures that the primary education sub-sector has adequate trained teaching staff.

Of the 266 post-primary institutions in 2013, private institutions have 56 per cent while government-owned constituted 44 per cent. This illustrates the Government's strategy of encouraging the private sector and one of the keys to improving the situation is to increase the level of education and skills by following a liberal economic development policy, since the Government has limited financing available for BTVET. Therefore a significant role in the area of education and training is left to the private sector, while the role of the Government is to a large extent limited to the provision of a supportive background, by providing an appropriate legal and regulatory framework and capacity-building. The founding bodies include Government (22.6 per cent), religion-based organizations (36.2 per cent of institutions), communities (17.3 per cent), and private entrepreneurs (22.6 per cent). The majority of post-primary schools (44 per cent in 2013) are operating as fully boarding, 38 per cent as partly boarding, and only 18 per cent are operating as day institutions.

Table 4: Post-primary institutions and enrolment by sub-region (2013)

Sub-region	Governmental		Private		Total	
	No. of Institutions (schools)	Enrolment (No. of pupils)	No. of Institutions (schools)	Enrolment (No. of pupils)	No. of Institutions (schools)	Enrolment (No. of pupils)
Acholi	8	2,631	10	1,374	18	4,005
Ankole	18	5,060	23	4,887	41	9,947
Buganda	19	6,605	35	5,780	54	12,385
Bukedi	10	2,967	0	0	10	2,967
Bunyoro	6	1,834	6	532	12	2,366
Busoga	9	2,909	10	1,952	19	4,861
Elgon	2	675	2	159	4	834
Karamoja	5	791	1	151	6	942
Kigezi	13	3,081	16	2,962	29	6,043
Lango	6	1,770	25	3,242	31	5,012
Teso	8	2,708	6	742	14	3,450
Toro	7	1,674	6	1,027	13	2,701
West Nile	7	2,170	8	1,115	15	3,285
TOTAL	**118**	**34,875**	**148**	**23,923**	**266**	**58,798**

Source: MES 2015.

3.3.3 Secondary Education

Provision of education in the secondary sub-sector is managed by the Government, with much stronger Public Private Partnership (PPP) than on the primary level. For instance, out of the 1,576 schools implementing Universal Secondary Education (USE) in 2013, 43.3 per cent were private schools. In terms of absolute numbers, out of the 2,838 secondary schools in 2013, the private sector constituted 64.09 per cent, in 2015 it was 68.17 per cent, and the increase is expected to continue.

The management and administration of secondary schools is greatly influenced by the founders. The share of government-founded secondary schools is even lower than in the case of primary schools, at 6.77 per cent. As of 2013, 40.8 per cent were established by faith-based organizations, with the Catholic Church and Church of Uganda taking the lead, followed by 31.30 per cent founded by entrepreneurs, and 14.90 per cent by communities. However the government constantly takes over privately founded schools to harness development, especially in areas where there is no established government secondary school.

The majority of the secondary schools 1,622 (54.98 percent) operate as day schools, 1,063 schools (36.03 per cent) are partly boarding, and 265 schools (8.98 per cent) have full boarding facilities.

In terms of location and distance from the nearest neighbouring primary school, the majority of secondary schools (almost 80 percent) are located less than 1 km from the nearest primary school, in line with the set target of the secondary sub-sector, of having at least a secondary school in each sub-county to ensure the sustainability/continuity of UPE.

Table 5: Secondary schools by location and distance of the nearest primary school

Distance of PS: Location:	Below 1 km	1 - 2 km	2.1 - 3 km	3.1 - 4 km	4.1 - 5 km	Above 5 km	Total
Peri-Urban	651	118	15	4	3	5	796
Rural	1,170	269	41	20	13	26	1,539
Urban	422	66	10	2	2	1	503
Total	**2,243**	**453**	**66**	**26**	**18**	**32**	**2,838**
	79.03%	15.96%	2.33%	0.92%	0.63%	1.13%	

Source: MES 2015.

Secondary education is divided into the lower Ordinary level and upper Advanced level (like the colonial British school system):

- Lower secondary consists of four years of schooling (Grades S1 to S4) at the end of which students undertake Ordinary-level exams (O-level) in 8-10 subjects, for the national Uganda Certificate of Education (UCE);
- Alternatives to the lower secondary schools are 3-year technical schools;
- Upper secondary consists of 2 years of schooling (Grades S5 and S6) at the end of which students sit Advanced-level exams (A-level) in at least 3 subjects, for the Uganda Advanced Certificate of Education (UACE); and

- Alternatives to upper secondary schools are Technical Institutes, Primary Teacher Colleges (PTCs), and Department Training Colleges (DTCs).

The recommended age of entry to Grade S1 is 12 years and the maximum age of exit from Grade S6 is 18 years. The ASC 2013 reported that 10.88 percent of the enrolment was over age while 0.83 percent was under age.

Table 6: Secondary institutions and enrolment by sub-region (2013)

Sub-region	Government		Private		Total	
	No. of Institutions (schools)	Enrolment (No. of pupils)	No. of Institutions (schools)	Enrolment (No. of pupils)	No. of Institutions (schools)	Enrolment (No. of pupils)
Acholi	47	24,327	50	20,514	97	44,841
Ankole	112	73,094	198	59,464	310	132,558
Buganda	252	183,334	675	261,061	927	444,395
Bukedi	68	44,980	96	40,292	164	85,272
Bunyoro	46	27,518	100	33,411	146	60,929
Busoga	79	213,463	186	242,437	265	455,900
Elgon	71	53,200	85	42,477	156	95,677
Karamoja	15	9,054	7	1,893	22	10,947
Kigezi	86	169,428	87	112,412	173	281,840
Lango	52	28,815	47	17,464	99	46,279
Teso	50	33,518	71	31,393	121	64,911
Toro	72	44,020	119	38,107	191	82,127
West Nile	69	33,978	98	28,735	167	62,713
TOTAL	**1,019**	**938,729**	**1,819**	**929,660**	**2,838**	**1,868,389**

Source: MES 2015.

In terms of gender admittance, 99.6 per cent are mixed (co-educational) schools.

The findings of the Annual School Census 2013 reveal an overall gender distribution of 53:47 in favour of the male students, however, this imbalance varies hugely at regional level. In the regions of Buganda and Kigezi, girls' enrolment has even surpassed boys slightly (MES 2013b). On the other hand, there are significant gender imbalances in the regions of West-Nile, Busoga, and Bukedi. Acholi region has the highest gender imbalance at 80 per cent of the schools (meaning that there are 80 per cent more boys than girls), followed by West-Nile at 70 percent and Karamoja region at 39 percent (MES, 2013a).

3.3.4 Post-Secondary (Tertiary) Education

Tertiary institutions include both degree and non-degree awarding institutions of different categories. Among the recognized categories are universities, national teachers colleges (NTCs), technical colleges, Uganda colleges of commerce, cooperative colleges, management institutions, health/medical institutes, agriculture/forestry institutions, theological colleges, media and communication institutions, hotel and tourism, law development centres, study centres and meteorological centres.

Business/commerce institutions dominate the sub-sector, constituting over 32 per cent of the total number of tertiary institutions in 2013, followed by universities (18 per cent), and health institutions (11 per cent).

Out of 189 tertiary institutions in 2013, only 28 per cent were government-aided while 72 per cent were private.

Table 7: Tertiary education institutions by type

Type	Private	Public	Total
Business / Commerce Institutions	56	5	61
Universities	29	5	34
Health Institutions	8	13	21
Management Institutions	11	2	13
Theology	14	0	14
Teachers Colleges (NTC)	2	5	7
Technical Colleges	2	6	8
Media Institutes	4	1	5
Agriculture, Fisheries and Forestry	0	3	3
Tourism Institutions	2	2	4
Cooperative Colleges	0	2	2
Others	1	1	2
Other Degree Awarding Institutions	1	1	2
Art and Design Institutions	3	0	3
Aviation Institution	0	1	1
Study centre's	2	1	3
Law Institute	0	1	1
Meteorological institution	0	1	1
Survey Institution	0	1	1
University Affiliated Colleges	2	1	3
National	137	52	189

Source: MES 2015.

Table 8: Tertiary education institutions by region

	Central	Eastern	Northern	Western	Total
Business / Commerce Institutions	34	5	4	18	61
Universities	20	6	2	6	34
Health Institutions	10	7	1	3	21
Management Institutions	8	1	1	3	13
Theology	9	3	0	2	14
National Teachers Colleges (NTC)	2	1	3	1	7
Technical Colleges	3	1	2	2	8
Media Institutes	4	0	0	0	5
Agriculture, Fisheries and Forestry	2	0	1	0	3
Tourism Institutions	2	1	0	1	4
Cooperative Colleges	0	1	1	0	2
Others	2	0	0	0	2
Other Degree Awarding Institutions	2	0	0	0	2
Art and Design Institutions	3	0	0	0	3
Aviation Institutions	0	1	0	0	1
Study centre's	0	0	2	1	3
Law Institute	1	0	0	0	1
Meteorological institutions	1	0	0	0	1
Survey Institutions	1	0	0	0	1
University Affiliated Colleges	2	1	0	1	3
TOTAL	106	28	17	38	189

Source: MES 2015.

Total enrolment of students in 2013 was 201,376 (113,746 males and 87,630 females).

3.3.5 Non-Formal Education

Non-formal education is designed to complement Universal Primary Education. The non-formal projects and programmes are very diverse in scope. What they usually have in common is an organized, systematic educational activity, carried out outside the framework of the formal education system, and providing different types of learning to particular groups in the population, both adults and children.

The programmes offering non-formal education include:

- Complementary Opportunity for Primary Education (COPE);
- Alternative Basic Education for Karamoja (ABEK);

- Basic Education for Urban Poverty Areas (BEUPA); and
- Child-Centered Alternative, Non-Formal Community-Based Education (CHANCE).

The non-formal sector is formed by 277 institutions/centres. The vast majority (91 per cent in 2013) of the non-formal schools are established by government. Their funding is provided by government (62 per cent), and in cooperation with many NGO partners (27 per cent), communities (9 per cent), and other (2 per cent) (MES, 2013a).

3.4 Staffing and Infrastructure Facilities of the Schools

The learning process is invariably affected by the quality and quantity of the physical and material infrastructure, as well as the school environment. This affects schools' ability to attract and retain teacher talent and other staff, as well.

For monitoring the sector´s performance the Government has set up national benchmarks (targets) for selected education system quality indicators.

Table 9: Education sector performance monitoring

Selected Indicator	Description of the Indicator	National Benchmark	Actual status (ASC 2013)
Primary class size	Average number of primary pupils per class (pupil per class ratio, PCR)	53	57
Pupils per primary teacher	Number of primary pupils per one teacher (Pupil teacher ratio,PTR) PTR is a proxy learning quality and resource availability indicator. In Uganda, the PTR is higher than the median PTR in primary for low income countries, which is 44		46
Secondary class size	Average number of secondary students per class (student per class ratio, SCR)	45	55
Students per secondary teachers	Number of secondary students per one teacher (Student teacher ratio, STR)		22
Number of latrine stances	Number of primary pupils/ secondary students per latrine stance (pupil stance ratio ,PSR, or student stance ratio, SSR)		63 PSR 44 SSR

Source: MES 2013b.

Annual School Censuses (ASCs) monitor the current state of infrastructure, sanitation facilities and instructional materials each year. As per the latest ASC report (MES 2013b), the total stock of permanent classrooms in primary schools resulted in a PCR of 72 pupils per class. In all schools (permanent and temporary), the average PCR is 57 (68 government and 31 private). The private schools have reached the government standard of 53 but Government schools did not.

Table 10: Monitored indicators of primary education sub-sector performance in 2013 (PTR, PCR, PSR)

	Pupil Teacher Ratio			Pupil Classr oom Ratio			Pupil Stance Ratio		
Sub-region	**Gov**	**Priv**	**Total**	**Gov**	**Priv**	**Total**	**Gov**	**Priv**	**Total**
Acholi	66	33	61	69	39	65	63	48	61
Ankole	43	24	37	43	27	38	52	35	47
Buganda	47	23	36	58	31	45	63	40	53
Bukedi	70	21	57	94	31	79	83	44	76
Bunyoro	58	24	45	68	30	54	55	44	52
Busoga	57	24	47	79	32	64	84	46	74
Elgon	58	23	51	79	29	68	114	45	99
Karamoja	58	81	60	71	111	74	61	61	61
Kigezi	42	23	38	45	25	41	55	30	50
Lango	64	24	59	82	32	74	80	38	75
Teso	67	22	58	87	29	76	82	46	77
Toro	53	26	45	67	32	57	69	41	63
West Nile	64	27	60	93	43	88	91	51	87
AVERAGE	**55**	**24**	**46**	**68**	**31**	**57**	**71**	**41**	**63**

Source: MES 2015.

In 2013, the total overall stock of classrooms in secondary schools (72,408 permanent and 79,770 temporary) resulted in a SCR of 55 students per class (64 government, and 49 private schools), not reaching the desired benchmark. On the other hand, there were also a reported 8,549 incomplete permanent classrooms, and 1,230 temporary structures, and a large number of complete structures (2,055 permanent and 252 temporary classrooms) which are not in use, in contrast to the congestion reported in most schools.

Table 11: Monitored indicators of secondary education sub-sector performance in 2013 (STR, SCR, SSR)

	Student Teacher Ratio			Student Classroom Ratio			Student Stance Ratio		
Sub-region	**Gov**	**Priv**	**Total**	**Gov**	**Priv**	**Total**	**Gov**	**Priv**	**Total**
Acholi	24	22	23	51	52	52	38	36	37
Ankole	22	17	19	54	47	51	44	32	37
Buganda	24	18	20	66	42	50	55	41	45
Bukedi	31	22	26	94	59	73	54	53	53
Bunyoro	25	21	23	30	25	27	43	36	39
Busoga	93	70	79	83	65	72	52	54	53
Elgon	28	25	26	80	63	71	53	60	56

	Student Teacher Ratio			Student Classroom Ratio			Student Stance Ratio		
Sub-region	**Gov**	**Priv**	**Total**	**Gov**	**Priv**	**Total**	**Gov**	**Priv**	**Total**
Karamoja	28	18	25	62	39	56	64	38	57
Kigezi	95	74	85	41	38	40	44	32	39
Lango	22	20	21	60	58	59	29	33	31
Teso	27	24	25	74	69	72	45	60	51
Toro	26	19	22	72	46	57	46	36	41
West_Nile	21	17	19	48	45	47	36	34	35
AVERAGE	25	20	22	64	49	55	47	41	44

Source: MES 2015.

3.5 Summary and Challenges of the Education Sector

There are more than 20,000 schools with more than 10 million students in Uganda, and their numbers continue to rise. Although the education sector has experienced large improvement in the past, there are numerous challenges in providing sufficient and good quality education:

- Lack of classrooms and latrines calls for the construction of more classrooms, requiring investment;
- Low infrastructure quality, many buildings need reconstruction, many schools need administrative and operational buildings, libraries, workshops;
- Lack of equipment, and no modern teaching tools in many of the schools, at all levels;
- Lack of teachers (and absenteeism), especially teachers for science, mathematics, and physical education especially in rural areas;
- Hard-to-reach and hard-to-stay areas require even more improvement in conditions in order to attract teachers;
- High dropout and absenteeism of pupils due to the inability of most parents to provide packed meals for the children, especially at the primary level, especially in the rural areas;
- Absence of girls during their period due to unsuitable sanitary conditions (lack of latrines causes limited privacy);
- Inadequate funding for the BTVET sector;
- Inadequate resources for salary enhancement for university lecturers, leading to high attrition rates. Inadequate resources to raise staff academic levels.

Coping with these challenges requires substantial funds for investments, as well as resources for the operation. However, the rising enrolment poses challenges not only to the education infrastructure and staff but for the educational curriculum, as well. With 700,000 new labour market entrants every year (World Bank, 2016) in a country like Uganda, where subsistence farming is still the major source of livelihood, the education system needs to provide extra-curricular skills and competences for the children.

4 BACKGROUND TO THE ENERGY SITUATION AT SCHOOLS

4.1 Energy for Cooking

Cooking practices differ depending on the level of school, due to different concepts of providing food.

In primary level schools, it is the parents' responsibility to provide children with meals, or pay for meals in the school. Day schools usually provide at least one meal (Global Child Nutrition Foundation, 2006) but not all schools do it, usually due to inability and unwillingness of the parents to pay for it. Similarly, the inability of most parents to provide packed meals for their children causes problems with dropout, absenteeism, or poor concentration for learning when the children are hungry.

The Government has prepared a school feeding programme, making it compulsory for each school to provide one meal per day, and supporting the schools in doing so by providing financial support for rations, grain processing, and firewood, as well as promoting dissemination of energy efficient cookstoves. This is elaborated in so called Clean Cooking Policy, pending approval by the Ugandan Parliament (Kizito, 2016)

The mixed (day and boarding) primary and secondary schools usually have twice the demand for cooking than do day schools of the same size (UNFCCC CDM Standardized baselines, 2015). In boarding schools (with residential facilities) the stove is usually used from morning up to around 6 p.m. for cooking all meals (breakfast, lunch, supper and sometimes evening tea). However, the schools tend to lack the funds to buy enough fuel wood, thereby cooking activities are carried out only once a day and all three meals are cooked at once , and many schools do not have resources to serve meals at all.

The cookstoves are used not only for making food but also for boiling the drinking water for disinfection. In Kampala city, 31 per cent of the schools still boil the water (Zziwa, 2015) unable to afford bottled water, purifiers or chemicals. In rural areas boiling is the main way of disinfecting water due to the high costs of purifiers or chemicals.

4.1.1 Cooking Fuel

The most common form of cooking fuel in the schools of Uganda is wood with 96 per cent of the schools using it as their main cooking fuel, followed by charcoal with 4 percent of the schools (MES, 2013a).

The fuel in urban and semi urban areas is obtained from retailers, who are sourcing it from ever-more-distant areas. The demand for wood is putting immense pressure on the forests around cities and towns, as these cities and towns are expanding. Forest management is not sustainable, reforestation activities are very sparse, and thus deforestation of the country is a growing problem.

Prices of fuel wood in urban and semi urban areas are rising, and are a major cost item for the school budgets. In rural areas, it is a common practice that pupils are obliged to bring wood from home, or they are being sent to collect the wood in the nearby forest instead of attending classes. This poses risks to the children and shortens the time they spend studying. Planting trees for fuel in own woodlots is not a common practice. Only a few schools have sufficient land that could be used for planting trees for fuel harvesting, or the land is not in their ownership.

In general, it is hard to establish the costs of fuel paid by the schools since conditions vary immensely. According to a study conducted in Wakiso District, rural schools spend about UGX 400,000 (about US$112) per month on firewood, with their urban counterparts spending twice as much (UNIDO, 2012).

4.1.2 Cooking technologies

Institutions in Uganda such as schools, health centres, prisons, commercial buildings primarily rely on traditional cooking technologies such as three stone stoves, open fires etc. (Government of Uganda, 2001). The majority of schools in Uganda still use these inefficient traditional cooking technologies; only a few have a so- called locally produced improved mud cookstove. Poor schools do not have kitchen facilities, but cook in the open air.

Figure 4: Open air kitchen; Busukuma Church of Uganda Primary School in Wakiso District, vs. kitchen building of Kansanga Primary School in Kampala; November 2015

Source: Laura Martonova, Energy Changes.

Figure 5: Open air cooking on three stones; Nawansanga Secondary School, and locally improved mud cookstove; 2015

Source: JEEP.

Depending on the size of school, there are one or more cookstoves in the kitchen. Medium-sized schools (with ca 600 students) have 3 to 5 stoves. Large schools (with 800 – 1,500 students) have 5 to 8 stoves (MEMD, 2011).

4.1.2.1 Biomass Cookstoves

Though improved institutional cookstoves (IICSs) are being promoted in the country, and there were several initiatives in the past decades, the coverage is still strikingly low. Despite lack of detailed, up-to-date and reliable data on numbers, types and the current status of the IICSs implemented so far, it is estimated from collected information that there are IICSs in not more than 1,000 schools in Uganda, where the total number of primary, post-primary and secondary schools is over 20,000.

The prevalent type of IICS is an on-site built fixed stove of bricks and clay which is the most suitable type for the schools due to large volumes of food which require sturdy design, and stability for saucepans. The types vary in external design mostly, but all types´ internal constructions feature high a degree of insulation, and a chimney.

Figure 6: Various designs of fixed institutional ICS

Unfortunately, very few of the past projects ensured the provision of continuous customer support, maintenance and repair for the schools after the completion of the cookstoves by the installation companies. The schools themselves have not reached out for it. This is believed to be due to the way these cookstoves have been provided; they have typically been 100 percent subsidized, thus restricting the ownership feeling of the school. Lack of awareness about the need for maintenance, and lack of money to pay for it were reasons, as well.

Quality check and quality guarantee mechanisms were rare. Installation companies were either not local which made it difficult to repair, or it was too costly. The investment costs were covered but maintenance for the years of operation was not considered. This decreased the operating lifetime (which is expected to be at least 10 years for a well-constructed and maintained stove), the energy efficiency, and even users' comfort. (MEMD, 2011)

Figure 7: Broken, smoking Bellarive stoves at St. Cecilia Girls School in Busheny

The second most prevalent type of stove are the rocket type institutional stove and the improved metal stove.

Figure 8: The rocket type and the improved metal stove

Source: (Scott, no date).

The table below provides an overview of past or ongoing governmental projects and programmes implementing IICS sin schools.

Table 12: Overview of the projects implementing improved cookstoves in schools

Funding entity or programme	Implementing entity	Number of schools, cookstoves	Comment
Energy for Rural Transformation, Phase 3 (ERT3) by Government of Uganda, funded by World Bank	PSFU (Private Sector Foundation Uganda)	The objective is to stimulate the cookstove market (local production), funding the distribution, production and ensuring quality of the improved cookstoves. Project developers who will produce 1,000 stoves and more per month will benefit from this support.	Under commencement
Promotion of renewable energy and energy efficiency (PREEP)	GIZ (Gesellschaft für Internationale Zusammenarbeit)	Installation of improved institutional cookstoves in schools. **Requirements to be met by the beneficiary institutions:** ■ should be catering for not less than 300 people; ■ contribute towards the cost of construction of the stove (at least 15 per cent); ■ have built spacious kitchen where stoves can be constructed; ■ carry out regular maintenance; MEMD should ensure supervision, training, and demonstration of good practices.	The project is ongoing until 2017
Construction of demonstration models for Institutional Rocket stoves		Capacity building through training artisans and technicians in technical skills Public awareness through mass and electronic media Exhibitions on all renewable energies and technologies Institutional stoves performance test	https://cleancookstoves.org/binary-data/ATTACHMENT/file/000/000/273-1.pdf
EnDev-Uganda programme		Training for artisans and private-business companies producing improved cookstoves	

4.1.2.2 Gas Cookstoves

Several schools use gas stoves for cooking. The fuel used is either LPG or biogas. Biogas for cooking can be produced by anaerobic fermentation of organic material in several types (designs) of biodigesters. The fixed dome biodigester (built from concrete or bricks) is the most widely used type in Uganda, and currently the only type used in schools.

The volume of the biodigester varies from 4 up to 30, or even 50 cubic metres.

Figure 9: Fixed dome biogas digester in Buwambo

The feedstock for biogas production can be human waste (from so called pour-flushed "bio latrines") and animal manure. A minimum of 400-600 hundred people need to use the toilet daily in order to produce reasonable amount of biogas (ca 4 m^3 of biogas are needed to fuel one cookstove for 4 hours a day).

The volume of biogas usually does not cover the full cooking needs and need to be complemented with other cookstoves. Moreover, the design of the gas stoves currently available on the market is not suitable for the large saucepans that are used in school kitchens, although local cookstove manufacturers are currently developing well-sized and improved gas.

Figure 10: Gas cookstoves designs are currently not sufficient for large volume saucepans

The following table summarizes information on existing gas cookstoves with bio-latrines available at the time of NAMA preparation (spring 2016).

Table 13: Existing gas cookstove with bio-latrines

No.	Location	School Name	Technology
1	Kasanga	Kasanga Primary School	Concrete fixed dome digester
2	Kisubi	St. Theresa Primary School	Concrete fixed dome digester
3	Jinja	Nakanyonyi Primary School	50 m^3 concrete fixed dome digester (by PSEM Ltd)

Source: Interviews with cookstove manufacturers.

Although application of the system for biogas production is technically more complicated, and requires specific conditions in terms of numbers of persons using the latrines, supply of animal manure, and indoor kitchens, it has several co-benefits:

- Replacing part of fuel for cooking;
- Elimination of odour and methane emissions;
- Hygienization of the toilet waste (elimination of pathogens);
- Improvement of hygiene and sanitation due to the need for pour-flush toilets construction;
- Reduction of costs of emptying the toilets;
- Potential source of organic fertilizer and irrigation water, potential source of income.

4.2 Electricity and Energy for Lighting

Access to modern energy services is limited in Uganda; only 15 per cent of the country's population is connected to the national grid; most of the connected clients are located in urban areas. Access to electricity in rural areas, where 84 per cent of the population lives, is only 5 to 7 percent, and the situation is the same for the schools located in these areas. In rural areas few of the school and dormitory buildings are wired for electricity, and only several have a diesel generator, due to the high costs. Solar photovoltaic (PV) systems supplying electricity are still very rare.

The majority of the schools are still not grid connected. In 2013, 84 per cent of primary schools and 87.6 per cent of secondary schools were not connected to the grid.

Availability of electricity (from grid or diesel generators or solar PV systems), is far worse in the case of Government schools than in the private ones. Only 26.40 per cent of the Government secondary schools have electricity, compared with 66.10 per cent of private schools. (MES, 2013a). This prevents use of any electrical appliances (e.g. radio, computer), and lighting options are limited to kerosene (paraffin) lamps or

candles. The kerosene light source is weak, unstable, the number of lamps is insufficient for all the pupils, and kerosene produces indoor pollution. In boarding schools, this makes it very difficult to study or do homework for students, and for teachers to prepare lessons after dark. In most schools, children are not permitted to use kerosene lamps and candles inside the dormitories, anyway. Thus, both students and staff lose hours of productive time a day and there are risks to moving around within the compound after dark.

Installations of photovoltaic systems to provide electricity and lighting have been implemented by a couple of governmental or NGO initiatives, but their numbers are still few. A detailed, countrywide and up-to-date list of all the schools with solar PV systems, their installed capacities and use, is not available. Based on partial information, the total number of installed PV systems in schools is estimated to be around 300.

The table below provides an overview of past or ongoing governmental projects or programmes implementing solar PV systems in schools.

Table 14: Overview of the projects implementing solar PV systems in schools

Funding entity or programme	Implementing entity	Number of schools, PV systems	Comment
Energy for Rural Transformation, Phase 2 (ERT2) by Government of Uganda, funded by World Bank	Government	Supply, Installation, Commissioning and Maintenance of Solar Photovoltaic Energy Packages (solar panels, lighting fixtures and accessories) for 310 post-primary education institutions including staff houses and dormitories located in different parts of the country	https://www.devex.com/projects/tenders/energy-for-rural-transformation-ert-ii-project-in-uganda-supply-installation-commissioning-and-maintenance-of-solar-photovoltaic-energy-packages-for-310-post-primary-education-institutions-in-uganda/74846
Uganda Energy Credit Capitalization Company (UECCC)	Commercial banks	Loan for the solar PV system 3 schools	Ongoing
Uganda Photovoltaic Pilot Project for Rural Electrification by Government of Uganda with financial support from UNDP and funded by GEF	GEF	The main objective of the project was to provide basic electrical services through solar PV to rural areas unlikely to have access to grid-based electricity in the foreseeable future.	1998-2003

4.3 Barriers and Gaps with respect to Sustainable Energy Solutions in Schools

Widespread implementation of sustainable energy solutions and technologies still faces similar barriers in most African countries. In Uganda, despite numerous initiatives by Government, donors, and NGOs in the past decades, country-wide provision of sustainable energy solutions in schools has not been achieved.

Major barriers to wide implementation of IICSs in schools include:

- Despite short payback periods, schools are not able/willing to cover high upfront costs;
- Additional costs for construction of kitchens or kitchenettes and fencing are needed in many cases;
- Lack of suitable financing solutions for the schools, very few schools are able to take bank loans;
- Lack of awareness of the existence of improved cookstoves and available suppliers of IICS (in remote rural regions);
- Absence of quality checks, quality guarantees, maintenance and repair in past projects have left a negative impression;
- Lack of awareness, capacities and conditions for the companies installing the IICS to take the lead and develop the sector via alternative, innovative business models, such as energy service companies (ESCOs);
- Lack of adequately trained artisans and technicians in technical skills for construction of efficient biomass energy technologies in some regions (although this situation could be remedied quickly if the demand arises).

Additional specific barriers for the biogas cookstoves fed by bio-latrines:

- Very high investment costs, with only a little saving on wood fuel. This makes a grant/subsidy inevitable for implementation, and the national Government budget does not provide for this, so another national or international financing source is needed;
- To achieve social acceptance awareness-raising efforts are needed.

Major barriers to wide implementation of PV systems in schools include:

- High upfront costs that the schools are not able to pay, especially for the larger systems that would provide electricity for appliances, not only lighting;
- Lack of suitable financing solutions for the schools; very few schools are able to take bank loans;
- Additional costs for fencing to protect from theft are needed in many cases;
- Lack of locally available and affordable maintenance and repair service providers in most rural areas;
- Absence of quality checks, quality guarantees, maintenance and repair in past projects;
- Installations (or components) stolen by the installation company during the night;
- Lack of awareness, capacities and conditions for the companies installing the IICS to take the lead and develop the sector via alternative, innovative business models, such as energy service companies (ESCOs).

Therefore, it is obvious that transformational change is necessary to break the status quo and remove the barriers for country-wide implementation of sustainable energy solutions in schools.

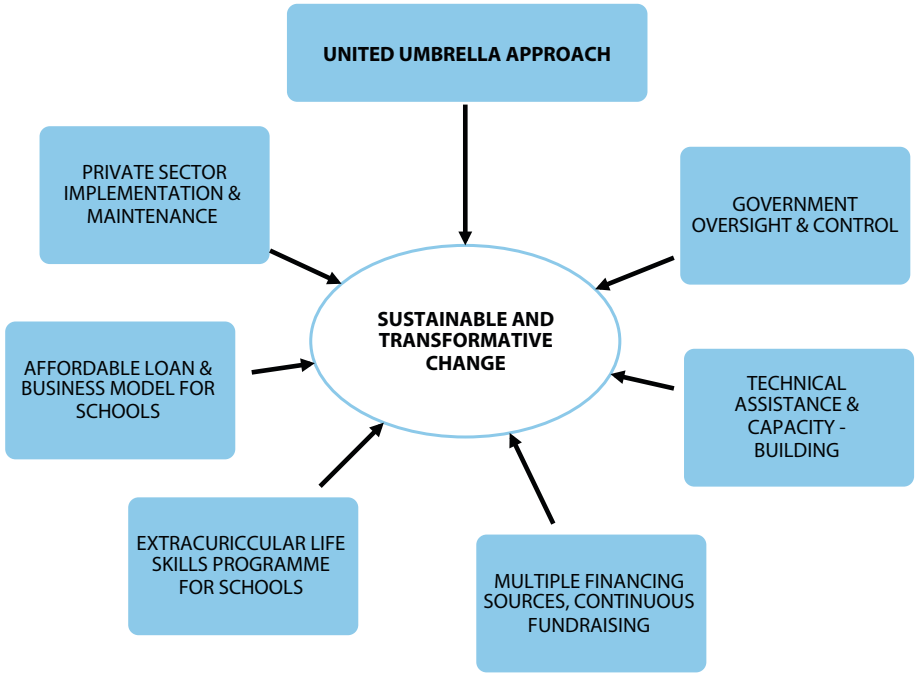
4.4 NAMA Solutions for the Transformational Change

The solution proposed by this NAMA is designed with aim of creating a programme for clean energy solutions dissemination that will:

- Unite and scale up various activities and initiatives of the Government and other stakeholders both in space (reaching the whole country), and over time (long lifetime, expected to last until 2030);
- Create a financing vehicle for the planned large scale rollout that is appropriate for schools, i.e. a Revolving Loan Fund (RLF), designing new business models for schools (to pay back the PV installation costs), and tapping various external financing sources (such as CSR, international donors, crowd-funding);
- Complement the technologies with a curriculum addition in the form of a Life Skills Programme for youth and local communities;
- Complement the technical interventions with technical assistance and capacity- building for governmental and private sector stakeholders for smooth implementation;
- Streamlining the roles and responsibilities of governmental and private sector stakeholders, strengthening market involvement in implementation, and strengthening planning, monitoring, oversight, and overall steering by the government.

This will enable transformational and sustainable change in the education sector, with positive impacts on the private sector and people's livelihood.

Figure 11: United umbrella approach for sustainable and transformative change



The table below provides a simplified overview of how the work and responsibility load are proposed to be shifted and distributed between the private sector and the schools, as equal partners on the journey to sustainable development of the education sector in Uganda.

Table 15: Proposed responsibilities for sustainable development of the education sector in Uganda

	Government	Private Sector	Schools
Planning & Condition Setting	●●●	●	●
Fundraising/Funding	●●	●●●	●
Identification of Beneficiary Schools	●●	●●	●●
Design of Technologies	●	●●●	●●
Installation & User Training		●●●	●●
Launch & Operation		●●	●●●
Maintenance & User Awareness		●●●	●●
Monitoring, Control, Evaluation	●●●	●	●●
Lessons Learnt & Condition Amendment	●●●	●	●●
Results Reporting, Public Awareness	●●●	●	●●

The positions of individual entities, their detailed tasks, competencies, and responsibilities are elaborated below in sections on institutional structure and implementation.

5 POLICY ENVIRONMENT IN UGANDA

Any NAMA, as a nationally appropriate measure, needs to be both in compliance with existing government policies, strategies and legislation, and also contribute to implementation of objectives of the relevant policies and strategies.

The Green Schools NAMA covers several important strategic sectors that are all necessary for achieving sustainable development of the country: education; energy; climate change and environment; health and sanitation.

Brief reviews of the relevant policies, and a description how the NAMA aligns with and contributes to their objectives, are provided below.

5.1 Constitution of Uganda

According to The Constitution of Uganda (1995, as amended 2006), a right to a clean and healthy environment are fundamental rights of every Ugandan and shall be protected and promoted.

In chapter XXVII. The Environment, section (ii), the Constitution declares that "The utilisation of the natural resources of Uganda shall be managed in such a way as to meet the development and environmental needs of present and future generations of Ugandans; and, in particular, the State shall take all possible measures to prevent or minimise damage and destruction to land, air and water resources resulting from pollution or other causes."

Moreover, section (iii) obliges the Government to "promote and implement energy policies that will ensure that people's basic needs and those of environmental preservation are met." (Government of Uganda, 2015a).

Constitution, NAMA Relevance: the NAMA will contribute to sustainable development of Uganda via improvement of energy availability and utilization in the schools, promotion of private sector development in RE/EE area, and promotion of rational use of natural resources via efficient use of fuel wood in the cookstoves.

5.2 Vision 2040

The Uganda Vision 2040 (Government of Uganda n.d.) is the national long-term development blueprint document, launched in April 2013. The national vision is for "*A Transformed Ugandan Society from a Peasant to a Modern and Prosperous Country within 30 years*."

Uganda Vision 2040 builds on the progress that has been made in addressing the strategic bottlenecks that have constrained Uganda's socioeconomic development since its independence, including; a weak private sector; underdeveloped human resources; inadequate infrastructure; a small market; lack of industrialization; an underdeveloped services sector; underdevelopment of agriculture; and poor democracy, among others.

The Vision seeks to strengthen the fundamentals of the economy to harness the abundant opportunities around the country.

The fundamentals relevant to the Green Schools NAMA include:

- **Human Resources** (chapter 4.2.1)**:** Uganda's human resource development strategy is premised on maximizing the benefits of the demographic dividend. Uganda intends to adopt an "Asian Tigers approach" to address the critical skills gap, technology deficiency, lack of creativity and innovativeness, low productivity and negative attitudes towards work, to spur faster development (point 183). In order to harness the expected potential of an abundant labour force, Uganda intends to build a modern world class education system that provides students with first rate education, compared with that offered by developed and emerging economies (point 184).

- **Energy** (chapter 4.2.3): Energy and in particular electricity is a driver of socioeconomic transformation. Availability of modern forms of energy is necessary to drive industrialization and service sectors. For Uganda to shift from a peasant-based to an industrialized and largely urban society, it must be propelled by electricity as a form of modern energy (point 199). Uganda will develop and generate modern energy to drive the industry and services sectors. Due to climate change, emphasis will be on renewable forms of energy including wind, solar and biogas. The Government will invest in R&D and provide incentives to encourage use of renewable energy (point 202). The objective is to improve access and availability of electricity to the rural and urban areas, especially to economic zones and other productive areas (point 204). Over the Vision period emphasis will be put on improving energy efficiency by promoting use of energy efficient technologies (point 205).

Vision 2040, NAMA Relevance: the NAMA contributes to tackling two fundamental issues of the economy and society that are a paramount to the Vision 2040: human resources and energy. Improvement of schools' conditions will build human resources, and both the energy efficient cookstoves and renewable energy technologies to be implemented in schools are fully in line with the objectives of the Vision.

5.3 Development Policies

5.3.1 The National Development Plan

The theme of the second National Development Plan (NDP II), elaborated for the period 2015/16-2019/20, is "*Strengthening Uganda's Competitiveness for Sustainable Wealth Creation, Employment and Inclusive Growth*".

The primary objective of the plan is sufficiently high economic growth for Uganda to reach middle-income status by 2020. Growth is not prioritized as an end in itself, but as a means to enhance human development through employment and wealth creation, to relieve environmental pressures and shift Uganda towards a more sustainable development trajectory by diversifying the economy away from natural-resource based activities and raw commodity exports (Government of Uganda, 2015a). The key result areas are a competitive economy, increased employment and wealth, and skilled human capital.

The Government recognizes the social sectors as key drivers of the transformation process and NDP II includes concrete interventions to enhance human capital development, from early-childhood development to adult education and training, and healthcare at all levels. Within the formal education system, the Government will focus on improving quality, investing in school inspection and increasing primary-to-secondary transition.

The Energy sector is considered one of the key sectors of the NDP. Increased access and consumption of electricity for growth, employment and socioeconomic transformation is one of the objectives of NDP II. The limitations of the forestry sector and their effect on the country's development are elaborated on, as well as challenges of the power sector.

NDP II, NAMA Relevance: The proposed NAMA is in line with and contributes to achieving the NDP II objectives of sustainable growth, by improving conditions for human capital development in education sector, improving access to modern energy for schools and the public, and enabling wealth creation and employment thanks to this energy access.

5.3.2 Millennium Development Goals & Sustainable Development Goals

Uganda adopted the Millennium Development Goals (MDGs) in September 2001. Since then, the character of the country and the quality of life of Ugandans have changed for the better. The 2015 Report, (Ministry of Finance, Planning and Economic Development, 2015) the fifth and final one, reveals that Uganda has come a long way in providing better life for its citizens.

Uganda's overall MDG results are impressive, although progress has not been uniform across all the goals. The report confirms the undisputable security of person and property, higher household incomes and standards of living, a substantially diversified economy, and a significant level of fiscal autonomy that characterize Uganda today.

Besides the evaluation, the report articulates, for both Government and other development actors, a clear way forward for bringing to conclusion the unfinished MDG business. The recommendations of the report are internalised in the Government's broader effort to accelerate the attainment of the goals and objectives of the Second National Development Plan 2015/16 – 2019/20 and the recently adopted Sustainable Development Goals (SDGs).

Table 16: Achievement of MDGs by Uganda in 2015

MDG Goal	Target	Comment
Goal 1: Eradicate extreme poverty and hunger	Target 1.A: Halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day	Achieved
	Target 1.B: Achieve full and productive employment and decent work for all, including women and young people	No Target
	Target 1.C: Halve, between 1990 and 2015, the proportion of people who suffer from hunger	Missed Narrowly
Goal 2: Achieve universal primary education	Target 2.A: Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling	Not Achieved
Goal 3: Promote gender equality and empower women	Target 3.A: Eliminate gender disparity in primary and secondary education, preferably by 2005, and in all levels of education no later than 2015	Not Achieved
Goal 4: Reduce child mortality	Target 4.A: Reduce by two thirds, between 1990 and 2015, the under-five mortality rate	Missed Narrowly
Goal 5: Improve maternal health	Target 5.A: Reduce by three quarters, between 1990 and 2015, the maternal mortality ratio	Not Achieved
	Target 5.B: Achieve, by 2015, universal access to reproductive health NO	No Target
Goal 6: Combat HIV/AIDS, malaria and other diseases	Target 6.A: Have halted by 2015 and begun to reverse the spread of HIV/AIDS	Not Achieved
	Target 6.B: Achieve, by 2010, universal access to treatment for HIV/AIDS for all those who need it	Achieved
	Target 6.C: Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases	Achieved
Goal 7: Ensure environmental sustainability	Target 7.B: Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss	Insufficient Evidence
	Target 7.C: Halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation	Missed Narrowly
	Target 7.D: By 2020, to have achieved a significant improvement in the lives of at least 100 million slum dwellers	No Target
Goal 8: Develop a global partnership for development	Target 8.B: Address the special needs of the least developed countries	Not Achieved
	Target 8.D: Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term	Achieved
	Target 8.E: In cooperation with pharmaceutical companies, provide access to affordable essential drugs in developing countries	Achieved
	Target 8.F: In cooperation with the private sector, make available the benefits of new technologies, especially information and communications	Achieved

Source: Ministry of Finance, Planning and Economic Development 2015.

Uganda's most important success is under MDG 1. Income poverty was reduced by two thirds, surpassing the 50 percent reduction specified by Target 1. A. Households with higher income levels are better able to meet the direct and indirect costs of accessing education and healthcare, so this progress has contributed to many of the other goals.

Satellite imaging data released by the FAO indicate that the proportion of Uganda's land area covered by forest had fallen to 15 per cent in 2010, from 18 per cent in 2005 and 25 per cent in 1990. Even within protected areas, deforestation is occurring at an estimated rate of 1.9 per cent each year, driven by the demand for agricultural and grazing land, timber and fuel wood.

The main drivers of environmental change include poverty, rapid population growth, urbanization, agricultural expansion, informal settlement development, industrialization and the impacts of climate variability among others, as well as low levels of compliance with environmental legislation. In response, the Government has created an environment police protection unit to enforce environmental laws and regulations, and has stepped up strategies to reduce forest depletion and increase reforestation efforts, instituting a ban on tree cutting in 2012 and strengthening the regulation of log harvesting, charcoal burning and other forestry activities, but the coverage and quality of data on the state of Uganda's natural ecosystems are not sufficient to assess whether such efforts have reduced the rate of biodiversity loss as targeted under MDG 7. Natural resources and ecosystems have immense economic, social and cultural value, but this has been poorly quantified and monitored, increasing the danger that economic growth could erode these resources and undermine the country's sustainable development. An important element of Uganda's post-2015 development agenda will be to better measure the value of natural capital and ecosystem services in order to guide strategic planning processes.

One of the three targets to be missed only narrowly is Target 7.C. The Government's investment in rural water supply has brought significant progress; the share of the rural population using an improved drinking water source increased from 52 per cent in 2001/2 to 72 per cent in 2012/13. Access to safe water is much higher in urban areas, but there has been limited improvement over the MDG period, with the rapid growth of Uganda's towns and cities often overwhelming urban planning capacity.

Amongst the four targets that Uganda did not achieved is Target 2.A.

These failures are mainly attributed to limited systemic capability in the education and health sectors, and the challenges the Government has faced inducing behavioural change, both within the public sector and among the population. The Government has greatly expanded resources and physical inputs in the education and health sectors. The pupil-teacher ratio fell from 65 in 2000 to 46 in 2012, while the pupil-to-classroom ratio fell from 106 to 57.

Transition to the SDGs:

The eight anti-poverty targets of the Millennium Development Goals (MDGs), that the world committed to achieving by 2015, have been a basis for establishing the Sustainable Development Goals (SDGs) adopted in September 2015, otherwise known as the Global Goals. The 17 SDGs not only build on MDGs but bring a broader sustainability agenda, going much further than the MDGs in addressing the root causes of poverty and the universal need for development that works for all people.

Figure 12: The 17 Global Sustainable Development Goals

Through the concerted effort of Uganda's United Nations Country Team (UNCT), the Government and in particular its National Planning Authority (NPA), Uganda is one of the first countries to be fully aligned with the Post 2015 agenda. The Second National Development Plan (NDPII) shows an average alignment rate of 76 per cent (120 targets addressed) with complete integration of the Goals dedicated to end poverty in all its forms everywhere (SDG 1), to ensure access to affordable, reliable, sustainable and modern energy for all (SDG 7), and to build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation (SDG 9). (UN Uganda, 2015)

Table 17: Transition of MDG commitments to SDGs and their alignment in NDPII

Unfinished MDG Business - Status		SDG Response	% of SDG targets addressed
Goal 2: Achieve universal primary education	The gross primary completion rate - the number of pupils in the final year of primary school as a percentage of all 12 year olds was 67% in 2012	SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	90% NDPII 70% UNDAF
Goal 5: Improve maternal health	Stagnated at 438 deaths per 100,000 live births	SDG 3: Ensure healthy lives and promote well-being for all at all ages	85% NDPII 77%UNDAF

Unfinished MDG Business - Status		SDG Response	% of SDG targets addressed
Goal 6: Combat HIV/AIDS, malaria and other diseases	HIV prevalence among persons aged 15 to 49 years stands at 7.3%	SDG 3: Ensure healthy lives and promote well-being for all at all ages	85% NDPII 77% UNDAF
Goal 7: Ensure environmental sustainability	Proportion of land area covered in forest: 15% (2010)	SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable SDG 12: Ensure sustainable consumption and production patterns SDG 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	80% NDPII 90% UNDAF 20% NDPII 20% NDPII 100% UNDAF 58% NDPII 75% UNDAF

Source: Government of Uganda 2015a.

While the new agenda will not only address problems inherited from the past (extreme poverty, hunger, etc.), it tackles emerging issues such as climate change, environmental degradation and global inequalities. The Post 2015 agenda is universal and demands structural transformations. For this, new and emerging resources for sustainable development finance, the following elements need to be considered:

- **Official Development Assistance (ODA).** will remain a crucial element of development financing. However, a more coherent framework needs to be created to account for climate finance and ODA. ODA and development cooperation must become more effective, transparent, and measurable;
- **Alternative Resource Mobilization.** The Post 2015 development agenda can only be implemented if we include private sources and support corresponding economic transformations to ensure that private investment decisions move towards achieving the SDGs. Changes in regulatory frameworks will be needed to steer private sector investments towards sustainable and inclusive development (address misaligned incentives) and to direct private finance towards a low-carbon economy;
- Develop infrastructure, enhance migrant remittances and financial inclusion, in particular for women to access resources, capacity building opportunities-and participation in key decision making processes;
- **Risk Reduction and Resilience.** Volatility is the new normal and governments need to invest in resilience and set the right regulatory, investment and legal regimes to ensure risk reduction; and
- **Data revolution.** Another challenge coming with adoption of the SDGs is the need for up-to-date and reliable data, as an important tool for planning, monitoring, and accountability, particularly with regard to assessment of the resources impact.

MDGs/SDGs, NAMA Relevance: The NAMA has the potential to contribute to several of the unaccomplished MDGs and the transition to the SDGs, namely reducing the deforestation due to fuel wood demand, improved environmental monitoring, improvement of sanitation with the bio-latrines, and improvement of education conditions thanks to safely cooked meals, boiled water, and clean lighting sources in the dark.

The NAMA will also mobilize much-needed private financing and steer investment to sustainable and inclusive development and a low-carbon economy.

5.4 Education Policies

Education and training in Uganda is governed by the Education Act and other related Acts of Parliament, including the University Act, the Tertiary Institutions Act and various other Acts and Charters for universities.

Current education policy focuses on expanding the functional capacity of educational structures and reducing inequalities of access to education between sexes, geographical areas, and social classes in Uganda. It advocates the redistribution of resources. More resources have been allocated to lower-level public sector education through the UPE programme in order to enhance equity of access at that level between boys and girls. Higher education, especially tertiary education, is increasingly becoming liberalized, which in fact means privatized (Syngellakis and Arudo, 2006)

5.4.1 Government White Paper on Education

The White Paper on Education (1992) is the basis of official policy on education. Its aims are to promote citizenship; moral, ethical and spiritual values; promote scientific, technical and cultural knowledge, skills and attitudes; eradicate literacy and equip individuals with basic skills and knowledge and with the ability to "contribute to the building of an integrated, self-sustaining and independent national economy".

The key policy for both rural and urban Uganda includes providing equitable access to quality and affordable education to all Ugandans.

5.4.2 Educational Sector Strategic Plan 2004 –2015

The Educational Sector Strategic Plan (ESSP) 2004–2015 (MES, 2004) and its revision of 2007 commit the Government to assuring universal access to primary education as the highest priority, urges the removal of financial impediments and pays particular attention to gender and regional equity. Putting the plan into practice was envisaged through shared contributions by the public and private sector, and by households and communities.

The objectives of the ESSP are:

- To build an education system that is relevant to Ugandan's national development;
- To ensure that all children participating in the education system achieve education goals; and
- To maintain an effective and efficient education sector.

Education Policy and Legislation, NAMA Relevance: The proposed NAMA is in line with Government policy, and directly contributes to implementation of the overall objective to provide good quality education by improving the cooking technologies, providing electricity access, and both saving the schools costs and creating new income generation potential.

5.5 Energy Policies

5.5.1 National Energy Policy

The main policy goal of the National Energy Policy (MEMD 2002) is "to meet the energy needs of the Ugandan population for social and economic development, in an environmentally sustainable manner". The Policy gives a detailed analysis of both supply and demand side sectors and develops policy objectives accordingly. Moreover, it outlines short-and medium-term action plans in order to realize these goals. The broad policy objectives are:

a. To establish the availability, potential and demand of the various energy resources in the country;

b. To increase access to modern, affordable and reliable energy services as a contribution to poverty eradication;

c. To improve energy governance and administration;

d. To stimulate economic development;

e. To manage energy-related environmental impacts; and

f. To increase the role of private sector in the power sector operations and future development.

NEP, NAMA Relevance: the NAMA will contribute to the NEP objectives a) and b) by establishing both access to modern energy sources for schools, and the demand from the schools for these energy services. In the long term, this should indirectly stimulate economic development by providing conditions for growth of the suppliers of the energy services in all regions of Uganda.

5.5.2 Renewable Energy Policy

The overall goal of the Renewable Energy Policy (REP) 2007 (MEMD 2007) is to increase the use of modern renewable energy from 4 per cent to 61 per cent by the year 2017.

The REP is based on the following key principles, among others (Article 23 of Executive Summary) (MEMD, 2007):

i. Energy is essential for poverty eradication, regional equity, and socioeconomic development.

ii. Reliability, efficiency, and sustainability are essential in the successful deployment of renewable energy technologies.

iii. Renewable energy enhances energy diversity, security, and independence.

The key policy objectives include:

1. To maintain and improve the responsiveness of the legal and institutional framework to promote renewable energy investments;
2. To establish an appropriate financing and fiscal policy framework for investments in renewable energy technologies;
3. To promote research and development, international cooperation, technology transfer and adoption of standards in renewable energy technologies;
4. To utilize biomass energy efficiently so as to contribute to the management of the resource in a sustainable manner;
5. To promote the sustainable production and utilization of bio-fuels; and
6. To promote the conversion of municipal and industrial waste to energy.

REP Policy Actions (article 26) to achieve the policy objectives have been devised to form of six specific programmes:

1. The Power Generation Programme promotes power generation from mini-hydro power schemes, biomass, cogeneration, wind, solar, geothermal and peat. There are plans to consider nuclear power generation in the power mix in the long term;
2. The Rural- and Urban-poor Electricity Access Programme aims to make electricity access (connections and services) affordable to rural populations and the urban poor via subsidies, independent grids, and prioritize supporting electrification for productive uses and key social services;
3. The Modern Energy Services Programme will support renewable energy technologies for cooking as substitutes for wood energy;
4. The Biofuels Programme;
5. The Energy Efficiency Programme seeks to implement the Energy Efficiency Strategy; and
6. The Wastes for Energy Programme will cover the conversion of waste to energy through direct combustion, gasification or biological conversion to biogas.

According to Article 26 of the REP, the total financial resources required to implement the strategic interventions are of the order of UGX 6,500 billion or US$ 3.5 billion over the next ten years. It is estimated that 86 per cent of these resources will come from direct private investment, while 14 per cent have to be obtained from the public sector, either through Government resources or from Development Partners.

REP, NAMA Relevance: The proposed NAMA is consistent with the overall goal of the REP, and addresses the sustainable use of biomass, installation of RE electricity, and biogas, and production of renewable biomass source. All NAMA interventions will contribute to the REP implementation. Moreover, it will bring forward a way of mobilizing the required private sector funding and channel it directly to implementation of EE/RE technologies in schools.

5.6 Climate Change Policies

Climate change strategy and planning are under the competence of the Climate Change Department (CCD) of Ministry of Water and Environment (MWE). This was initially created as the Climate Change Unit (CCU) in 2008, directly under the office of the Permanent Secretary within the MWE. The main objective for the establishment of the CCU was to strengthen Uganda's implementation of the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol (KP).

Uganda's approach to climate change is closely linked to its international engagement with climate change politics, having ratified the UNFCCC and the Kyoto Protocol (UNFCCC, 2016a), committing itself to the adoption and implementation of policies and measures designed to mitigate climate change and adapt to its effects. Uganda submitted its First National Communication to the UNFCCC in 2002, and its Second National Communication in 2014, and submitted its National Adaptation Programme of Action (NAPA) to the UNFCCC in 2007. Despite being rather active at the international level, domestic legislation and policy are still underdeveloped; "Uganda lacks a comprehensive and overarching legislation that provides the basis for domestic action on climate change, but rather has a number of relevant official plans, policies and institutional bodies relating to climate change" (LSE, 2015).

At the national level, the Climate Change Policy was adopted in 2013. The Climate Change Act, developed by the CCD, is currently pending adoption by the Parliament,

5.6.1 National Climate Change Policy

A policy response to climate change in Uganda is crucial for reducing the country's vulnerability and to adjust to and cope with the projected impacts of climate change. Actions on climate change undertaken in Uganda have tended to be scattered and uncoordinated, with an inappropriate institutional framework for effective coordination. A policy to tackle the challenges of climate change in Uganda needs to be as multi-sectoral as the problem itself, and provide direction for key sectors and stakeholders to facilitate more resilient national development, and mobilize and scale up the financing for climate change actions significantly.

In the view of above, the goal of the National Climate Change Policy (NCCP) 2013-2017 is "to ensure a harmonised and co-ordinated approach towards a climate-resilient and low-carbon development path for sustainable development in Uganda". (Ministry of Water and Environment, 2015).

The policy provides a framework for coordinated action, with attention to capacity requirements and the development of financial mechanisms. This policy will be the guiding document behind the development of a national, costed implementation strategy that will detail actions by sector and designate tools to be prioritized.

The overarching objective of the policy is to ensure that all stakeholders address climate change impacts and their causes through appropriate measures while promoting sustainable development and a green economy.

Climate change adaptation is being emphasized as the first priority for Uganda, while mitigation efforts are embraced as secondary. Adaptation policy priorities are specified for agriculture and livestock, water, fisheries and aquaculture, transport and works, forestry, wetlands, biodiversity and ecosystem services, health, energy, wildlife and tourism, human settlements and social infrastructure, disaster risk management, and cross-cutting priorities for vulnerable groups.

Mitigation policy priorities are specified for sectors of forestry, land use and land use change, reduced emissions from deforestation and forest degradation, wetlands, agriculture, energy generation, energy utilization, transport, waste management, the industrial sector, and cross-cutting priority of technology transfer and large-scale diffusion of clean, low-carbon technologies.

NCCP, NAMA Relevance:

Under Priority Adaptation, the NAMA directly supports implementation of the following sector-specific priorities:

- Forestry-specific strategy 3 - to promote and encourage efficient biomass energy production and utilization technologies to reduce biomass consumption;
- Energy-specific strategy 3 - to diversify energy sources by promoting the use of alternative renewable energy sources (such as solar, bio mass, mini-hydro, geothermal and wind);
- Energy-specific strategy 4 –to promote energy-efficient firewood cookstoves and solar and liquefied petroleum gas (LPG) cookers;
- Human Settlements and Social Infrastructure- specific strategy 8 – Diversify economic activities to improve the resilience of rural communities dependent on climate-sensitive sectors such as agriculture and livestock rearing.

Under Priority Mitigation, the NAMA directly supports implementation of the following sector-specific priorities:

- Energy Generation-specific strategy 4 – to promote the use of alternative renewable energy sources such as solar, biomass, wind and bio fuels, as well as their associated technologies;
- Energy Utilization-specific strategy 3 – to promote the use of energy-efficient technologies such as compact florescent lamps and other commercially available high-efficiency lamps;
- Energy Utilization-specific strategy 4 – to promote efficient firewood/charcoal stoves and solar and LPG cookers, and address the high upfront costs of acquiring these technologies through household subsidies or tax waivers;
- Energy Utilization-specific strategy 5 – to reduce deforestation by providing alternative clean energy sources and efficient appliances for energy use, management, and conservation;
- Waste management-specific strategy 4 – to promote the use of human waste for production of biogas, which can be used for cooking and lighting in institutions such as schools and hospitals, while effluent can be used as fertiliser.

5.6.2 Nationally Determined Contributions (NDCs)

Uganda became a signatory to the UNFCCC process in June 1992. The COP 21 in Paris in December 2015 has resulted in adoption of a ground breaking international climate agreement in the fight against the climate change. The goal is to keep global warming "well below" 2°C, and continue all efforts to limit the temperature rise to 1.5°C.

The two main pathways for achieving this are:

Mitigation = Strategy/Action to reduce or remove GHGs

Adaptation =Enhance resilience and reduce vulnerability

The "building block" of the Agreement and the Climate Action efforts is the so called "Nationally Determined Contribution"

Uganda submitted its Intended Nationally Determined Contributions (INDCs) before the COP 21 in Paris on October 28 2015. They define adaptation as the priority, especially in the following sectors:

- Energy Supply and Demand
- Agriculture and Livestock
- Forestry and Wetlands
- Infrastructure (settlements, social infrastructure and transport)
- Water and Health
- Disaster Risk Management

Uganda is one of smallest GHG emitters in the world, therefore, the mitigation actions included within NDCs consist of a series of policies and measures in the energy supply, forestry and wetland sectors in the INDC.

As a both mitigating, and adaptation measure, the Green School NAMA is specifically included in Uganda´s INDC, to help achieve Uganda´s climate targets. In the business -as-usual (BAU) scenario the estimated emissions in 2030 will be 77.3 million tons of carbon dioxide equivalent per year ($MtCO_2eq$/yr). The estimated potential cumulative impact of the policies and measures could result in a reduction of approximately 22 per cent in national greenhouse gas emissions in 2030 compared with business-as-usual. (Government of Uganda, 2015).

5.6.3 Financing of the NDC

The Government of Uganda will continue to commit resources to climate-change relevant strategies. However, the full implementation of these actions is conditional on the support of the international community coming from both climate finance instruments and international market mechanisms. As set out in the Uganda National Climate Change Policy and its Costed Implementation Strategy, national sources are assumed to cover approximately 30 per cent of incremental costs of the activities in the next 15 years, with 70 per cent assumed to originate from international sources.

NDCs, NAMA Relevance: The proposed NAMA will contribute to the reduction of GHG emissions via implementation of energy efficient and renewable energy technologies, that can be considered both as adaptation and mitigation activities. The NAMA proposal also explicitly notes the required support in the form of finance, technology, and capacity development.

With regards to the specific activities and programmes listed under mitigation, the NAMA directly contributes to the following sectors and actions:

Table 18: Relevance of the NAMA to stated mitigation priorities in Uganda's INDCs

Priority Sectors	Priority Adaptation Actions	Relevance of the NAMA
Forestry	Encouraging efficient biomass energy production and utilization technologies	NAMA will implement institutional improved cookstoves
Water	Extending electricity or expanding use of off-grid solar system to support water supply	NAMA will implement solar PV systems for electricity generation
Energy	Increasing the efficiency in the use of biomass in the traditional energy sector	NAMA will implement energy efficient institutional cookstoves
	Promoting renewable energy and other energy sources	NAMA will implement solar PV systems, and biogas

5.7 Summary and Conclusions

With the above review of the Ugandan national strategies and policies it can be established clearly that sustainable energy solutions in schools, access to modern energy sources for the schools, and sustainable energy for new income-generating activities among the public are among the factors that will promote socioeconomic development. In addition, the NAMA actively involves and promotes the private sector, as an inherent player in financing, service delivery and further development of the education and energy sectors.

The proposed NAMA is in not only line with and supportive of the country´s strategies, and will directly contribute to achieving objectives through rapid and sustainable implementation of the identified activities.

6 NAMA BASELINE INFORMATION

The baseline of this NAMA is the hypothetical (business-as-usual, BAU) scenario describing what will happen in the absence of the proposed NAMA interventions.

The proposed NAMA will ensure availability of clean cooking (CC) and renewable electricity (RE) technologies to meet the electricity and cooking energy requirements of the schools in a sustainable way.

The NAMA baseline scenario consists of two components:

- GHG baseline; and
- Sustainable Development baseline.

Setting the baseline scenario allows the impacts arising from the NAMA interventions to be properly assessed and quantified through the monitoring activities described in the Measurement, Reporting and Verification (MRV) system.

6.2 GHG Emission Baseline

6.2.1 GHG Baseline for Cooking Technologies

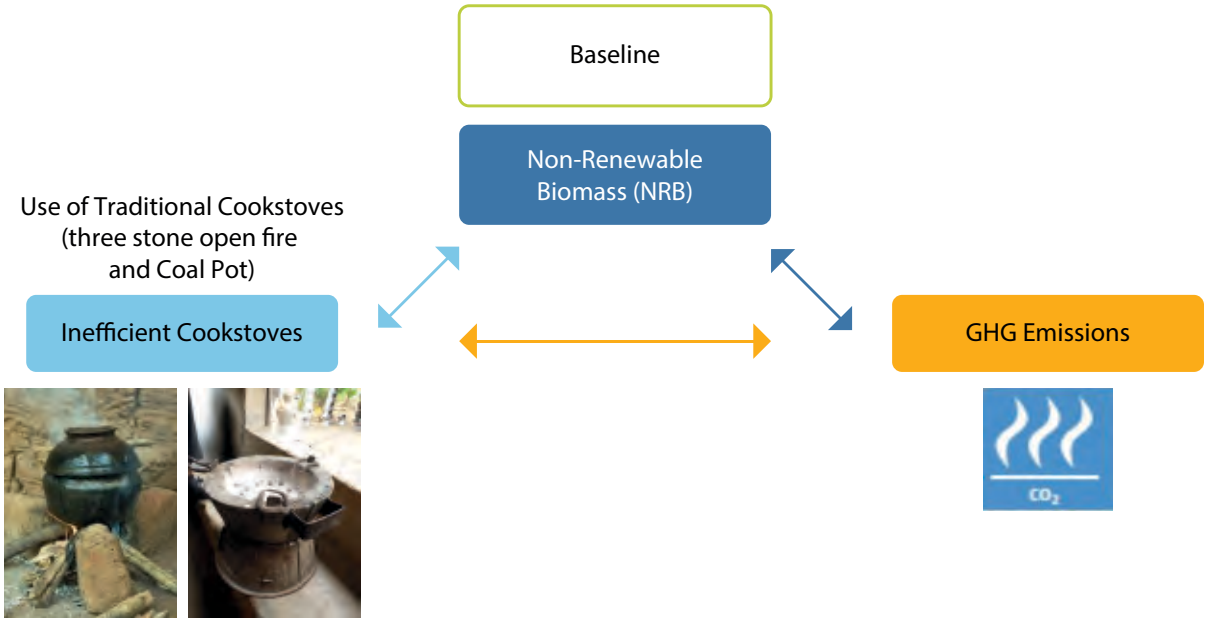
As described in Section 5.1., the prevalent cooking fuel in the schools is wood, and most of the schools in Uganda still use inefficient traditional cooking technologies.

The baseline is a current or an expected business-as-usual (BAU) scenario. The BAU scenario for cooking activity in Uganda's schools is the continued use of predominantly non-renewable biomass (firewood and charcoal) as fuel in the traditional three stone or open fire cookstove, with only marginal use of IICSs. In the baseline, the schools will continue the established practice.

The GHG emissions reduction estimation for the NAMA interventions are applying the "Standardized baseline for institutional Cookstoves in Uganda, V 01.0" (UNFCCC CDM Standardized baselines, 2015), which is derived using the UNFCCC approved CDM methodologies "AMS-II.G: Energy efficiency measures in thermal applications of non-renewable biomass, version 07.0" (CDM, 2015) and "AMS-I.E: Switch from non-renewable biomass for thermal applications by the user, version 06.0".

In accordance with the Standardized Baseline (SB), the baseline scenario assumes the projected use of fossil fuels to meet similar thermal energy needs as those provided by the project devices.

Figure 13: Baseline scenario for cooking technologies



The baseline scenario must also take into consideration the issue of suppressed demand. To take account of suppressed demand, the baseline may include a scenario where future anthropogenic emissions are projected to rise above current levels, due to the specific circumstances of the host party (UNFCCC, 2012). This is also reflected in the applied SB.

6.2.2 Determining GHG Emission Reduction for Cooking Technologies

The GHG emission reduction achieved by the NAMA intervention will be determined as the difference between the baseline emissions and the NAMA intervention emissions.

Definition of Renewable and Non-Renewable Biomass

- Woody biomass is "renewable" if one of the conditions mentioned in Annex 18 of the report of the 23rd meeting of the CDM Executive Board is met. Otherwise where none of these conditions applies, the biomass is considered as "non-renewable" (UNFCCC, 2006).

Definition of system boundary

- The system boundary encompasses significant anthropogenic GHG emissions by sources under the control of the project participant that are reasonably attributable to the NAMA intervention as a project activity.
  - For the IICSs, the project boundary is the physical, geographical site of the efficient cookstoves that use firewood and/or charcoal.
  - For gas stoves fed from bio-latrine, the system boundary is the physical, geographical site of the biogas digester and the biogas stoves that utilize biogas.

The total GHG emissions reductions of this NAMA in a given year y (ERy) is the sum of the emissions reductions achieved through implementation of the above-mentioned technology interventions. The emission reductions are calculated as:

Equation 1: $ER_y = ER_{IICS,y} + ER_{BD,y} + ER_{SC,y} + ER_{pv,y}$

Where:

Variable	Description
ER_y	Emissions reductions achieved under this NAMA in year y ($tCO_{2_{eq}}$)
$ER_{IICS,y}$	Emissions reductions achieved through implementation of IICS in year y ($tCO_{2_{eq}}$)
$ER_{BD,y}$	Emissions reductions achieved through implementation of biogas digester in year y ($tCO_{2_{eq}}$)
$ER_{SC,y}$	Emissions reductions achieved through implementation of solar cooker in year y ($tCO_{2_{eq}}$)
$ER_{pv,y}$	Emissions reductions achieved through implementation solar PV systems in year y ($tCO_{2_{eq}}$)

The emission reductions achieved by the NAMA interventions are calculated by comparing the project emissions (PEy) with the emissions under the baseline scenario (BEy):

Equation 2: $ER_y = BE_y - PE_y$

Where:

Variable	Description
ER_y	Total emissions reductions achieved under this NAMA in year y (tCO_2eq)
BE_y	Baseline emissions in year y (tCO_2eq)
PE_y	Project emissions in year y (tCO_2eq)

6.2.3 GHG Baseline for PV Electricity Systems

Under this intervention, the solar PV-based electricity generation systems will be provided to schools which, in the business-as-usual scenario, are not connected to the grid or are connected but face frequent power failures. In the absence of the solar PV-based system, the supply and consumption of electricity would rely on fossil fuel based off-grid electricity system(s). The CDM methodology AMS-I.L is applied for calculation of emissions reductions; and with a view to accurate and cost-effective monitoring, a conservative default emission factor of 1.0 tCO_2eq/MWh is applied.

Assumptions:

- The PV systems are characterized by short distances between the places where the electricity is generated and the places where the electricity is consumed or recharging takes place. Thus no losses will be taken into account. All the electricity generated by the system will be consumed, that is the electricity generated is equal to the electricity consumed.
- All systems installed in year y under the NAMA are considered to be operational in that year and the date of commissioning of the system installed in year "y" will be the first day of year "y".

System boundary:

The project activity is the installation of solar PV based system. Thus, the project boundary encompasses the PV system, encompassing electricity generation and consumption on the same site.

6.2.4 Determining the GHG Emission Reduction for PV Electricity Systems

In order to calculate emission reductions achieved through implementation of RE technologies, the business-as-usual scenario for this intervention is taken from the Clean Development Mechanism (CDM) approved "Small-scale Methodology: AMS-I.L.: Electrification of rural communities using renewable energy, Version 03.0" (CDM, 2014). This methodology addresses the issue of suppressed demand and it assumes the use of fossil fuel based off-grid power generators as baseline.

Significant GHG emissions arise from the use of fossil fuels in the baseline scenario. A fossil fuel based off-grid electricity generation system, such as a diesel generator, emits carbon dioxide into the atmosphere. Therefore, the generated electricity is directly linked to carbon dioxide (CO_2) emissions that can be expressed as the emission factor (tCO_2eq/MWh).

In line with Methodology AMS-I.L and considering the challenges for the NAMA actors of monitoring electricity generation at each facility, the conservative default emission factor of 1.0 tCO_2eq/MWh is applied as the emission factor for this intervention.

GHG emissions reductions achieved through the implementation of solar PV systems in a given year y (ERPV,y) are calculated as:

Equation 6a: $$ER_{pv,y} = \sum_{i=1}^{n} EG_{pv,I,y} EF_{CO2}$$

Where:

Parameter	Description
$ER_{pv,y}$	Electricity generated by PV system i, supplied to consumer appliances over the time y in MWh. Average electricity output per kWp per year will be determined and fixed ex ante based on manufacturers' data and/or international or equivalent national standards. For the ex ante estimation a value of 1132.80 kWh per kWp per year is used.
EF_{CO2}	Fossil fuel emissions default factor = 1.0 tCO_2eq/MWh
y	Period of time defined by the project participant
i	PV system identification

6.3 Sustainable Development Baseline

The general baseline of sustainable development in Uganda is described in Section 6.3.2 on SDGs.

For the purpose of monitoring the NAMA's impact on sustainable development, the baseline is quantified using selected indicators in the areas relevant to the NAMA.

The Sustainable Development (SD) indicators were selected using the *Sustainable Development Evaluation Tool (SD Tool)* prepared by UNDP (UNDP, 2014).

The SD Tool defines 5 domains of sustainable development:

- Environment
- Social
- Growth and Development
- Economic
- Institutional

The tool requires for each of the interventions to decide whether an indicator (such as air pollution, job creation, health, etc.) is selected, identify the impact, add an explanation on the chosen indicator, define the effect (positive, negative, both) and indicate whether monitoring is undertaken.

The interventions under the proposed NAMA will contribute to improvement of the following sustainable development indicators:

Table 19: The SD indicators relevant to the NAMA

Domain	Indicator	Measured under NAMA (Yes/No)	Contribution to specific SDGs and targets
Environment	Air pollution/quality	No	
	Water pollution/quality	No	
	Soil pollution/quality	No	
	Others (Noise/visibility)	No	
	Biodiversity and Ecosystem balance	No	
	Climate change adaptation and mitigation	Yes GHG Emission Reduction	Goal 13, all targets
Social	Health	Yes No. of boarding facilities electrified	Goal 3, all targets
	Livelihood of poor, poverty alleviation, peace	Yes Total no. schools, pupils, and staff served with sustainable energy	Goal 1, All targets Goal 2, Target 2.1 Goal 16, Target 16.1
	Affordability of electricity	No	
	Access to sanitation and clean drinking water	Yes Total no. of bio-latrines constructed	Goal 6 Targets 6.1, 6.2, 6.4, 6.5
	Food security (Access to land and sustainable agriculture)	No	
	Quality of employment	Yes Total no. of school kitchens conditions improved	Goal 8.3
	Time savings/time availability due to project	Yes Total no. of teacher/staff of boarding schools electrified	Goal 1
	No child labour	No	
Growth and Development	Access to clean and sustainable energy	Yes Total no. of IICS/PV installed	Goal 7, Targets 7.1, 7.2, 7.3
	Education	Yes Total no. of schools with better cooking/electrified/ own woodlot	Goal 4, All targets

Domain	Indicator	Measured under NAMA (Yes/No)	Contribution to specific SDGs and targets
Growth and Development	Empowerment of women	No	
	Access to sustainable technology	Yes Total capacity of IICS/bio-latrines/PV installed	Goal 4, Target 4.3 Goal 7, Targets 7a, 7b Goal 9, Target 9b
	Energy security	Yes Total no. of schools with better cooking/electrified/ own woodlot	Goal 7, Target 7.1, 7.2, 7.3
	Capacity-building	Yes. Total no. of institutions having capacity-building programmes Total no. of Life Skills Programme participants	Goal 4, Target 4.3, 4.5 Goal 6, Target 6.a
	Equality (quality of jobs given, job condition for men/women)	No	
Economic	Income generation/expenditure reduction/Balance of payments	Yes Total no. of Life Skills Programme participants	Goal 8, Targets 8.1, 8.2, 8.3, 8.4 Goal 10, Target 10.1
	Asset accumulation and investments	No	
	Job Creation (number of men and women employed)	Yes No. of enterprises involved No. of new enterprises established	Goal 8, All targets
Institutional	Policy and planning	Yes NAMA Coordinating and implementing entities	Goal 16, targets 16.6, 16.11
	Laws and regulation	Yes Total grants/loans and country contribution "CSR-taxing legislation"	Goal 17, targets 17.1, 17.3, 17.4

The positive benefits of the NAMA implementation are comprehensively listed for each Intervention and described in the MS Excel-based SD Tool, annexed to the NAMA document.

Note: Please, refer to Section 12.1.2 under MRV to see more information on monitoring the SD impacts.

7 NAMA SOLUTIONS AND APPROACH

As discussed above, the solution proposed by this NAMA is designed with the aim of creating a programme for clean energy solutions dissemination that will enable transformational and sustainable change in the education sector, with positive impacts in the private sector and on people's livelihood.

The main characteristics of the NAMA design are therefore, as follows:

- The geographical scope of the NAMA covers the whole country of Uganda, targeting schools in urban, semi-urban and rural areas;
- In the long term, NAMA should cover all types of schools and educational institutions in Uganda: government-aided and private; primary, secondary, and tertiary; as well as institutions with educational activities (not having the status of a school). This translates to more than 18,000 primary schools, almost 3,000 secondary schools, and about 50 tertiary schools. (MES, 2015). These high numbers will be dealt with as follows:
  - The NAMA will be implemented in bundles (groups of schools) in the same area, to simplify logistics; and
  - The NAMA will use a prioritizing tool to identify the "most needy", as well as "most promising" areas for future roll-out.
- The energy needs of the schools differ widely, as do schools' capacities and capabilities to implement and use the various energy solutions. Similarly, the economic feasibility of the technologies differs. Therefore, implementation is adjusted to reflect the applicability and readiness of the technology:
  - Institutional improved cookstoves (IICSs) are the primary focus, being widely applicable, and generating good returns on investment. IICSs will be disseminated as soon as the NAMA is launched, the first batch financed by the CSR contributions of national private sector.

- A Revolving Loan Fund (RLF) will be established and capitalized for the full roll out.
- Photovoltaic systems (PV) for light and electricity will require development of a business model to identify ways to pay back the investment, and to be included in the RLF scheme. This shall be done as part of the technical assistance measures in the first year, in conjunction with piloting and testing the models. Financing will be sought.
- Gas cookstoves fed from biolatrines require a substantial grant component due to high investment costs but low pay back potential. Therefore specific fundraising and marketing shall be done.

- Financing is designed for individual technology interventions, combining traditional and innovative, national and international sources:
  - A Revolving Loan Fund (RLF) will be established and capitalized for the full roll out of the IICS;
  - The RLF will be used for financing the PV systems, with an optional subsidy scheme, as will be defined within technical assistance for development of a business model to identify ways and potential to pay back the investment;
  - Donor grants, crowdfunding, CSR contributions, and national government contributions will be the sources of financing for the bio-latrines.
- The implementation structure is designed for effective and efficient coordination, implementation, progress monitoring, quality assurance and will have the following features:
  - A NAMA Implementing Entity (NIE) will be established for everyday operation and management;
  - Private sector-led implementation and maintenance;
  - Strong oversight, guidance, and verification by the Government.
- Non-technology measures under the NAMA will include:
  - A Life Skills Programme for youth and local communities;
  - Technical assistance for the NIE and Government to develop NAMA management, MRV, monitoring and database tools;
  - Capacity-building and training for the NIE, the Government and private sector.

Summary of the proposed technology interventions:

- Improving cooking conditions of schools with improved institutional cookstoves (IICSs);
- Improving cooking and sanitation conditions of schools with IICS and biolatrines; and
- Self-sufficient and clean supply of lighting and/or electricity with solar PV systems.

Technology interventions are detailed in Section 9 below.

7.1 NAMA Launch, Implementation and Roll-Out

The NAMA will be launched officially in the fourth quarter of 2016, when the declarations, memorandums, etc. will be signed and national Government pledges towards the NAMA implementation will be published.

THe NAMA roll-out will entail the following activities:

- Marketing and fundraising to generate the financing pool will continue, together with activities needed to identify and establish individual entities for the implementation (especially the NIE for everyday operation, and the Financial Trustee for operating the RLF);
- Procurement for provision of services included under the non-technology measures (technical assistance and capacity building) will be performed and the assignments will be launched when finance is obtained;
- All potential financing sources will be addressed in order to find financing for NAMA management and MRV (especially the NIE, Project Management Unit, and MRV costs);
- Physical activities under the technology intervention will start in January 2017, with the first implementation of IICSs, using the existing momentum built in the readily available financing source from national private sector Corporate Social Responsibility (CSR) activities;
- Development of a business model to identify ways and potential to pay back the investment of PV systems will be identified, piloted and tested in conjunction with technical assistance measures in the first year. This will include entrepreneurial activities by the school itself (sale of services based on electricity, rent of electrified space, etc.); and
- All potential financing sources will be addressed in order to find financing for the bio-latrines.

7.1.2 Physical Interventions Roll-Out

Geographically, the NAMA will start in districts of Kampala, Jinja, and Wakiso. In each district, a bundle of pilot schools has been selected, resulting in total number of 100 schools. Technologies implemented will be limited to built-in IICS. In average, 2.5 IICS in each school (depending on the number of pupils) will be installed.

Financing and coordination will be provided by Ugandan companies active in CSR activities, acting as provisional implementation entities. In addition, the sponsoring entity will also make available all the process know-how, database, and monitoring data to the NIE.

7.1.2.1 Implementation in Bundles

For Intervention 1 and Intervention 3 (IICS and PV systems), it is proposed that implementation of the NAMA be in bundled groups of 10-30 schools in nearby areas of an identified priority region, e.g. schools in one valley, along a particular road, etc. This is with the aim to optimize and simplify the transport and logistics, and thus reduce the costs. It will also allow the inclusion of a few lower priority and disadvantaged schools in a bundle of high-priority schools (e.g. very small schools). For each bundle one installation company will undertake the technologies´ installation and maintenance. The average sizes of the schools in Uganda implies that a bundle of 10-30 schools translates into 5,400-16,200 pupils, and ca 30-90 cookstoves.

7.1.2.2 Prioritizing

The objective of prioritizing is identification of the areas/regions with the highest potential impact. It will be done by identification of the regions with the highest number and/or density of schools that are in the high need of the sustainable energy technologies.

The prioritizing will therefore be applied two-fold:

1. **on the level of schools**

   - Each school shall be assessed against the selected scoring criteria;
   - Separate scoring criteria are applied for individual interventions, for cooking technologies and for PV electricity;
   - Assessments will be performed applying the scoring tool (MS Excel based); the tool will be redesigned as needed per lessons learnt from the implementation; and
   - The results are then transferred into the GIS database (to be developed under NAMA Phase 1).

2. **on the level of regions/districts**

   - In the GIS maps, regions with the highest number/density of prioritized schools will be identified visually;
   - A list of schools falling within the identified regions will be prepared, and potential impacts quantified (e.g. number of cookstoves, number of pupils, etc.); and
   - The identified regions will be prioritized based on the potential impacts.

The scoring criteria used for prioritizing:

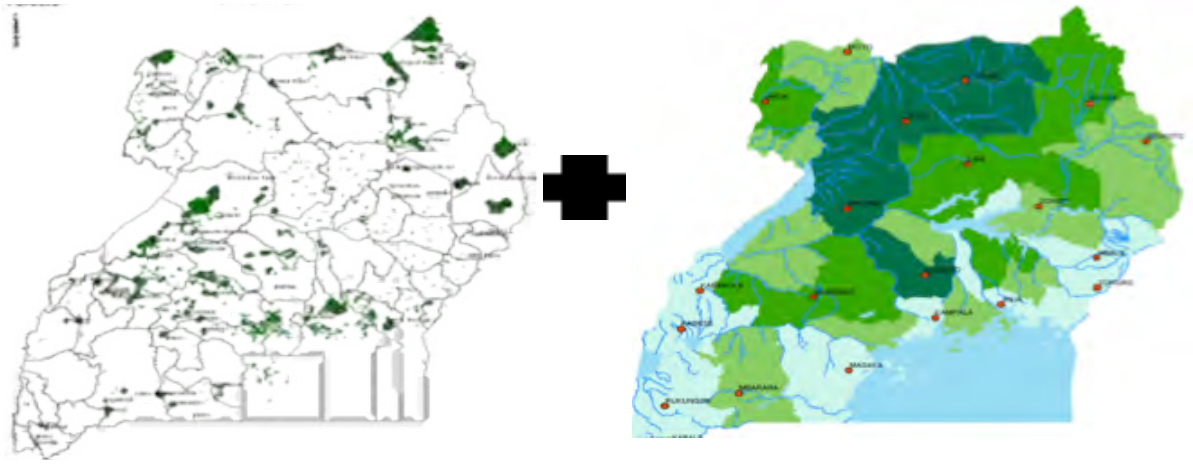
I. Localization

Rationale: The geographical scope of the NAMA covers the whole of Uganda, targeting schools in urban, semi-urban and rural areas, with their specific conditions. Urban and semi-urban areas are characterized by high dependence on fuel wood supply from external sources, resulting in high prices. Grid connection is usually available. Overall infrastructure, facility conditions, access to services, and maintenance tend to be generally good. Access to information is good, and thus awareness of sustainable energy technologies is usually not an issue. The parents´ ability to pay is better than in rural areas. The schools in urban areas tend to be larger. Rural areas benefit from lower prices of fuel wood or even own local sources for free. However, they are often challenged by weaker infrastructure, access to services and information, and lower ability/willingness of the parents to pay. Therefore, these needs and capacities will be considered in the NAMA by reflecting the geographic location of the schools for individual intervention.

Intervention 1: Installation of improved institutional cookstoves (IICS), biomass-based

The localization is assessed according to:

- Spatial biomass availability (based on natural land cover, altitude, precipitation rates, etc.), in combination with; and
- Restricted access areas (e.g. national parks, reserves) where the wood biomass can be abundant but the people are not allowed to harvest it freely.



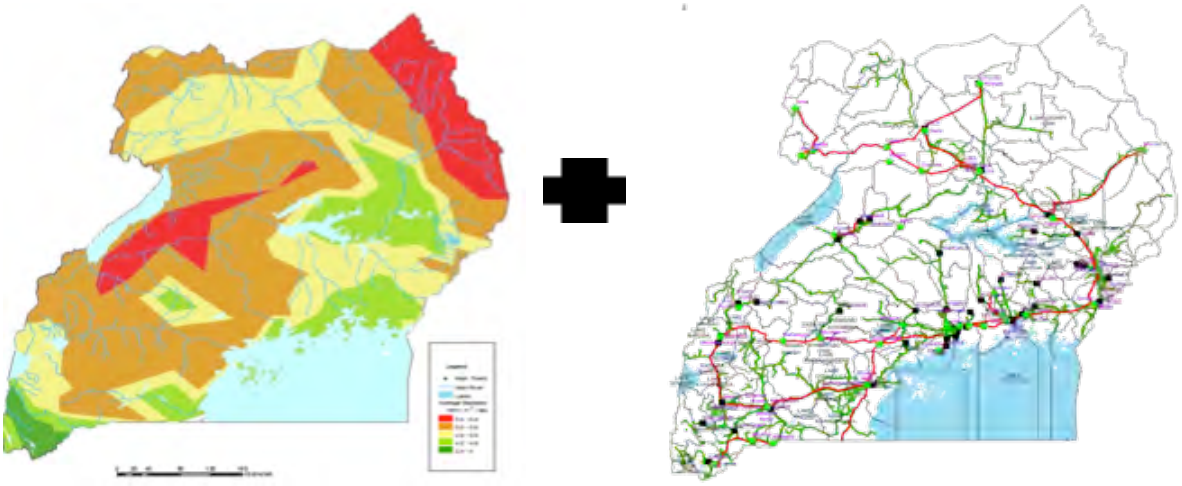
Intervention 2: Installation of biogas cookstoves fed by biogas fed from biodigesters with biolatrines

The same as for Intervention 1

Intervention 3: Solar PV installations for electricity and lighting

The localization is assessed according to:

- Grid connection (current availability or plan): the highest priority will be given to the schools in areas without grid connection and where electrification is not even planned in the near future, as per the Rural Electrification Strategy and Plan 2013-2022 (Rural Electrification Authority, 2013); and
- Value of solar irradiation: priority will be given to areas with the highest irradiation.



7.2 NAMA Targets

The values used for setting up the NAMA targets are:

Table 20: Values for NAMA targets

Description of Item	Value
Total no. of schools in Uganda	21,460
Share of boarding schools in total numbers	10%
The % of total schools expected to have IICSs installed under the NAMA	100%*
	ca 22,000
Total no. of pupils/students	10.5 million
Average number of IICSs per school	2.5
Total number of IICSs installed	ca 55,000
The % of total schools expected to have PV Systems installed	30%
	ca 6,500
Average kWp of Solar PV systems to be installed per school	1
The % of total schools expected to have biolatrines installed	5%
	ca 1,100
Average no. of biolatrines installed per school	1
Total no. of schools with Life Skills Programme	10%
	2,200
Total no. of Life Skills Programme participants	100 per school
	220,000

*For simplification, the number of schools that already have IICSs is not included, and new schools that will be established over yjr NAMA´s lifetime to cope with the increasing enrolment are added; the figure is rounded-up.

The overall NAMA objectives of improving the energy situation in schools, increasing private sector involvement, and building capacity, are translated below into quantifiable impacts under the five SD domains of the UNDP SD Tool.

The NAMA targets are defined as:

Table 21: NAMA targets for SD indicators

Domain	Indicator	Parameter	Target Value (estimated ex-ante)
Environment	Climate change adaptation and mitigation	GHG Emission Reduction from IICS in day schools (tCO_2e)	574,000 tCO_2/a
		GHG Emission Reduction from IICS in boarding schools (tCO_2e)	191,000 tCO_2/a
		GHG Emission Reduction from PV (tCO_2e)	6,500 tOC2/a
		GHG Emission Reduction from bio-latrines (tCO_2e)	81,000 tOC2/a
Social	Health	No. of boarding facilities electrified	ca 1,300
	Livelihood of poor, poverty alleviation, peace	Total no. schools served with sustainable energy	ca 22,000
		Total no. of pupils served with sustainable energy	ca 10.5 million
		Total no. schools staff served with sustainable energy	ca 80,000
	Access to sanitation and clean drinking water	Total no. of bio-latrines constructed	1,100
	Quality of employment	Total no. of school kitchens improved (approximate no. of all schools with new IICS)	ca 22,000
	Time savings/time availability due to project	Total no. of boarding schools electrified	ca 650
Growth and Development	Access to clean and sustainable energy	Total no. of IICS installed	ca 55,000
		Total no. of PV installed	6,500
	Education	Total no. of schools with better facilities	22,000
	Access to sustainable technology	Total no. of schools with better cooking/electrified	22,000

Domain	Indicator	Parameter	Target Value (estimated ex-ante)
Growth and Development	Capacity building	Total no. of govt. institutions having capacity-building programmes	3
		Total no. of non-govt. institutions having capacity-building programs	1
		Total no. of schools with Life Skills Programme	2,200
Economic	Income generation/ expenditure reduction	Total No. of Life Skills Programme participants	220,000
	Job Creation (number of men and women employed)	No. of enterprises involved	30
		No. of new enterprises established	10
Institutional	Policy and planning	NAMA Coordinating entity	1
		NAMA implementing entity	1
	Laws and regulation	Total grants/loans and country contribution	

The targets will be achieved by a combination of three technology interventions, and five non-technology measures involving capacity building and technical assistance:

Technology interventions:

- Improving cooking conditions of schools with IICSs;
- Improving cooking and sanitation conditions of schools with IICS and biolatrines;
- Self-sufficient and clean supply of lighting and/or electricity with solar PV systems.

Non-technology measures involving capacity-building and technical assistance:

- Establish NAMA Implementing Entity (NIE), including capacity-building and technical assistance;
- Technical assistance to Government: database; redesign/adaptation of school monitoring tools and design of verification and reporting;
- Develop and test business model for solar PV systems;
- Capacity-building and awareness: trainings for companies;
- Life Skills Programme to support the technical intervention for schools.

8 NAMA INTERVENTIONS

NAMA interventions are the core physical, technical activities to be realized on the ground, and bring about the major part of the emission reduction and expected SD benefits. The proposed interventions are directly aligned to the objectives of the NAMA stated in Section 2.4.

This section deals with technical aspects of the interventions, it should be read in conjunction with the sections on phased implementation.

- Intervention 1: Improving cooking conditions of schools with improved institutional cookstoves (IICSs);
- Intervention 2: Improving cooking and sanitation conditions of schools with IICS and bio-latrines; and
- Intervention 3: Self-sufficient and clean supply of lighting and/or electricity with solar PV systems.

Physical Outcomes of the NAMA interventions are real and measurable outcomes that will lead to scaled up emission reduction. They are quantified below:

- Intervention 1:
  - Outcome 1.1: 55,000 IICSs in 22,000 schools
- Intervention 2:
  - Outcome 2.1: 1,100 biogas cookstoves with bio-latrines
- Intervention 3:
  - Outcome 3.1: 6,500 solar PV systems installed

8.1 Intervention 1: Improved institutional cookstoves (IICSs)

Intervention 1 will implement institutional improved biomass cookstoves, replacing 3-stone fireplaces and any type of unimproved cookstove.

Reckoning the average size of the schools in Uganda, and capacity of the average and most common IICS (ca 100 litres, catering for about 200 pupils, there will be 2.5 IICSs installed in each school. The exact number of IICS implemented in a school will depend on:

- Size of the school–total number of pupils and staff catered for;
- Type of the school–daily or boarding;
- Size of the IICS–number of potholes and size of the saucepans (depending on the regional customs, schools' preferences, and the technology provided by individual installation companies).

Table 22: Characteristics and eligibility criteria for IICS

Parameter/criterion:	Value:	Assessed:
Cookstove body	Fixed, built-in Watertight masonry structure with an appropriate platform for the cook(s) to operate the stove Saucepan seat (submerged type), fitted with saucepan stabilizers to position the saucepan in the centre Should have sufficient structural strength to withstand tough operating conditions including high temperature (up to 1,000°C) and incidental impulsive stress Fitted with a chimney for removal of exhaust gases / smoke from kitchen	Protocol and pictures at the commencement
Combustion Chamber	Rocket elbow combustion chamber Fitted with a by-pass type of inlet air duct and a cast iron grate or high temperature ceramic grate, above the air inlet, to provide support for firewood beyond the firewood magazine Cross section: rectangular / square or circular Should have abrasion resistant interior lining that can withstand high temperature conditions	

Parameter/criterion:	Value:	Assessed:
Thermal insulation for fire passages and combustion chamber	Lining with abrasion resistance to scratches from firewood and firewood shelf Thermal insulation materials should be non-toxic /asbestos free Thermal insulation material should be of minimum thickness 6 centimetres	
Additional equipment	Supplied with matching stainless steel saucepan & lid of stainless steel (human food grade), bottom plate of minimum thickness 3mm and sides of 2mm Should be fitted with handles for use when lifting (insulated handles preferred) Should be fitted with a matching lid which withstands sagging at cooking temperatures Should be fitted with a flange near the top rim to seal off smoke emission in the kitchen and direct it to the chimney Fabrication with smooth finishing (fabrication using TIG welding preferred)	
	Each of the stoves should be supplied with a scoop for ash removal	
Placement of the cookstove	The stoves should be built inside kitchens or kitchenettes, sheltered from harsh weather conditions including rain etc.	
No. of people cooking for	min. 50	Number of pupils & staff of the school (annual enrolment data from the MES)
Capacity/volume	min. 20 litres recommended 100-120 litres	Volume of the saucepan/cooking vessel used
Energy efficiency	min. 40%	Measured by Water Boiling Test (annually)
Lifetime	10 years (with annual maintenance)	Operation monitored annually
	The warranty for each of the stoves should be 2 years minimum, meaning stoves should be free from defect(s) caused by poor workmanship and it should have structural integrity	
	The contractor should conduct user training and supply an illustrated user manual for each of the stoves.	At commencement & up-date annually at the maintenance

Figure 14: Examples of eligible types of fixed IICS: a) with ceramic tiles and full metal lining; b) with facing bricks, metal lining on the top edge; c) with smooth cement surface and full metal lining

Inclusion of other types of IICS technology:

During the lifetime of NAMA implementation, it is assumed that cooking technology progresses, and other types of IICS can be deemed eligible. Alternatively, manufactured "mobile" steel stoves can be included, too.

Inclusion of new technology will require that NAMA Steering Committee:

- Approves the technology;
- Sees that conditions of efficiency, lifetime, warranty and required maintenance are specified;
- Oversees recalculation of ERs and SD indicators, and MRV system is adapted to the new technology.

Figure 15: Examples of manufactured steel IICS

Quality assurance:

Currently, there is no standard for built-in cookstoves in Uganda. The quality of the IICS implemented under NAMA will be assured by set of measures:

- Ex ante assessment of the technology according to the detailed description of the construction process provided by the installation company when applying for inclusion in the pre-qualified list (see Section 11.5.1 on pre-qualification of companies). The assessment will be performed by expert technical personnel; and

- Annual lifetime maintenance will be secured with each installation company, for each bundle. The installation company will sign up to regular annual maintenance work in order to maintain the expected 10-year lifetime of the IICS, and maintain its energy efficiency.

Quality control:

- Test at commencement After the construction is finalized, the IICS will be tested in the presence of both the installation company and of school representative(s). The Commencement Test will verify that the cookstove and all its parts are functional and a simple Water Boiling Test (WBT) will be performed to test the efficiency. A Protocol of the Commencement Test will be prepared and signed by the company and the school. Only installations successfully passing the test will be considered as delivered and eligible for second staged payment. If the test is not successful, it is the sole responsibility of the installation company to do the repairs or amendments.

- Ex-post 3 months after the commencement the school will repeat the WBT and report that the IICS is operation and the WBT results will lead to the Protocol of the 3-months Test. Passing the 3-months-test will entitle the installation company for the third staged payment. If the IICS operation during the first 3 months is not satisfactory, or fails to pass the WBT 3-months-test, the school will communicate this to the installation company which will undertake repairs or amendments.

- Ex-post annual WBT tests will be performed each year after the regular maintenance by the installation company. Annual IICS Protocols will be prepared and signed by both the installation company and the school representative(s). Costs of the maintenance will be covered by the school.

Table 23: Outcomes of Intervention 1

Outcomes of Intervention 1:	GHG emissions reduction per year	GHG emissions reduction per 10-years lifetime
IICSs in day schools:		
One 100 litres IICS in day school	ca 29 tCO_2	ca 250 tCO_2e
Total 49,500 IICSs in 19,800 day schools	1,435,000 tCO_2	12,288,000 tCO_2
IICSs in boarding schools:		
One default 100 litres IICS in boarding school	ca 87 tCO_2	ca 750 tCO_2
Total 5,500 IICSs in 2,200 boarding schools	478,000 tCO_2	4,096,000 tCO_2
TOTAL IICS INSTALLED	1,913,000 tCO_2	16,383,000tCO_2

8.2 Intervention 2: Improving cooking and sanitation conditions of schools with IICSs and biolatrines

Intervention 2 builds strongly on the lessons learnt from Intervention 1, and will be implemented in by adding a sanitation component in the form of the so-called biolatrine technology composed of biodigesters fed by latrine effluents and manure (cow dung preferably, based on availability). The biogas produced will be used in the gas stoves, complementing the biomass-based IICS.

Figure 16: Composition of the bio-latrine technology: bio-latrine, biodigester, and gas cookstove

Since the bio-latrine technology needs more precise designing and planning, and the high investment costs require a grant component, Intervention 2 will be implemented only after the required financing is obtained.

Table 24: Parameters for Intervention 2

Parameter/criterion:	Value:	Assessed:
Biodigester	Brick or concrete masonry chambers Size (volume): depending on the school size; average 20 m^3	Protocol and pictures from the construction
Cookstove	Metal welded gas-burning stove Should have sufficient structural strength to withstand the large saucepan Fabrication with smooth finishing (fabrication using TIG welding preferred)	Protocol and pictures at the commencement
Additional equipment	Supplied with matching stainless steel saucepan & lid of stainless steel (human food grade), bottom plate of minimum thickness 3mm and sides of 2mm Should be fitted with handles for use when lifting (insulated handles preferred) Should be fitted with a matching lid which withstands sagging at cooking temperatures	
Placement of the cookstove	The stoves should be built inside kitchens or kitchenettes, sheltered from harsh weather conditions including rain etc.	

Parameter/criterion:	Value:	Assessed:
No. of people cooking for	min. 600	Number of pupils & staff of the school (annual enrolment data from the MES)
Capacity/volume	Biodigester: Cookstove: holding min. 20 litres saucepan (recommended 100-120 litres)	Volume of the saucepan/ cooking vessel used
Energy efficiency	min. 40%	Measured by WBT (annually)
Lifetime	10 years (with annual maintenance)	Operation monitored annually
	The warranty for each of the stoves should be 2 years minimum, meaning stoves should be free from defect(s) of poor workmanship and it should have structural integrity	
	The contractor should conduct user training and supply an illustrated user manual for each of the stoves.	At commencement & update annually during maintenance

The requirements and conditions for the IICS remain as described for Intervention 1.

8.3 Intervention 3: Solar PV installations

The intervention will implement solar PV based systems for power generation.

The objective of the Intervention 3 is to cover the electricity requirements of the individual facilities of the school compound for lighting, and other small electric appliances (e.g. radio, computer, mobile charging, water purification, etc.).

Table 25: Parameters for Intervention 3

Parameter/criterion:	Value:	Assessed:
PV panels	Monocrystalline, polycrystalline, or thin film	Protocol and pictures at the commencement
Fixture/placement	mounted on the roof or free standing	
	The school will have to ensure the safety of the installed system; the school compound must be fenced, or access to the panels must be restricted	
Components	Inverters battery banks Wiring	
Additional equipment	Light bulbs (indoor)	

Parameter/criterion:	Value:	Assessed:
	Watch light (outdoor)	
Capacity/volume	Depending on the school size and type (see the estimation below)	Number of pupils & staff of the school (annual enrolment data from the MES)
Lifetime	10 years (with annual maintenance)	Operation monitored annually
	The warranty for each of the stoves should be 2 years minimum, meaning stoves should be free from defect(s) of poor workmanship and it should have structural integrity	
	The contractor should conduct user training and supply an illustrated user manual for each of the stoves	At commencement & up-date annually at the maintenance

Estimation of the electricity needs and the respective PV system size is based on the following assumptions:

- 236 of school days/year
- 300 of boarding days/year

Table 26: Solar PV capacity estimations

Day school solar PV capacity estimation						
Electricity Use	**no of units**	**unit cap (Watt)**	**total load (Watt)**	**daily use (hours)**	**daily use (Watt-hours)**	**annual use (Watt-hours)**
Computer (laptop)	0	25	0	8	-	
Fans	0	75	0	8	-	
LED lights	50	20	1,000	8	8,000	
Total			**1,000**		**8,000**	**1,888,000**
Annual use	kWh	1,888				
Solar PV size	kWp	1.44				
Area needed	sq.ft.	144				

Boarding facility solar PV capacity estimation						
Electricity Use	**no of units**	**unit cap (Watt)**	**total load (Watt)**	**daily use (hours)**	**daily use (Watt-hours)**	**annual use (Watt-hours)**
Computer (laptop)	0	25	0	4	-	
Fans	0	75	0	8	-	
LED Lights	250	20	5,000	8	40,000	
Total			**5,000**		**40,000**	**1,888,000**
Annual use	kWh	12,000				

Boarding facility solar PV capacity estimation						
Electricity Use	**no of units**	**unit cap (Watt)**	**total load (Watt)**	**daily use (hours)**	**daily use (Watt-hours)**	**annual use (Watt-hours)**
Solar PV size	kWp	9.13				
Roof top areas needed	sq.ft.	913				

Boarding school (daily & boarding facility) solar PV capacity estimation		
Annual use	kWh	13,888
Solar PV size	kWp	10.6
Roof top areas needed	sq.ft.	1,057

Source: Own Calculations

Figure 17: Rooftop mounted solar PV panels

Figure 18: Stand alone PV panels

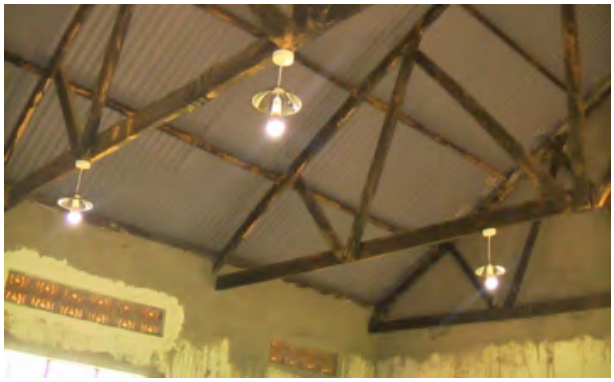
Quality assurance:

The quality of the solar PV systems implemented under NAMA will be assured by the following set of measures:

- Ex ante assessment of the technology and detailed description of the construction process provided by the installation company when applying for inclusion in the pre-qualified list (see Section 11.5.1 on pre-qualification of companies). The assessment will be performed by expert technical personnel;
- Ex ante assessment of compliance with the standards (Uganda National Bureau of Standards, 2016);
  - US 149-1:2002 Secondary cells and batteries for solar photovoltaic energy systems, Part 1: General requirements and methods of test (2nd edition);
  - US 152:2000 Code of practice for installation of photovoltaic systems;
  - US 464:2002 Susceptibility of photovoltaic (PV) modules to accidental impact damage (resistance to impact test);
  - US 468:2002 Specifications for photovoltaic systems–systems design, installation, operation, monitoring and maintenance–Part 3: test procedure for main components-inverters; and
  - US 469:2005 Characteristic parameters of standalone photovoltaic (PV) systems.
- Annual lifetime maintenance will be secured with each installation company, for each bundle. The installation company will sign up to regular annual maintenance work in order to maintain the expected 10 year lifetime of the IICS, and maintain its energy efficiency.

Quality control:

- Test at commencement–after the construction is finalized, the IICS will be tested at the presence of both the installation company and school representative(s). The Commencement Test will verify that the cookstove and all its parts are functional and a simple Water Boiling Test (WBT) will be performed to test the efficiency. A Protocol of the Commencement Test will be prepared and signed by the company and the school. Only installations successfully passing the test will be considered as delivered and eligible for second staged payment. If the test is not successful, it is the sole responsibility of the installation company to do the repairs; or
- Ex post 3 months after the commencement the school will repeat the WBT and report that the IICS is operation and the WBT results in the Protocol of the 3-months Test. Passing the 3-months-test will entitle the installation company for the third stage payment; or
- Ex post annual WBT tests will be performed each year after regular maintenance by the installation company. An Annual IICS Protocol will be prepared and signed be both the installation company and the school representative(s). The costs of maintenance will be covered by the school.



Note: The final design of the solar power plant may be a hybrid solution combined with grid supply or diesel generators or other small renewable energy solutions (e.g. pico-hydro, small wind etc.), but for the purpose of this NAMA it is intended to be a stand-alone PV based power solution to ensure that the design is universally applicable across Uganda. For the GHG and SD MRV purposes, only the PV component will count.

Table 27: Outcomes of Intervention 3

Outcomes of Intervention 3:	GHG emissions reduction per year	GHG emissions reduction per 10-year s lifetime
1 kWp	1.13 tCO_2	ca 14 tCO_2e
Total 6,500 kWp installed in 6,500 schools		
TOTAL PV INSTALLED	**7,360 tCO_2**	**88,360 tCO_2**

9 NAMA MEASURES–TECHNICAL ASSISTANCE AND CAPACITY-BUILDING

The NAMA measures are non-technology-related activities necessary to build up a stable programme structure, capacities, and tools for management, coordination, communication, and dissemination.

The measures include technical assistance activities requiring external expertise and assistance, and capacity-building activities that build national capacities and skills for the NAMA programme implementation.

Non-technology measures:

1. Establish NAMA Implementing Entity (NIE), including capacity-building and technical assistance;
2. Technical assistance to the Government: the database, re-design/adaptation of school monitoring tools, design of verification and reporting;
3. Develop and test a business model for solar PV systems;
4. Capacity-building and awareness: trainings for companies;
5. Life Skills Programme for schools.

Note: the measures will be implemented simultaneously, since they build on each other and are all important pieces of the NAMA implementation and development.

9.1 Measure 1: Establish the NAMA Implementing Entity (NIE)

After the NAMA launch, a permanent NIE will be identified and approved by the Government.

The measure includes capacity-building and technical assistance for the NIE provided by external consultants (combination of international and national; individuals or companies) during the first three years of NAMA implementation.

The NIE will be supported during process implementation to obtain:

- Training on objectives, benefits and procedures of the NAMA;
- Training in project and programme management, including use of database software;
- Case study training for project sampling and verification;
- Training in MRV for GHG emission reductions and SD co-benefits;
- Training on reporting to the NAMA Coordinating Authority (NCA).

This part of the Capacity Development Programme will help to create the documents:

- Prepare the documents (application forms, call and tender templates, evaluation and reporting forms, etc.);
- Prepare the procedures for practical implementation (procurement rules, monitoring manual, evaluation, cross-check, approval and reporting structures, etc.); and
- Ensure that the relevant forms and procedures are subject to consultation with potential end users and are sufficiently robust to secure practicability, avoid bureaucracy and disable corruption.

The NIE will be assisted to elaborate the strategies and plans for the NAMA, consult about them with stakeholders, and obtain approval from the NCA:

- Prepare detailed implementation roadmap and schedule;
- Prepare a prioritized list of schools, propose bundles;
- Prepare a marketing strategy for securing additional sources of financing (e.g. supporting document for Green Climate Fund (GCF) application);
- Targets for Intervention 3 (solar PV systems) based on the results of the pilot and business model testing.

The implementation plan will be formally approved by the NCA.

9.2 Measure 2: Technical Assistance to the Government

The Measure includes capacity-building in the NAMA Coordinating Authority (NCA) and various kinds of technical assistance provided to relevant governmental bodies (involved ministries) in order to develop tools for database keeping, monitoring tools, and design of verification and reporting. One-off external consultancies (a combination of international and national, individuals or companies) are also planned.

9.2.1 Capacity-Building for NAMA Coordinating Authority

Capacity development (CapDev) for the NCA will consist of general training for the whole NAMA Steering Committee, and specific capacity development for the Project Implementation Unit (PIU) that will be the executive body of the NCA.

The tasks of NCA and PIU are expected to be undertaken by existing staff (no new recruitments are made during this period, the salaries and operating expenses of the staff based on a share of work load for the NAMA will be considered as a national contribution (e.g. a director and 2 manager-level staff members can be allocated to the NAMA using 25 per cent of their current capacity).

9.2.1.1 Cap Dev for the NAMA Steering Committee

CapDev for the NCA will consist of two days of general training for the whole NAMA Steering Committee (multiple representatives of all the members) on:

- NAMA objectives, targets, strategies and planning;
- Structure, coordination, roles and competencies, cooperation and communication; and
- Financing and fundraising.

9.2.1.2 CapDev for the Project Implementation Unit

Capacity development and technical assistance for the PIU (see 11.2 below) will consist of:

- Training for reporting to the donors (as required);
- Training for verification and reporting sampling, performing on site checks, and verifying the results:
  - Develop and test sampling procedures for verification by the NCA;
  - Develop and approve official verification procedures (remote verification by phone calls, online surveys, on-site verifications); and
  - Develop procedures to communicate the verification results, create the rules to deal with various cases of non-compliance.
- Training for evaluating and including the technology suppliers to the list of pre-qualified companies;
- Training on marketing and fundraising activities, including negotiations and cooperation with CSR companies; and
- Designing/Maintaining the NAMA Website.

The web page is one of the main communication tools of the NAMA, providing information about the qualification criteria for projects, case studies, best practices and success stories, templates, news and achievements of the NAMA; and donors.

- Coordinating General NAMA awareness raising.

To create good awareness of the NAMA amongst schools, the private sector, and the wider public, various awareness-raising activities will be undertaken e.g.;

- continuous information to the media about the implementation and outcomes of the NAMA;
- energy-related events will be organized; and
- preparing/disseminating NAMA marketing materials (Typical materials will include leaflets, pens, notepads, a best practice guide, folders, banners, etc.).

9.2.2 GIS-Based Schools Database

The measure includes one-off third-party consultancy to assist the MES and MEMD with elaboration of a comprehensive database of schools that will be shared with the NIE, which will use it for everyday NAMA operation and management.

Consultancy is expected to be performed by 3rd party consultants (national and/or international as appropriate) within the first year of NAMA implementation. It is assumed that the assignment will take about eight months, in order to allow for governmental institutions to implement the new processes.

Individual tasks of the assignment will include:

- Transforming/unifying the existing lists of primary, secondary, and tertiary schools, and non-formal educational institutions from the MES into one database using software compatible with GIS;
- Elaboration of the database and map layers in GIS software, using the expertise of the MEMD;
- Preparation of data collection road map and templates for continuous long-term data collection for the database and database updates. Elaboration of cooperation rules for the MES, MEMD and NIE, and specification of responsibilities for coordinated approach;
- Definition of data management processes, generation of outputs, reporting/sharing among all NAMA stakeholder.

9.2.3 Adaptation of the Annual Schools Census

The measure includes a one-off third party consultancy to assist the MES with adjusting the currently used data monitoring sheets of the Annual Schools Census (ASC). The purpose of the adjustment is unification of the monitored parameters for each school type (same parameters for primary, secondary, tertiary and non-formal institutions in order to allow comparisons), and the addition of parameters required by the NAMA. Thus the ASC can become the main governmental monitoring tool for comprehensive and up-to-date information on the energy situation of the whole education sector in Uganda.

- The adjusted ACS becomes the main governmental monitoring tool for comprehensive and up-to-date information on the energy situation of the whole education sector in Uganda;
- Using the existing structure saves the MRV costs and efforts.

The consultancy is expected to be performed by third party consultants (national and/or international as appropriate) within the first year of NAMA implementation. It is assumed that the assignment will last about 16 months, in order to allow for the MES to implement the new processes, to assess the results of the first adjusted ASC, and re-adjust as needed.

9.3 Measure 3: Business Model for PV Systems

As the unit costs of installing PV are relatively high and there is no current scope for fuel savings, the proposed RLF model for IICSs may not succeed for PV. However, PV allows the generation of electricity which can be used for additional income generating activity, particularly after school hours.

The measure involves:

- Select the pilot schools (numbers depending on the financing obtained);
- Perform consultations with schools on optional income generating activities, e.g.
  - Rent of electrified/lighted working space for micro enterprises after class hours;
  - Provision of charging, refrigeration services, water purification;
  - Provision of TV time, internet connection, etc.;
- Implement the PV systems for lighting and electricity and test the chosen models; and
- Elaborate report on tested models, including recommendations and best practices.

9.4 Measure 4: Capacity-Building and Awareness

The proposed measure will involve regular trainings for:

- Technology suppliers;
- Life skills programme service providers.

The trainings will be held in order to ensure competencies, dissemination of know-how and good practices and to enlarge the pool of trained and certified technology and/or service providers.

The trainings for technology suppliers will be based on those provided within the Energy for Rural Transformation (ERT) project, utilizing the expertise and knowledge already created. Thus efforts and resources will be used effectively.

Schedule:

- 4 trainings/workshops annually for each of 2 types of stakeholders for the first 3 years – in order to enlarge the experts pool; and
- 1 training/workshop per year from the year 4 onwards – in order to maintain the up-to-date competencies.

Each supplier/provider should attend 1 training per year.

The task will be performed with the cooperation of MEMD, the NIE and third party consultants.

9.5 Measure 5: Life Skills Programme

The NAMA takes an innovative approach in developing a sustainable financial model. This is done by enhancing the use of clean energy interventions being made available to schools in Uganda. While the proposed interventions of IICS and PV systems contribute to improving the lives of the students and staff, the technologies remain under-utilized, particularly in day schools. Indeed, the PV systems will be used to provide electricity during the school's operating hours. The objective of the Life Skills Programme is to use this (then) available resource to provide energy to additional stakeholders particularly during after school hours and weekends for income generating activity.

As schools are located across the entire country, they form an important infrastructure for local communities across Uganda. This allows schools to have a reach that is currently unparalleled. The introduction of PV systems will greatly enhance the ability of schools by making modern technology accessible as internet, computers, lights (to allow activities to be carried out after work hours) and potentially can be expanded to include small equipment and machinery, such as sewing machines.

The Life Skills Programme aims to introduce and train local communities (senior students, adults, women, youth etc.) to establish micro enterprises such as tailoring, beading, making leather goods and handicrafts etc. that will allow them to undertake income generating activities. The stakeholders will be trained in skills that will allow them to generate income for life and thus support the communities in achieving a certain level of socioeconomic self-sufficiency. The training will be provided by NGOs and training institutions experienced with promoting small and medium sized business enterprises with financing made available through the CSR Model. Beyond the scope of this NAMA are additional possibilities to include micro-finance, outreach to international markets through eco-labels (e.g. Fairtrade) and potential tie-ups with large industries.

10 IMPLEMENTATION STRUCTURE

The implementation of the NAMA requires an institutional structure, which will meet the following requirements.

- It must be embedded in national and sectoral policies and strategies;
- It must be capable of effective communication and reporting as required by international agencies, such as the UNFCCC;
- It should provide an interface to international bilateral and multilateral NAMA funding entities, such as the Green Climate Fund;
- It must be able to ensure proper management of financial flows between the NAMA funding entities and the recipients;
- It must be able to ensure the achievement of NAMA targets in terms of installing the RE/EE technologies in schools, GHG mitigation and sustainable co-benefits; and
- It must be able to allow transparent monitoring of GHG emission reductions and the Sustainable Development indicators.

The recommended institutional structure of the NAMA is based on the following principles:

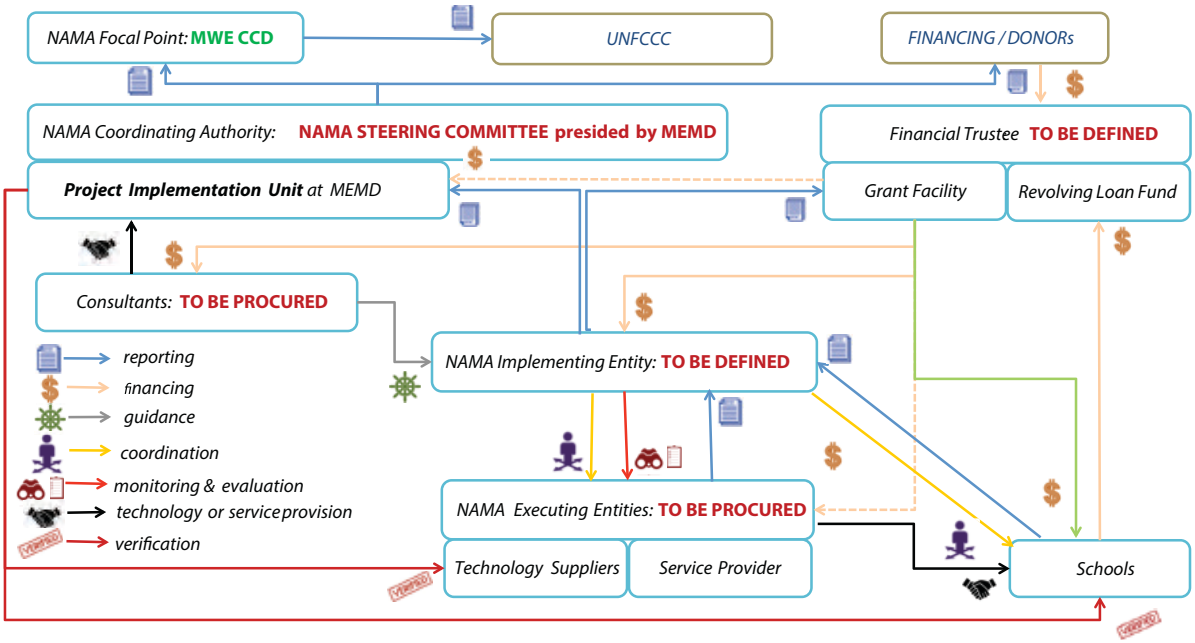
- Ensuring strong involvement of national stakeholders to create country ownership and political commitment;
- Using existing and experienced entities and organizational systems which are already in place and allow for prompt and smooth implementation of the NAMA; and
- Ensuring that the institutional structure is appropriate for the receipt of international private and/or public donor funding.

The following bodies constitute the institutional structure for the NAMA at the country level:

- NAMA National Focal Point or National NAMA Approver (NA);
- NAMA Coordinating Authority (NCA);
- NAMA Implementing Entities (NIEs);
- NAMA Executing Entities (NEEs);
- Financing Trustee;
- Consultants.

The diagram below shows the implementation structure, how positions within the implementation structure will be assumed by the individual entities in Uganda, and the relationships amongst them.

Figure 19: Schematic overview of NAMA institutional structure and relationships



The following sections provide an in-depth understanding of the roles and responsibilities of the institutional bodies listed above.

10.1 National NAMA Approver/Focal Point

The national NAMA Focal Point or National NAMA Approver (NA) has the following roles:

- Approve and submit the NAMA for registration in the UNFCCC´s NAMA Registry, and communicate with the UNFCCC;
- Provide guidance to the NAMA Coordinating Authority with respect to accessing the climate finance, accounting of emission reductions to avoid double;

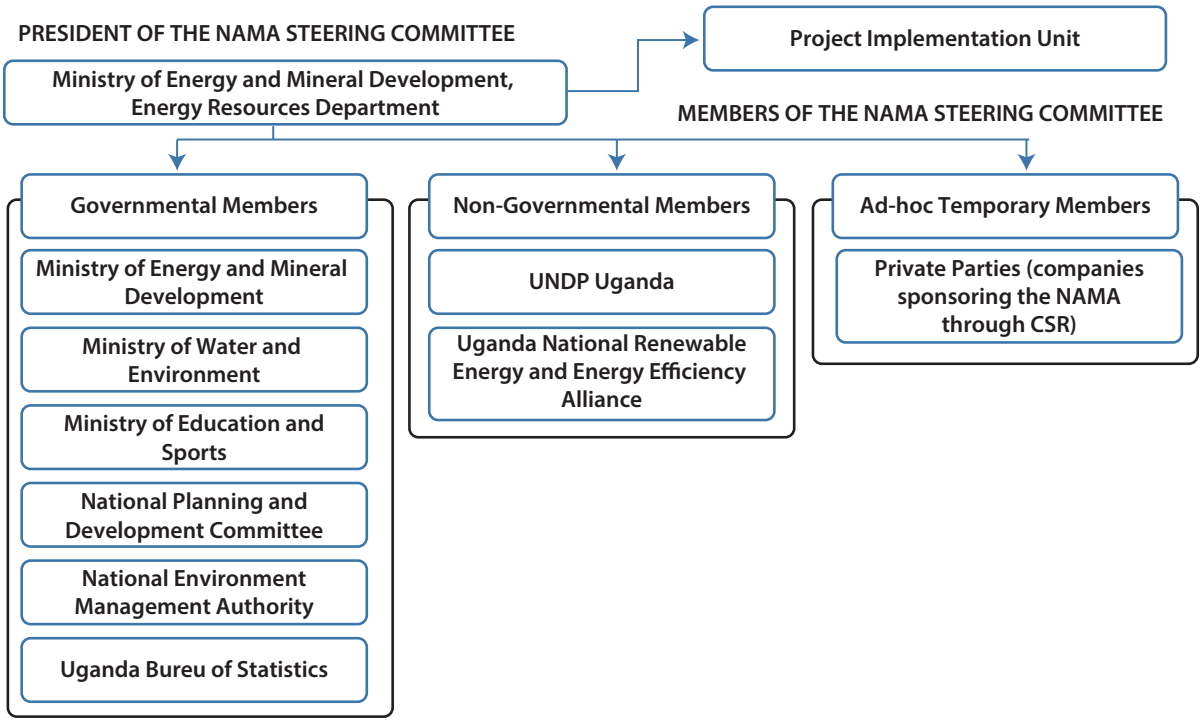
- In coordination with the NAMA Coordinating Authority, prepare NAMA reports for all stakeholders, especially the sections on GHG;
- Undertake marketing and fundraising for the NAMA.

The Ministry of Water and Environment already been appointed as the NAMA Approver (NA)/Focal Point to the UNFCCC (UNFCCC, 2015).

10.2 National NAMA Coordinating Authority

The Green School NAMA has a very strong inter-sectoral impact overlapping three main areas of interest and competence: energy; education; and environment. Therefore it is crucial to ensure very good coordination and management on governmental level. Another important feature is inclusiveness and acknowledgment of the partnership of government with the private sector, which is the very foundation of this NAMA.

Figure 20: Internal structure of the National Coordinating Authority



The NAMA Steering Committee (NSC) will act as the NAMA Coordinating Authority (NCA) for the Green Schools NAMA. The NSC will be established by transforming the existing Low Emissions Capacity Building Project Steering Committee that has worked on the initial development of the NAMA idea within the UNDP-funded Nationally Appropriate Mitigation Actions Consultancy for the elaboration of existing NAMAs, in years 2013-2015 (UNDP, 2015c).

Thanks to its inter-sectoral composition, the NCA will ensure a coordinated approach, inclusive communication, and cooperation among the institutions involved.

The NSC will be composed of representatives of the following governmental bodies:

- Ministry of Energy and Mineral Development;
- Ministry of Water and Environment;
- Ministry of Education and Sports;
- National Planning and Development Committee;
- National Environment Management Authority;
- Uganda Bureau of Statistics.

Non-governmental members of the NSC will be:

- UNDP Uganda;
- Uganda National Renewable Energy and Energy Efficiency Alliance.

Ad-hoc temporary members of the NSC will be:

- Private Parties (companies sponsoring the NAMA through CSR), if requested.

The NSC will hold an assembly of the representatives at least twice a year to deal with NAMA matters. The NSC assemblies will be presided over by the Ministry of Energy and Mineral Development, Energy Resources Department, (MEMD ERD) that is championing the Green Schools NAMA. MEMD ERD will also operate a Project Implementation Unit (PIU), that will be the executive body of the NSC, and act as the NCA towards all external stakeholders.

The PIU will perform all the NCA tasks as listed below, and report all the activities to the NSC assembly. NSC assembly will review the PIU´s activities, give guidance, and steer the NAMA director.

The NCA has the following tasks:

- Set NAMA objectives, targets, interventions, and implementation plan, including identification of school bundles;
- Manage and direct the NAMA activities performed by governmental institutions;
- Oversee the NAMA implementation by NIE/s, communicate and coordinate with NIE/s, approve annual monitoring reports prepared by the NIE/s;
- Oversee the NAMA financing by National Financing Institution/s (NFI/s), communicate and coordinate with NFI/s, approve annual monitoring reports prepared by the NFIs (applicable from Phase 2);
- Ensure the quality of energy solutions for schools implemented under NAMA by:
    - Elaborating, approving and setting technical conditions, standards, norms, eligible technology lists, etc., as needed;

- Preparing and updating annually a list of pre-qualified technology suppliers;
  - Performing spot checks and on-site testing of installed technologies in schools.
- Monitoring, verification:
  - Data collection and management;
  - Coordinate elaboration of GIS-based database of schools;
  - Verification of results by on-site spot checks, surveys, and questionnaires.
- Prepare summary reports on NAMA implementation, with inputs from NIE/s, NFI/s, and governmental stakeholders;
- Marketing and fundraising for the NAMA;
- Act as a primary contact for national and international donor(s) and partners, and report on NAMA implementation to them as requested;
- Disseminating information, raising awareness (for other governmental institutions, schools, the private sector, the general public).

10.3 NAMA Implementing Entity

The NAMA Implementing Entity (NIE) is the main operative body of the NAMA, managing the physical implementation of the technology interventions and measures, and coordinating flow of data, and flow of money.

For the initial period (2017), the physical implementation will be organized and financed directly by Private Parties (companies that will sponsor the NAMA through so called Corporate Social Responsibility programmes; see Section 12.4.1 for details). They will therefore act as temporary, joint NAMA Implementing and Financing Entity/ies.

The main tasks of the temporary NIEs are to:

- Select a bundle of schools from the proposed pilot list, or agree with the NCA on another bundle;
- Contract suitable technology suppliers from the list of pre-qualified companies to perform the installation of technologies in schools;
- Collect evidence from the technology supplier that the technologies have been properly installed;
- Contract a suitable organisation (e.g. non-governmental organisation (NGO), training institute) to elaborate and execute the pilot Life Skills Programme in 20 schools;
- Prepare summary report on implementation for the NCA, cooperate with the PIU on data collection and knowledge transfer.

During the first year of implementation, a permanent NIE will be selected (or newly established) by the NCA, including specification of the tasks, responsibilities, and competencies.

The main tasks and roles of the permanent NIE will be:

- Be responsible for the overall technical implementation of the NAMA activities over the life span of the NAMA;
- Oversee the successful installation of the technologies, and implementation of the Life Skills Programmes;
- Act as the key point of contact for all queries and communications with the NAMA stakeholders, particularly the NEEs (NAMA Executing Entity/ies);
- Provide capacity development for institutions and private sector participants involved in the implementation of the NAMA;
- Coordinate promotion and awareness campaigns;
- Coordinate data collection and store the data, particularly the monitored indicators;
- Ensure that outcomes are in line with the SDGs and INDCs;
- Prepare reports to the NCA in coordination with the financial NIE for MRV of GHG emission reductions and SD impacts.

Expected personnel structure (team) of NIE will comprise:

- 1 director;
- 2 managers (financial and executive);
- 4 expert technical staff, field operation officers;
- 4 additional (administration) staff for the entire duration of the NAMA life span.

Expected operating hardware and equipment of the NIE:

- 11 computers with software (open-source word processor, and data sheet);
- Internet connection;
- 7 mobile phones and 1 land line;
- Office furniture;
- 4 vehicles for field operation officers.

10.4 NAMA Executing Entities

NEEs will be private companies or non-governmental organizations that will perform the physical activities. NEEs will be contracted by NIEs and the technology/service, scope, duration, and price will be specified in this contract.

For the technology interventions, the NEEs will be technology suppliers. For the non-technology measure of Life Skills Programme, NEE will be service provider (NGO, education institution, etc).

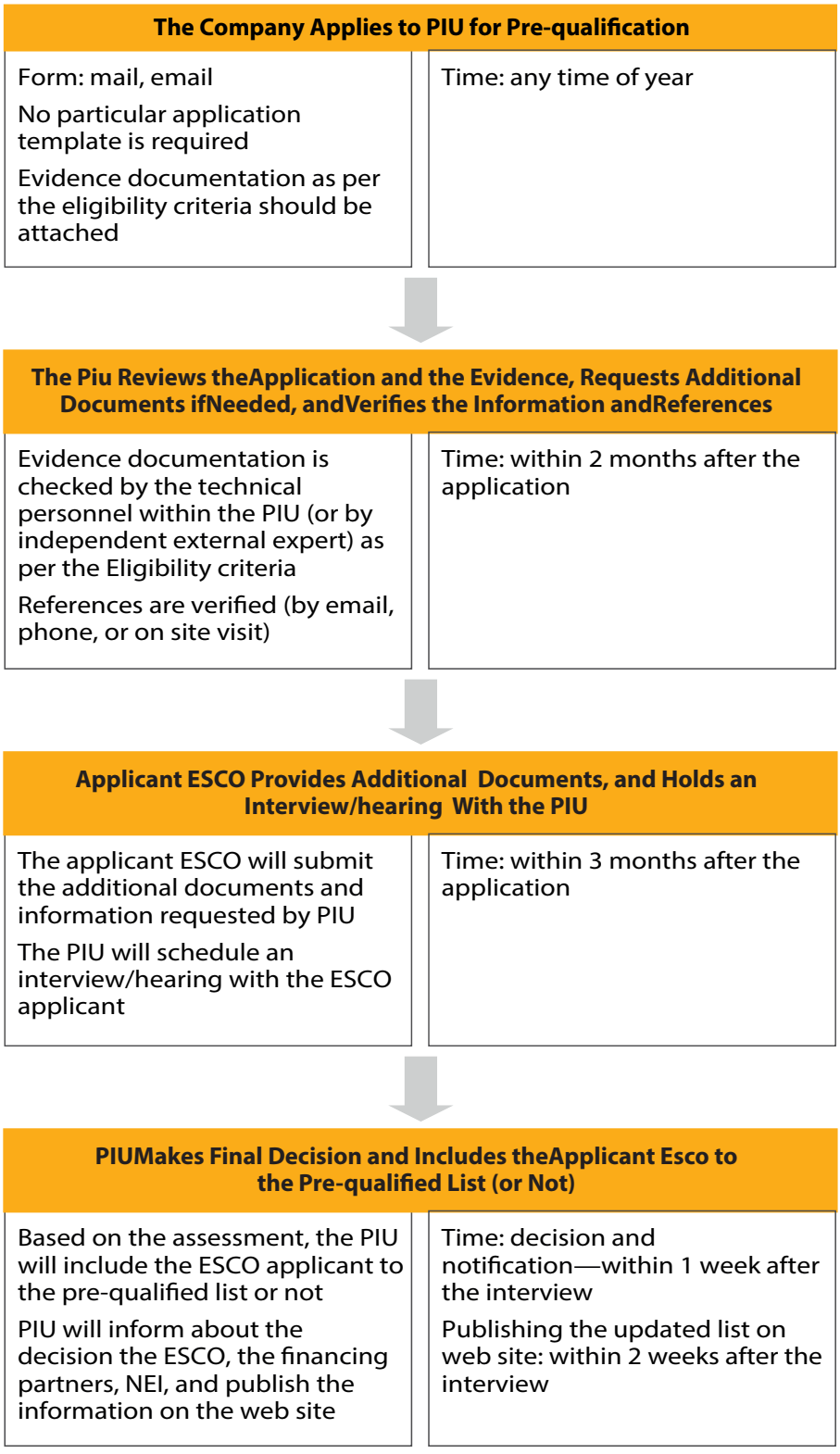
10.4.1 NEEs for Technology Interventions–Technology Suppliers

To ensure that quality work and technology are provided to the schools under the Green Schools NAMA, the technology suppliers willing to execute NAMA interventions will be assessed by the PIU, according to criteria developed in order to ensure that the companies hired for the technical installation of the technologies in schools are experienced in the sector, have good references, are professionally skilled, and capable of handling the amount of orders required, both for installation and maintenance. Technology providers approved by the PIU will be included in the list of pre-qualified companies, separate for each of the three technology interventions: IICS, solar PV systems, and biodigesters.

For Phase 1, the list of pre-qualified companies for IISC and a list for solar PV systems are available, attached in Annex 3. The temporary Implementing Entities will select from these lists for the pilot implementations.

For Phase 2, all interested potential technology providers will apply for inclusion to the Project Implementation Unit at NCA. The applications will be handled continually; however, the list will be updated based on the PIU´s capacities, at least on annual basis. The lists will be published on the PIU´s website.

Figure 21: Steps for inclusion on the List of pre-qualified companies



The table below lists the criteria that the technology supplier needs to fulfil in order to be listed as pre-qualified supplier, including the evidence and documentation that needs to be submitted with the application in order to verify its eligibility, and details on how the PIU will assess and verify the information.

Table 28: Eligibility criteria, evidence, and ways of verification

Eligibility criteria		Evidence, document	Assessment
Legal, non-governmental entity	Legal status	Copy or scan of the relevant: Business registration NGO registration	Valid document
	Details on entity and representative	Address/es Name and contact (email, telephone) of the statutory representative	-
	Bank account	Bank account No. Or declaration of willingness to open a bank account if assigned for implementation	-
Capacities - personal, technical	Personal capacities	Number of staff (permanent, temporary, external subcontractors)	-
	Technical skills of the staff	CVs of the skilled personnel Training certificates	The PIU will assess how many skilled personnel the company has, who could act as team leaders to oversee the workduring the technology installation Based on this it will be decided what size bundle company would be able capable to handle. 1 skilled team leader, maximum of 30 schools per year
	Technical documentation of the relevant technologies	Description of the technologies, materials, and equipment used by the company Description of the installation process Material certificates, if available Pictures of the installation works	Technical personnel within the PIU (or independent external expert) will check the documentation to confirm that the process and materials are suitable, sufficient, and of good quality to ensure the required quality of the final product

Eligibility criteria		Evidence, document	Assessment
References	References of installed relevant technologies (separately for IICS, bio-digesters, solar PV systems)	List of individual installations, including: Name of client/ beneficiary Address of the client Contact person and telephone Type of technology, size, capacity, efficiency/ saving Numbers of technologies Month and year of installation Services provided since the installation (monitoring, maintenance, repair) Pictures	The PIU will assess the capacity of the company in number of installations per year, to complement assessment based on the personal capacities. The PIU will contact at least 20% of the referenced clients (evenly distributed depending on the year of installation), to confirm the information, and to check the satisfaction of the client with the performance of the company and the technology. The PIU will perform on-site verification visits of 10% (minimum 1, maximum 5) installations. Site visits will not be carried out with installations which were contacted by phone.

The applicant company has no legal claim to be included on the list, just as there is no legal claim for the pre-qualified technology supplier to be hired for any implementation.

Pre-qualification will be valid for 36 months from the inclusion date, but can be cancelled based on non-professional behaviour of the technology supplier during that period, upon the decision of the NAMA Steering Committee.

Reasons for cancellation may be:

- Fraud of the assigned funds;
- Multiple delays of more than 3 months;
- Loss of professional personnel.

10.4.2 NEEs for Life Skills Programme

The NEE for the non-technology measure of Life Skills Programme, will be service providers (NGO, training institute, education institution, etc) contracted by NIEs to perform the physical activities.

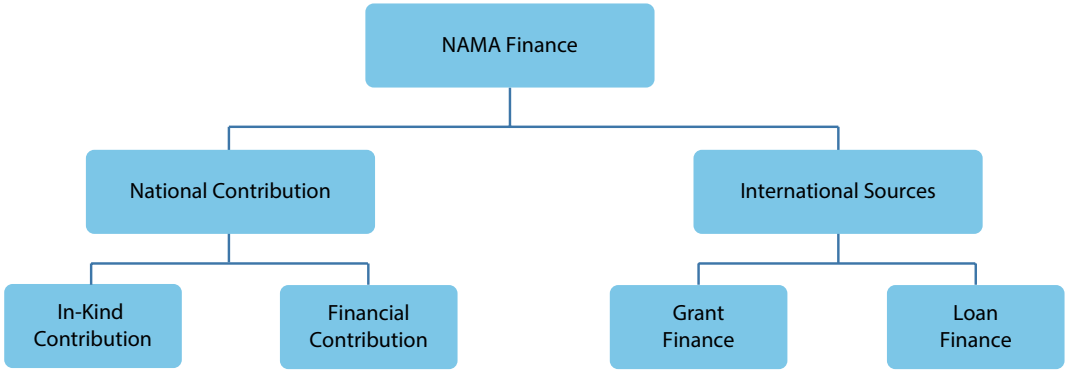
11 NAMA FINANCE

11.1 Overview of NAMA Finance

This chapter provides an indication about the financial requirements for the NAMA and the financial mechanisms which will be used to meet those requirements. It must be noted that the financing of this NAMA, and particularly the financial mechanisms, are indicative and based on the support provided by private sector in Uganda (Phase 1) and the resulting finance from national and international sources (Phase 2).

Taking into account that a NAMA should finance the specific interventions designed within, and support the mechanism of financing wider sector actions, the sources of finance are categorized as shown in the figure below:

Figure 22: Schematic overview of the sources of NAMA Financing



National Contribution: National contribution includes in-kind contributions, namely contributions of goods or services other than finance and can take the form of office space and equipment, IT, hardware, and other equipment that directly contributes to the project activities related to the NAMA. The national financial contribution can take the form of contributions made available through budgetary allocation,

consumer payments, operational subsidies from the Government and cost reduction measures, such as waived taxation. In the context of NAMA Finance, typically the "National Contribution" refers to support provided by national/local government. However, this model includes provisions for other types of "national contributions" made by the Uganda-based private sector and third party entities through Corporate Sector Responsibility (CSR) and/or crowd funding schemes.

International Sources of Finance: This finance is linked directly to capacity development actions, direct investment grants, direct operational subsidies, and loan schemes provided by international support partners consisting of multilateral financing institutions and/or multilateral/bilateral programmes. International finance which goes directly to venture entities (through subsidies or grants) or capacity development will be managed by a trustee charged with oversight of the funds. Approval of payments and disbursements will come from the appropriate NAMA institutional and governance system (typically the coordinating or implementing entity) and funds will be disbursed through an appropriate entity (e.g. loans are made available through national banks or financing institutions and grants can be paid directly through the NAMA institutional system).

11.2 Scenario for NAMA Finance

Assumptions for estimating NAMA Financing–Interventions

The NAMA looks at implementing green technologies (e.g. PV, IICS, bio-latrines) across 20,000+ schools in Uganda over an extended duration. As the final implementation plan can be influenced by various factors including the availability of finance, the cost estimations for this chapter are defined for a specific scenario. The table provides a list of the assumptions:

Table 29: Key assumptions determining the NAMA Financing

Description of Item	Value	Unit
Total no. of schools in Uganda	21,761	Units
Average number of IICSs per school	2.5	Units
The % of total schools expected to have PV Systems installed	30%	%
Average kWp of Solar PV systems to be installed per school	1	kWp
The % of total schools expected to have Bio-Latrines installed	5%	%
Average no. of Biolatrines installed per school	1	Unit
Unit cost of IICSs (incl. Installation)	1,500	US$
Unit cost of PV per kWp (incl. Installation)	1,000	US$/kWp
Unit cost of Biolatrines (incl. Installation)	22,000	US$
Repayment of IICSs (No. of years after installation)	3	years
Interest rate for loans extended on IICSs	0%	%

The implementation plan assumes that the number of schools benefiting under the NAMA is gradually scaled up from an initial "learning phase" (2017-2020) wherein the capacity measures and institutional systems are put in place to peak by year (Figure 22). The intermediate years (2021-2026) account for 80 per cent of the installation which is gradually scaled down (2027-2028). The implementation plan is assumed to occur over a 12-year period from 2017 to 2028, two years short of the proposed NAMA life span of 2017-2030 to account for the loan re-payments which will continue after the last installations are undertaken in 2028. While the actual implementation may not follow the annual distribution as noted in the table below, the pattern is expected to follow a similar path, with the initial years focusing on gradual scaling-up and the middle years accounting for majority of the installations before and a final period leading to the closure of the NAMA activities. This provides potential NAMA financers with the opportunity to devise an "exit strategy" and forms the basis for proposing a Loan Fund model for financing of NAMA interventions, particularly the IICS as further elaborated in the subsequent sections. The Table below provides an overview of the proposed installation schedule of the three technologies.

Table 30: Proposed implementation of technologies by year and quantities

			NAMA Interventions		
Year	**% of Schools**	**Number of Schools**	**IICS installed**	**kWp of PV installed**	**Biolatrines installed**
% of schools by technology			**100%**	**30%**	**5%**
2017	0.5%	109	272	33	5
2018	2.0%	435	1,088	131	22
2019	5.0%	1,088	2,720	326	54
2020	7.5%	1,632	4,080	490	82
2021	10.0%	2,176	5,440	653	109
2022	15.0%	3,264	8,160	979	163
2023	15.0%	3,264	8,160	979	163
2024	12.5%	2,720	6,800	816	136
2025	12.5%	2,720	6,800	816	136
2026	10.0%	2,176	5,440	653	109
2027	5.0%	1,088	2,720	326	54
2028	5.0%	1,088	2,720	326	54
2029		0	0	0	0
2030		0	0	0	0
TOTAL	**100%**	**21,761**	**54,403**	**6,528**	**1,088**

Assumptions for estimating NAMA Financing–Measures

While this NAMA document elaborates on the measures required to create an enabling environment for the interventions, the financing broadly divides the measures into the following 5 categories:

- **Financing required for salaries and operating cost of the NIE:** This is expected to comprise of the salaries for a team of dedicated NIE staff including one director, 2 managers, 4 technical staff and 4 additional staff for the entire duration of the NAMA life span. The operating costs include the cost of hardware (e.g. computers, internet, furniture etc.), internet, vehicles etc.

- **Financing required for salaries and operating cost of Government staff including the NCA:** This category of finance looks at the national Government contribution towards salaries and operating costs of staff from various participating ministries and agencies who play a direct role in the NAMA. Government staff are expected to only spend part of their time on the NAMA. The costs are assumed for three employees at 25 per cent capacity with an annual salary of US$ 3000 (full time) and an ad-hoc cost of US$ 10,000 annually for the entire duration of the NAMA.

- **Financing required for capacity-building and training workshops:** These are aimed at technology suppliers and third party service providers for the Life Skills Programme. This is assumed at four workshops annually for each of two types of stakeholders for the first three years and then one annual workshop thereafter.

- **Financing required for one-off consultancies:** The one-off consultancies are expected to be undertaken by third party consultants (national and/or international as appropriate) during the initial years of the NAMA and will provide critical information for facilitating the implementation process, re-designing the existing school survey process to align it with the NAMA implementation, creating a GIS database of the schools and testing the NAMA business model. The latter is aimed at strengthening the RLF loan fund in the context of PV technologies.

- **Financing for an international consultant:** This looks at the salary and operating cost of appointing one international consultant for a period of three years who will be responsible for strengthening and building capacity of the NIE staff.

Indicative Costs for NAMA Financing

The above assumptions provide a basis for the determining the total costs related to the interventions and measures that are summarized in the table below:

Table 31: Indicative costs for NAMA Financing – Interventions and Measures

No.	Interventions	Description	Amount (US$)
1	Install 54,403 units of IICS	Total cost for procurement and installation of IICS	81,603,750
2	Install 6,628 kwp of PV	Total for procurement and installation of PV	6,528,300
3	Install 1,088 units of bio-latrines	Total for procurement and installation of bio-latrines	23,937,100
TOTAL NAMA Costs – Interventions (US$)			**112,069,150***

No.	Interventions	Description	Amount (US$)
	Measures	**Description**	**Amount (US$)**
4	Salaries and operating cost of NIE	Salaries and operating cost of 11 employees for 14 years	524,500
5	Salaries and operating cost of Government staff	Part salary and operating cost of government employees	234,500
6	Capacity Building Workshops	42 workshops over 12 years at US$ 2,000 per workshop	84,000
7	One-off consultancies	3 consultancies	180,000
8	International consultant	Salary and operating cost for 3 years	180,000
TOTAL NAMA Costs – Measures (US$)			**1,213,000**
Total NAMA Costs - Interventions and Measures (US$)			**1,213,000**

*Note: the numbers represent the total costs and NOT the NAMA Financing required.

11.3 NAMA Finance–Measures

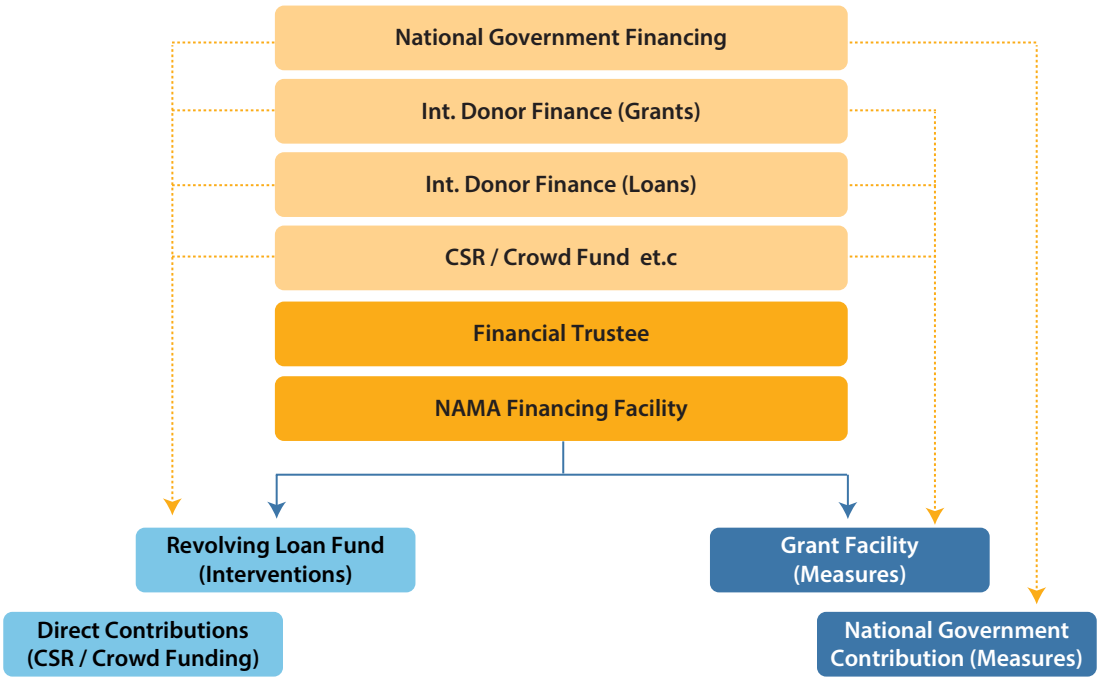
Financing Facility

Section 12.1 lists national and international sources of finance, while Section 12.2 classifies the two categories of costs required under interventions and measures. The allocation of funds will be done primarily through a NAMA Financing Facility managed by a Financial Trustee. At this point, the financial trustee has not been defined; however it can be a private financial institute such as a bank or a Government owned organization such as the UECCC. Alternatively, an international donor may choose to define its own management structure.

The majority of the financial contributions from international donors (loans or grants) will be parked within the financing facility. The facility will consist of two sources of funds: a grant facility that will allocate financing in the form of grants (e.g. one-off consultancy projects), and a RLF loan facility that will primarily deal with loans to the beneficiary schools for implementing the green technologies.

The figure below provides an overview of the financial management structure and the flow of funds to the interventions and measures.

Figure 23: Overview of the NAMA Finance and Management Structure



Grant Finance

The grant facility will focus on 4 of the 5 measures stated earlier, and consist of the following individual components:

Measure 1: Salaries and operating cost of the NIE	
Salary of 1 Director (NAMA life span)	US$ 5,000 / year / employee
Salaries of 2 Managers (NAMA life span)	US$ 3,000 / year / employee
Salaries of 4 Technical Staff (NAMA life span)	US$ 1,500 / year / employee
Salaries of 4 office Staff (NAMA life span)	US$ 500 / year / employee
Operating cost of NIE (computers, internet, furniture rentals etc.)	Assumed at 25% of the annual salary
One off purchase of 2 vehicles	Based on the costs for the purchase of a new 4x4 utility vehicle
Operating cost of vehicles (fuel, maintenance etc.)	Assumed at 10% of vehicle cost annually
Measure 3: Workshops for Capacity-Building and Awareness Creation	
For technology suppliers of IICS, PV and bio latrines	US$ 2000 per workshop for 21 workshops over 12 years
For NGOs and 3rd party service providers for life skills programme and similar	US$ 2000 per workshop for 21 workshops over 12 years

Measure 4: One-off consultancy contracts	
Testing of Biz Dev Model for PV	US$ 80,000
Re-design of School Survey	US$ 50,000
GIS School Database	US$ 50,000
Measure 5: International Consultant for Capacity Building of NIE	
Salaries and operating cost for period of 3 years	US$ 60,000 / year

National Government Contributions– Grants:

These are financial contributions made directly by the Government of Uganda either through budgetary allocation or through other financial instruments (e.g. reduced taxes, technology subsidies etc.). Under the current scenario, it is assumed that the salaries of government staff corresponding to US$ 234,500 are paid by the national Government.

Measure 2: Salaries and operating cost of government staff	
Salaries of 3 Staff from 3 government entities at 25% capacity (NAMA life span)	US$ 3,000 / year / employee
Salaries of staff based on ad-hoc support	US$ 10,000 / year (lump sum)

11.4 NAMA Finance–Interventions

The financing for interventions will happen primarily through the RLF Loan Fund facility in addition to provision for funding under a CSR and Crowd funding models.

11.4.1 CSR Model

In addition to the financing requested through donors, the Green School NAMA aims to involve other innovative and private sources of financing in the NAMA Finance.

It is noted that Uganda has a small but vibrant industrial sector with a good understanding of Corporate Social Responsibility (CSR). Indeed, private parties (i.e. companies) practising CSR have a high level of awareness about the impacts of climate change and the positive impacts of promoting sustainable development and green growth. Several companies have dedicated staff (typically a CSR Manager) who are responsible for promoting "philanthropic CSR"' while seeking means of integrating CSR into business strategy.

This NAMA seeks to channel the existing and/or new financing that companies in Uganda allocate for CSR activities into implementing the NAMA, while creating an opportunity for integrating CSR with business strategy and Uganda's national priorities.

Allocation of CSR Finance: Under the CSR Model payment for technology supply and installation is made by a sponsoring private party directly to the technology provider under a contractual agreement executed between the two parties. The private party also informs the coordinating agency of its intent to undertake the installation including the school(s), technology and number of units. Alternatively, the sponsoring entity can allocate funds directly into the NAMA Financing Facility for specific interventions and/or measures based on their corporate strategy.

As an example, Kakira Sugar – a Uganda based company is seeking to finance 33 schools for the implementation of IICS as part of their corporate strategy. The NAMA will encourage similar participation by other businesses. There are several advantages to this approach:

- In financing the NAMA, the CSR model will allow the NAMA to kick-start the implementation process of the NAMA interventions for a select number of schools and technologies while providing the government and potential donors with a working example of the activities;
- This ensures that there is no delay in the NAMA implementation due to the time required to secure financing, identify and implement a robust MRV and institutional framework;
- The private parties can help to create a knowledge base through sharing experience which will be crucial for the NIE until the NAMA institutional framework is operationalized;
- There is an additional opportunity to test a sustainable business model for financing of PV systems, which in turn will allow the NAMA to include additional technologies and schools into the NAMA; and
- As the success of the installation and their continued operation will have a positive impact on the CSR activities of the sponsoring private party, it is expected that the respective business organization brings in a sense of ownership and responsibility towards the installations.

11.4.2 Crowd Funding Model

Crowdfunding is a practice of funding a project or venture by raising monetary contributions from a large number of people, today often performed via Internet-mediated registries, but the concept can also be executed through mail-order subscriptions, benefit events, and other methods. Crowdfunding is a form of alternative finance, which has emerged outside the traditional financial system.

The crowdfunding model is based on three types of actors: the project initiator who proposes the idea and/or project to be funded; individuals or groups who support the idea; and a moderating organization that brings the parties together to launch the idea.

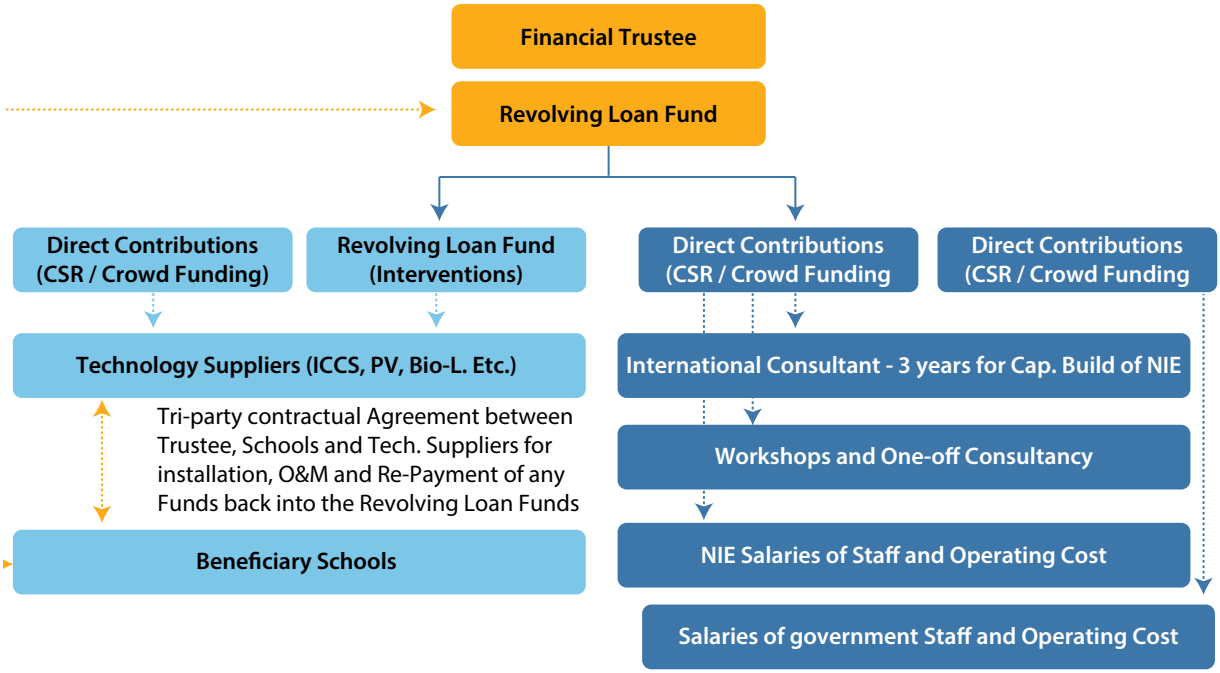
The NAMA encourages individuals or groups to participate in financing the NAMA through the crowd funding route, and at present there is one entity that aims to raise finances for sponsoring on school in the installation of IICS.

11.5 Revolving Loan Fund and NAMA Business Model

The allocation of finances for the interventions either through the RLF, or through direct contributions from the CSR / Crowd Funding model is made to the beneficiary schools through the technology suppliers. Under this scheme the technology providers, typically small and medium sized enterprises in Uganda dealing with IICS and other technologies, directly receive the payments for the purchase and installation of equipment in a beneficiary school through a well-defined approval process led by the NIE.

This is backed up by a tri-party agreement between the technology suppliers, the beneficiary school and the financial trustee, that provides that all financing (including CSR/crown funding model) will be considered as a loan, and the schools will then be responsible for re-payment of the financing into the RLF from the fuel savings.

Figure 24: Overview of the Financial Flows

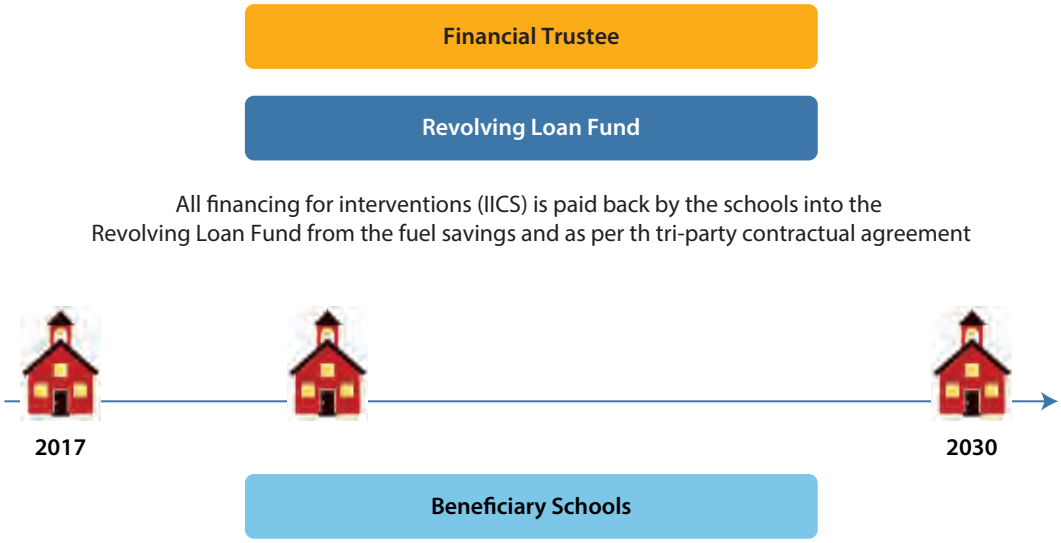


11.5.1 The Revolving Loan Fund

Establishing a RLF is the key component of the entire NAMA financing model. In creating a RLF, the actual donor financing required is efficiently "recycled" by using loan re-payments to extend additional loans in the subsequent years.

The RLF is to be established through an initial seed funding contribution by the national Government and/or international donors. The funds are then raised from one or more international donors in the form of soft loans with the loan repaid (at a minimum the principle amount) towards the end of the NAMA life span.

Figure 25: Revolving Loan Fund — Schematic Approach



11.5.1.1 Business Model for the Revolving Loan Fund – IICS

As the basis for the RLF is repayments, the installation of IICS is currently the only technology that offers the opportunity for loan repayments through fuel savings. Schools in Uganda are provided with a regular source of government funding for purchase of wood fuels. The savings on wood fuels from use of IICS can be used by the schools to repay the loans extended for the installation of IICS. The scenario below considers the cost of installing the IICS and provides a scheme for the NAMA Finance required from international donors. For the purpose of estimating the business model, the scenario does not assume that any loans will be extended for PV and biolatrines.

Interest Rates for Loans: The business model assumes a 0% interest rate for the loans with repayments made over a three-year timeframe. But this is for the purpose of simplification to help understand the operation of the RLF and the annual donor finance required. However, during the actual implementation of the NAMA, an interest rate may be charged to cover the costs for operating the financing facility, including the Financial Trustee. Moreover, the financing extended by international donors may be subject to interest conditions as the loans are not expected to be repaid to donors until the end of the NAMA life span. The table below provides an overview of the RLF loan fund under this defined scenario.

Table 32: RLF financing

Year	Cost of IICSs	Re-payment Yr1	Re-payment Yr2	Re-payment Yr3	Loan Re-paid in year, y	Donor Finance Required
2017	408,019	0	0	0	0	408,019
2018	1,632,075	136,006	0	0	136,006	1,496,069
2019	4,080,188	544,025	136,006	0	680,031	3,400,156
2020	6,120,281	1,360,063	544,025	136,006	2,040,094	4,080,188
2021	8,160,375	2,040,094	1,360,063	544,025	3,944,181	4,216,194
2022	12,240,563	2,720,125	2,040,094	1,360,063	6,120,281	6,120,281
2023	12,240,563	4,080,188	2,720,125	2,040,094	8,840,406	3,400,156
2024	10,200,469	4,080,188	4,080,188	2,720,125	10,880,500	0
2025	10,200,469	3,400,156	4,080,188	4,080,188	11,560,531	0
2026	8,160,375	3,400,156	3,400,156	4,080,188	10,880,500	0
2027	4,080,188	2,720,125	3,400,156	3,400,156	9,520,438	0
2028	4,080,188	1,360,063	2,720,125	3,400,156	7,480,344	0
2029	0	1,360,063	1,360,063	2,720,125	5,440,250	0
2030	0	0	1,360,063	1,360,063	2,720,125	0
2031	0	0	0	1,360,063	1,360,063	0
2032	0	0	0	0	0	0
Total	**81,603,750**	**27,201,250**	**27,201,250**	**27,201,250**	**81,603,750**	**23,121,063**

As noted in the above table, the total loans extended for installing 54,403 units of IICSs (i.e. the capital cost of IICSs) is US$ 81.6 million. In other words, this represents the total grant finance that would be required under a conventional financing scheme. However, under a RLF model, the annual repayments are circulated back as loans in subsequent years, which dramatically reduces the actual donor financing required. The annual donor financing required is a "top-up" amount that makes up for the shortfall between the financing required for extending loans and the cash available to the financing entity from repayments. Over a certain number of years (by 2023 in this example), there is enough cash flow in the system that the repayments are sufficient to cover the annual financing required. For the sake of comparison, the total amount required from potential donors is US$ 23.1 million, approximately 30 per cent of US$ 81.6 million which represents the total value of goods and services circulated into the national economy.

11.5.1.2 Life Skills Programme and Business Model for PV

As the unit costs of installing PV are relatively higher and there is no current scope for fuel savings, the proposed RLF model for IICS may not succeed for PV. However, PV allows the generation of electricity which can be used for additional income generating activity particularly after school hours. The NAMA proposes establishing a Life Skills Programme wherein training will be imparted to adult school children, local youth and women to undertake income generating activity and pay for the electricity used. This in turn can be used to repay the loans extended for installation of the installation of PV.

11.5.2 Conclusions

Under the assumed scenario of financing with a focus only on IICSs, the grant accounts for 5 per cent or less with the remaining 95 per cent of the financing made available through loans. With the finance for measures acting as a fixed cost compared to the interventions which are a variable cost dependent on the technologies, the total units to be installed and the unit cost, this ratio will be further skewed with the grant financing required falling well below 5 per cent. As compared to the NAMA costs which represents US$ 83 million without PV and biolatrines (or US$ 113 including PV and biolatrines) the NAMA Finance is estimated at US$ 24 million.

Table 33: Total NAMA finance

	Total NAMA Finance		
	Interventions - IICSs	Measures	Total
2017	408,019	394,500	802,519
2018	1,496,069	124,500	1,620,569
2019	3,400,156	124,500	3,524,656
2020	4,080,188	52,500	4,132,688
2021	4,216,194	52,500	4,268,694
2022	6,120,281	52,500	6,172,781
2023	3,400,156	52,500	3,452,656
2024	0	52,500	52,500
2025	0	52,500	52,500

	Total NAMA Finance		
	Interventions - IICSs	**Measures**	**Total**
2026	0	52,500	52,500
2027	0	52,500	52,500
2028	0	52,500	52,500
2029	0	48,500	48,500
2030	0	48,500	48,500
2031	0	0	0
2032	0	0	0
2033	0	0	0
TOTAL	**23,121,063**	**1,213,000**	**24,334,063**
%	95.0%	5.0%	

12 NAMA MRV SYSTEM

A comprehensive MRV system is a crucial component of a NAMA. As a NAMA is a results-based instrument, its results need to be measurable, reportable and verifiable (MRV) in order to guarantee sustainability and success of the interventions.

The MRV system focuses on three main groups of indicators: emissions reductions; sustainable development; and financial support.

12.1 Measurement

The methodology for measuring the impacts of this NAMA will follow the general principles of transparency, reliability, and conservativeness. Hence, measurement of the following components will be carried out as part of MRV system:

- GHG emissions reductions;
- SD impacts; and
- finance (support).

However, measurement of these three components will be approached differently and with distinct sets of parameters and indicators. In addition to measuring the impacts of the NAMA, progress in implementing the activities under the NAMA will also be monitored.

12.1.1 GHG Emissions Reductions

The monitoring of GHG emissions reductions includes measurement of the parameters used in their calculation. The total GHG emissions reductions from this NAMA in a given year y (ERy) is the sum of

the emissions reductions achieved by implementation of all RE and clean cookstove technologies. The calculation of emissions reductions uses both default values and measured data.

The means of estimating the GHG emissions reduction achieved under this NAMA uses the approved CDM methodologies. In deriving the GHG baseline and mitigation targets the following definitions are used:

- Definition of Renewable and Non-Renewable Biomass: Woody biomass is "renewable" if one of the conditions mentioned in Annex 18 of the report of the 23rd meeting of the CDM Executive Board. Otherwise where none of these conditions applies, the biomass is considered as "non-renewable" (UNFCCC, 2006);
- Definition of System Boundary: The system boundary encompasses significant anthropogenic GHG emissions by sources under the control of the project participant that are reasonably attributable to the NAMA intervention as a project activity; and
- The total GHG emissions reductions of this NAMA in a given year y (ER_y) is the sum of the emissions reductions achieved through implementation of the three above- mentioned technology interventions: institutional improved cookstoves; biodigesters, and solar PV systems. The emission reductions are calculated as:

Equation 1: $$ER_y = ER_{IICS,y} + ER_{BD,y} + ER_{pv,y}$$

Where:

Variable	Description
ER_y	Emissions reductions achieved under this NAMA in year y (tCO_2eq)
$ER_{IICS,y}$	Emissions reductions achieved through implementation of IICS in year y (tCO_2eq)
$ER_{BD,y}$	Emissions reductions achieved through implementation of biogas digester in year y (tCO_2eq)
$ER_{pv,y}$	Emissions reductions achieved through implementation solar PV systems in year y (tCO_2eq)

The emission reductions achieved by each of the interventions are calculated by comparing the project emissions (PE_y) with the emissions under the baseline scenario (BE_y):

Equation 2: $$ER_y = BE_y - PE_y$$

Where:

Variable	Description
ER_y	Total emissions reductions achieved under this NAMA in year y (tCO_2eq)
BE_y	Baseline emissions in year y (tCO_2eq)
PE_y	Project emissions in year y (tCO_2eq)

1. GHG Emission Reduction Calculation for Implementation of IICS:

GHG emissions reductions achieved through the implementation of IICSs in a given year y ($ER_{IICS,y}$) are calculated by comparing actual (project) emissions ($PE_{IICS,y}$) with the emissions under the baseline scenario ($BE_{ICS,y}$).

Equation 3: $$ER_{IICS,y} = BE_{IICS,y} - PE_{IICS,y}$$

System Boundary: The project boundary is the physical, geographical site of the efficient cookstoves (IICSs) that utilize firewood and/or charcoal.

The potential leakage due to the use/diversion of non-renewable woody biomass saved under the project activity by non-project households/users that previously used renewable energy sources will not be considered.

Baseline Emissions ($BE_{ICS,y}$): As described in Chapter 7 the baseline scenario is the continuation of the current situation or an expected business-as-usual (BAU) scenario. In Uganda, the current situation involves the use of non-renewable biomass in the form of firewood or charcoal as fuel in the existing/conventional less efficient cookstoves such as the three stones and open fire.

In line with CDM methodology AMS-II.G, it is assumed that in the absence of the NAMA intervention, the baseline scenario would be the projected use of fossil fuels to meet similar thermal energy needs as those provided by the project devices. The methodology yields an emission factor 81.6 tCO_2eq/TJ for the projected use of fossil fuels. Therefore, by reducing the amount of fuel required for cooking, the replacement of the traditional stoves by IICSs reduces the amount of CO_2 emitted into the atmosphere due to the reduction of non-renewable woody biomass used by the improved stoves.

Assumptions:

All IICSs implemented in year y under the NAMA are considered to be operational and the date of commissioning of the IICSs implemented in year "y" will be the first day of year "y".

Schools are assumed to be using exclusively the IICSs, no other cookstoves.

The baseline emissions ($BE_{IICS,y}$) are calculated as follows:

Equation 3a: $$BE_{IICS,y} = \sum_{a=1}^{a-y} B_{old,i} \times N_{y,i,a} \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected\_fossilfuel}$$

Where:

Variable	Description
a	'a' is the indices for the age (in years) of the cookstoves that are operating in the year y. Since the lifetime of cookstoves is often shorter than the project lifetime and cookstoves are likely to show significant efficiency losses over time, this aspect needs to be captured. The operating life time of the project device is considered to be ten years as confirmed by various manufacturers. Value: 1 or 2 or 3 or 4……..or 10 depending on the date of commissioning of the project devices.

Variable	Description
$B_{old,i}$	Annual quantity of woody biomass that would be used in the absence of the NAMA intervention to generate thermal energy equivalent to that provided by the IICS type i, if the IICS operates throughout the year y. A default value of 0.38 tons/person per year for boarding category and 0.19 tons/person per year for day school is used to derive this parameter ((UNFCCC CDM Standardized baselines, 2015)). Number of persons served per cookstove is based on annual enrolment data from MES. Please refer to Box 1 for a detailed calculation of $B_{old,i}$. This is fixed ex-ante.
$N_{y,i,a}$	Number of IICSs type i and age a operating in year y. All IICSs implemented in year y under the NAMA are considered to be operational and the date of commissioning of the IICSs implemented in year "y" will be the first day of year "y". This will be monitored ex-post.
$f_{NRB,y}$	Fraction of woody biomass saved by the IICS in year y that can be established as non-renewable biomass. A value of 0.82 is used for calculation from UNFCCC-approved CDM standardized baseline. This is fixed ex-ante.
$NCV_{Biomass}$	Net calorific value of the non-renewable woody biomass (TJ/ton). An IPCC (Intergovernmental Panel on Climate Change) default for wood fuel, 0.015 TJ/ton, based on the gross weight of the wood that is "air-dried" is used and this is fixed ex-ante.
$EF_{Projected\_fossilfuel}$	The emission factor for the fossil fuels projected to be used to substitute for non-renewable woody biomass by similar consumers (tCO_2eq/TJ). A value of 81.6 tCO_2eq/TJ is adopted from the UNFCCC approved CDM methodology AMS-II.G. This is fixed ex ante.

Box 1: Estimation of $B_{old,i}$

$B_{old,i}$ is determined by using default value of 0.38 tons/person per year for boarding category and 0.19 tons/person per year for day school in accordance with CDM standardized baseline. The number of persons served per cookstove is 50, which is based on annual enrolment data from the MES.

$B_{old,i}$ is calculated as:

For boarding category: $B_{old,i} = 0.38 * 50 * 1 = 19 \frac{tons}{device}$

For day category: $B_{old,i} = 0.19 * 50 * 1 = 38 \frac{tons}{device}$

Project Emission ($PE_{ICS,y}$): Project emissions will be due to the use of firewood or charcoal in the project scenario.

Assumptions

- IICSs implemented under the NAMA intervention must have minimum thermal efficiency of 0.50 for the first year of operation and their efficiency will be based on certification by a national standards body or an appropriate certifying agent recognized by that body. Therefore, an efficiency of 0.50 for all IICSs implemented under the NAMA will be assumed for the calculation of project emissions.

The project emissions ($PE_{ICS,y}$) are calculated as follows:

Equation 3b:

Where: $$PE_{IICS,y} = \sum_{a=1}^{a-y} B_{old,i} \times \frac{\eta_{old}}{\eta_{new,i,a=1} \times (1 - \nabla\eta)} \times N_{y,i,a} \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected\_fossilfuel}$$

Variable	Description
η_{old}	Efficiency of the baseline (pre-project) cookstoves (fraction). A default value of 0.12 is used as per CDM standardized baseline and this is fixed ex-ante.
$\eta_{new,i,a=1}$	Thermal efficiency of IICS type i being deployed as part of the NAMA intervention (fraction), based on certification by a national standards body or an appropriate certifying agent recognized by that body. A value of 0.50 is used in the year of its installation (=1) and this is fixed ex-ante.
$\Delta\eta_{i,y}$	Efficiency de-rating factor of IICSs type i being deployed as part of the NAMA intervention (fraction) in year y. A linear decrease in efficiency of 0.3 per annum as per CDM methodology AMS-II.G is applied from the second year of operation. This is fixed ex-ante.

The default values that are fixed ex ante are provided below.

Variable	Description	Value	Unit
a	' a 'is the index for the age (in years) of the improved cookstoves that are operating in the year y.	The operating life time of the project device is considered to be ten years as confirmed by various manufacturers. So, values a of will be either 1 or 2 or 3 or 4…….. or 10 depending on the date of commissioning of the project devices.	Number
$B_{old,i}$ (Boarding school)	Annual quantity of woody biomass that would be used in boarding school in the absence of the NAMA intervention to generate thermal energy equivalent to that provided by the IICS type i, if the IICS operates throughout the year y.	114	tons/ device
$B_{old,i}$ (Day school)	Annual quantity of woody biomass that would be used in day school in the absence of the NAMA intervention to generate thermal energy equivalent to that provided by the IICS type i, if the IICS operates throughout the year y.	38	tons/ device
$f_{NRB,y}$	Fraction of woody biomass saved by the IICS in year y that can be established as non-renewable biomass.	0.82	Fraction

Variable	Description	Value	Unit
$NCV_{Biomass}$	Net calorific value of the non-renewable woody biomass	0.015	TJ/ton
$EF_{Projected\_fossilfuel}$	Emissions factor for the fossil fuels projected to be used for substitution of non-renewable woody biomass by similar consumers	81.6	tCO_2/TJ
η_{old}	Efficiency of the baseline (pre-project) cookstoves.	0.12	Fraction
$\eta_{new,i,a=1}$	Thermal efficiency of IICS type i	0.40	Fraction
$\Delta\eta_{i,y}$	Decrease in efficiency per annum of IICSs type i being deployed as part of the NAMA intervention (fraction) in year y.	0.03	Fraction

The data parameters which will be monitored can be seen below.

Data/Parameter:	$N_{y,i,a}$
Data Unit:	Number of IICSs
Description:	Number of IICSs type i and age a operating in year y.
Measurement and QC procedures (if any):	Number of IICSs type i and age a operating in year y. As noted in Chapter 7, all IICSs implemented under the NAMA are considered to be operational and the date of commissioning of the IICSs implemented in year "y" will be the first day of year "y". This will be monitored ex-post.
Monitoring frequency:	Measured – Continuously Recorded – Monthly

2. GHG Emission Calculation for Implementation of Biogas Digester

GHG emission reductions achieved through implementation of biogas digester in a given year y ($ER_{BD,,y}$) are calculated by comparing actual (project) emissions ($PE_{BD,y}$) with the emissions under a baseline scenario ($BE_{BD,y}$).

Equation 8: $$ER_{BD,y} = BE_{BD,y} - PE_{BD,y}$$

System Boundary: Under this intervention, conventional cookstoves will be replaced by biogas stoves. Thus the system boundary is the physical, geographical site of the biogas digester and the biogas stoves that utilize biogas.

The potential source of leakage due to the use/diversion of non-renewable woody biomass saved under the project activity by non-project users that previously used renewable energy sources will not be considered.

Baseline Emissions ($BE_{BD,y}$): In the absence of this Intervention, schools in Uganda will continue to use non-renewable biomass as fuel in the conventional less efficient cookstoves such as the three stone and open fire cookstove. Under this intervention, schools will be provided with biogas digester along with biogas

cookstoves. In this way, biogas stoves will replace the traditional cookstoves. By doing this, the amount of CO_2 emitted into the atmosphere due to the reduction of non-renewable woody biomass used by the conventional cookstoves will be saved.

In line with CDM methodology AMS-I.E, it is assumed that in the absence of the NAMA intervention, the baseline scenario would be the projected use of fossil fuels to meet similar thermal energy needs as those provided by the project devices. The methodology recommends an emission factor 81.6 tCO_2eq/TJ for the projected use of fossil fuels.

Assumptions

- All biogas digester implemented under the intervention will be considered to be operational and it is assumed that schools are using biogas exclusively; and
- All digesters installed in year y under the NAMA are considered to be operational and the date of commissioning of the digester installed in year "y" will be the first day of year "y".

The baseline emissions ($BE_{BD,y}$) are calculated as follows:

Equation 8a:

Where: $ER_{BD,y} = BE_{BD,y} - PE_{BD,y}$

Variable	Description
B_y	Annual quantity of woody biomass that would be used in the absence of the NAMA intervention to generate thermal energy equivalent to that provided by the biogas digester. A default value of 0.3665 tons per year per m^3 (volume of digester) is used in accordance with CDM methodology AMS-I.E. This is fixed ex-ante.
N_y	Total volume of biogas digester in m^3 operating in year y. All digesters installed in year y under the NAMA are considered to be operational and the date of commissioning of the digester installed in year "y" will be the first day of year "y". This will be monitored ex-post.
$f_{NRB,y}$	The fraction of woody biomass saved by the biogas digester in year y that can be established as non-renewable biomass. A value of 0.82 is used for calculation of baseline emission, on the basis of the CDM standardized baseline. This is fixed ex ante.
$NCV_{Biomass}$	Net calorific value of non-renewable woody biomass (TJ/ton). IPCC default for wood fuel, 0.015 TJ/ton, is based on the gross weight of the "air-dried" wood that is used and this is fixed ex ante.
$EF_{Projected\_fossilfuel}$	Emission factor for the fossil fuels projected to be used for substitution of non-renewable woody biomass by similar consumers (tCO_2eq/TJ). A value of 81.6 t CO_2eq/TJ is used, based on the UNFCCC approved CDM methodology AMS-I.E. This is fixed ex ante.

Project Emission ($PE_{BD,y}$): Project emission is considered zero as per CDM methodology AMS-I.E.

The default values under the intervention-biogas digester are shown below.

Variable	Description	Default Value	Unit
B_y	Annual quantity of woody biomass that would be used in the absence of the NAMA intervention to generate thermal energy equivalent to that provided by the biogas digester.	0.3665	tons/ annum per m^3
$f_{NRB,y}$	Fraction of woody biomass saved by the digester in year y that can be established as non-renewable biomass.	0.82	Fraction
$NCV_{Biomass}$	Net calorific value of the non-renewable woody biomass (TJ/ton).	0.015	TJ/ton
$EF_{Projected\_fossilfuel}$	Emissions factor for the fossil fuels projected to be used for substitution of non-renewable woody biomass by similar consumers (tCO_2eq/TJ).	81.6	tCO_2eq/TJ
old	Efficiency of the baseline (pre-project) cookstoves.	0.12	Fraction

The data parameters which will be monitored can be seen below.

Data/Parameter:	N_y
Data Unit:	Volume of biogas digester
Description:	Total volume of biogas digester in m^3 operating in year y.
Measurement and QC procedures (if any):	Total volume of biogas digester in m^3 operating in year y. All digesters installed in year y under the NAMA are considered to be operational and the date of commissioning of the digester installed in year "y" will be the first day of year "y".
Monitoring frequency:	Measured-Continuously Recorded-Monthly

3. GHG Emission Reduction Calculation for Solar PV Based Systems

In the absence of the solar PV based system, the supply and consumption of electricity would rely on fossil fuel based off-grid electricity system(s). As discussed above, the CDM methodology AMS-I.L is applied for calculation of emissions reductions; and with a view to accurate and cost-effective monitoring, a conservative default emission factor of 1.0 tCO_2eq/MWh is applied.

Assumptions

- The PV home systems are characterized by short distances between the places where the electricity is generated and the places where the electricity is consumed or recharging takes place. Thus no losses will be taken into account. All the electricity generated by the system will be consumed, that is the electricity generated is equal to the electricity consumed; and

- All systems installed in year y under the NAMA are considered to be operational and the date of commissioning of the system installed in year "y" will be the first day of year "y".

System Boundary: The project activity is the installation of solar PV based system. Thus, the project boundary encompasses the PV system, encompassing electricity generation and consumption on the same site.

GHG emissions reductions achieved through the implementation of solar PV systems in a given year y ($ER_{PV,y}$) are calculated as:

Equation 6a:

Where: $$ER_{pv,y} = \sum_{i=1}^{n} EG_{pv,i,y} EF_{CO2}$$

Parameter	Description
$EG_{pv,i,y}$	Electricity generated by PV system i, supplied to consumer appliances over the time y in MWh. Average electricity output per kWp per year will be determined and fixed ex ante based on manufacturers' data and/or international or equivalent national standards. For the ex ante estimation a value of 1132.80 kWh per kWp per year is used.
EF_{CO2}	Fossil fuel emissions default factor = 1.0 tCO_2eq/MWh
y	Period of time defined by the project participant
i	PV system identification

As all the electricity generated by the PV systems will be consumed, only the quantity of electricity generated on site will be considered, i.e. the average amount of electricity generated by the PV system, over a defined period of time, needs to be determined. The parameters described below will be determined ex ante.

- Average electricity output per kWp per year: The average electricity generated per kWp of solar PV system will be determined and fixed ex ante. It will based on manufacturers' data or international/ national standards data or data certified by an independent third party. The average electricity output as determined is equal to the electricity generated by PV system i, supplied to consumer appliances over the time y ($EG_{PV,i,y}$).

The default values that are fixed ex ante are provided below.

Variable	Description	Default Value	Unit
	Average electricity output per kWp per year	1132.80	kWh per kWp per year
EF_{CO2}	Fossil fuel emissions default factor. This is fixed ex ante.	1	tCO_2/MWh

During NAMA implementation, the following data are to be monitored and recorded:

Data/Parameter:	$N_{kWp,y}$
Data Unit:	kWp
Description:	Total kWp of solar PV system installed in year y.
Measurement and Quality Control (QC) procedures (if any):	All solar PV system installed under the NAMA are considered to be operational and the date of commissioning of the system installed in year "y" will be the first day of year "y".
Monitoring frequency:	Measured–Continuously Recorded–Monthly

The input parameters and calculation method is provided below:

Parameters	Value	Reference/Remarks
Volume of biogas generated in normal conditions of temperature and pressure per unit useful volume of the digester per day	0.13 Nm^3/m^3/day	As per CDM methodology AMS-I.E
Efficiency of baseline cookstove	12%	As per CDM Standardized baseline
Number of days of utilization in a year	236 per annum	The total school operation days in a year are 236 days. This is as per proposed CDM standardized baseline document submitted to UNFCCC.
Net Calorific Value (NCV) of biogas	0.0000215 TJ/m^3	As per CDM methodology AMS-I.I
NCV of woody biomass	0.015 TJ/ton	As per IPCC-2006
Quantity of thermal energy generated by a biogas digester with one m^3 capacity	0.00000280 TJ/day/m^3	Calculated {(0.13×0.0000215)}
Daily quantity of woody biomass displaced by a biogas digester (with capacity one m^3)	0.001553 tons/day per m^3	Calculated {0.00000280/(12%×0.015)}}
Annual quantity of woody biomass displaced by a biogas digester with capacity one m^3 (By)	0.366456 tons/annum per m^3	Calculated {(0.001553×236)}

12.1.2 Sustainable Development Benefits

In addition to GHG emissions, the MRV system will monitor the impacts of the NAMA interventions on the identified SD indicators. The measurement process for these indicators is described below:

Data/Parameter:	$N_{EL,Boarding\ \ facility}$
Data Unit:	Number
Description:	Number of boarding facilities electrified
Measurement and QC procedures (if any):	The School management committee collects data from the schools and report it to the Education Committee at district level. Finally, the Ministry of Education and Sports (MES) collects data from the Education committee as part of EMIS (Education Management Information System) through the Annual School Census process.
Monitoring frequency:	The MES will prepare a record on an annual basis.

Data/Parameter:	$N_{SE,\ schools}$
Data Unit:	Number
Description:	Number of schools served with sustainable energy
Measurement and QC procedures (if any):	The School management committee collects data from the schools and reports to the Education Committee at district level. Finally, the Ministry of Education and Sports (MES) collects data from the Education committee as part of EMIS through the Annual School Census process.
Monitoring frequency:	The MES will prepare a record on an annual basis.

Data/Parameter:	$N_{SE,\ pupils}$
Data Unit:	Number
Description:	Number of pupils served with sustainable energy
Measurement and QC procedures (if any):	The School management committee collects data from the schools and reports to the Education Committee at district level. Finally, the Ministry of Education and Sports (MES) collects data from the Education committee as part of EMIS through the Annual School Census process.
Monitoring frequency:	The MES will prepare a record on an annual basis.

Data/Parameter:	$N_{SE,\ staff}$
Data Unit:	Number
Description:	Number of schools staff served with sustainable energy
Measurement and QC procedures (if any):	The School management committee collects data from the schools and reports to the Education Committee at district level. Finally, the Ministry of Education and Sports (MES) collects data from the Education committee as part of EMIS through the Annual School Census process.
Monitoring frequency:	The MES will prepare a record on an annual basis.

Data/Parameter:	$N_{bio-latrines}$
Data Unit:	Number
Description:	Number of bio-latrines constructed
Measurement and QC procedures (if any):	The School management committee collects data from the schools and reports to the Education Committee at district level. Finally, the Ministry of Education and Sports (MES) collects data from the Education committee as part of EMIS through the Annual School Census process.
Monitoring frequency:	The MES will prepare a record on an annual basis.

Data/Parameter:	$N_{school\ \ kitchens}$
Data Unit:	Number
Description:	Number of school kitchens improved
Measurement and QC procedures (if any):	The School management committee collects data from the schools and reports to the Education Committee at district level. Finally, the Ministry of Education and Sports (MES) collects data from the Education committee as part of EMIS through the Annual School Census process.
Monitoring frequency:	The MES will prepare a record on an annual basis.

Data/Parameter:	$N_{school\ \ kitchens}$
Data Unit:	Number
Description:	Number of teacher/staff of boarding schools electrified
Measurement and QC procedures (if any):	The School management committee collects data from the schools and reports to the Education Committee at district level. Finally, the Ministry of Education and Sports (MES) collects data from the Education committee as part of EMIS through the Annual School Census process.
Monitoring frequency:	The MES will prepare a record on an annual basis.

Data/Parameter:	N_{IICS}
Data Unit:	Number
Description:	Number of IICS installed
Measurement and QC procedures (if any):	The School management committee collects data from the schools and reports to the Education Committee at district level. Finally, the Ministry of Education and Sports (MES) collects data from the Education committee as part of EMIS through the Annual School Census process.
Monitoring frequency:	The MES will prepare a record on an annual basis.

Data/Parameter:	N_{PV}
Data Unit:	Number
Description:	Number of PV installed
Measurement and QC procedures (if any):	The School management committee collects data from the schools and reports to the Education Committee at district level. Finally, the Ministry of Education and Sports (MES) collects data from the Education committee as part of EMIS through the Annual School Census process.
Monitoring frequency:	The MES will prepare a record on an annual basis.

Data/Parameter:	$N_{school,\ energy}$
Data Unit:	Number
Description:	Number of schools with better cooking/electrified/own woodlot
Measurement and QC procedures (if any):	The School management committee collects data from the schools and reports to the Education Committee at district level. Finally, the Ministry of Education and Sports (MES) collects data from the Education committee as part of EMIS through the Annual School Census process.
Monitoring frequency:	The MES will prepare a record on an annual basis.

Data/Parameter:	$N_{capacity}$
Data Unit:	Number
Description:	Total capacity of IICS/bio-latrines/PV installed
Measurement and QC procedures (if any):	The School management committee collects data from the schools and reports to the Education Committee at district level. Finally, the Ministry of Education and Sports (MES) collects data from the Education committee as part of EMIS through the Annual School Census process.
Monitoring frequency:	The MES will prepare a record on an annual basis.

Data/Parameter:	$N_{institutions,\ capacity-building}$
Data Unit:	Number
Description:	Number of institutions having capacity building programs
Measurement and QC procedures (if any):	The NIE will keep records on it. Supporting documents such as minutes of discussions, programme reports and attendees lists will be kept for future verification.
Monitoring frequency:	The MES will prepare a record on an annual basis.

Data/Parameter:	$N_{life\ skills}$
Data Unit:	Number
Description:	Total number of Life Skills Programme participants
Measurement and QC procedures (if any):	The NIE will keep records on it. Supporting documents such as minutes of discussions, programme reports and attendees lists will be kept for future verification.
Monitoring frequency:	The MES will prepare a record on an annual basis.

Data/Parameter:	$N_{enterprises}$
Data Unit:	Number
Description:	Number of enterprises involved
Measurement and QC procedures (if any):	The NIE will keep records on it.
Monitoring frequency:	The MES will prepare a record on an annual basis.

Data/Parameter:	$N_{new\ enterprises}$
Data Unit:	Number
Description:	Number of new enterprises established
Measurement and QC procedures (if any):	The NIE will keep records on it.
Monitoring frequency:	The MES will prepare a record on an annual basis.

Data/Parameter:	$N_{MS,\ NCA\ \&\ NIE}$
Data Unit:	Management system
Description:	Overall operational management system of the NCA and NIE
Measurement and QC procedures (if any):	The NIE along with other key stakeholders including the NCA will prepare documentation on the NCA and NIE operational management system.
Monitoring frequency:	The MES will prepare a record on an annual basis.

Data/Parameter:	$N_{MS,\ NCA\ \&\ NIE}$
Data Unit:	USD
Description:	Total grants/loans and country contribution
Measurement and QC procedures (if any):	The NIE will keep records on it.
Monitoring frequency:	The MES will prepare a record on an annual basis.

12.1.3 Financial Support

The monitoring of financial support involves tracking the resources required and the support received from national contributions and international donor(s). The following financial support will be measured.

Data/Parameter:	$FS_{international}$
Data Unit:	US$
Description:	International financial support spent per activity
Measurement and QC procedures (if any):	
Monitoring frequency:	Measured continuously and recorded annually

Data / Parameter:	$FS_{national}$
Data Unit:	US$
Description:	National financial support spent per activity
Measurement and QC procedures (if any):	
Monitoring frequency:	Measured continuously and recorded annually

12.2 Verification

The goal of verification is to have an independent third party auditor ensure that the NAMA is operating as planned and that the measuring and reporting system is being implemented as planned. Verification also ensures that emissions reductions and SD benefits are real and measurable.

Auditors should be accredited entities. They can be entities accredited under the CDM or under another accreditation system acceptable to the Government of Uganda and the NAMA donor(s).

Verification should occur every two years. The verification will consist of:

- Desk review of documents;
- Interviews with key stakeholders.

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