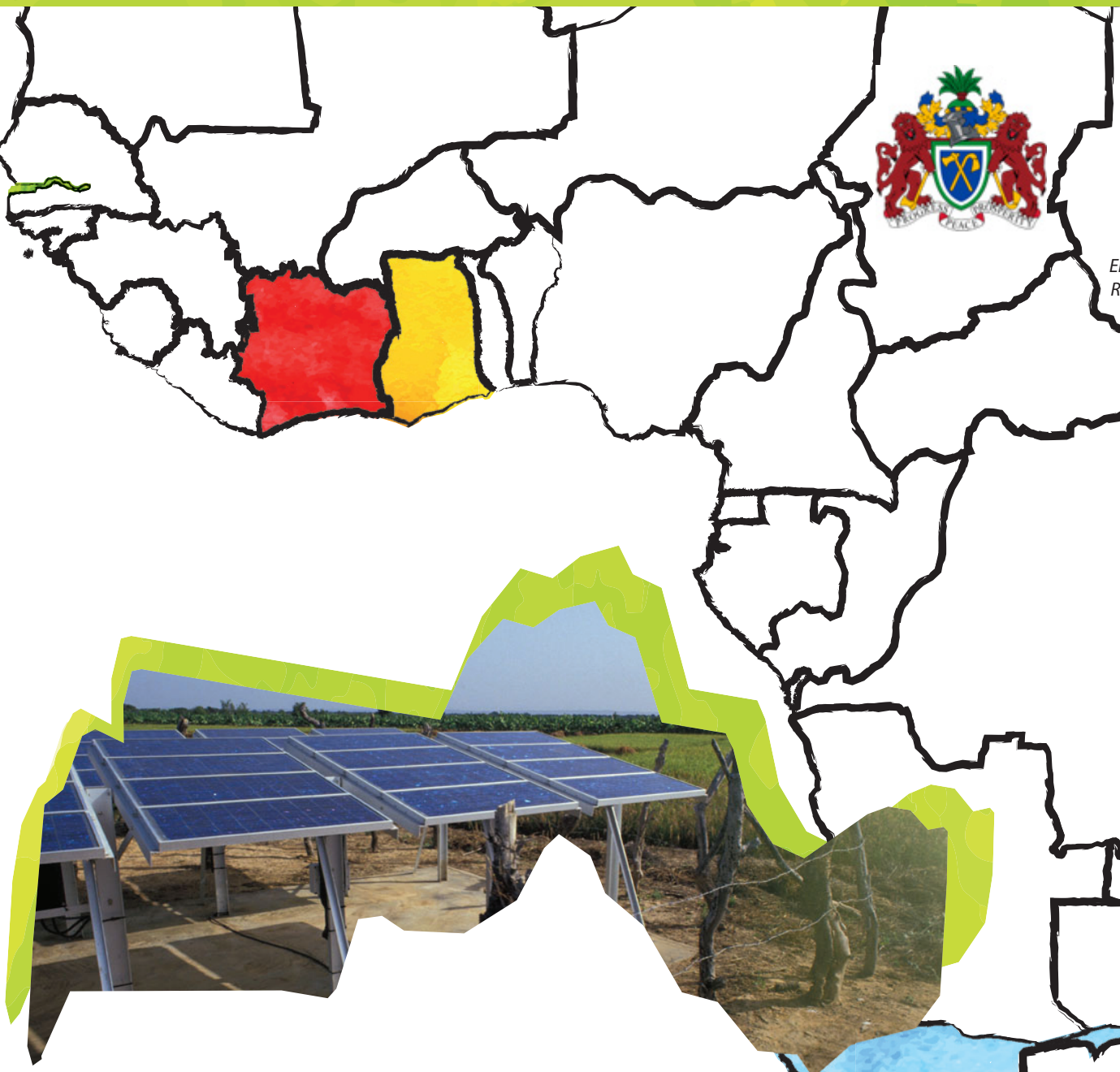

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NAMA DESIGN DOCUMENT FOR RURAL ELECTRIFICATION WITH RENEWABLE ENERGY IN THE GAMBIA

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FOREWORD

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Nationally Appropriate Mitigation Actions (NAMAs) are voluntary, non-binding policy instruments that provide a framework for pursuing a country's socio-economic 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.

The NAMA for 'Rural Electrification with Renewable Energy in The Gambia' offers the unique opportunity to accelerate access to electricity through small-scale, off-grid and stand-alone projects, as well as income-generating opportunities to the local population. The guiding principle for the design of the NAMA is to increase or provide access to electricity across the country's rural communities. By promoting these projects, the NAMA will increase the proportion of renewable energy in the energy mix, help strengthen public–private partnerships, increase and improve access to electricity for the majority of the population and fuel sustainable growth in rural and remote areas of the country.

The overall target of the NAMA is to support The Gambia to achieve the objectives of the Vision 2020. The Vision 2020 "maps out a strategy for a socio-economic landscape that aims to raise the standard of living for the population by transforming The Gambia into a dynamic middle-income country". The NAMA is in line with the country's prime objective for the energy sector to ensure an adequate supply of energy at affordable prices.

During recent years, NAMAs have become a focus of climate change mitigation negotiations in the United Nations Framework Conventions on Climate Change (UNFCCC) process. The NAMA modality can provide the essential holistic framework to transform a whole sector. The transformative change of the NAMA can be seen when framed within the context of sustainable development, greater national development goals and beyond pure mitigation aspects. This focus on the sustainability of the entire sector is essential for achieving lasting results.

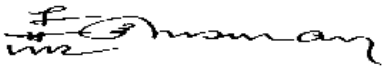
Moreover, the understanding of the NAMA concept is still evolving, and there is relatively little on-the-ground experience with respect to turning the concept into concrete actions. In this regard, UNDP's MDG-Carbon Programme has supported the development of this NAMA in order to support The Gambia to achieve a transformative change and bring about sustainable rural development as long-term goal.

The outcomes of this NAMA with regards to Sustainable Development, Greenhouse Gas (GHG) Emission Reductions and Green Growth are strongly interrelated building blocks as a pathway of a change framework that shall ensure that the NAMA is fully embedded in the Vision 2020.

The NAMA design will provide the country with an accurate and credible information framework by applying a robust MRV system for 'Nationally Appropriate Improvements' in the context of sustainable development as well as GHG emission reductions. The calculation of GHG emission reductions are based on a CDM methodology while the MDG Carbon Sustainable Development Tool will allow to quantify and monitor the sustainable development impacts.

This NAMA for 'Rural Electrification with Renewable Energy in The Gambia' is designed as an encouraging holistic framework that will help The Gambia to shift towards low-emission energy access and power generation while ensuring a low-emission sustainable development pathway.

Marcel Alers



Honorable Pa Ousman Jarju

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Executive Summary

With a national electrification rate of an estimated 40 per cent and with certain rural areas having an electrification rate as low as 6 per cent, the time is ripe in The Gambia for the Rural Electrification with Renewable Energy (RE) Nationally Appropriate Mitigation Action (NAMA). A number of building blocks have already been put in place in the country. The 2013 Renewable Energy Act provides the framework for both on and off-grid renewable energy tariffs and net metering, as well as establishing a national RE Fund. There has been development of pilot renewable energy projects as well as diesel powered multi-function platforms, which provide energy access for economic activities in rural areas.

The NAMA has five key objectives which are:

1. Increase the level of renewable energy (for electricity) and contribute to the national long-term target of increasing the share of renewable energy within the power generation sector.
2. Reduce greenhouse gas emissions in the power generation sector.
3. Increase the rural population's access to sustainable electricity.
4. Encourage an increase in rural community income generation, and improve rural livelihoods.
5. Increase the level of private sector participation within the power sector.

These objectives will be accomplished through a number of activities, divided into Phase 1 and Phase 2. Phase 1 activities will include the establishment of two types of ventures which will connect unelectrified rural communities: RE Community Energy Centres (RE-CEC) and RE Micro-Grids (RE-MGs). Phase 2 ventures will comprise RE systems which will displace thermal generation at existing regional grids (referred to as RE Displacement Systems—RE-DIS) and RE independent power producers (RE-IPPs).

Both RE-CECs and RE-MGs will have as a core design component a rural productivity zone (RPZ), where community members will be provided energy access which can be used to start up small businesses; these businesses may include setting up a shed where people pay to use industrial equipment or providing irrigation via a water pump. The RPZ will also provide energy to a limited number of public buildings. The key difference between the RE-CEC and the RE-MG ventures is the manner of distribution of electricity to households: RE-CECs provide electricity through rechargeable batteries, while RE-MGs provide individual household connections. Approximately 50 households will receive electricity access from each of the eight proposed RE-CEC ventures and the eight RE-MG ventures. The business model applied for both venture types will be a public-private partnership (PPP), in which a public entity owns the RE system but a private sector company manages and maintains the system. In addition to the implementation of the ventures, ongoing capacity-building at all levels will occur. Regulations and policies will be updated, training sessions will be held and awareness will be raised.

Phase 2 will shift activities to a larger scale private sector model. Ventures will include six RE-DIS, of various capacities, and a seven megawatt RE-IPP.

The activities of the NAMA will be paid for via both international and national finance. At the national level, finance will come from the national budget, cost reduction measures and consumer payment schemes. Finance will be provided to through mechanisms such as direct investment grants, the RE Fund and a loan facility. The NAMA will be governed by a multi-stakeholder approval committee and coordinated by the Coordinating Authority.Technical advice will be provided by an expert group and a trustee will manage financial flows.

Abbreviations and Acronyms

AC	Alternating Current
AMS	Approved Small-Scale Methodology
ASB	Approved Standardized Baseline
CDM	Clean Development Mechanism
COO	Community Owned and Operated
COP	Conference of Parties (to the Kyoto Protocol)
DC	Direct Current
DWR	Department of Water Resources
ECOWAS	Economic Community Of West African States
EPC	Engineering Procurement and Construction
ER	Emissions Reduction
ESPs	Energy Service Providers
FiT	Feed-in Tariff
FPS	Full Private Sector
GBA	Greater Banjul Area
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEG	Global Electric Group
GEF	Global Environment Facility
GHG	Greenhouse Gas
GIEPA	Gambia Investment and Export Promotion Agency Act
GMD	Gambian Dalasi (currency)
GREC	Gambia Renewable Energy Centre
hp	Horsepower
hr	Hour
INDC	Intended Nationally Determined Contribution
IPP	Independent Power Producer
IPCC	Intergovernmental Panel on Climate Change
IRENA	International Renewable Energy Agency
IRR	Internal Rate of Return
kVA	Kilo-volt Ampere
kW	Kilowatt
kWh	Kilowatt-hour
kWp	Kilowatt-peak
LECRDS	Low Emission Climate Resilient Development Strategy
MRV	Measurement, Reporting and Verification
MW	Megawatt
MWp	Megawatt-peak
MDGs	Millennium Development Goals
MFP	Multifunctional Platform
MOE	Ministry of Energy

MOECCWW	Ministry of Environment, Climate Change, Water Resources, Parks and Wildlife
NAMA	Nationally Appropriate Mitigation Action
NAPA	National Adaptation Plan of Action
NAWEC	National Water and Electricity Company
NCC	National Climate Committee
NDA	National Designated Authority
O&M	Operation and Maintenance
OP	Office of the President
PAGE	Programme for Accelerated Growth and Employment
PPA	Power Purchase Agreement
PPP	Public-Private Partnership
PURA	Public Utility Regulatory Authority
PV	Photovoltaic
RBF	Results Based Financing
RE	Renewable Energy
RE-CEC	Renewable Energy Community Energy Centres
REDD-plus	Reducing Emissions from Deforestation and forest Degradation
RE-DIS	Renewable Energy Displacement Systems
REF	Renewable Energy Fund
RE-IPP	Renewable Energy Independent Power Producer
RE-MG	Renewable Energy Micro-Grids
REMP	Renewable Energy Master Plan
REP	Rural Electrification Project
RPZ	Rural Productivity Zone
SD	Sustainable Development
SMME	Small, Medium and Micro Enterprise
tCO2/MWh	Tonnes of Carbon Dioxide per Megawatt-hour
UEMOA	West African Economic and Monetary Union
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
US$	United States Dollar
v	Volt

1 Introduction to Rural Electrification with Renewable Energy Nationally Appropriate Mitigation Actions

A Nationally Appropriate Mitigation Action (NAMA) for Rural Electrification with Renewable Energy in The Gambia is presented in this design document. The document is divided into 10 chapters. Chapter 1 introduces the concepts of NAMAs and of energy access, and then ties the two concepts together. Chapter 2 presents the background to rural electrification in The Gambia, including information about the country's geography and economy, its progress in achieving the Millennium Development Goals (MDGs), the energy sector, with particular emphasis on electricity, and key stakeholders for the NAMA. Chapter 3 contains an analysis of the most relevant national policies, programmes and laws. Chapter 4 provides the baseline scenario for rural electrification in The Gambia followed by baseline and target details for greenhouse gas (GHG) emissions and sustainable development (SD). Chapter 5 presents the two phase NAMA implementation plan, including the business models and financial requirements of the NAMA ventures. Chapter 6 provides details about the capacity development included within the NAMA. Chapter 7 details the financial requirements for the NAMA, as well as the financial mechanisms which will be used to meet the requirements. Chapter 8 provides the NAMA implementation structure, including the implementation pathway, stakeholders and scheduling. Chapter 9 details the NAMA's Measurement, Reporting and Verification (MRV) system. Chapter 10 presents some concluding reflections on key aspects of the NAMA design.

1.1 Nationally Appropriate Mitigation Actions

NAMAs are voluntary, non-binding policy instruments that provide a framework for pursuing a country's socio-economic 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 towards the development and implementation of NAMAs, which can help countries achieve their growth objectives and participate in the global climate change mitigation agenda. NAMAs allow governments to leverage national and international support to achieve appropriate, effective and transformational GHG mitigation and sustainable development targets for the country.

COP 19 in 2013 saw the introduction of Intended Nationally Determined Contributions (INDCs), which are to be submitted by all countries, whether developed or developing, which are parties to the United Nations Framework Convention on Climate Change (UNFCCC). The INDCs are to take effect from 2020 and will detail actions the parties will take to address climate change. The types of actions (e.g. mitigation, adaptation) and the means of implementing them are yet to be determined. The exact relationship of INDCs and NAMAs is thus also yet to be determined but both will set short- to medium-term goals. NAMAs act as an implementation tool to translate short- to medium-term goals into action by outlining the means and vehicle/action plan to implement these (GIZ/UNEP, 2014). As of May 2015, The Gambia was undertaking the process of developing its INDC.

1.2 Energy Access

An affordable, reliable and sustainable energy supply can facilitate the provision of safe water, increased agricultural productivity, the creation of local jobs and the functioning of educational and healthcare facilities. Access to a reliable energy supply is also recognized as a crucial milestone towards the achievement of the MDGs. However, approximately 1.2 billion people around the world are still deprived of such access, particularly to electricity and liquefied petroleum gas, among other vital energy sources: (SE4All, 2013).

Energy access in rural areas is typically characterized by the challenges of lack of grid availability and limited energy production or transmission infrastructure. In order to meet energy needs in rural areas, biomass and petroleum products such as kerosene and paraffin wax candles are used. The use of these products often results in environmental degradation, the release of greenhouse gas emissions and health problems. The high cost of petroleum products can also be a significant financial burden which often leads to suppressed demand, that is, to energy needs not being completely met.

Recognizing the problem of energy access, the Economic Community of West African States (ECOWAS)/West African Economic and Monetary Union (UEMOA) adopted in 2006 the White Paper for a Regional Policy Geared towards Increasing Access to Energy Services for Rural and Peri-urban Populations. Two of the regional targets set for 2015 included: 1) at least 60 per cent of people in rural areas to have access to productive energy services in villages, in particular motive power to boost the productivity of economic activities; and 2) 66 per cent of the population, or 214 million people, to have access to an individual electricity supply (ECOWAS/UEMOA, 2006). Renewable energy offers an attractive way of meeting these targets. The White Paper recognizes the importance of renewable energy. One of the measures of the success of the regional policy is that at least 20 per cent of new investments in electricity generation should be driven by local and renewable resources, including hydro-electricity, in order to achieve energy self-sufficiency, reduced vulnerability and sustainable environmental development in keeping with the regional plan (ECOWAS/UEMOA, 2006).

1.3 Opportunities for a NAMA in Rural Electrification with Renewable Energy

Renewable energy offers a unique opportunity to accelerate access to electricity through small-scale, off-grid and stand-alone projects, often with simple and cost-effective solutions. Additionally, renewable energy systems in rural communities provide income-generating opportunities for the local population.

Whether because of high upfront costs or lack of access to credit, financing remains one of the most significant challenges to implementing renewable energy projects, particularly off-grid renewable energy projects. A NAMA provides an opportunity to facilitate the flow of financing for such projects.

In The Gambia, a renewable energy NAMA that is designed within the appropriate policy environment and required regulatory framework, and which has a sufficient level of technical and financial support, could be a catalyst for transformational change in the energy sector.

The proposed renewable energy NAMA for The Gambia focuses on rural electrification, thus addressing multiple SD objectives—poverty alleviation, local job creation, alternative income generation, provision of opportunities for greater income equality, improved energy access, and better health, educational and environmental conditions.

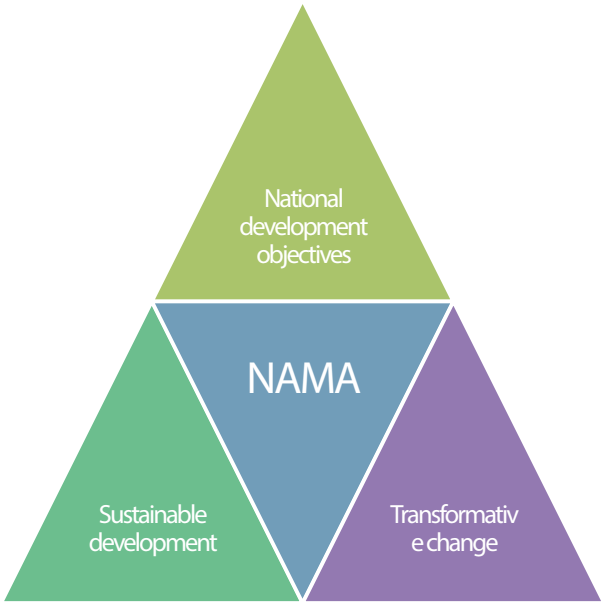
The guiding principle for the design of the Rural Electrification with Renewable Energy NAMA is to increase or provide access to electricity across the country's rural communities. The objective is to increase total installed electricity generation capacity through a set of renewable energy projects which will be facilitated by specific policy and financial instruments.

By promoting these projects, the NAMA will increase the proportion of renewable energy in the energy mix, help strengthen public private partnerships, increase and improve access to electricity for the majority of the population and fuel sustainable growth in the most remote rural areas of the country.

The NAMA differs from traditional funding mechanisms which promote rural electrification and renewable energy projects because of the following three key components (shown graphically in **Figure 1**).

- **Alignment with national development objectives.** The interventions under a NAMA framework must be compatible with the host country's policy and development objectives.
- **Focus on sustainable development.** The NAMA is designed with sustainable development benefits in mind. The design includes a focus on interventions which allow for income generating activities which can create business opportunities for individuals, households and communities.
- **Facilitating transformative change.** The NAMA will spur the development of an environment which facilitates a transformative change in the energy sector. An attractive regulatory and policy environment which incentivizes the private sector will be created. Initial interventions will catalyse private sector development and the creation of local jobs. The business models associated with the NAMA interventions will be easily replicable in other communities across the country.

Figure 1. NAMA components



2 Rural Electrification in The Gambia

This chapter will introduce The Gambia and the status of rural electrification in the country. Information about the country's geography and economy, its progress in achieving the Millennium Development Goals (MDGs), and the energy sector will be provided. The key stakeholders for the NAMA are then described.

2.1 Geography

The Gambia is the smallest country in continental Africa, with a total land area of about 11,295 km^2 (CIA, 2014). It is located in West Africa and is bordered by Senegal on three sides, with the Atlantic Ocean coastline on its western edge. The country's population, according to the preliminary results of the 2013 Population and Housing Census, is 1,882,450. Around 60 per cent of the population lives in urban or semi-urban areas. The country experienced a high annual population growth rate of 3.3 per cent between 2003 and 2013[1], and the consequent increase in domestic demand has been exerting enormous pressure on the country's natural resources, which in turn is having an impact on environmental, social and economic conditions (Gambia Bureau of Statistics, 2013).

Figure 2. Maps of The Gambia

Source: World Atlas, 2014.

2.2 The Economy

The Gambia's gross domestic product (GDP) is largely dependent on agriculture and tourism. However, economic growth is vulnerable to external factors, such as sluggish tourism trends and destructive weather conditions (such as the prolonged drought of 2011). The agriculture sector employs 75 per cent of the country's working population

1 If this rate is maintained, the population will double in 21 years.

and accounts for 70 per cent of domestic exports, while contributing only 25 per cent of GDP. The services sector accounts for approximately 60 per cent of GDP (with tourism, re-exports, trade and telecommunications the major drivers of growth and job creation). The telecommunications sector has developed dramatically in the past few years, with a mobile phone penetration of 89 per cent, which is well above the African average of 53 per cent (IRENA, 2013; Nshimyumuremyi, 2014). As Figure 3 illustrates, GDP growth has been strong and steady since 2008, with the exception of 2011 when the prolonged drought affected the economy.

Figure 3. GDP growth, 2005–2013[a]
(%)

[a] 2013 data provisional.
Source: Central Bank of The Gambia, 2013.

In 2014, delayed rains and the Ebola scare in West Africa affected The Gambia's agriculture and tourism sectors. These factors affected economic growth and exerted further pressure on government budgets (IMF, 2014). The country remains highly dependent on external sources of funding and grants to propel its growth.

2.3 The Millennium Development Goals

In 2000, world leaders adopted the United Nations Millennium Declaration and, along with it, the Millennium Development Goals (MDGs) which aimed to reduce extreme poverty by 2015.

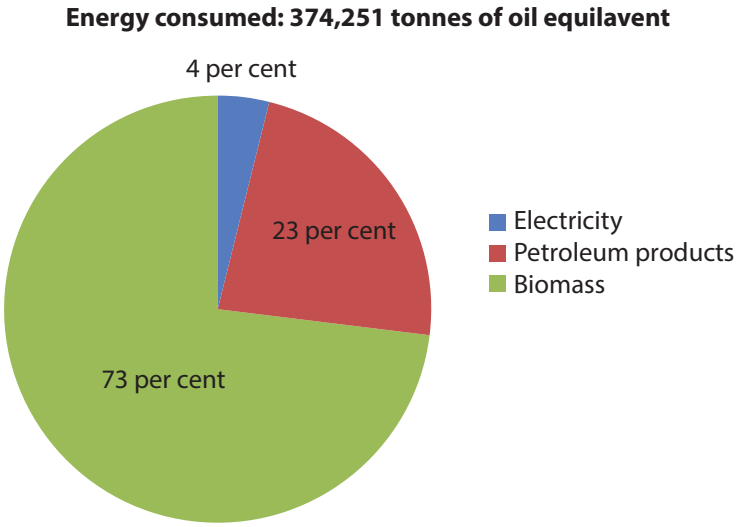
As seen in the 2014 MDG Status Report (Ministry of Finance and Economic Affairs 2014): The Gambia has made significant progress towards attaining some targets in all MDGs. However, significant efforts are required to achieve the MDG's in its entirety. Gains have been made in the area of poverty reduction, proportion of households with improved water source, childhood mortality, proportion of women attended by skilled personnel during delivery and gender parity in primary and secondary. Significant areas of needed improvement include: employment to population ratio; representation of women in the national parliament; maternal health; and combatting HIV/AIDs, malaria and other diseases.

2.4 Energy and Electricity

2.4.1 Energy Overview

The main source of energy in The Gambia is wood fuel and other biomass fuels), followed in decreasing order by petroleum products, electricity and a small fraction of renewable energy, as seen in Figure 4. The biggest consumers of energy in The Gambia are households and the transport sector, with a steady and consistent increase during the past decade in the consumption of petroleum products.

Figure 4. Energy consumption in The Gambia, 2009



Source: Sustainable Energy for All, 2012.

Wood fuel consumption is increasing due to increasing energy demand from households for cooking and household-related needs. The dependence on wood fuel means that users are subject to the associated health hazards (such as indoor air pollution) and spend excessive time, effort and money collecting or buying wood fuel. The Government, however, is committed to providing safer energy services (clean cooking fuel and electricity) at affordable prices (IRENA, 2013).

As a part of its Programme for Accelerated Growth and Employment (PAGE), which was designed to foster cross-sectoral socio-economic development, the Government intends to increase electricity generation, enhance access to electricity and improve operational efficiency by focusing on the following four objectives (Ministry of Finance and Economic Affairs, 2012):

a. providing reasonable incentives and facilitation to promote private sector investment in electricity-generation projects;

b. promoting efficient technologies in utility companies to increase their operational efficiency

c. undertaking the replacement and upgrading of ageing transmission and distribution systems; and

d. promoting the use of renewable energy technologies (such as wind, solar and biomass), with emphasis on rural areas (MOFEA, 2011).

The current level of electrification in The Gambia is insufficient and the Government lacks the resources to improve the situation, given the huge demand. In 2011, The Gambia had an overall electrification rate of approximately 35 per cent, with very high regional variations (from 6 per cent in the North Bank region to 93 per cent in the Banjul region). These electrification rates indicate average electricity access of only 12 per cent[2] in the rural and semi-urban regions. Table 1 shows the status of electrification in different regions in 2011.

Table 1. Electrification rates by region, 2011
(%)

Regions	Electrification Rate
Banjul	93
Western	22
Upper River	14
Lower River	12
Central River	7
North Bank	6

Source: IRENA, 2013 citing Ministry of Energy, 2011.

In 2013, the national electrification rate was estimated to be 40 per cent, indicating an insignificant improvement from 2011's figures (Ministry of Energy 2014a). The bulk of the electrification is in urban areas, leaving many rural areas without access to electricity.

Most of the electricity which is produced in The Gambia is produced using fossil fuels (IRENA, 2013). The electricity grid comprises the main Banjul grid and six regional grids. Six regional power projects were commissioned as part of a Rural Electrification Project in 2006, which raised total installed capacity to 4 MW. Since then, installed capacity in the regional grids has grown to 11 MW. In the future, there are plans to connect the regional grids, reducing their number from six to two.

As Table 2 shows, the total installed capacity for the country is approximately 70 MW, but the available generating capacity range is only between 45 and 55 MW. Adding to the challenge, the existing supply suffers from planned and unplanned outages due to the inefficient distribution network (Ministry of Energy, 2014b).

2 Average of regions other than Banjul grid.

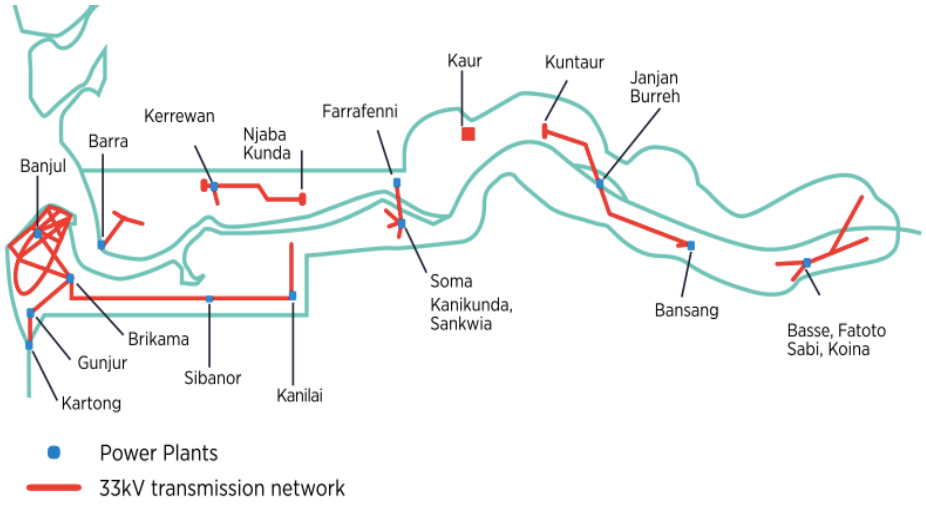
Table 2: Installed electricity capacity in The Gambia, 2012

Electricity system (grid)	Power plant	Installed capacity (MW)
Greater Banjul Area (GBA) central grid	Kotu Power Plant	25.30
	Brikama Power Plant (GEG[3])	26.00
	Batokunku	0.15
	Brikama Power Plant (Wartsila)	9.00
	Tanji Power Plant[4]	0.90
Provincial stations	Essau	0.58
	Kerewan	0.90
	Farafenni	3.30
	Kaur	0.22
	Bansang	0.90
	Basse	2.60
Total		**69.85**

Source: UNDP, Mitsubishi UFJ Morgan Stanley Securities, 2014.

The country's generation and distribution network, illustrated in Figure 5, is not at all robust or reliable.

Figure 5. The electricity transmission and generation network



Source: (PURA, 2011).

3 The Global Electric Group (GEG) was the first independent power producer in the country.
4 The project is now stalled and generates no electricity.

2.4.2 Electricity Challenges

Several challenges burden The Gambia's electricity subsector, such as high tariffs due to its dependence on fossil fuel generation, poor operational efficiency and heavy electricity losses due to its ageing transmission and distribution infrastructure (Ministry of Energy, 2014b).

According to the World Bank Investment Climate Assessment for The Gambia, the lack of a stable and extended electricity system represented the most serious obstacle to business in the country in 2006[5]. Considering the continuing instability and fragility state of the energy sector, it is likely that the unreliable provision of electricity remains a major obstacle to economic expansion. Lack of access to electricity also hinders social development and constrains the delivery of healthcare and education services in the country (World Bank, 2009).

The Gambia is confronted with both infrastructural and financial constraints in providing grid connectivity to rural and remote areas. Electricity in the country is quite expensive: regional benchmarks suggest that electricity tariffs in The Gambia are quite high for both residential and commercial users. As seen in Table 3 , in the regional context (West Africa), the country has the highest electricity tariffs for domestic (credit metering) customers, at US$0.24 per kWh (PURA, 2012). During times of high international oil prices and unfavourable foreign exchange rates, which are beyond the control of government institutions, the regional power stations operate for limited hours and on a day-to-day basis. The regional grids experience constant challenges in operating and carrying out necessary equipment maintenance (SE4All, 2012).

Table 3. Comparison of tariffs in West African countries, 2011

Country	Effective residential tariff (US$/kWh)[a]
The Gambia	0.28
Senegal	0.24
Burkina Faso	0.20
Cote d'Ivoire	0.12
Ghana	0.08

[a] The tariffs are estimated for comparable capacity connections in each country, such as a monthly consumption of 100 kWh.

Sources: IRENA, 2013, citing World Bank, 2012 and NAWEC, 2012.

To increase electricity access in rural areas, the Government of The Gambia launched the Rural Electrification Project (REP). The REP established diesel-powered regional grids. Phase 1 of the project concluded in 2007 and resulted in the commissioning of seven production centres which provide electricity to 46 villages and towns. Phase 2 aims to connect 44 additional villages (Gambia Affairs, 2014).

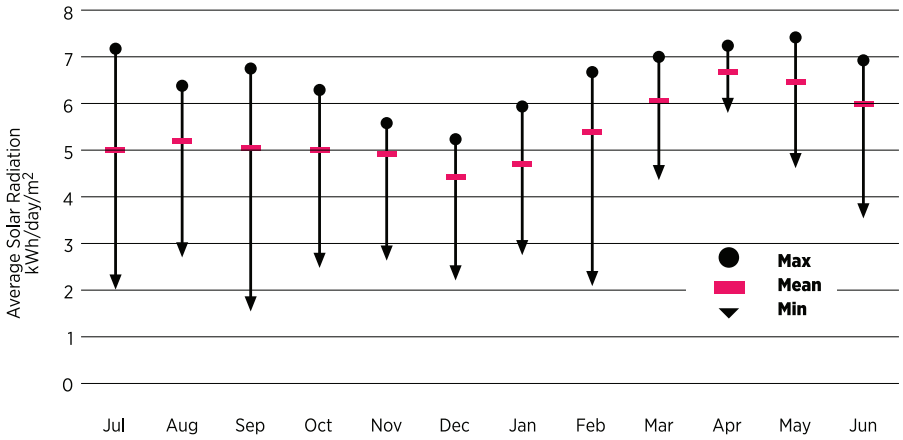
5 The report was published in 2009 but used 2006 survey data.

2.4.3 Renewable Energy

The Gambia offers an abundance of natural resources to meet its energy needs. In light of the NAMA, the renewable energy discussed here will focus on electricity, not thermal energy. In 2005-2006, solar and wind measurements were taken as part of a study for the Renewable Energy Master Plan (Lahmeyer International, 2006).

Solar radiation measurements were taken at eight stations and the study concluded that there is high solar radiation in all regions of The Gambia. The average solar radiation is 4.4-6.7 kWh/ m^2/day. Even in the rainy season when radiation is at its lowest level, the amount of radiation is high enough to power solar energy projects (Lahmeyer International, 2006). The average solar radiation levels per month can be seen in Figure 6.

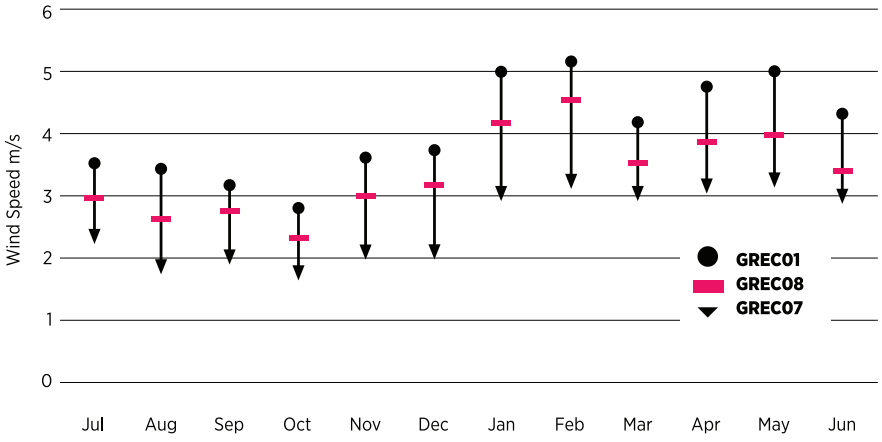
Figure 6. Average solar radiation levels



Source: IRENA, 2013, citing Lahmeyer International, 2006.

Information from the World Wind Atlas, coupled with measurements from eight wind stations, provided data on wind conditions in The Gambia. Average wind conditions in the country are moderate (4.0 m/s at 30m), with higher speeds found along the coast. The wind regime at three of the measurements sites can be seen in Source: IRENA, 2013, citing Lahmeyer International, 2006.

Figure 7. Average wind speed



Source: IRENA, 2013, citing Lahmeyer International, 2006.

Stand-alone renewable energy projects have a long history in The Gambia, with the first solar installation dating back to the 1980s. Solar photovoltaic (PV)-based projects have been used for telecommunications, lighting and in water-pumping systems (to provide a clean water supply in rural communities). The Ministry of Energy (2014b) estimates the installed capacity of the solar PV systems for water-pumping systems at approximately 2 MW. Grid-connected renewable energy generation represents approximately 1 per cent, or about 1 MW, of total grid capacity. Information about off-grid solar PV installations is readily available for only a limited number of projects. Three resort hotels utilize off-grid solar PV. Box 1 provides information about the Promoting Renewable Energy Based Mini Grids for Productive Uses in Rural Areas in the Gambia Project, which has resulted in the installation of two off-grid renewable energy projects.

Box 1. Promoting Renewable Energy Based Mini Grids for Productive Uses in Rural Areas in the Gambia

The Government of The Gambia in collaboration with the United Nations Industrial Development Organization (UNIDO) implemented a Global Environment Facility (GEF) - 4 funded[6] project (2012–2015), ***Promoting Renewable Energy Based Mini Grids for Productive Uses in Rural Areas in the Gambia***, under which four significant renewable energy projects were developed (Ministry of Energy, 2014):

- GAMWIND[7] Tanji wind farm installed two turbines of 450 kVA each; the wind farm was fully operational in 2013, but because of financing issues it ceased generating power as of March 2014[8].
- 8.3 kW modern solar PV at a rural training centre that provides income opportunities for women in the community. This project has been operational since the beginning of 2014
- Qcell solar/wind hybrid stations
- 60 kW NAWEC solar/diesel hybrid system at Kaur.

The Project also addressed the financial and institutional barriers which constrict renewable energy development in The Gambia. The project worked to enhance awareness of the need for renewable energy-based mini-grids, to build up the capacity of technology suppliers and energy companies to provide business development advice, to offer market and technology assessments, to encourage project identification and development, to secure quality assurance for renewable energy equipment, to introduce a culture of monitoring and evaluation of renewable energy projects, and to create a database of renewable energy resources and projects.

6 The GEF is a partnership for international cooperation to address global environmental issues. GEF provides co-financing for variety of projects, including climate change and renewable energy. The project in The Gambia is ongoing.

7 For more details, see www.gamwind.com/.

8 The project is currently stalled, and a re-negotiation process is ongoing between the National Water and Electricity Company and GAMWIND.

Figure 8. Windpower Festival (Gamwind, 2015)

A new GEF/UNIDO project began in 2014. The project, entitled Greening the Productive Sectors in The Gambia: Promoting the Use and Integration of Small and Medium Scale Renewable Energy Systems in the Productive Sectors, has three main components:

- development of strategy and regulation on the integration of small-to-medium scale RE systems;
- demonstrating technical feasibility and promoting investment in Renewable energy; and
- renewable energy projects entrepreneurship skills development (Gaye, 2014).

Renewable energy projects can provide electricity efficiently to rural and remote areas, mainly because of their low operating costs. However, high capital costs, the difficulty of sustaining village-level maintenance and the lack of availability of technical know-how remain huge barriers to an increased uptake of these projects.

Additionally, to succeed, renewable energy projects in rural areas require a strengthening of the institutional, financial, legal and regulatory mechanisms in the country.

The proposed NAMA presented in this design document will help to overcome these challenges and kick-start the spread of renewable energy projects through the implementation of the renewable energy ventures described in detail in Chapter 6.

2.5 Key Stakeholders

The Rural Electrification with Renewable Energy NAMA for The Gambia will only be as strong as the support and active participation it receives from all involved institutions. Equally critical will be the coherence of ideas and the synergies between the actions of those institutions. The following is a brief introduction to the institutions with critical roles in The Gambia's rural electrification subsector.

2.5.1 The Office of the President

The Office of the President (OP) oversees the policymaking work carried out by government ministries and is the final approving authority on all policy-related matters. Each ministry must regularly update the Office of the President on project developments and initiatives.

2.5.2 The Ministry of Finance and Economic Affairs

The Ministry of Finance and Economic Affairs (MOFEA) is responsible for the national budget. Within MOFEA sits a Public Private Partnership (PPP) Unit which was institutionalized to help facilitate private sector engagement in infrastructure and services.

2.5.3 The Ministry of Energy

The Ministry of Energy (MOE) has primary authority over the generation of electricity and related matters. Various institutions operate under its guidance and within the frameworks that it provides.

The Gambia Renewable Energy Centre (GREC) was established in 1987 within the MoE. The GREC is the technical arm of the Government in the field of energy efficiency and renewable energy. Its primary function is to conduct adaptive research, develop and promote the use of renewable energy and energy efficiency technologies (through sensitization and communication campaigns), and advise the Government on related issues. GREC organizes a biannual energy show and exhibitions, assesses and tests household energy appliances, and provides training on renewable energy and energy-efficient appliances. GREC acted as the coordinator for the GEF-4/UNIDO renewable energy promotion project

2.5.4 The Ministry of Environment, Climate Change, Water Resources, Parks and Wildlife

The Ministry of Environment, Climate Change, Water Resources, Parks and Wildlife (MOECCWW) has responsibility for the sustainable management of forest resources, the conservation of biodiversity and the prioritization of climate change aspects in policy recommendations and decisions. The Ministry comprises the Department of Forestry, the Department of Parks and Wildlife Management, the Department of Water Resources and the National Environmental Agency.

The Climate Change Unit lies within the MOECCWW. As the national focal point for the UNFCCC, the Department of Water Resources (DWR) takes the lead in implementing the Convention.

2.5.5 The National Climate Committee

The National Climate Committee (NCC) was established in the 1990s to coordinate the country's climate change activities. Constituted as an ad hoc body with representation from all ministries, the NCC is chaired by MOECCWW. The NCC produced two national communications[9] to the UNFCCC, in 2003 and 2012. The NCC conducts studies in relation to climate change, and since developing the National Adaptation Plan of Action (NAPA) in 2006, it has worked to integrate climate change and environmental issues into all sectors of the economy.

2.5.6 The Public Utility Regulatory Authority

The Public Utility Regulatory Authority (PURA) is a multi-sector regulatory agency, established in 2005 after the liberalization of the energy and telecommunications sectors, to manage the licensing of electricity generation projects, the tariff structure and the quality of service standards. Electricity tariffs were adjusted downwards twice, in 2009 and early 2010. However, tariffs have since increased significantly, rising, between 2011 and 2012, by 26 per cent for domestic (prepayment) users and 13 per cent for commercial users (Sanneh and Ceesay, 2013). For 2015, a much smaller increase, of 1-2 per cent, has been proposed (Kargbo, 2015).

Under the 2013 Renewable Energy Act, PURA was appointed as the managing entity for the newly established Renewable Energy Fund (REF). PURA is also charged with implementing a number of components of the Act, such as streamlining, permitting and setting the renewable energy feed-tariff.

2.5.7 The National Water and Electricity Company (NAWEC)

The National Water and Electricity Company (NAWEC) is the country's main utilities supplier. It was incorporated in June 1996. Its main power station (Kotu) is the principal provider of electricity to the Greater Banjul Area. The company is involved in the generation and distribution of electricity, drinking water and sewage services to domestic, industrial and commercial users. It oversees both urban and rural electrification.

2.5.8 Independent Power Producers

2.5.8.1 Global Electric Group

Global Electric Group (GEG) is the first independent power producer (IPP) in the country. GEG's power plant was commissioned in 2006 and is located in Brikama Kabafita. The plant has an installed capacity of 25 MW and uses heavy fuel oil as the primary fuel (ECOWAS Observatory for Renewable Energy and Energy Efficiency, 2015).

2.5.8.2 Gamwind

Gamwind was the initiator of the first wind project in The Gambia, the Batukunku wind project (150 kVA), which it owns and operates. The Tanji wind project (900 kVA) began operations in 2012 but shut down in 2013.

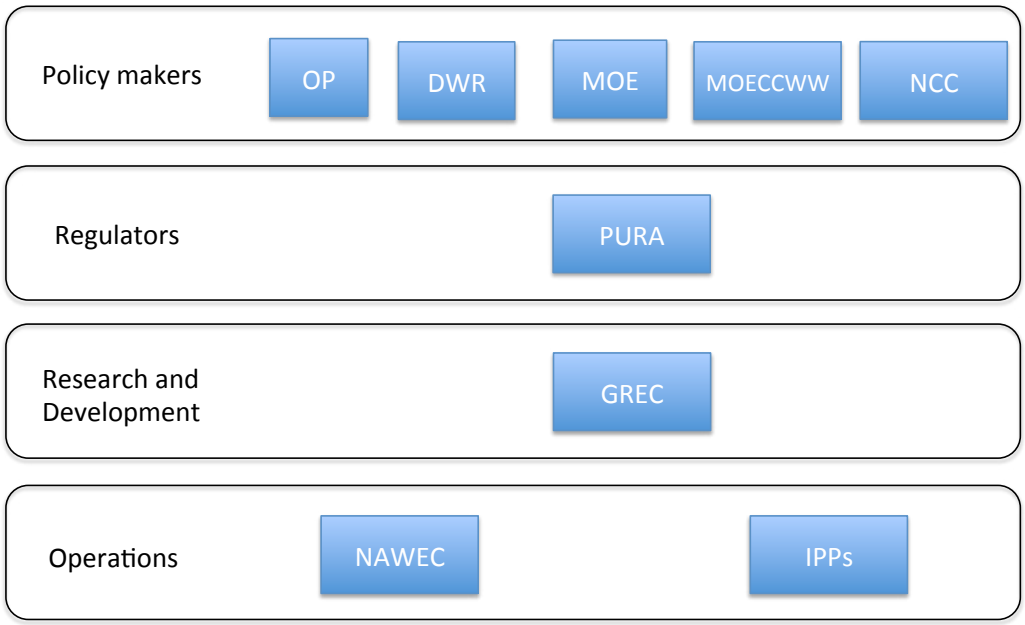
9 Submission of national communications is a statutory requirement of the UNFCCC for participating countries. The national communication provides information on emission sources and GHG sinks as well as details of activities undertaken to implement the UNFCCC. For more information, see http://unfccc.int/national_reports/items/1408.php.

2.5.8.3 Gamsolar

Gamsolar is a leading solar energy company in The Gambia; it has carried out several small-scale PV projects in the country. Gamsolar's projects include the electrification, combined with the provision of a water pump, of a tertiary care hospital in Bwiam and powering water pumps in a number of villages (Gam-solar, 2015).

A summary of the key rural electrification stakeholders in The Gambia is provided in Figure 9.

Figure 9. Institutional stakeholders in rural electrification projects in The Gambia



3 Policy Analysis

This chapter provides information about the policies in The Gambia which are most relevant to rural electrification with renewable energy and, therefore, to the NAMA. For each policy, a brief summary is provided. Each summary is followed by an analysis of the gaps which need filling in order to provide the policy framework ideal for supporting the NAMA. Finally, recommendations on how to fill the gaps are given.

3.1 Vision 2020, 1996

As a guiding framework, Vision 2020 was launched in 1996 "to clearly map out a strategy for a socio-economic landscape that aims to raise the standard of living for the population by transforming The Gambia into a dynamic middle-income country". Vision 2020 includes a prime objective for the energy sector to "overcome the existing bottlenecks and to ensure a reliable and adequate supply of energy, both conventional and renewable, at affordable prices. The total generating capacity for electricity is targeted to increase to 150 megawatts (MW) by the year 2020" (Republic of The Gambia, 1996).

3.1.1 Gaps

Vision 2020 does give some emphasis to energy, including renewable energy. However, it does not specifically address the issue of rural electrification.

3.1.2 Recommendations

It is recommended that, in the next guiding development document for The Gambia, specific targets for rural electrification are included.

3.2 Programme for Accelerated Growth and Employment (PAGE), 2012–2015

PAGE follows The Gambia's Poverty Reduction Strategy Paper II, as the implementation framework for Vision 2020. Improving and modernizing infrastructure is one of the key pillars of PAGE, The energy sector falls under this pillar. PAGE acknowledges the importance of the provision of electricity to both urban and rural populations and the need to promote renewable energy (MOFEA, 2011). PAGE also highlights using renewable energy for solar generators for water supply.

3.2.1 Gaps

PAGE does not specifically promote the use of renewable energy for off-grid energy systems, apart from the use of solar generators for water supply.

3.2.2 Recommendations

It is recommended that, in the next implementation framework, a direct link between renewable energy and off-grid rural electrification is made.

3.3 The Gambia Investment and Export Promotion Agency Act, 2010

The Gambia Investment and Export Promotion Agency (GIEPA) Act served to establish The Gambia Investment and Export Promotion Agency, create export processing zones and foster a conducive environment for investment and enterprise development (Republic of The Gambia, 2010). The GIEPA Act lists nine priority sectors with one being energy, including electricity generation, transmission and distribution; and renewable energy sources (solar, wind, hydro and biochemical). The GIEPA Act provides a number of incentives for investment in priority sectors. The incentives include granting for newly established investment enterprises that fall within any priority investment category: a tax holiday in respect of its corporate or turnover tax, depreciation allowances, withholding tax or dividend for five years (in the case of priority sectors) and for a maximum of eight years (in the case of a priority area) from the date of commencement of operation (Republic of The Gambia, 2010.

3.3.1 Gaps

The GIEPA Act has no major gaps. It does, however, require clarification for the purposes of the NAMA, particularly with regard to its applicability to public private partnerships (PPPs). The GIEPA Act defines its applicability to domestic and foreign investors but not to PPPs.

3.3.2 Recommendations

Although the GIEPA Act has no major gaps, the incentives in the GIEPA Act should be extended and made explicitly applicable to the activities in the NAMA. The provision that "an existing investment enterprise within any priority investment category that embarks on an expansion project worth at least two hundred thousand dollars shall be granted a sales tax waiver for its imports for one year" should be extended to apply for one year from the commissioning of an installation. This is because, under the NAMA, one enterprise may install a number of ventures over a course of several years. The tax holidays provided in the Act should be extended from five to 15 years or to five years, renewable three times. The same extension should also be applied to the import sales tax waiver.

Finally, the applicability of the GIEPA Act should be revised so that it is applicable to approved PPPs, where the ***total*** investment (i.e. not just the investment of the private party) exceeds US$250,000.

3.4 The Renewable Energy Act, 2013

The passing of the Renewable Energy Act was a major step forward for The Gambia, in terms of promotion of renewable energy in the country. The Act defines a number of functions for the Ministry of Energy, including:

- recommending national renewable energy targets;
- determining equipment eligible for tax exemption;
- preparing and co-ordinating the permitting process for facilities using renewable energy resources;
- promoting the implementation of educational programmes within the renewable energy sector;
- encouraging the development of technical and standard requirements and certification of renewable energy installations; and
- establishing and managing a registry to monitor renewable energy facilities (Ministry of Energy, 2013).

The Act defines a number of functions for PURA, including:

- managing the Renewable Energy Fund;
- maintaining a register of appropriately qualified installers of systems using renewable energy resources; and
- Requiring importers of systems using renewable energy resources to provide details of compliance with internationally recognized performance and safety standards.

The Act establishes a Renewable Energy Fund and defines its funding sources, activities to be funded and management structure. The Act allows for feed-in tariffs for on-grid renewable electricity. The maximum national capacity limit for electricity production that is eligible under the Act is to be published in the Feed-in Tariff Rules.

Importantly, the Act also provides clarification about off-grid tariffs. Renewable energy or hybrid off-grid systems of no greater than 200 kW are allowed to charge electricity tariffs to end consumers up to the current national retail tariff rates. For systems of greater than 200 kW and if a system developer wants to charge above the national retail tariff rate, developers must justify the tariff to the PURA as per the Electricity Act.

3.4.1 Gaps

The Renewable Energy Act provides the skeleton regulatory and governance framework for the renewable energy sector in The Gambia. However, many sections of the framework remain to be filled. Gaps are not limited to but include:

- renewable energy targets;
- provision of feed-in tariffs for on-grid renewable energy systems of more than 1.5 MW, the current maximum capacity allowed (Sanneh & Ceesay, 2013)(Sanneh and Ceesay, 2013);
- provision of tariffs for off-grid renewable energy systems of more than 200 kW;
- equipment eligible for tax exemption; and
- technical and standard requirements and certification of renewable energy installations.

3.4.2 Recommendations

It is recommended that renewable energy targets be set.[10] The draft Electricity Strategy and Action Plan (AF-Mercados EMI, 2012) recommended that The Gambia should find ways to establish a renewable target that involves setting either a renewable electricity target of 5 per cent by 2025 and 10 per cent by 2030 or a target where over 50 per cent of demand is met by renewable electricity by 2030 drawing on regional hydropower. The International Renewable Energy Agency (IRENA) Renewables Readiness Assessment (IRENA, 2013) suggests that the 2005-2006 solar and wind assessment study in The Gambia undertaken by Lahmeyer International (2006) as a contribution to the development of the Renewable Energy Master Plan could serve as a good basis for evaluating the economic potential of wind and solar systems. It is recommended that clear renewable energy targets be set for both on-grid production and for the use of renewable energy in rural electrification.

10 The draft Energy Policy 2014-2018 includes a renewable energy target. Once the Policy has been finalized, its target should be included in a revised Renewable Energy Act.

The GIEPA Act already provides for tax exemptions for renewable energy equipment. However, stakeholder consultations should be held to determine if any relevant equipment is excluded by the terminology in the GIEPA Act.

As recommended in the Renewable Energy Act, technical and standard requirements and certification of renewable energy installations should be determined and made accessible to all stakeholders. A database of all developers who are awarded certification should also be created and maintained.

3.5 The National Energy Policy

The National Energy Policy was launched in June 2005. It defines broad policy objectives and strategies, including those for rural electrification and renewable energy. It contains objectives for electricity which encompass improving and expanding the generation, transmission and distribution of electricity, reducing the cost of electricity, encouraging investment in the supply of rural electricity, and encouraging the use of alternative technologies (Ministry of Energy, 2005). In the renewable energy subsector, the policy promotes the use of renewable sources of energy and encourages the use of renewable energy technologies and the development of a domestic production capacity. The policy also seeks to ensure a sustainable supply of technologies at competitive prices in the private sector.

The National Energy Policy is being updated for the period 2014-2018; it is as of, May 2015, still under development. The Policy includes objectives relevant to rural electrification that include increasing the adequacy, accessibility and reliability of electricity, reducing the cost of electricity, encouraging private sector participation, providing energy security and promoting rural development. The new energy policy highlights the importance of energy in meeting SD goals. For instance, it recognizes that energy access can assist in achieving the goal of eradicating extreme poverty and hunger because, for example:

- access to energy services enables companies to develop;
- lighting extends trading hours beyond daylight;
- using machines improves productivity;
- energy may be supplied by small local businesses, thereby creating jobs (because of demand for maintenance, etc.)
- Privatizing energy services can raise funds for governments which can then invest them in social services (Ministry of Energy, 2014b).

The Policy prioritizes rural electrification and promotes the use of renewable energy resources such as wind and solar for electricity generation, particularly in the rural areas. The Policy includes a target of achieving at least 30 per cent renewable energy generation capacity by 2018.

3.5.1 Gaps

The revised National Energy Policy refers to the promotion and encouragement of renewable energy and rural electrification. Although some strategies for promotion and encouragement are included in the Policy, the range of strategies included in insufficient.

The majority of references to the rural electrification sector are in relation to extending the national or regional electricity grid to rural areas. However, there are only limited references to rural electrification through the use of off-grid systems.

3.5.2 Recommendations

Further recommendations about promoting and encouraging renewable energy generation and particularly renewable energy-powered off-grid rural electrification systems should be included. Specific recommendations can include: collaborating with financial institutions to facilitate access to credit, providing technical training; establishing public-private partnerships; and facilitating the leasing of land for renewable energy power plants.

3.6 Low Emission Climate Resilient Development Strategy (LECRDS) for The Gambia, 2015

The Low Emission Climate Resilient Development Strategy (LECRDS) was, as of May 2015 (Lamour, 2015), drafted but awaiting consultation and approval. The Background Paper on LECRDS of The Gambia (Lamour and Jallow, 2014) provides insight into the LECRDS. The goal of the LECRDS is to allow The Gambia to respond more effectively to climate change. It would do this not only by serving as the programmatic nexus for capturing conventional and innovative sources of sustainable development and climate financing, but also by assisting Government institutions in designing, implementing, monitoring and building upon existing low-emission climate-resilient development projects and programmes (Lamour and Jallow, 2014).

One of the key proposed LECRDS activities is to promote and increase the renewable energy mix (solar, wind, biomass) in the production and consumption of electricity in The Gambia based on mini grids for productive uses in rural and peri-urban areas of The Gambia (Lamour and Jallow, 2014).

The promotion of private sector solar markets and PPPs is also included in the background paper.

3.6.1 Gaps

As of March 2015, the design and approval of the LECRDS for The Gambia has not yet been completed. The background paper includes the recommendation to establish a National Climate Change Fund but this appears not to be connected to the Renewable Energy Fund which is being set up under the Renewable Energy Act. The background paper mentions the importance of the private sector but does not include suggestions on how to facilitate its involvement. Finally, there is very limited mention of off-grid rural electrification.

3.6.2 Recommendations

The LECDRS will play an important role in building the framework for a low emissions pathway in The Gambia. It is therefore crucial that this document clearly sets out activities to be undertaken so as to 1) align all on-going low emissions and climate resilience initiatives in The Gambia; 2) engage the private sector; and 3) promote rural electrification. Regarding the alignment of initiatives, the Renewable Energy Act and Renewable Energy Fund need to be integrated into the LECRDS. In terms of engagement of the private sector, although there is a brief mention of taxes and subsidies, a more detailed treatment will provide a better pathway for the implementation of the LECRDS. The details could include, for example, ensuring that renewable energy companies are eligible to receive tax holidays for income and the importation of relevant equipment. Finally, throughout the LECRDS, whenever renewable energy is mentioned, it should be considered not just in terms of grid connected renewable energy but also in terms of off-grid or mini grid rural electrification.

4 NAMA Baseline and Targets

This chapter provides information about the baseline and targets of the NAMA. To set the stage, the baseline scenario will first be established, followed by the approach which will be employed to ensure that the NAMA is looked at in a bigger picture, helping to ensure transformative. Information will then be provided about the baseline and targets for GHG emissions and SD. The targets of the NAMA are developed in alignment with the priorities of national development plans.

4.1 Baseline scenario

As was previously mentioned in Chapter 3 , electrification rates in The Gambia remain low, with less than 40 per cent of the population having grid access and the majority of the grid access being in urban areas. As this NAMA focuses on rural electrification, the baseline scenario is the business-as-usual scenario for the rural population.

As described in detail in Chapter 6 , the NAMA is divided into two phases and it includes four different types of venture. Phase 1 includes:

1. Renewable Energy Community Energy Centres (RE-CECs); and
2. Renewable Energy Micro-Grids (RE-MGs).

Phase 2 includes:

3. Renewable energy systems at existing regional mini-grids, or Renewable Energy Displacement Systems (RE-DISs) and
4. Renewable Energy Independent Power Producers (RE-IPPs).

Phase 1 connects rural consumers who, in the business-as-usual scenario, are not connected to an electricity grid. Therefore, for Phase 1, the business-as-usual scenario 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". The baseline scenario assumes the use of fuel-based lighting systems, stand-alone power generators, and fossil fuel based mini-grids (UNFCCC, 2014).[11] Examples of the technologies are provided in Figure 10.

11 Car batteries are often used to power equipment but, as these are charged using generators, they are not specified in the baseline scenario.

Figure 10. Examples of baseline scenario technologies

Kerosene lighting

Fossil fuel based generators for economic activities

Fossil fuel based generators for residential purposes

Sources: The Insider, 2014; DFID, 2011; Gardners, 2014.

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 by sources are projected to rise above current levels, due to the specific circumstances of the host party (UNFCCC, 2012). This principle can be specifically applied to the methodology AMS-I.L:

"A suppressed demand situation is applicable when a minimum service level[12] to meet basic human needs[13] was unavailable to the end user of the service prior to the implementation of the project activity. Hence, these guidelines are applicable when basic human needs were not met. For example, in the pre-project scenario, households may have had only very few kerosene lamps in place that were only operated for short time periods, thereby only partially meeting the basic lighting demand of the household" (UNFCCC, 2012).

In the Gambian situation, the application of suppressed demand translates into the baseline scenario being that all people have basic human needs met through the use of the fossil fuel technologies previously mentioned.

Phase 2 of the NAMA includes two different venture models which provide electricity to consumers who are already grid connected, either to diesel powered regional mini grids or to the GBA grid. Therefore, the baseline scenario for consumers connected to the regional mini grids is the use of electricity generated by diesel generators. The baseline scenario for consumers connected to the GBA grid is the use of electricity generated by the five thermal power plants connected to the GBA grid.

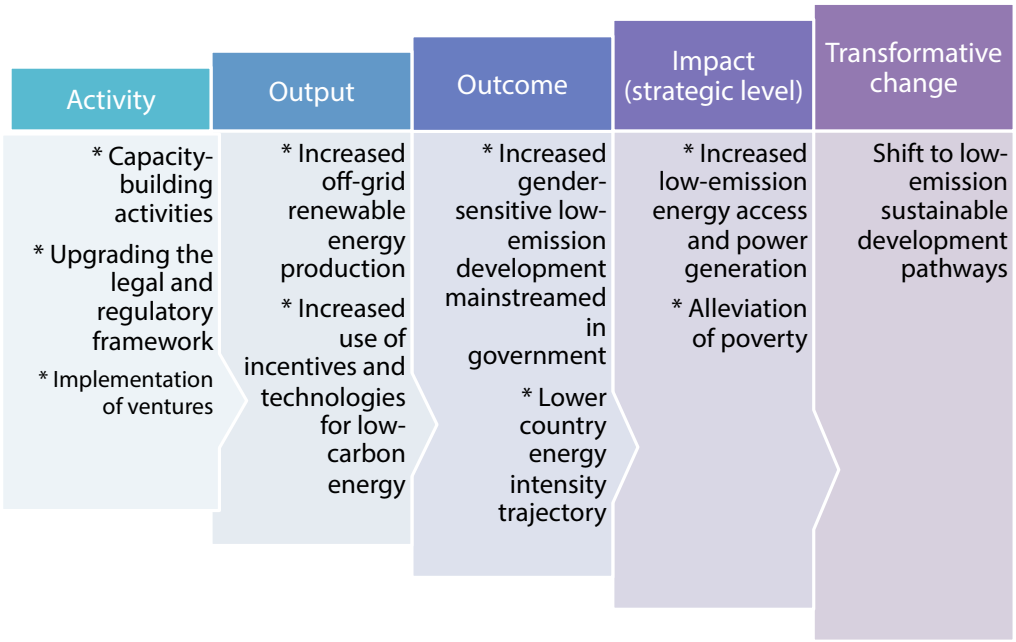
12 Defined as a service level that is able to meet basic human needs. In some situations, this service level may not have been provided prior to the implementation of the CDM project activity, indicating suppressed demand with a consequent future emissions increase due to income effect, rebound effect or other technical factors such as limited availability of a service (e.g. connection to a very weak grid) or low quality of a service (e.g. aversion to pollution caused by kerosene lanterns).

13 Defined for the purpose of the guidelines to include physical and physiological needs such as basic housing, basic energy services (including lighting, cooking, drinking water supply and space heating), sanitation (waste treatment/disposal) and transportation.

4.2 Transformative Change

The transformative change of the NAMA can best be seen through the application of a theory of change approach. The theory of change approach "defines all building blocks required to bring about a given long-term goal. This set of connected building blocks—interchangeably referred to as outcomes, results, accomplishments, or preconditions—is depicted on a map known as a pathway of change/change framework, which is a graphic representation of the change process" (Center for Theory of Change, 2013). Using this approach will help to ensure that the NAMA focuses not just on emissions reductions but also on sustainable development, national development goals and transformative change. This approach is also aligned with the Green Climate Fund (GCF) results framework. The overall NAMA targets for activities, outputs, outcomes, impacts and overall high-level paradigm shift can be seen in Figure 11.

Figure 11. The theory of change approach to NAMA targets



The transformative change also must occur in a fashion which is aligned with national development goals. Vision 2020 is the overarching development framework for The Gambia. Table 5 depicts the nine long-term objectives of Vision 2020 and how the NAMA will address these objectives.

Table 4: Vision 2020 objectives aligned with NAMA goals

Vision 2020 objective	How the NAMA addresses the objective
Agriculture and Natural Resources	The ventures will provide energy for irrigation, which will improve agriculture efficiency. The NAMA will also help to create rural jobs, reducing dependence on subsistence agriculture.
Industry and Infrastructure	The NAMA will result in increased energy access, providing infrastructure and an opportunity for small industries to be developed.
Services	Engagement of the financial sector in the NAMA will help to improve access to financial services, particularly for private sector energy service providers (ESPs).
Human Resource Development	Jobs will be created through the establishment of private sector ESPs, rural productivity zones and income- generating activities enabled by energy access. The NAMA may also improve health by replacing dirty kerosene lighting and candles, which may also cause fires, with clean, efficient light bulbs.
Population	Lighting allows children to study in the evenings, facilitating their education. Educated girls have fewer children (Koppell, 2013), assisting in lowering the nation's population growth rate.
Housing	Energy access will result in improved housing conditions.
The Environment	The use of renewable energy will replace the use of fossil fuels, which contribute to air pollution and may contribute to soil and water pollution.
The Private Sector	The NAMA is designed to encourage private sector participation and growth.
Public Sector Institutions	The initial ESPs are envisaged to be public private partnerships (PPPs). Participation in PPPs will strengthen the public sector's involvement and skills in the energy sector.

The targets for outputs, outcomes and impacts will be divided into two categories, those relating to GHG emissions and those relating to SD, as will be detailed in Sections 5.3 and 5.4. Whether or not transformative change has occurred can be determined only at the end of the NAMA lifetime, once all of the NAMA MRV results can be analysed.

4.3 Greenhouse gas emission baseline and targets

4.3.1 GHG baseline emissions

Significant GHG emissions arise from the use of fossil fuels in the baseline scenario. The emission factors included in the CDM methodology AMS-I.L. were determined in a conservative manner through the application of emissions factors gathered from a variety of sources such as information from CDM projects, research and the Intergovernmental Panel on Climate Change (IPCC) (Pöyry, 2010).

As per AMS-I.L., the following are the baseline emission factors for each tranche of the annual amount of renewable electricity consumed per consumer during the crediting period:

a. for the first 55 kWh of renewable electricity consumed by each consumer the baseline emission factor is 6.8 tonnes of carbon dioxide per MWh (tCO_2/MWh);

b. for the facility consumption of more than 55 kWh but equal to or less than 250 kWh, the baseline emission factor is 1.3 (t CO_2/MWh) for the tranche between 55 and 250 kWh;

c. for the facility consumption beyond 250 kWh, the baseline emission factor is 1.0 (t CO_2/MWh) for the tranche beyond 250 kWh (UNFCCC, 2014).

The distinct emission factors for three levels of energy consumption take into consideration the baseline technologies used to meet basic household lighting energy needs (i.e. 15W bulbs x 5 hrs/day x 365 days = 55 kWh (Pöyry, 2010)); more extended household energy needs/micro enterprise needs (i.e. 100W fan or TV x 5 hrs/day x 365 days = 183 kWh (Pöyry, 2010)) or public buildings and/or small, medium and micro enterprises (SMMEs) which are assumed to use 250 kWh or more.

In light of the challenges for the NAMA actors of monitoring electricity generation per facility, a simplified and conservative baseline emission factor is chosen. Therefore, the baseline emission factor for Phase 1 ventures will be 1.0 t CO_2/MWh.

For Phase 2, the emission factor must be calculated based on the pre-existing six regional mini grids and the GBA grid. The Phase 2 model RE-DIS displaces the use of a diesel generator which powers the mini grid. In this case, the emission factor is 0.8 tCO_2/MWh, as seen in the approved standardized baseline (ASB) ***ASB0009 Standardized baseline: Emission factors for central grid and regional mini-grids of The Gambia, Version 01.0*** (UNFCCC 2015). The Phase 2 model RE-IPPs displaces electricity generated by the 5 thermal power plants connected to the GBA Grid. Therefore the emission factor for solar power is 0.697 tCO_2/MWh, also as per the ASB (UNFCCC 2015).

4.3.2 GHG emissions targets

Using the formulas given in Section 5.3.1 , the GHG emission targets for the 16 Phase 1 ventures are as seen in Table 5.

Table 5. GHG emissions targets for Phase 1 ventures

	Total for RE-MG Ventures	Total for RE-CEC Ventures	Total
Number of ventures	8	8	**16**
Power delivered/sold per annum (kWh/yr)	424,948	424,948	**849,895**
Power delivered/sold over venture lifetime - 15 yrs (kWh)	6,374,214	6,374,214	**12,748,428**
Annual GHG emissions reductions (tCO_2/yr)	425	425	**850**
GHG emissions reductions over venture lifetime - 15 yrs (tCO_2)	6,374	6,374	**12,748**

Again using the formulas given in Section 5.3.1 , the GHG emissions target for the Phase 2 ventures are as seen in Table 6.

Table 6. GHG emissions targets for Phase 2 ventures

	Total for RE-DIS	Total for RE-IPP	Total
Number of ventures	6	1	**7**
Power delivered/sold per annum (kWh/yr)	1,157,521	9,186,675	**10,344,196**
Power delivered/sold over venture lifetime - 15 yrs (kWh)	17,362,815	137,800,118	**155,162,933**
Annual average GHG emissions reductions (tCO_2/yr)	926	6,403	**7,329**
GHG emissions reductions over venture lifetime - 15 yrs (tCO_2)	13,890	96,047	**109,937**

4.4 Sustainable development baseline and targets

Energy access is a priority area in national development policies because it is a crucial component of sustainable development. The current baseline scenario affects sustainable development in two ways: first, because of the technologies that it currently uses; and second, because of a lack of reliable energy access.

To assess the baseline and to propose targets for sustainable development, the United Nations Development Programme (UNDP) SD Evaluation Tool (UNDP MDG Carbon, 2014) was utilized. Qualitative SD indicators for the NAMA are shown in Annex 2.

As further explained in Chapter 10 six key indicators will be quantitatively measured as SD proxies for Phase 1. The measurement of SD indicators will most likely need adjustment during Phase 2 of the NAMA; these adjustments will be made at a later time. The proxies and quantitative baselines and targets are shown in Table 7.

Table 7. Quantitative baseline and target impacts of proxy sustainable development indicators

Parameter	Baseline	Target for all 16 ventures
Number of operating SMMEs using energy from the ventures	0	320
Number of new jobs created through the ventures and through energy from the ventures (disaggregated into female and male)	0	320 jobs for females, 320 jobs for males
Number of hours of equipment use in the RPZ (hrs/yr)	0	3,112
Number of hectares irrigated using water pumped by electricity from the venture (ha/yr)	0	240

Parameter	Baseline	Target for all 16 ventures
Number of households connected to the mini grid which are consuming energy	0	800
Number of public buildings (e.g. schools, clinics) connected to the mini grid	0	20

4.5 Summary of NAMA Targets

A summary table of the NAMA targets for GHG emissions reductions and SD is shown in Table 8.

Table 8. Summary of NAMA targets

Target	Indicator
Reduce GHG emissions	Target emissions reductions of 12,748 tCO_2 from Phase 1 ventures over the 15 year lifetime of the venture and 109,937 tCO_2 from Phase 2 ventures over its 15 year lifetime.
Contribute to sustainable development	• 320 SMMEs created • 320 new jobs for females, 320 new jobs for males • 3,112 hours of equipment use per year in the RPZ • 240 ha irrigated • 800 households connected • 20 public buildings connected

5 NAMA Ventures

This chapter focuses on one of key elements of the NAMA, namely the establishment and sustainable operation of NAMA ventures, which are the physical actions leading to GHG emissions reductions, sustainable access to electricity, and the increased sustainable development of communities within The Gambia. The objectives of undertaking the ventures are to:

1. increase the level of renewable energy (electricity) in The Gambia, and contribute to the national long term target of increasing the share of renewable energy within the power generation sector;
2. reduce GHG emissions in the power generation sector, based on the business-as-usual and suppressed demand scenarios;
3. increase the access of The Gambia's rural population's to sustainable electricity;
4. encourage an increase in rural community income generation, and improve rural livelihoods; and
5. increase the level of private sector participation within the power sector in The Gambia.

This chapter first describes the two-phase implementation plan of the NAMA, including the NAMA ventures and the sustainability components to be established for the implementation and operation of the ventures. The presentation of the plan is followed by a phase-by-phase description of the specific venture types and financial requirements for planned implementation and operation of the ventures during the life of the NAMA. An explanation of the recommended business models, with a focus on private sector participation, for the ventures is then provided.[14]

5.1 Two-phase Implementation Plan

In order to understand the mechanisms and plan for the implementation of this NAMA, an implementation plan is required. The plan takes into account the current situation in The Gambia and the practical needs and requirements for governance, financing and establishment of ventures under the NAMA. The implementation pathway is divided into two phases based on the types of ventures being established under the NAMA. ***Phase 1*** establishes the first ventures under the NAMA, solar ***Renewable Energy Community Energy Centres*** (RE-CECs) and solar ***Renewable Energy Micro Grids*** (RE-MGs). Both of these venture types have as their backbone ***Rural Productivity Zones*** (RPZs), a key sustainability component of the NAMA.

Internationally, there exist many innovative rural electrification models which focus on providing energy access at a small scale, distributed household level (i.e. a private sector entity owns the solar panels on the house and sells the energy to the residents as a service to the consumer). However, for the Gambian NAMA, the focus is on providing energy both for residential and income-generating purposes. Therefore, the models presented in this design document will emphasize RPZs.

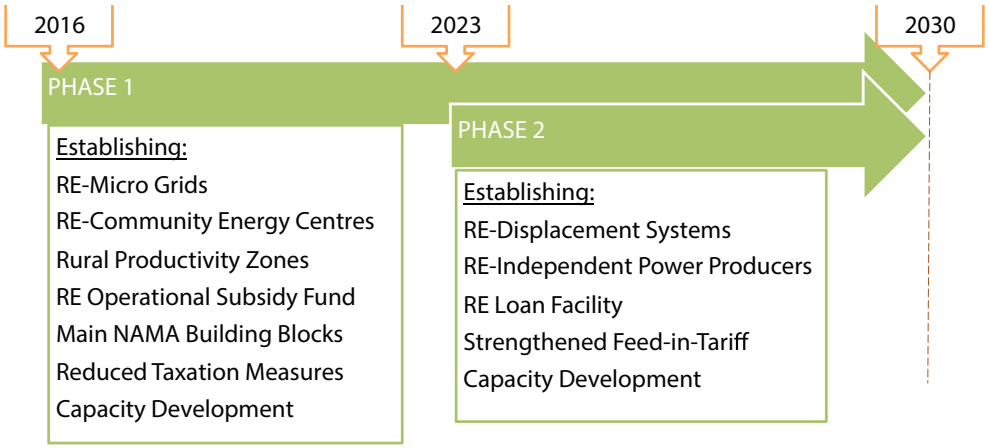
Phase 1 starts at the beginning of the NAMA and carries on throughout the 15-year NAMA lifetime (i.e. Years 0-15). The ventures established in Phase 1 are expected to continue in operation for 15 years from the date of commissioning. Some of the ventures will continue operating past the end of the NAMA's lifetime.

14 Some sections of this chapter are derived from the UNDP MDG Carbon paper entitled "Finance Structure and its Management for a Rural Electrification NAMA" (UNDP MDG Carbon, 2014a), with NAMA and country specific changes in context and content.

Phase 2 builds on the experience gained during Phase 1 and establishes two new venture types: renewable energy at existing rural mini grids, or ***Renewable Energy Displacement Systems*** (RE-DISs) and grid-connected ***Renewable Energy Independent Power Producers*** (RE-IPPs). It is noted that under this NAMA, there is nothing to prevent the implementation of additional ventures utilizing the components and mechanisms already established. However, the NAMA budget and finance take into account only the ventures defined in this chapter. Phase 2 is expected to begin in Year 7 and continue for eight years, until the end of the NAMA (i.e. Years 7–15). The ventures established in Phase 2 are expected to continue in operation for 15 years from the date of the commissioning. All of the Phase 2 ventures will continue operating past the end of the NAMA lifetime.\

Figure 12 indicates the main components which will be established under the NAMA, as well as the envisioned timeframe, if the NAMA begins implementation in 2016.

Figure 12. Two-phase implementation and components



PHASE 1 (years 0-15)

Phase 1 will result in the establishment of a supportive regulatory framework and finance mechanisms and in the physical implementation and operation of 16 ventures. The 16 ventures will comprise eight RE-CECs and eight RE-MGs. Phase 1 implementation is divided into two sub-phases.

- PHASE 1a: In the first years of Phase 1 of the NAMA, the focus is placed on implementing the main NAMA building blocks and establishing the 16 ventures (RE-MGs and RE-CECs) using a PPP business model. RPZs are introduced in both models as a means to increase community income generation and the long-term sustainability of the ventures. This sub-phase also includes the updating of the country's Renewable Energy Fund to bring it into alignment with the NAMA set-up, and the implementation of taxation reduction measures to ensure the long-term financial viability of the first venture types.
- PHASE 1b: In the remaining years of Phase 1 of the NAMA, the focus is placed on the operation of the 16 ventures, the operation of the RE Fund, and tapping the potential for expansion of consumer demand for the output of the 16 ventures. It may be possible to implement new RE-MG and RE-CEC ventures in addition to the planned 16 ventures but these would not be financed under the NAMA.

PHASE 2 (years 7 - 15)

Phase 2 builds on the pathway and results of Phase 1. Phase 2 aims to capitalize on the strengthened sectoral know-how and institutional capacity gained from the establishment under Phase 1 of the RE-MG and RE-CEC systems, the RE Fund and the mechanisms for regulation and finance. Phase 2 will expand renewable power generation capacity in the existing electricity grids (i.e. the national and regional grids) through the implementation of six RE-DISs and one RE-IPP. Phase 2, implementation, is not divided into sub-phases, but envisages several actions being taken in parallel. These actions comprise:

- establishing the six RE-DIS ventures at the existing regional grids under the existing operational companies;
- advancing the renewable energy loan facility (RE Loan Facility) of the RE Fund; the RE Loan Facility will serve as a financing mechanism allowing the private sector to gain access to debt capital through a revolving loan fund and/or loan credit programme;
- increasing the Feed-in-Tariff (FiT), in terms of rate and maximum capacity, for IPPs, to allow for specific tariffs which will encourage private actors to establish larger scale renewable power generation; and
- establishing one RE-IPP as a new power generator in the country.

Detail on the implementation pathway and process of Phase 2 can be found in Chapter 8, though it is noted that the main focus of this document is Phase 1. The design of Phase 2 will be elaborated in more detail during Phase 1.

5.2 Phase 1 Ventures: RE-CECs and RE-MGs

As indicated previously, Phase 1 focuses on two types of venture: Renewable Energy Community Energy Centres (RE-CECs) and Renewable Energy Micro-Grids (RE-MGs).

Phase 1 will provide renewable power generation and distribution systems to an expected 16 rural villages in The Gambia, providing green and sustainable access to electricity for approximately 8,500 people in rural areas. The villages selected to receive RE-CECs and RE-MGs ventures do not currently have any form of centralized electricity and are expected to be located in areas where it is cost prohibitive to extend the electricity grid. The new access to electricity is expected to contribute significantly to the livelihoods of the village populations. Both venture types will also include the installation and operation of the energy systems for an RPZ, thus creating high potential for increasing community income generation and facilitating sustainable development. Both ventures are expected to operate under the PPP business model (explained further in Section 6.4). RE-CECs will be installed in eight villages with a total installed capacity of approximately 370 kilowatt-peak (kWp); RE-MGs will be installed in the same number of villages with the same total installed capacity. All 16 of the ventures in Phase 1 will be established using a competitive bidding process for engineering, procurement and construction (EPC) and PPP partners.

The RE-CEC and RE-MG design components, including the RPZ model, will now be discussed. After describing the design components, further details about the RE-CEC and RE-MG ventures will be provided.

5.2.1 Design components

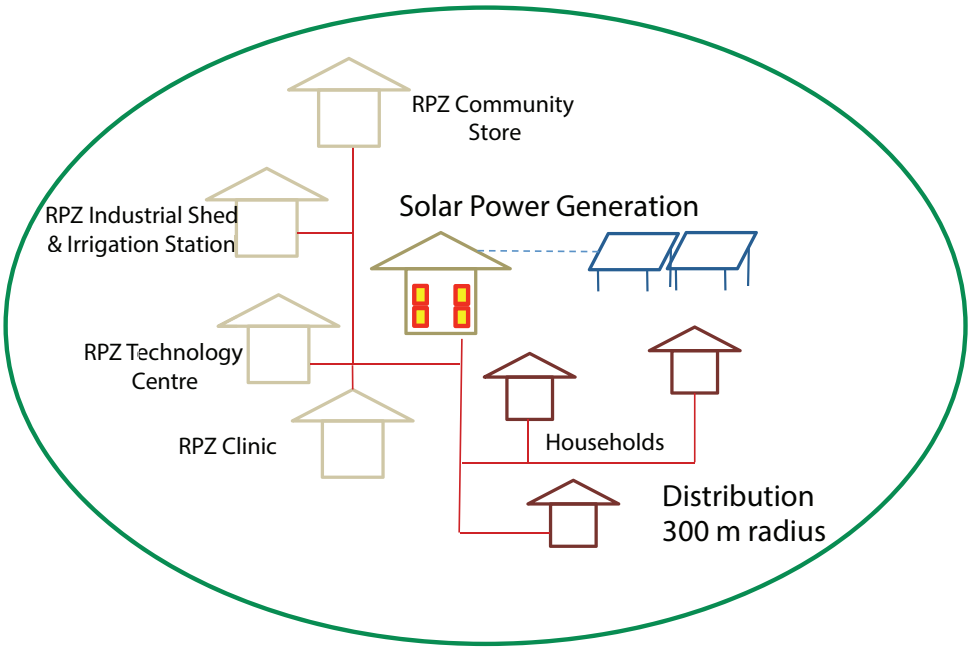
One of the core components of the RE-CEC and RE-MG ventures is the establishment of RPZs. The RPZ component arose from the paradigm of an integrated approach to sustainable rural development. The RPZ consists of setting up an energy

system and associated infrastructure in a rural area. The zone provides power for a range of activities that leads to income enhancement and social development. The resulting economic activity results in money being generated, which in part goes to paying for the investment, and operation and maintenance (O&M) of the energy system and infrastructure. The rest of the income generated is then used by the individual business owners in the community to support their livelihoods, with the aim of increasing the income level and standard of living in the community. In this manner, RPZs increase the ability of consumers to make consumer payments for electricity. In addition to powering economic activities, RPZs can potentially also power social infrastructure for healthcare and education, which builds a sense of ownership and supports local capacity to further the community's sustainable development (UNDP MDG Carbon, 2014a).

The RPZ builds on the concept of a multifunctional platform (MFP) which was introduced in The Gambia in 2013, with the support of UNDP. The MFP helps to create income-generating opportunities through the provision of affordable energy services. The MFP is powered by a diesel generator and in turn powers machines for milling, grinding and husking. Community members pay to use the equipment and a community association is charged with management of the MFP. Five MFPs were installed in 2013 in rural areas of The Gambia. Fifty one community members (10 men and 41 women) were trained in MFP electrical wiring, maintenance and operations (UNDP Gambia, 2014). The RPZ in the NAMA, as described below, offers a sustainably powered opportunity for income-generating activities.

For the purpose of illustrating the design of and quantifying the costs of a single RE-CEC or RE-MG venture, a theoretical design concept, including the core RPZ component, is provided in this sub-section. In this context, the difference between the design concepts of the RE-CECs and RE-MGs is the electricity distribution method: RE-CECs distribute electricity via individual batteries while RE-MGs distribute electricity via mini grids. Similar in both models are the central electricity demand, power generation equipment and core RPZ component. As seen in Figure 13 below, the design concept allows for meeting the basic electricity needs of a single rural village.

Figure 13. Design concept of the Phase 1 ventures



Details of the design concept components and the corresponding component characteristics can be seen in Table 9.

Table 9. Design concept components and characteristics

Component	Characteristics
Households	• Connection of 50 households and an approximate population of 410 persons, on the basis of a national average of 8.2 persons per household (Gambia Bureau of Statistics, 2013). • Estimated daily electricity demand of 0.8-–0.9 kWh per household. Demand results from daily operation of two compact fluorescent lights (CFLs) or light emitting diode (LED) lights, one radio and one mobile phone charger
1 Store	Estimated daily electricity demand of 6.7-7.0 kWh for one store. Demand results from daily operation of four CFLs/LED lights, two fans and three refrigerators/freezers.
1 Technology centre	Estimated daily electricity demand of 5.0 kWh for one community technology centre. Demand results from daily operation of two CFL/LED lights, one computer/printer, one mobile charger station and one LED TV and receiver.
1 Health clinic	Estimated daily electricity demand of 5.0 kWh for one community level health clinic. Demand results from daily operation of two CFL/LED lights, one computer/printer, one mobile charger station and basic clinic instruments.
1 Industrial shed	Estimated daily electricity demand of 70-73 kWh for one community industrial shed. Demand resulting from daily operation of four CFL/LED lights, 10 textile sewing machines, four 1-horsepower (hp) machine motors, and 2 one 1-hp food processing mills and one 7.5-hp water pump with the capacity to irrigate a maximum of 15 ha.
1 Solar powered generator system	A 46.2-kWp PV power generation system generating electricity to meet daytime and nighttime power demand. This system also includes the additional solar panels (capacity) needed to charge batteries to use at night.
1 Diesel generator set (genset)[15]	One diesel generator set of 2 8kW diesel generators providing 24-hour power backup
Parasitic load	Estimated parasitic daily load of 15–16 kWh for energy generation system, including batteries to store energy for nighttime power demand.
Electricity distribution	Electricity distribution through commercial batteries charged under the RE-CEC ventures or through a mini grid under the RE-MG ventures

As noted previously, the key difference between the RE-CEC and RE-MG design concepts is design of the electricity distribution system to households.

15 The choice of diesel backup is based on the fact that: 1) battery-only backup systems are commonly designed for 48 hours of backup power which, due the significant number of additional batteries needed to store 48 hours of power, leads to significant investment and operational cost increases; and 2) the likelihood of a total solar power generation system failure is very small since major equipment redundancy is built into the Design Concept.

The main technical information and impact of the Phase 1 ventures as per the design concept are shown in Table10 below. Each of the venture types is described in later sub-sections.

Table 10. Main technical and impact information of ventures under Phase 1

	Individual RE-MG Venture	Total for RE-MG Ventures	Individual RE-CEC Venture	Total for RE-CEC Ventures	Total
Number of ventures	1	8	1	8	**16**
Power delivered/sold per annum (kWh/yr)	3,541	28,330	3,541	28,330	**56,660**
Power delivered/sold - 15 yrs (kWh)	53,118	424,948	53,118	424,948	**849,895**
Annual irrigation potential ('000 m^3)	175	1,402	175	1,402	**2,803**
Annual irrigation potential (ha)	15	120	15	120	**240**

5.2.2 Renewable Energy Community Energy Centres

The RE-CEC model venture encourages the use of renewable electricity, via solar PV with a battery charge-distribution design option. The general physical characteristics and itemized cost of this design are described in Annex 1, while investment and O&M costs are discussed in Section 8 It should be stressed that the details presented in this design document address only the energy system and not such costs as the investment costs of community or industrial buildings or industrial equipment needed for the RPZ. These will need to be calculated at a later stage as they will vary widely depending on community resources and needs. The RE-CEC model venture requires a higher cost of investment than a diesel only model but has a slightly lower investment cost than the RE-MG model venture. The key investment costs in the RE-CEC model venture are related to the PV generation system and the batteries needed for distribution of electricity to consumers (households).

The RE-CEC model venture employs the concept of ***charging and distributing electricity via batteries supplied to households***. This means that household electricity use is based on a direct current (DC) electricity system, which may have future limitations because some larger appliances require an alternating current (AC) system. However, a DC electricity system can supply the basic foreseeable needs of households (i.e. lighting, radio and mobile phones). The battery rotation, or the rotation between spent and charged batteries, per household will be 2–4 days, given expected household electricity demand of 0.8-0.9 kWh per day. This means that deep-cycle 12 volt (v) batteries (>200 ampere-hour) will be needed for distribution as they can supply this magnitude of power demand. The batteries will be charged directly using DC current at an Energy Centre shop located at the power generation station. As these high capacity batteries are expensive, it is important to determine actual household power demand at the start of NAMA implementation: the number of batteries purchased should match the demand for batteries. Each household will be provided with a consumer DC lighting kit and 12v connector.

The RPZ facilities will have a three-phase AC power supply and metering/surge protection to power the electricity demand of various pieces of equipment in the RPZ. The concept assumes that household consumers will pick up loaned charged batteries and drop off spent batteries at Energy Centre shops located at the power generation station; consumers will pay for the electricity charge in each charged battery picked up.

It is noted that there is one real economic and social risk with RE-CECs: this is related to the method of determining the actual energy used in any given battery. As batteries are charged and depleted, over time they store and distribute less energy. It is also not practical to measure energy consumption via meters on batteries. Thus, consumer payment based on actual electricity consumed is problematic and a more levelized cost[16] basis is needed taking into account the battery exchange. (Section 8.4.2 contains more information on the recommended consumer payment option and method for RE-CECs.)

5.2.3 Renewable Energy Micro-Grids

The RE-MG model venture encourages a sustainable supply of renewable electricity through the use of a micro-grid with a solar PV generation design option. The general physical characteristics and itemized cost of this design are described in Annex 1; investment and O&M costs are discussed in Section 8 The details offered in this design document address only the energy system and not such costs as the investment costs of community or industry buildings or the industrial equipment needed for the RPZ. Again, these will need to be calculated at a later stage as they will vary widely depending on community resources and needs. The RE-MG is the more expensive of the two Phase 1 model ventures. The key investment costs in the RE-MG model venture are related to the PV generation system, the micro grid and consumer connections in the village.

As indicated previously, the RE-MG model venture will distribute electricity via a low voltage micro grid, which directly distributes single-phase AC power to each household. Each household will be provided with a consumer connection which includes a basic lighting kit and a ready-board with prepaid meter, surge protection and power sockets. The RPZ facilities will be provided with a three-phase AC power supply and metering/surge protection, to power the electricity demand of various pieces of equipment in the RPZ. Consumers will pay for residential electricity via prepaid metering and for electricity used at the RPZ facilities through consumption meters. (Section 8.4.2 contains more information on consumer payment options.)

5.3 Phase 2 Ventures: RE-DISs and RE-IPPs

Phase 2 of the NAMA builds on the technical/commercial know-how, capacities, sustainable development, and financial strengths developed in Phase 1. The full design and details for Phase 2 ventures will be developed during the first part of Phase 2. Phase 2 primarily consists of two types of ventures, as indicated previously: renewable energy at existing rural mini grids, or Renewable Energy Displacement Systems (RE-DISs); and a Renewable Energy Independent Power Producer (RE-IPP).

The RE-DIS model consists of the installation of six solar PV generation systems of 882 kWp at existing diesel power generation facilities and regional mini grids. The renewable energy generated will displace diesel generated power. The RE-IPP model includes the development of a system by an IPP which will build, own and operate a large-scale grid-connected solar PV power plant of 7 MWp capacity. The RE-DISs and RE-IPP are expected to provide green and sustainable power, generating approximately 1,200 and 9,200 MWh annually respectively.

16 Levelized cost refers to the average total cost to build and operate the solar power system over its lifetime divided by the total power output of the system over its lifetime.

Both the RE-DISs and RE-IPP will be financially viable in a fully developed power sector which has ready access to capital. However, as access to capital is limited in The Gambia, the establishment of a Renewable Energy Loan Facility and a strengthened feed-in tariff (FiT) are needed to make the ventures viable under national conditions. The establishment of these two components is part of Phase 2 and is described later, in Section 8

5.3.1 Renewable Energy at Existing Regional Mini Grids

One of the key goals for Phase 2 is generating solar power at the six existing regional mini grids in The Gambia. These RE-DIS ventures comprise solar PV systems adjacent to the existing diesel generation facilities; the ventures will utilize the existing power infrastructure in the facilities and mini grid. These ventures will displace the generation of diesel power only during the daytime so there will be no energy storage. An island-mode balancing system, balancing the optimum operating load of the diesel gensets with the solar power being generated based on instantaneous demand from the mini grid, is incorporated into the design of the venture model. This will ensure the most efficient operation of the diesel gensets during daytime and nighttime hours. The table below presents the current diesel generation capacity in The Gambia and potential additional solar generation capacity, as indicated by Flores (2010).

Table 11. Existing diesel capacity and potential solar generation capacity under Phase 2

Power / Cost	Bansang	Barra	Basse	Farafenni	Kuntaur	Kerewan
Installed (Diesel) (kW)	600	460	1,400	1,400	180	220
Potential (Solar) (kWp)	130	90	310	270	37	45
Displacement (kWh/yr)	183,000	127,000	436,000	380,000	52,000	63,000

Table 11 illustrates the existing diesel generation capacity of 4.26 MW at the six mini grids and the potential for solar power displacement of 882 kWp capacity (Flores, 2010).

5.3.2 Renewable Energy Independent Power Producers

The other venture for Phase 2 is the establishment of one RE-IPP under a private sector business model. In this venture, a private sector company will invest in, build, own, and operate one large solar power station. One single large solar power installation is chosen as the best option because private sector investors are often more willing to finance a single large project than a pool of smaller ones.

A renewable energy master plan focusing on The Gambia, by Flores (2010), indicated that solar generation capacity of 7 MWp could couple with the existing GBA grid, if balancing were implemented. Therefore, a single IPP of 7 MWp capacity is envisaged under Phase 2 of this NAMA. This single 7 MWp solar power generation plant could deliver on average 9,200 MWh per year (over 15 years of operation) to the GBA grid.

5.4 Venture Business Models for Rural Electrification and Grid Electrification

There are numerous options for business models for rural electrification with solar renewable energy involving renewable energy electricity generation and distribution (Alliance for Rural Electrification, 2011). Most of these business models revolve around a central entity, referred to in this NAMA as energy service providers (ESPs).

This section will now give an overview of ESP business models recommended for the NAMA ventures. In the case of the NAMA ventures, ESPs are legal or social entities consisting of an individual rural community cooperative, a public or semi-public utility company, or purely private companies. For the purpose of this NAMA, ESPs are encouraged to be legally established entities in order to allow for transparent financial transactions and accountability at the venture level.

In the case of rural electrification in developing countries, there is a general dilemma: the electricity tariff is often much higher than the cost that rural community members can afford. This dilemma must be taken into account in business models and venture finance, in terms of its implications on short- and long-term risks and sustainability.

UNDP MDG Carbon (2014b) highlights the private sector based business model for rural electrification and grid electrification. In this model, private sectors ESPs invest in and/or operate the systems on a long-term basis. This model faces resistance due to perceived and real risks leading to what are often referred to as market failures in the power sector. Among other factors, these market failures arise from the lack of:

- established revenue mechanisms for renewable energy;
- guarantee mechanisms for payment for services;
- financing from the banking sector;
- local technical know-how; and
- political stability, in some cases.

In short, the widespread implementation of a fully private sector based business model can only be viable once at least the majority of the perceived and real sources of market failures no longer exist. The establishment and functionality of enabling mechanisms to overcome these sources of market failure eventually encourage viable private sector activities in the energy sector. Such private sector engagement is one of the main goals of this NAMA. These enabling mechanisms require a significant level of sectoral and institutional development, economic activity and individual rural income generation.

For the purpose of this NAMA, there are two potential business models which are applicable to the RE-CEC and RE-MG ventures; each model requires direct financing by international development partners and multilateral institutions. The PPP business model helps lead to the development of new rural electrification enabling mechanisms involving the private sector, and is further described in Section 6.4.1 . The PPP business model is the preferred option for the RE-CECs and RE-MGs and it will be the main focus of Phase 1 of this NAMA. It is noted that there is an alternative business model for the RE-CECs and RE-MGs referred to as community owned and operated (COO) model. The COO business model is not addressed further in this NAMA as it is deemed to have a lower level of sustainability than the PPP.[17] Challenges of the COO model may include lack of: community awareness, buy-in,

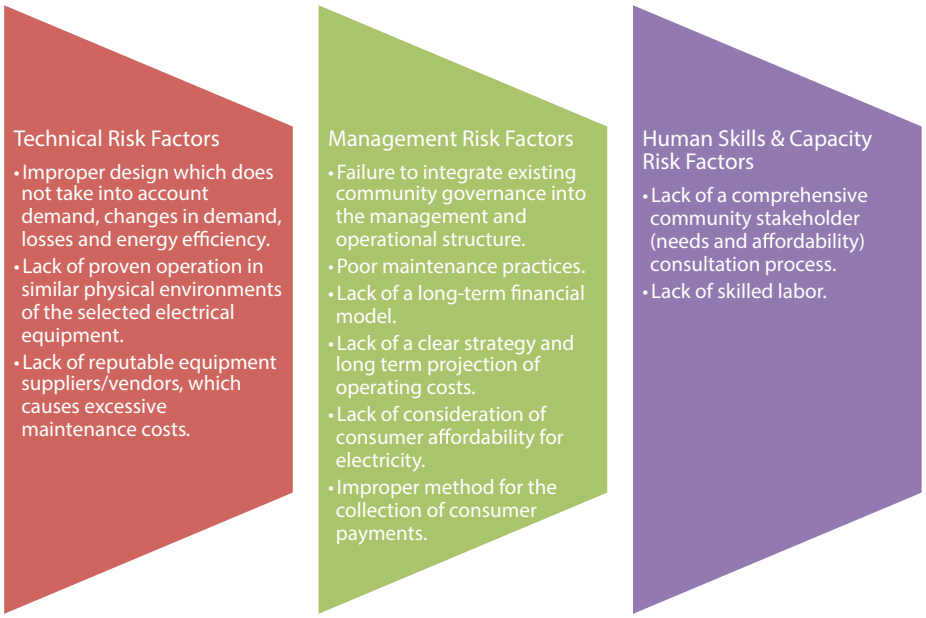
17 For more information on the COO model and its differences from the PPP model, see UNDP MDG Carbon, 2014b.

technical skills, business development and operation skills, and financing. This means that the application of a COO model requires significant capacity development support in addition to traditional project finance support (Alliance for Rural Electrification, 2011).

Finally, is it expected that a full private sector (FPS) business model is the main focus of Phase 2 of this NAMA, to be applied to the RE-IPP ventures. (For further details on the FPS model, see Section 6.4.2 .

Several sources in the literature have highlighted risk factors relating to operations and finance affecting business models in rural electrification and new grid electrification. These must be taken into account when designing and implementing business models in the national context. These risk factors are shown in Figure 14.

Figure 14. Risk factors



Sources: UNDP MDG Carbon, 2014b; Alliance for Rural Electrification, 2011.

5.4.1 Public Private Partnership

The PPP business model is the preferred model for the RE-CEC and RE-MG ventures under this NAMA. A PPP business model results in the RE-MGs and RE-CECs being operated as private businesses. The model is established in rural communities where the private sector is willing to operate and where the public partner (e.g. the community or the state) wishes a more experienced party to handle all ESP activities. The businesses in the RPZs are expected also to be run by private sector companies, individuals or community organizations. The ESP will ensure that the business owner in the RPZ has reliable access to electricity and that the business owner is in charge of running the business (e.g. shop, industrial shed).

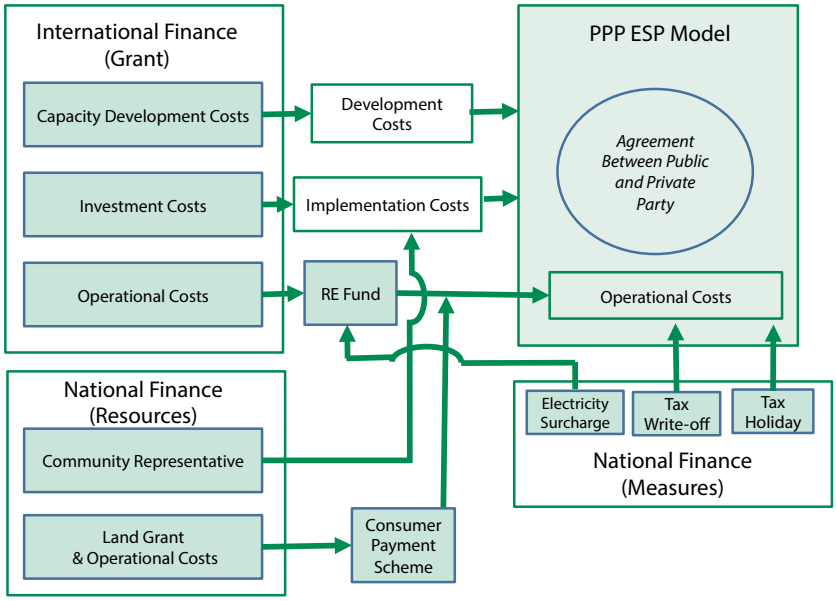
Under a PPP, the community or state partner plays one role while the private sector partner plays another:

- the public partner has title/ownership of the assets (the generation and distribution system); while
- the private party operates, maintains and manages the energy services.

Facilitating the development of PPPs is one of the main tasks of international NAMA advisers embedded in the NAMA Coordinating Authority.

The general concept of financing the ventures under a PPP business model, followed by a description of each financial component, is shown in Figure 15.

Figure 15. Illustrative financial flow diagram for PPP venture business model



The ***national finance (resources)*** contribution under the proposed PPP ESP business model consists of the public partner providing two types of in-kind resource contribution during the development phase.

1. The first of the in-kind contributions is a local public partner representative who will work for the community and with external consultants during the development phase of the venture. The scope of activities for the representative during this phase will be to establish community buy-in, analyse technical and financial feasibility, and establish agreements with the Government and development partners (with expertise provided by the international adviser for NAMA capacity-building).
2. The second in-kind contribution from the public partner is the provision of land for the power generation system, rights-of-way for the distribution system, and land for any additional facilities directly or indirectly supported under the venture (e.g. for RPZ units such as light industry workshops, shops, a health clinic, a water pumping station and a technology centre).

The national level ***operational finance*** contribution will be provided via participation in the ***pre-payment Consumer Payment Scheme*** (see Section 8.4.2), where it is expected that consumer based revenues will be close to national

consumer prices for electricity (estimated at US$0.20 / kWh in this NAMA). National Finance will also include the ***national contribution into the RE Fund*** (see Chapter 9) which is managed by the Trustee (see International Finance below).

The ***national finance (measures)*** contribution will consist of cost reduction measures (see Chapter 9) for the ESP which will include tax holidays and write-offs and an electricity surcharge which will help to provide national financial contributions to the RE Fund.

To summarize, the national finance contributions will come in the form of both direct and in-direct monetary resources. Direct resources to be provided include staff, land and financial contributions (including consumer payments and national government payments to the RE Fund). In-direct monetary resources, or measures, include tax holidays. Full details are provided in Chapter 9.

International finance is controlled and managed by the Trustee, and is expected to fund a significant portion of the Phase 1 costs. International finance is expected to cover all of the ***Investment Costs*** for the ventures' implementation through direct grant finance (paid directly to the EPC contractor or technology supplier). International finance also consists of direct grant finance to the capacity development costs of the NAMA and ventures, including but not limited to the costs of:

- project feasibility and approval;
- engineering supervision of installation and commissioning;
- oversight of O&M training, including community skills building;
- oversight of community cooperative business development and training; and
- establishing businesses and developing and establishing the consumer payment scheme (PPP business model implementation).

A key component of operational revenues in the PPP venture business model is that international finance will provide grants to the RE Fund, as defined and agreed by the development partner(s) and the Government of The Gambia. The RE Fund will be co-financed by national finance and have as its objective the provision of funds to fill the annual gap between the net operating costs of a venture and the revenues received through the consumer payment scheme. The RE Fund is further described in Section 8.5.2 .

In terms of longer-term sustainability, after the 15 year life cycle costs have been covered by NAMA finance, it is hoped that each venture will have achieved a level of sustainability within the national context. Indicators of sustainability include:

- a RPZ has been created, allowing the community to generate new revenue streams and income, employment and increased demand which will reduce unit costs and the net cost of electricity per household;
- cost of electricity produced by the venture for the community is lower than the alternatives; and
- the national Government has the ability to finance all of the RE Fund either as a stand-alone fund or rolled into a matured national tariff scheme.

5.4.2 The Full Private Sector (FPS) model

The FPS business model is to be applied to the RE-DIS and RE-IPP venture model and is applicable only in Phase 2. Under a FPS model, the private company will invest equity and take on debt to cover both the development and implementation costs of an RE-IPP venture. It is expected that all equity will come from the private sector, but that debt will need to be raised through the Renewable Energy Loan Facility as described in Section 8.5.3 . In the RE-IPP venture, the private company will own the generation and distribution assets of the venture, but may enter into a long-term land concession agreement (of at least 25 years) with the national or local government. For the RE-IPP to be viable, the national Government must grant a full concession to generate and distribute power into the grid, and the IPP must be able to secure payment for the electricity delivered. The private company has the obligation to operate, maintain, and manage the generation and distribution assets under such a concession. The private company as well has the responsibility for monitoring and reporting, and regulatory compliance (UNDP MDG Carbon, 2014b).

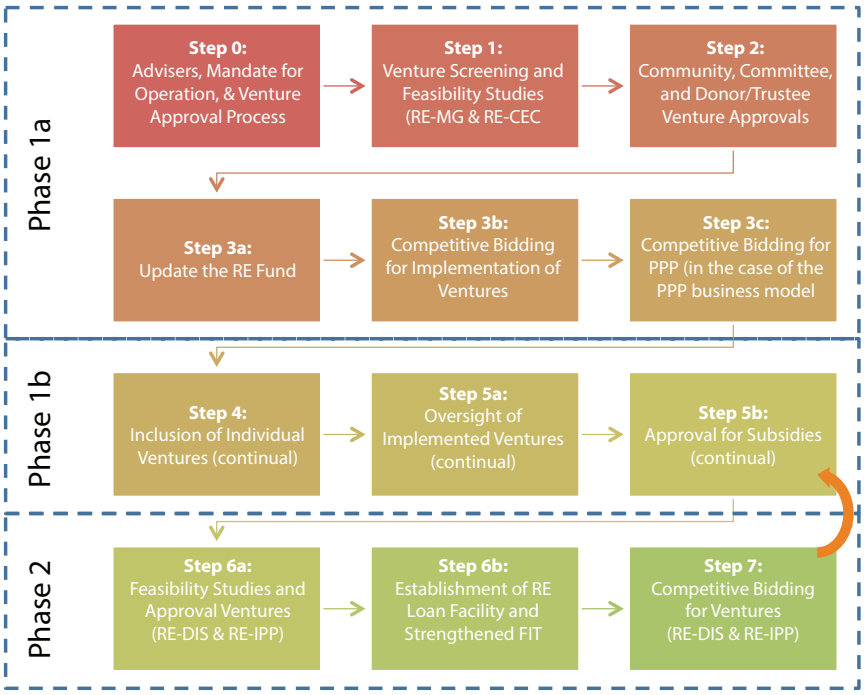
The concession agreement between the Government and the private sector company should include a Power Purchase Agreement (PPA) with a financially viable FiT which allows for a fair internal rate of return (IRR) during the concession period. The private partner should also benefit from the national finance cost reduction measures (e.g. tax reductions) and any rural development and RE subsidies.

The private company should be selected through a tender process, or evaluated against a cost/quality benchmark, to ensure competitive costs and technical ability. This evaluation will take into account the experience gained in Phase 1. The eligibility criteria and tender for the private partner will be determined in a national context during the implementation phase of the NAMA, by the NAMA Coordinating Authority and NAMA Venture Approval Expert Group.

5.5 Process for Venture Approval, Implementation, Operation and Finance

It is critical during the inception and development phase of a NAMA to consider the process and budgeting for venture approval, implementation, operation and finance. It is important to address and define the processes needed to ensure quality and proper management of the NAMA and its ventures. In this context, the following set-up is recommended as a pathway to ensure sustainable venture implementation and operation under Phases 1 and 2. Figure 16 shows this pathway followed by a general explanation of the processes and components.

Figure 16. Step by step process for venture approval, implementation, operation and financing[a]



[a]Derived from UNDP MDG Carbon, 2014b, and customized for this NAMA.

PHASE 1

The primary objective of Phase 1 is to establish a sustainable regulatory framework, finance mechanisms and the physical RE-MGs and RE-CECs. The pathway for Phase 1 is divided into two sub-phases.

- PHASE 1a: In the first years of Phase 1 of the NAMA, the focus will be on implementing the main building blocks, and establishing RE-CEC and RE-MG ventures under the PPP business model.
- PHASE 1b: The focus will be on the operation of established ventures, adding to or expanding the RE-CEC and RE-MG ventures, and strengthening private sector involvement in the power sector through the operation of the ESPs.

The coordination of the processes of venture approval, implementation and finance will be managed by the NAMA Coordinating Authority, an appointed NAMA Venture Approval Expert Group and the Trustee. Their roles will be well-defined in a mandate from the National Government which takes into account considerations of international partners.

Phase 2 has as its primary objective the expansion of renewable power generation capacity in the existing electricity grids (mini grids and the main grid) through the use of RE-DISs and RE-IPPs.

The ongoing Measurement, Reporting and Verification (MRV) of the activities in Phases 1 and 2 allows for continuous improvement and changes during the establishment and operation of the NAMA. While the overall responsibility for performing monitoring and evaluation is under the NAMA Coordinating Authority, oversight and implementation of changes will fall under the mandate of the NAMA Approval Committee to ensure that improvements are made in a timely manner. Further details about the NAMA institutions are provided in Section 9.1.1 .

6 Capacity Development

In order for the financial mechanisms, and the regulatory/policy measures, of the NAMA to be successfully implemented, capacity development needs must be met through the provision of capacity-building activities. The majority of these activities will occur in Phase 1; it is expected that, by Phase 2, only a limited number of capacity-building activities will be required. Therefore, the focus of this sub-section is on Phase 1, followed by a mention of Phase 2 activities.

6.1 Phase 1

6.1.1 Institutional

There are a number of capacity development activities which will occur as part of the NAMA. The categories of institutional capacity development activities include revision of regulations and policies, document templates and staffing.

6.1.1.1 Revision of Regulations and Policies

As detailed in Chapter 4 the successful implementation of the NAMA requires the revision of a number of national laws, frameworks and policies. The revision of laws such as the GIEPA Act should be supported by a lawyer who will be contracted. The revision of policies and guidelines can be supported by a consultant. Following the drafting of the revised laws, frameworks, policies and guidelines, stakeholder workshops (up to four) should be held with the relevant stakeholders. The regulatory documents will then be updated in accordance with stakeholder comments and be approved by the relevant government institutions

6.1.1.2 Document Templates

Before the implementation of ventures, a number of templates will need to be drafted to ensure a standardized process. Contractual templates, such as contracts between the public and private partners in a PPP, should be drafted by a lawyer. Other templates, such as a venture application form can be drafted by the international adviser and national NAMA staff. Importantly, MRV templates should be drafted. These MRV templates include:

- data collection templates for ESP reporting to the NAMA Coordinating Authority;
- financial templates for Trustee reporting to the NAMA Coordinating Authority; and
- an overview template for the NAMA Coordinating Authority reporting to:
  - the NAMA Approval Committee
  - Domestic Financiers
  - the Trustee.

6.1.1.3 Staffing

The final component of institutional capacity development is staffing. This includes the hiring and employment of the NAMA Coordinating Authority staff, comprising one international adviser and three national staff members. Capacity development costs also include additional expenses to meet staff needs (i.e. office supplies, communications, international and national travel).

In addition to the NAMA Coordinating Authority staff, the members of the Venture Approval Expert Group must be appointed. Approximately eight Venture Approval Export Group meetings will be held in Phase 1; each meeting will last for approximately three days. There will be four meetings held in Year 1 and four in Year 2. In Phase 2, there will be two meetings held, one in Year 10 and one in Year 11. Costs of the meetings include a stipend for participants as well as room rental costs.

6.1.2 Training

Training is a core component of capacity development. It will be provided to four groups of stakeholders:

- NAMA Coordinating Authority staff
- the Trustee and Financial Institutions
- the public sector
- the private sector.

6.1.2.1 NAMA Coordinating Authority Staff

The national staff hired for the NAMA Coordinating Authority is expected, at the time of hiring, to possess at least a basic level of knowledge about climate change, renewable energy and energy access. However, the staff will be neither required nor expected to possess in-depth knowledge about the challenges of rural electrification, the intricacies of NAMAs and how to develop and maintain proper MRV systems. Therefore, five training sessions will be provided over the course of the first two years of the NAMA. These training sessions may be led by the international adviser or by external sources such as rural electrification experts.

6.1.2.2 Trustee and Financial Institutions

The amount of training required for the Trustee depends on whether the Trustee is a local organization with limited NAMA and rural electrification knowledge, or an international organization which already possesses knowledge of the key areas.

For local Trustees, significantly more capacity development is required. The provision of training for the Trustee provides an opportunity also to train staff of those financial institutions which will be providing debt to the ESPs.

There will be six workshops held. These workshops will include the following topics:

- introduction to NAMAs and NAMA opportunities
- rural electrification and renewable energy (2 sessions)

- innovative financial mechanisms
- MRV systems
- sharing of lessons learned (years 2 and 3).

If the Trustee is an international institution with capacity in NAMAs and rural electrification, the above six workshops will still be held, to build the capacity of financial institutions but the focus for the NAMA Trustee will be rural electrification and renewable energy in the NAMA, MRV systems and the sharing of lessons learned.

6.1.2.3 PPP partners

The next set of trainings is for both private sector and public sector representatives. As PPPs are developed, the goal is to have private and public sector actors develop together, facilitating their collaboration. Eight trainings will be held for PPP partners over three years. The eight trainings will cover a range of topics similar to those covered in the workshops for financial institutions but will focus on their application to the development of ventures. The regulatory incentives developed as part of the NAMA will also be presented to the partners.

6.1.2.4 Private sector

In addition to the private sector training provided in conjunction with public participants, five private sector ESP-specific training sessions will be held. This training will include topics such as:

- business plan writing
- marketing
- taxation
- women entrepreneurs
- financing
- training on infrastructure protection for the renewable energy facility to increase the climate resilience of the community.

Ongoing support via a help desk will be provided to the private sector throughout the lifetime of the NAMA.

Training will also be provided to developers of SMMEs in the RPZs. At least two training workshops will be held in each of the 16 RPZs, for a total of 32 training sessions. One training will be held in each RPZ in the first year of operation, a second will be held in the following year. These trainings will help to kick-start the development of SMMEs in the RPZs. They will cover topics such as:

- RPZ introduction
- business plan writing
- health and safety
- the empowerment of women
- basic skills training.

Private sector suppliers of equipment for the ventures will also be provided with two trainings, one in Year 1 and another in Year 2. These trainings will provide an introduction to the NAMA, the incentives included in the NAMA design and the opportunities provided by the NAMA.

6.1.3 Marketing

The marketing of the NAMA is the final component of capacity development. The marketing will be done through different forms of communication with stakeholders. These forms include:

- a NAMA brief created by a designer
- a NAMA launch event with a wide variety of stakeholders invited
- a radio campaign using a NAMA marketing segment
- sixteen meetings with community members (one meeting per community where the Phase 1 ventures will be developed)
- a NAMA website (design and maintenance).

6.2 Phase 2

By the start of Phase 2, the majority of the capacity development needs should be met and the private sector should be fully engaged in rural electrification. Therefore, the bulk of the capacity development costs in Phase 2 arise from maintaining the NAMA Coordinating Agency and its staff. In addition to these institutional costs, a limited number of funds will be available for continued help desk meetings, meetings with communities where the Phase 2 ventures will be located and maintenance of the NAMA website.

7 NAMA Financial Requirements and Mechanisms

This chapter will provide details about the financial requirements for the NAMA and the financial mechanisms which will be used in the NAMA. First, the financial requirements for Phase 1 and Phase 2 ventures will be described. Next, the financial requirements for capacity development will be provided. Then, the mechanisms for national and international finance will be described. Finally, indicative NAMA finance needs and the financing provided via the different mechanisms will be detailed. It should be noted that costs are described in light of the 15 year lifetime of the NAMA, not the lifetime of the ventures, which may extend beyond the NAMA lifetime.

7.1 Financial Requirements for Ventures

Table 12 presents the envisaged costs of the Phase 1 model ventures under a PPP business model, over the 15 year life cycle of the NAMA, broken down into investment and O&M costs. Investment costs are indicative, and based on nominal costs of end suppliers and expected country labour costs in The Gambia estimated in 2014. Prices/ costs may change due to changes in exchange rates and raw material costs. The indicative investment costs do not include financing costs, taxes and duties, and variations due to specific country conditions, or inflation. O&M costs are annualized taking into account periodic replacement of required equipment. The cost of investment in the RPZ community technology centre, cooperative, and industrial sheds and equipment are not included.

The breakdown of which mechanisms will be used and whether the finance will come from national or international sources can be found in Section 8.6.

Table 12 also presents the envisaged costs of the Phase 2 ventures under a FPS business model over the 15 year lifetime of the NAMA. The estimated net unit cost of the RE-DIS ventures throughout the 15 year venture lifetime is US$0.68/kWh for all six ventures. This is higher than the projected cost of US$0.50/kWh[18]of diesel power generation over 15 years, and thus a subsidy will be needed to make the investment financially viable.

The estimated net unit cost of the RE-IPP venture throughout the 15 year venture lifetime is US$0.29/kWh. This is lower than the projected cost of US$0.50/kWh[19] for diesel power generation over 15 years. There is therefore no need for an additional subsidy, as long as the FiT is viably priced at that time.

Given the complexity of financing and establishing a solar power generation capacity under the FPS business model (existing business and IPP), a general commercial finance model is used and net (non-levelized) unit costs are derived for the solar power generation plants. The costs are based on 2014 costs and an 18 per cent IRR on equity for private investors, and exclude all taxes. The investment and O&M costs include development, finance, EPC and operating costs.

18 Assumes a diesel price of US$1.26/litre, nominal genset efficiency and a 3 per cent annual price increase over 15 years.
19 Assumes a diesel price of US$1.26/litre, nominal genset efficiency and a 3 per cent annual price increase over 15 years.

Table 12. Main financial information on ventures

Phase 1	Year															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Cumulative number RE-CEC	0	2	6	8	8	8	8	8	8	8	8	8	8	8	8	8
Cumulative number RE-MG	0	2	6	8	8	8	8	8	8	8	8	8	8	8	8	8
Venture Investment (US$ million)	—	2,465	4,931	2,465	—	—	—	—	—	—	—	—	—	—	—	9,861
Venture O&M Costs (US$ million)	—	252	682	897	897	897	897	897	897	897	897	897	897	897	897	11,701
Phase 2	**Year**															
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**Total**
Cumulative Number of RE-DISs	—	—	—	—	—	—	—	3	6	6	6	6	6	6	6	6
Cumulative Number of RE-IPPs	—	—	—	—	—	—	—	—	—	—	1	1	1	1	1	1
Venture Investment (US$million)	—	—	—	—	—	—	—	1,910	1,910	—	14,926	—	—	—	—	18,747
Venture O&M Costs (US$ million)	—	—	—	—	—	—	—	394	787	787	3,451	3,451	3,451	3,451	3,451	19,224

7.2 Financial Requirements for Capacity Development

The most significant expense for capacity development will come in the first two years of the NAMA. For this reason, Table 13 shows the capacity development costs during the first two years separately, as well as the costs over the lifetime of the NAMA. The costs of capacity development will be fully met by international finance. Office space will be provided from national resources.

Table 13. Capacity development costs (US$ million)

Activity	Years 1 & 2 total	15 year total
Institutional activities	500	2,609
Training activities	33	44
Marketing activities	7	18
Contingencies	81	401
Total capacity development	**621**	**3,071**

7.3 National and International Finance: Sources and Distribution Mechanisms

7.3.1 The Distinction between National and International Finance[20]

In the context of this NAMA, the main focus of the design of the financial mechanisms is constructing a reliable and transparent structure of financial flows and a system which serves to enforce the measures needed to ensure the sustainable use of funds. The NAMA is a co-financed effort between the Government of The Gambia and its International Support Partners, and there must be proper systems in place to ensure that all funds are accounted for. In establishing these financial management systems, it is important to recognize the distinction between national and international finance.

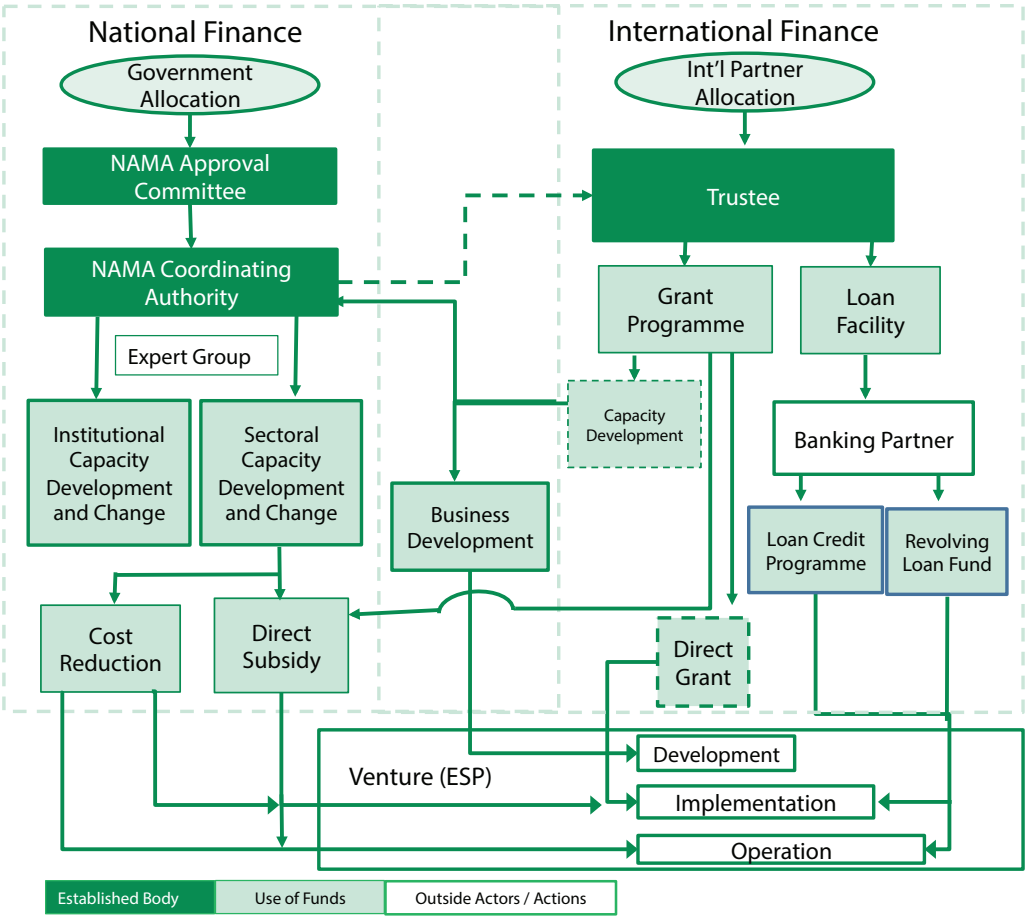
National Finance: For the purpose of this NAMA, national finance is defined as financial flows or capital which originates from the national government. Much of this capital is linked directly to policies and actions relating to the energy sector, the business sector, and rural development. These policies and actions may already exist or they may need to be devised and implemented as part of NAMA. In this NAMA, national finance includes flows of capital which take the form of consumer payments, operational subsidies from Government, and cost reduction measures such as waived taxation. This capital may also contribute to funding the direct operation of the NAMA Approval Committee and NAMA Coordinating Authority, as well as to capacity development under the NAMA, often on an in-kind basis.

International Finance: International finance is defined as financial flows or capital which originates from the International Support Partners consisting of multilateral financing institutions and/or multilateral/bilateral programmes). Much of this capital is linked directly to capacity development actions, direct investment grants, direct operational subsidies, and loan schemes. International finance which goes directly to venture entities (through subsidies or grants) or for capacity development will be managed by a single Trustee charged with oversight of the funds. Approval of payments and disbursements will come from the NAMA Coordinating Authority.

For each of the types of finance, there are two components: 1) management and governance of capital; and 2) disbursement of funds. Figure 17 offers a flow chart for the proposed financial governance and disbursement structure.

20 Derived from UNDP MDG Carbon, 2014b.

Figure 17. Flow chart of National and International Finance[a]



[a] *Figure derived from UNDP MDG Carbon, 2014a.*

Since the NAMA is based on the principle of results based financing (RBF), it is very important that the expectations of the NAMA stakeholders and their outputs/impacts are clearly and realistically defined, with flexibility built in, at the start of the different NAMA phases/sub-phases.

The financial mechanisms of this NAMA will now be detailed. Two activities are directly financed from national funds: these are government allocations and cost reduction measures (reduced national taxation). The remaining financial mechanisms are funded from international finance, or a combination of national and international finance. These mechanisms include direct investment grants, loans provided via the RE Loan Facility and direct subsidy measures provided via the RE Fund.

7.4 National Finance Sources

7.4.1 Government Allocations

These are funds for NAMA activities which originate from government and regulatory activities. The funds may be direct capital raised from taxes/surcharges or national budget items allocated for specific purposes (such as the Renewable Energy Fund, see below), in-kind contributions from ministry and agency activities covered under their budgets, or cost saving actions which reduce government revenues (e.g. reduced national taxation measures). These funds can be considered as NAMA co-investments from the Government of The Gambia. The source and context of these funds are described in later sections of this chapter. Government allocations may also include infrastructure, such as offices for the NAMA governing bodies.

Cost Reduction Measures (Reduced National Taxation) A key component of the national finance contribution is the enactment of special measures to reduce national taxation for rural electrification and renewable energy power generation. These measures are proposed as a means to reduce the cost of investment and operation of PPPs, IPPs and existing facilities. Taxation on imported equipment and local equipment and services, and taxation on services provided by the ESP, could significantly increase the investment costs for Phases 1 and 2. Designing and setting up the reduced national taxation measures will be one of the first tasks of the NAMA Coordinating Authority and will include comprehensive consultation and coordination with several national entities in The Gambia.

As was mentioned in Chapter 4 the GIEPA Act already offers a number of relevant taxation measures but there is still room for expansion of the incentives in the act.

Summarizing the previously mentioned recommended taxation measures, they include:

- extension of the ***sales tax waiver on imports*** to apply for one year from the commissioning of an installation worth at least US$250,000; ***Tax holidays*** in respect of an enterprise's corporate or turnover tax, depreciation allowances, withholding tax or dividend, should be for priority sectors extended to a period of 15 years, or five years twice renewable. For priority areas, the eight year tax holiday should be extended to 15 years or should be once renewable for a further eight years ;
- Approved PPPs should be eligible for the above tax measures, where the total investment for the PPP ventures exceeds US$250,000.

7.4.2 Consumer Payment Schemes

There are different characteristics and requirements relating to revenues from consumer payments under Phases 1 and 2. The most critical impact of revenues from consumer payments is in Phase 1, on the business models for RE-CECs and RE-MGs. The business models for RE-DISs and RE-IPP under Phase 2 will not establish new methods of direct consumer payments. Rather, the Phase 2 models will use the consumer payment mechanisms already in place for the existing mini grids. The IPP, however, is expected to enter into a PPA with the electricity distributor or government agency, and thus there will be no direct consumer payments to the private sector company; payment will come from the national government.

Consumer payment for electricity is crucial in terms of sustainability for any energy related venture and especially a RE-CEC and RE-MG. A Consumer Payment Scheme ensures some form of payment for services by the end user and encourages a sense of ownership and responsibility among consumers. It also ensures the accountability of the ESP for

delivering a reliable energy supply to the community. There can be three primary forms of Consumer Payment Schemes for the types of ventures. The advantages and disadvantages of these different forms are briefly explained in Table 14.

Table 14: Advantages and disadvantages of different consumer payment schemes

Consumer Payment Scheme	Advantage	Disadvantage
Fixed Price	• Easy to administer at the community level and transparent in terms of cost per consumer • Easy to set fixed rates based on consumer class (e.g. households, businesses) based on weighted consumption • No need for metering	• Does not account for actual consumption for each consumer, and could lead to social conflicts as some consumers will use more electricity than others • Encourages less efficient energy consumption, and may require community-wide control (e.g. time limits on energy supply)
Consumption-based Price	• Encourages efficient energy consumption • Less social conflict	• Additional O&M equipment and labour costs due to the need for meter reading
Pre-payment	• Encourages efficient energy consumption • Less social conflict • Allows for innovative new payment methods • Easier to "top-up" to what the consumer can afford • Less payment risk for energy providers	• Minimal but additional O&M costs (for equipment and mobile transactions) due to the need to maintain a prepayment system

Source: UNDP MDG Carbon, 2014a.

For the RE-CEC and RE-MG ventures, it is recommended the pre-payment consumer payment scheme be used. For the RE-CEC ventures, pre-payment will take the form of payment for each fully charged battery picked up by the consumer at the village energy centre(s). The pre-payment (for each fully charged battery) is equal to the net cost of total power consumed in charging and the operational costs of the PPP divided by the projected number of batteries exchanged. The consumer then in essence pays for their consumption of electricity supplied by the batteries. Consumers will need to leave a deposit for the batteries to help ensure that the spent batteries are returned. There is a social risk in the model insofar as individual batteries will have different levels of power stored when fully charged, and when dropped off. However, the risks and losses under such a consumer payment scheme will be distributed across the community over time, and this must be accepted by the community.

For the RE-MG ventures, pre-payment will take the form of actual energy consumption, where the right to use *x* kWh is paid for before the energy is used under a "top-up" service. Under this pre-payment consumer payment scheme, pre-pay energy meters are installed at each individual consumer unit and consumers purchase fixed amounts of electricity (in kWh) at a fixed price (US$/kWh) from the ESP. The ESP then issues an activation code to the consumer, which is entered into the pre-pay energy meter, in turn opening access to the amount of purchased electricity (in kWh). The activation code can be purchased and distributed physically at the ESP office, community store or through a mobile pay system as chosen by the ESP.

The pre-payment scheme can also apply to the use of equipment in the RPZ. Consumers can pre-pay for each hour that they use equipment such as computers, mills or saws. Water for irrigation can be pre-paid on the basis of cubic metres of water or hectares irrigated.

The consumer payment component starts from the assumption that affordability is a major concern for rural communities. The unit cost of electricity for all consumers is then set at a fixed affordable rate covering a portion of operational costs. This rate is set at US$0.20/kWh, which is lower than the reported national pre-payment price of US$0.212/kWh (PURA, 2011). Estimates of household power demand suggest that this rate will lead to monthly expenditure for the average household of up to US$5.40. The RE Fund will then subsidize the power that is consumed at a fixed rate weighted according to the venture type. Overall, the Fund's national component will contribute US$0.60/, leaving the Fund's international component to contribute the remaining US$0.15/kWh. (The RE Fund is described in more detail in Section 8.5.2 .)

Should income generation and electricity consumption increase in the community where the venture is located, then the per-unit cost will slowly drop, although total net cost of generation and distribution will increase. It is assumed that consumer payment per unit will be consistent over time, and that the net value of the RE Fund contribution will need to be capped in order to stay within the budgeted limits of NAMA finance.

7.5 Financial Distribution Mechanisms

7.5.1 Direct Investment Grants

International finance capital is needed under this NAMA to establish the Phase 1 (RE-CEC and RE-MG) ventures. This international finance capital will come directly from the International Support Partners to cover the investment costs of the RE-CEC and RE-MG ventures. The funds will be managed by the Trustee, and directed to individual ventures. The funds will be approved by the NAMA Coordinating Authority.

7.5.2 Renewable Energy Fund

Due to the high unit cost (US$/kWh) of electricity generation from the Phase 1 ventures (RE-CECs and RE-MGs) and Phase 2 ventures (RE-DIS), coupled with the likely inability of the rural consumers to pay for the full cost of electricity, the long-term financial viability of the ventures cannot be sustained without some form of subsidy. This remains the case even when considering the potential new income generated from the RPZs. In the case of RE-CECs and RE-MGs, the policy of providing subsidies directly to the ESPs (the PPPs in the case of this NAMA) is one of

the better options to ensure financial viability. This policy is particularly effective when the subsidies are based on performance, applying the RBF model. A performance based subsidy would be provided on the basis of payments per unit of produced electricity (US$/kWh), with added incentives for improved sustainable development impacts or increased consumer connections in the form of the fixed extension and expansion funds. Under the proposed PPP business model for the RE-CECs and RE-MGs ventures, international finance covers the cost of investment in the ventures. The remaining costs of the ventures arise from the O&M costs (or operational finance). In the case of this NAMA and the PPP business model, the monetary value of the subsidy can be designed based on the gap in operational financing needs, plus the envisaged extension and expansion funds.

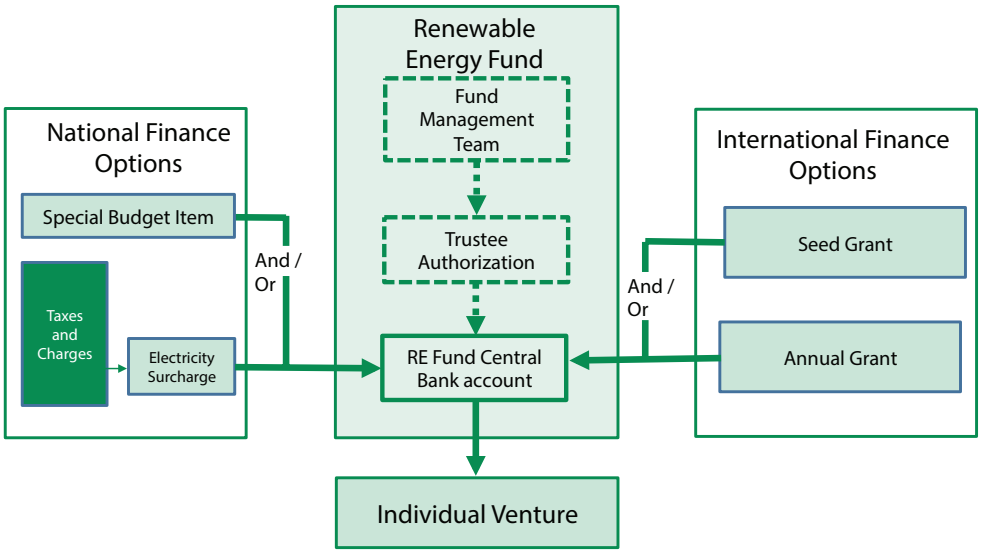
The Gambia's RE Fund was established under the 2013 Renewable Energy Act. The Fund was officially established in 2015 under the management of PURA. This Fund will be expanded to meet the requirements of the NAMA. Adjusting the pre-existing Renewable Energy Fund to accommodate NAMA requirements will be one of the first tasks of the NAMA Coordinating Authority (and the embedded international adviser). This start-up phase will include comprehensive consultation and coordination with several national entities in The Gambia and the partners providing the international finance. In this manner, the Renewable Energy Fund will be adapted to the NAMA before the commissioning of the RE-CEC and RE-MG ventures. It is proposed that the governance of the Renewable Energy Fund should be included within the NAMA management structure as follows.

1. The NAMA Coordinating Authority, under which will be a Renewable Energy Fund Management Team, including representatives from the NAMA Coordinating Authority and PURA (the official manager of the RE Fund, as per the Renewable Energy Act), will certify the need for and value of payments to be made to individual ESPs on a timely basis, and authorize the Renewable Energy Fund to make payments to the ESPs. The NAMA Coordinating Authority will also ensure and track a minimum standard of applied monitoring and reporting at the venture level. The standard will be developed and implemented under the MRV actions of this NAMA and must be met by all ESPs if they are to receive subsides.
2. The Trustee is then responsible for managing the transfer and oversight of funds needed to cover the gap in operational finance for the duration of the ventures' life cycle. The capital of the Renewable Energy Fund can be placed in the Trustee's account or in a trusted regional bank in an escrow[21] account. Under the escrow model, the capital gains interest from the escrow deposit; the interest can contribute to covering fund management costs. The funds can then be transferred into the Central Bank of The Gambia Renewable Energy Fund account.
3. The Renewable Energy Fund will distribute the subsidy directly to the ESPs on a monthly or quarterly basis, based on the measured performance of the ventures. It should be noted that basing the amount of subsidy distributed on performance allows for output expansion of the ventures and incentivizes the ESPs to improve performance over time.

Figure 18 shows a schematic diagram of the capital flows of the Renewable Energy Fund.

21 An escrow account is an account held by a third party, e.g. a domestic bank, on behalf of the other parties in the transaction, e.g. the Trustee and the ESPs.

Figure 18. Cash Flows and decisions for Renewable Energy Fund



In order to ensure reliable flows of subsidies on a long-term basis, capital will need to be mobilized from two sources, international finance and national finance. The Renewable Energy Fund should at a minimum be seeded with enough capital from Seed Grants and Special Budget items to cover the expected requirement for the first two years of capital demands on the fund (the seeding should include O&M components and extension and expansion funds). The additional 15 year life cycle costs, which are to be met from international finance in the NAMA timeframe, can be acquired through annual grants or seed grants. The additional national finance in the NAMA timeframe (15-year life cycle costs) will be raised from Special Budget items or an electricity surcharge, as explained below.

At the national finance level, capital is to be contributed to the RE Fund via an electricity surcharge which provides new revenue generation from a small surcharge on generated electricity. The electricity generation companies are few in number (< 10), and are already financially regulated. This means that the additional cost of electricity will be passed on to consumers starting from the point of generation, instead through a route such as taxing consumers at the distribution level. In 2011 electricity production from the 11 primary generation stations in the GBA grid and the regional mini grids was approximately 232 million kWh (NAWEC, 2012). This means that an electricity surcharge of a minimum of approximately US$0.0041/kWh will be needed to fund the national contribution to the Renewable Energy Fund. It is recommended that the electricity surcharge be US$0.006 /kWh, which is less than 2 per cent of the price of D9.10/kwh for power paid for by domestic pre-payment metering (PURA, 2011). A surcharge of US$0.006/kWh will produce potential revenues of US$ 1.4 million. The recommended electricity surcharge will decrease the risk associated with other methods of revenue collection and possibly allow for additional funds to be utilized for renewable energy activities and new ventures outside of the NAMA. The additional funds are most likely to be generated during the years when only the Phase 1 ventures (RE-CECS and RE-MGs) are operating, and before the commissioning of the Phase 2 ventures (RE-DISs).

7.5.3 Renewable Energy Loan Facility

A loan facility is expected to be included in the Renewable Energy Fund under phase 2. It will be capitalized using international finance. Funds in the RE Loan Facility will be used as collateral for loans taken out by RE-DIS and RE-IPP

ventures approved by the NAMA Coordinating Authority. The RE Loan Facility will provide two types of loan funds, the Revolving Loan Fund and the Loan Credit Programme.

The Revolving Loan Fund is to be established through the deposit of international funds, to provide low- or no-interest loans to support individual ventures under the NAMA. Under a Revolving Loan Fund, loans will be issued to and loan payments made by ESPs on a continual basis. As payments are deposited, the fund capital will replenish and, once sufficient funds have accumulated, new loans to support new non-NAMA ventures may be offered.

The second loan fund, the Loan Credit Programme, will be a credit facility which will provide collateral insurance. On joining the Loan Credit Programme, ESPs will not need to provide collateral to financial institutions for taking out loans. Instead, the ESPs will provide the financial institution proof of insurance from the fund. If the private sector company does not pay back its loan, the Loan Credit Programme will pay the financial institution the required collateral costs.

Given that the RE-DIS and RE-IPP ventures have very different investment magnitudes and risks of servicing debt, it is expected that the Revolving Loan Fund will focus on capital investments for the RE-DIS ventures, and the Loan Credit Programme will focus on capital investments for the RE-IPP ventures. Assuming a nominal debt to equity ratio of 70 per cent: 30 per cent for RE-DIS and RE-IPP investments, the RE Loan Facility will require up to US$13.2 million in capital and credit. This will be divided between US$2.7 million in capital for RE-DIS ventures through the Revolving Loan Fund, and approximately US$ 10.5 million in capital or credit for RE-MG ventures through the Loan Credit Programme. The expected operational costs of the loan facility will in theory be paid for by the national level ESPs who are taking out the loans, with the cost covered in the form of applied loan/credit fees (higher gross interest rates).

Designing and setting up the RE Loan Facility will be one of the first tasks of Phase 2 of the NAMA, and will be the responsibility of the RE Fund Management Team in comprehensive consultation and coordination with several national entities in The Gambia and international finance institutions. The RE Loan Facility will need to be operated via a Trustee, if not the main Trustee of the NAMA. It is expected that main parameters for the RE Loan Facility will be to provide long-term loans of 10 years or longer, with low gross interest rates (including fees and charges).

7.6 Indicative NAMA Financing Needs

The required financial resources will be deployed in a phased approach and are expected to originate from several national and international sources. It is key to the success of the NAMA that the indicative total costs of all the NAMA components, as well as the anticipated capital requirements by source of funds, are presented.

Table 15 summarizes the indicative investment and operating costs of the NAMA components by item and phase. The rest of this section presents the details of the indicative capital needs in terms of national and international sources. All values in this section are based on 2015 US dollars. There was no application of levelization, discounting, inflation, adjustments for foreign exchange fluctuations or taxation applied to the values. These adjustments need to be determined at the time of preparing the feasibility studies. However, due the significant depreciation of the Gambian dalasi against the US dollar over the past five years, payment for foreign exchange rate protection has been included in the financial model.

Table 15: Summary of indicative costs of the NAMA (US $ million)

NAMA Venture Investments	
Phase 1	
Number of RE-CECs Implemented	8
Number of RE-MGs Implemented	8
International Component (grant) (US$)	9,861
International Component (credit) (US$)	-
National Government Component (grant) (US$)	-
Private Sector (equity) (US$)	-
Phase 1 – Total (US$)	**9,861**
Phase 2	
Number of RE-DISs Implemented	6
Number of RE-IPPs Implemented	1
International Component (grant) (US$)	—
International Component (credit) (US$)	13,123
National Gov Component (grant) (US$)	—
Private Sector (equity) (US$)	5,624
Phase 2 – Total (US$)	**18,747**
Venture Investment Total	
Venture Investments Total (US$)	**28,608**
NAMA Venture O&M Costs	
Phase 1	
National Government Component (grant) (US$)	6,629
International Component (grant) (US$)	2,340
Consumer Payments (US$)	2,210
International Foreign Exchange Rate Protection (US$)	448
National Foreign Exchange Rate Protection (US$)	74
Phase 1 – Total (US$)	**11,701**
Phase 2	
National Government Component (grant) (US$)	2,170
International Component (grant) (US$)	—
Consumer Payments (US$)	17,054
Phase 2 – Total (US$)	**19,224**
Venture O&M Costs Total (US$)	**30,925**

Capacity Development (US$)	
Capacity Development – Phase 1 (US$)	**1,569**
Capacity Development – Phase 2 (US$)	**1,501**
Capacity Development – Total (US$)	**3,071**
Total Costs	
International Component (grant) (US$)	15,720
International Component (credit) (US$)	13,123
National Component (US$)	8,874
Consumer Payments (US$)	19,263
Private Sector (US$)	5,624
Phase 1 - Total (US$)	23,132
Phase 2 – Total (US$)	39,472

As explained in sub-section 8.3, the NAMA will be financed both by the Government of The Gambia and consumers nationally and by International Support Partners. Co-financing is crucial both to establishing the NAMA and to ensuring its success. The International Support Partners as a whole are critical to the start-up and establishment of the NAMA and its ventures, as a source of targeted grants and the RE Loan Facility. The International Support Partners will also be vital in helping ensure an affordable price of electricity to the poorest of the population, and the sustainability of private sector operations through grants to the RE Fund. However, it is the Government of The Gambia, as well as consumers, who will ensure that the NAMA is sustainable in the long term.

8 NAMA Implementation Structure

In order to understand the mechanisms and plans for implementation of the NAMA, an implementation pathway has been developed taking into account the current situation in The Gambia and the practical needs and requirements for governance and the establishment of ventures under the NAMA. As previously mentioned, Phase 1 establishes the first framework components for the NAMA and the first RE-MG and RE-CEC ventures. Phase 2 builds on Phase 1, strengthening and expanding the NAMA components, both in terms of regulatory measures as well as establishing RE-DIS and RE-IPP ventures. This section provides information on:

- stakeholders who will provide governance for the NAMA
- the schedule for the implementation pathway.

The implementation pathway should be considered indicative in nature. It is expected that this implementation pathway will change as a result of consultations with the Government of The Gambia and interested international supporters.

8.1 NAMA Stakeholders

The main stakeholders in the NAMA will now be discussed. The stakeholders are divided into two groups: governance bodies and implementation entities.

8.1.1 Governance Bodies

The governance bodies under this NAMA are: the NAMA Approval Committee, the NAMA Coordinating Authority, the NAMA Venture Approval Expert Group, the Trustee, and, potentially, other governance entities such as the National Designated Authority (NDA).

8.1.1.1 NAMA Approval Committee

The primary role of the NAMA Approval Committee is to provide oversight of NAMA activities. The secondary role is to provide strategic vision and to set functional goals for the NAMA. The NAMA Approval Committee will have the ultimate decision-making control of final proposals for the allocation of national and international funds for NAMA activities (both capacity development and ventures), in terms of what activities are allocated NAMA funds. The Committee should also act as the body with financial oversight of the use of funds. The NAMA Approval Committee is appointed by the already existing NCC. It is recommended that many members of the NCC should be appointed to the NAMA Approval Committee, in order to best use the existing capacities in the country. The Committee will consist of people representing entities that are key stakeholders in the NAMA. Committee members should include personnel from the MOE, the MOECCWW, NAWEC and PURA, as well as representatives of the International Support Partners (including the Trustee). The NAMA Approval Committee should meet at least once every six months under Phase 1 and at least annually under Phase 2.

8.1.1.2 NAMA Coordinating Authority

The NAMA Coordinating Authority will be a sub-unit most likely in the MOE. The Coordinating Authority will act as the team which manages and tracks the operational and financial elements required to implement and operate the NAMA, and as such will serve a long-term function lasting the lifetime of the NAMA. Under the Coordinating Authority will be the Renewable Energy Fund Management Team, which will include representatives from the Authority and from PURA.

The Coordinating Authority is answerable to the NAMA Approval Committee and will act as the coordinating body for the use of both national and international funds; the Coordinating Authority holds the authority to approve and audit the use of fund allocations. The NAMA Coordinating Authority will consist of at least three national employees (NAMA Programme Officer, Assistant Programme Officer-Administrative, and Assistant Programme Officer-Technical) and one embedded international adviser. The Fund Management Team will comprise two members of the NAMA Coordinating Authority and two PURA representatives. The NAMA Coordinating Authority should have a budget category within the NAMA finance budget and, under that budget, include budget lines for at least the following activities:

- performing planning and management of NAMA activities;
- coordinating with the Trustee and other International Support Partners;
- supporting the activities of the NAMA Approval Committee, both technically and financially;
- supporting inter-governmental actions on capacity-building;
- supporting inter-governmental actions on MRV;
- institutionalize and support the NAMA Venture Approval Expert Group;
- administering the tenders and contracts of contractors, partners and consultants;
- certifying national and international finance/subsidies;
- facilitating venture-based results reporting (e.g. bottom level MRV data flows);
- supporting internal capacity-building;
- hosting NAMA related meetings;
- managing external financial and evaluation audits;
- funding institutional expert consultancy needs;
- preparing inputs to national and international level NAMA reporting;
- hosting a NAMA website containing information about NAMA procedures and a NAMA database;
- writing NAMA procedures/policies and validating these procedures/policies with stakeholders.

It is suggested that the NAMA Coordinating Authority receives funding from the capacity development budget line. However, given the heavy inter-linkage of activities and that delay or non-performance of one activity could lead to wider failures, the performance of the NAMA Coordinating Authority is crucial. Therefore, the NAMA Approval Committee will have the mandate to recommend to the Trustee the suspension of funds per budget line in the case of non-performance of the NAMA Coordinating Authority. The NAMA Coordinating Authority should be given notice of non-performance at least six months before suspension of funds.

8.1.1.3 NAMA Venture Approval Expert Group

The NAMA Venture Approval Expert Group will be under the NAMA Coordinating Authority. It will be composed of no more than six people, of whom at least two will be from the NAMA Coordinating Authority (a national employee and the embedded international adviser), two selected national energy sector experts, and two international support partners. The NAMA Venture Approval Expert Group effectively acts as the technical experts who focus on overseeing bidding processes and the incorporation of new ESPs/ventures into the NAMA. The qualifications and meeting rules and procedures of the NAMA Venture Approval Expert Group will be prepared by the NAMA Coordinating Authority. The NAMA Venture Approval Expert Group will have a budget category within the NAMA finance budget under the NAMA Coordinating Authority

Funds/reimbursements for the group meetings should be disbursed at the conclusion/output of each planned group meeting, not for meeting attendance. The NAMA Coordinating Authority will decide if the objectives of each meeting are met, then, when required, will distribute funds accordingly within two weeks of the meeting conclusion. This means that the conclusion/output of each panel meeting and the related capacity requirements of each panel member should be well planned in advance by the NAMA Coordinating Authority. It would be best to include the suggested outputs in an annual work plan and budget, in line with the NAMA design. This work plan should then be approved by the NAMA Approval Committee and Trustee.

8.1.1.4 Trustee

The Trustee has the critical role of financial oversight of capital used for NAMA activities. The Trustee is charged with directly allocating funds to the account of the RE Fund. Before an entity becomes the Trustee for the NAMA, it will need to demonstrate compliance with a set of fiduciary and environmental and social safeguard standards to be agreed on by the NAMA financiers and the NAMA Approval Committee.

The Trustee will be audited at least bi-annually and will be notified of shortcomings found in the audits by the NAMA Approval Committee. There are a number of organizations which have the capability to act as the Trustee for this NAMA. The following is a list of potential Trustees with positive track records in Africa, but is not exhaustive.

- Banks and corporations:
  - African Development Bank
  - World Bank
  - ECOWAS Bank for Investment and Development
  - Nordic Environmental Finance Cooperation
  - KFW Development Bank
  - Access Bank
  - Ecobank Gambia
- Development programmes:
  - United Nations Development Programme
  - United Nations Environment Programme
  - Acumen Fund.

8.1.1.5 Other

If the NAMA is funded via the Green Climate Fund (GCF), an NDA will be involved in the oversight of the NAMA. At least one member from the NDA will be on the NAMA Approval Committee. Further information about the GCF and the key national GCF stakeholders is given in Box 2.

Box 2: The Green Climate Fund: An Introduction

GCF was created in 2010 at 16th Conference of Parties to the Kyoto Protocol (COP16) in Cancun with the aim of increasing the predictability and efficiency and addressing the adequacy of climate change finance under the Convention. The GCF is an operating entity of the financial mechanism of the UNFCC and is accountable to and functions under the guidance of the COP. The Fund and its independent secretariat are located in Songdo, South Korea.

All developing country Parties to the UNFCCC are eligible to access the GCF. The Fund will finance activities to enable and support enhanced action on:

- adaptation;
- mitigation (including REDD-plus, i.e. "reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries");
- technology development and transfer (including carbon capture and storage);
- capacity-building; and
- preparation of national reports by developing countries.

The fund also has a private sector facility which enables it directly and indirectly to finance private sector activities.

At a GCF project/programme level, there are three main stakeholders. The stakeholders and their roles are shown in Table 16.

Table 16. GCF national stakeholders

Stakeholder	Role/Responsibility
NDA	• Main point of communication for the GCF Secretariat • Principal signing authority on behalf of the national government • Provide letter of no objection for national/regional GCF proposals
Implementing entity	• Required to be accredited by the GCF • Origination and preparation of a funding proposal • Subsequent project/programme management of the necessary stages of the implementation process until its conclusion • Reporting obligations
Executing entity	• Project owners or entities directly responsible for the operational implementation and execution of the project/programme • Accountable to the relevant implementing entity

8.1.2 Implementation Entities

The main implementation entities under the NAMA are the ESPs, contractors and consultants.

8.1.2.1 ESPs

All individual ESPs will receive national cost savings (reduced taxation), consumer payments, and subsidy payments on a performance basis dependent on the generation of renewable electricity. In order to prevent bottlenecks, adequate warning of non-performance and remedy periods must be given to individual ESPs in relation to RBF; non-performance and remedy periods are to be tracked via the NAMA MRV system.

In order to incentivize growth and performance in the PPP business model of the ESPs, performance based payments (consumer payments and subsidies) should be based on a minimum threshold to meet minimum financial needs (e.g. revenues and returns are equal to cost coverage and fixed profit margin). Technically, this minimum threshold is set by assuming a minimal power generation level. The incentive should be positive in terms of growth so that when they exceeding the minimum thresholds, the ESPs gain more net profit.

8.1.2.2 Contractors and Consultants

Contractors and consultants will play a critical role in implementation and operation of the NAMA and its ventures. The service providers must be selected in a process which applies international standards and which uses transparent quality and cost basis tender and evaluation. The contractors and consultants will be contracted directly with the NAMA Coordinating Authority or Trustee. As previously indicated, the tenders for the service providers will be prepared by the NAMA Coordinating Authority in cooperation with the NAMA Venture Approval Expert Group. Open and competitive tenders will incentivize participation of the private sector, in terms of fair competition and secured payments. Contracts with contractors and consultants should be based on the payment-on-deliverables principle. If so decided by the Trustee or NAMA Coordinating Authority, awards for early delivery or penalties for late delivery can be applied (typically +/-10 per cent of contract value).

8.2 Pathway Implementation Schedule

The pathway implementation schedules for Phases 1 and 2 are presented in Table 17 and Table 18 respectively. The schedule is measured in years.

Table 17 Phase 1 implementation schedule

PHASE 1 - STEP / YEAR	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Establishment of pre-Phase 1 conditions																
0: Mandate for Operations & Venture Approval Process & Recruitment of International Advisers																
1: Venture Screening and Feasibility Studies (RE-MG & RE-CEC)																
2: Venture Approval																
3a: Update the RE Fund																
3a: Competitive Bidding for Implementation of Ventures																
3b: Competitive Bidding for PPP																
- First ventures construction & commissioning																
4: Inclusion of new Individual Ventures (continual)																
5a: Oversight of Implemented Ventures (continual)																
5b: Approval of Subsidies (continual)																

Table 17 indicates that Phase 1 commences in Year 0 with the establishment of pre-NAMA conditions. These pre-conditions include the establishment of agreements and modalities between the Government of The Gambia and the institutions providing multi- and bilateral international support to Phase 1 of the NAMA. Then, beginning in Year 1, as previously described in Section 6.1, steps 0 through 3b take place; these steps cumulate in the commission and implementation of the RE-MG and RE-CEC ventures. Venture implementation and commissioning occurs over a three year period depending on how the ventures are packaged. Steps 4, 5a, and 5b begin as early as Year 3, depending on the timing of the venture implementation, and continue throughout Phase 1.

Table 18. Phase 2 implementation schedule

PHASE 2 - STEP / YEAR	7	8	9	10	11	12	13	14	15
Establishment of pre-Phase 2 conditions									
6a: Feasibility Studies and Approval of Ventures (RE-DIS)									
6a: Feasibility Studies and Approval of Ventures (RE-IPP)									
6b: Establishment of RE Loan Facility and Strengthened FiT									
7: Competitive Bidding for Ventures (RE-DIS)									
7: Competitive Bidding for Ventures (RE-IPP)									
- First RE-DIS ventures implementation and commissioning									
- First RE-IPP venture implementation and commissioning									

As shown in Table 18, after the successful application of the steps in Phase 1, the establishment of Phase 2 needs to be addressed through similar agreements and modalities as seen in Year 0 of Phase 1. The establishment of pre-Phase 2 conditions is expected to take place in year seven of the NAMA and is to be followed by steps 6a, 6b, and 7. These steps are divided between activities focusing on the RE-DIS or RE-IPP ventures. This is due to fact that the RE-IPP ventures require a more complex set of enabling mechanisms to be implemented by the private sector and to function in a commercially sustainable manner. Thus, the RE-DIS ventures are expected to undergo implementation and commissioning from Year 8, and the RE-IPP venture(s) from Year 10.

9 Measurement, Reporting and Verification

A comprehensive MRV system is a crucial component of the NAMA. Data collection and analysis ensures that the NAMA is functioning well and allows for the NAMA's developers to adjust for any challenges that are found during the MRV. Furthermore, MRV systems allow the NAMA to be transparent, both for domestic and international partners, as well as for a wider audience. The MRV system will be an integrated system with a centralized reporting structure and data system. Included in the system are three types of data, relating to GHG emissions, sustainable development and financial support.

The following sections provided details about the MRV system including the reporting structure, the approach, and types of data.

9.1 Measurement

The MRV system focuses on emissions reductions, sustainable development (SD) and financial support, which will be described in the following sub-sections.

9.1.1 Emissions Reductions

Emissions reductions are calculated using measured data and default values. The equations and parameters used to calculate emissions reductions can be seen below.

Emissions reductions are calculated as: $ER_y = BE_y - PE_y$

Where:

Variable	Description
ER_y	Emissions reductions in year y (tCO_2)
BE_y	Baseline emissions in year y (tCO_2)
PE_y	Project emissions in year y (tCO_2)

Baseline emissions for the NAMA are calculated in the following manner:

$BE_y = BE_{new,y} + BE_{exist,mini,y} + BE_{exist,GBA,y}$

Where:

Variable	Description
$BE_{new,y}$	Baseline emissions for new consumers in year y (tCO_2).
$BE_{exist,mini,y}$	Baseline emissions of existing consumers connected to a regional mini-grid i.e. baseline emissions from displacement of electricity from an existing mini-grid (tCO_2). $BE_{exist,reg,y} = 0$, if there are no existing consumers.
$BE_{exist,GBA,y}$	Baseline emissions of existing consumers connected to the GBA Grid i.e. baseline emissions from displacement of electricity from the existing GBA Grid (tCO_2). $BE_{exist,GBA,,y} = 0$, if there are no existing consumers.

$BE_{new,y} = EC_{new,y} \times EF_{new}$

Where:

Variable	Description
$EC_{new,y}$	Electricity consumption of new consumers in year ***y*** (MWh/yr), net of transmission losses.
EF_{new}	Emission factor of new consumers. Default value of 1.0 tCO_2/MWh is provided.

$EC_{new,y} = EG_{new,y} \times (1-TL_y)$

Where:

Variable	Description
$EG_{new,y}$	Gross renewable electricity to be provided to new consumers in year ***y*** (MWh/yr).
TL_y	Transmission losses in year ***y*** (%). Default value of 0.

$BE_{exist,rmini,y} = EC_{exist,mini,y} \times EF_{exist,mini}$

Where:

Variable	Description
$EC_{exist,mini,y}$	Electricity consumption of consumers previously connected to a regional mini-grid in year ***y*** (MWh/yr), net of transmission losses.
$EF_{exist,mini}$	Emission factor of consumers previously connected to a mini-grid. Default value of 0.8 t CO_2/MWh is provided.

$EC_{,exist,mini,y}=EG_{exist,mini,y} \times (1-TL_y)$

Where:

Variable	Description
$EG_{mini,y}$	Gross renewable electricity to be provided to consumers previously connected to a regional mini-grid in year ***y*** (MWh/yr).
TL_y	Transmission losses in year ***y*** (%). Default value of 0.

$BE_{exist,,GBA,y}=EC_{exist,GBA,y} \times EF_{exist,GBA}$

Where:

Variable	Description
$EC_{exist,GBA,y}$	Net electricity consumption of consumers previously connected to the GBA grid in year ***y***.
$EF_{exist,GBA}$	Emission factor of households previously connected to the GBA grid. Default value of 0.697 t CO_2/MWh is provided.

$EC_{,exist,GBA,y}=EG_{exist,GBA,y} \times (1-TL_y)$

Where:

Variable	Description
$EG_{exist,GBA,y}$	Gross renewable electricity to be provided to consumers previously connected to the GBA grid in year ***y*** (MWh/yr).
TL_y	Transmission losses in year ***y*** (%). Default value of 10 per cent.

Default values utilized in the above baseline emissions calculations are summarized below.

Variable	Default value	Unit
EF for new consumers	1.0	t CO2/MWh
EF for consumers previously connected to a mini-grid	0.8	t CO2/MWh
EF for consumers previously connected to the GBA grid	0.697	t CO2/MWh
TL for new consumers	0	%
TL for consumers previously connected to a regional mini-grid	0	%
TL for consumers previously connected to the GBA grid	10	%

Project emissions for continued use of fossil fuels may need to be taken into consideration. However, for simplicity's sake, project emissions are not considered in this design document.

Therefore, $PE_y = 0$.

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

Data / Parameter:	Operating renewable energy generation systems
Data unit:	Number
Description:	Renewable energy systems which are in operation
Measurement procedures (if any):	Renewable electricity generation systems can be counted as operating only if they can show one of the following: (a) a valid manufacturer's warranty; or (b) regular maintenance arrangement (e.g. with suppliers/ distributors/implementers); or (c) demonstration that the systems are procured following the standards/guidelines (local/national/international) to ensure that the systems are of adequate quality and provide the required performance. [22]
Monitoring frequency:	Annually

Data / Parameter:	$EG_{new,y}$
Data unit:	MWh/yr
Description:	Electricity generated by the mini-grid system provided to new customers
Measurement procedures (if any):	Measurements are undertaken using energy meters. Calibration should be undertaken as prescribed in the relevant paragraph of the "General Guidelines for SSC CDM Methodologies". In the case of electricity sold to a third party, measurement results shall be cross-checked with records of sold/purchased electricity (e.g. invoices/receipts). The net electricity displaced is the gross energy generation by the project activity power plant minus the transmission loss.
Monitoring frequency:	Continuous monitoring, hourly measurement and at least monthly recording

Data / Parameter:	$EG_{exist,mini,y}$
Data unit:	MWh/yr
Description:	Electricity generated by the mini-grid system provided to consumers previously connected to a mini-grid

22 Adapted from UNFCCC, 2014.

Measurement procedures (if any):	Measurements are undertaken using energy meters. Calibration should be undertaken as prescribed in the relevant paragraph of the "General Guidelines for SSC CDM Methodologies". In the case of electricity sold to a third party, measurement results shall be cross-checked with records of sold/purchased electricity (e.g. invoices/receipts). The net electricity displaced is the gross energy generation by the project activity power plant minus the transmission loss.
Monitoring frequency:	Continuous monitoring, hourly measurement and at least monthly recording

Data / Parameter:	$EG_{exist,GBA,y}$
Data unit:	MWh/yr
Description:	Electricity generated by the mini-grid system provided to consumers previously connected to the GBA grid
Measurement procedures (if any):	Measurements are undertaken using energy meters. Calibration should be undertaken as prescribed in the relevant paragraph of the "General Guidelines for SSC CDM Methodologies". In the case of electricity sold to a third party, measurement results shall be cross-checked with records of sold/purchased electricity (e.g. invoices/receipts). The net electricity displaced is the gross energy generation by the project activity power plant minus the transmission loss.
Monitoring frequency:	Continuous monitoring, hourly measurement and at least monthly recording

9.1.2 Sustainable Development

To monitor all of the impacts on sustainable development that the NAMA has will be very challenging and burdensome for the ESPs. Therefore, a select number of 6 SD indicators are included in the MRV system. These indicators can be seen below.

Data / Parameter:	N_{SMMEs}
Data unit:	Number
Description:	Number of operating SMMEs using energy from the venture
Measurement procedures (if any):	SMMEs will be visited annually to ensure that they are operational.
Monitoring frequency:	Annual recording

Data / Parameter:	N_{jobs}
Data unit:	Number of females, number of males
Description:	Number of new jobs created through energy access
Measurement procedures (if any):	SMMEs and households will be visited annually to assess number of jobs created through energy access.
Monitoring frequency:	Annual recording

Data / Parameter:	$N_{hrs\_equipment}$
Data unit:	Number of hours, per unit of equipment
Description:	Number of hours of equipment use in RPZ
Measurement procedures (if any):	Equipment use will be purchased at an hourly rate. Upon purchase, the type of equipment used, the number of hours purchased, the rate paid and the purchaser's name and contact details are to be recorded.
Monitoring frequency:	Measured continuously and recorded at least monthly

Data / Parameter:	$N_{households}$
Data unit:	Number
Description:	Number of households connected to the mini-grid which are consuming energy
Measurement procedures (if any):	Household connections will be recorded by the ESPs as the connections are made. Electricity purchased by consumers, either in the form of MWh or charged batteries, will be measured continuously and recorded at least monthly. A sample of households will be visited annually to ensure that consumers are regularly utilizing the electricity.
Monitoring frequency:	Measured continuously and recorded at least monthly

Data / Parameter:	N_{public}
Data unit:	Number
Description:	Number of public buildings (e.g. schools, clinics) connected to the mini-grid
Measurement procedures (if any):	Public building connections will be recorded by the ESPs as the connections are made. Public buildings will be visited annually to ensure that they are operational and utilizing the electricity.
Monitoring frequency:	Annual recording

Data / Parameter:	$N_{ha\_irrigate}$
Data unit:	Number
Description:	Number of hectares irrigated using water pumped by the ventures
Measurement procedures (if any):	The amount of water pumped will be recorded at the water pumps.
Monitoring frequency:	Measured continuously and recorded at least monthly

As previously mentioned, the measurement of SD indicators will most likely need adjustment during Phase 2 of the NAMA. These adjustments will be made at a later time.

9.1.3 Support

The support provided as part of the NAMA will also need to be measured. Support will be provided in many forms: capacity building, technology transfer and financial. As the bulk of support will come in the form of financing, it is the financial support which should be measured.

Data / Parameter:	$FS_{international}$
Data unit:	US$
Description:	International financial support spent per activity
Measurement procedures (if any):	All finances disbursed need to be tracked as per the standard governmental tracking procedures.
Monitoring frequency:	Measured continuously and recorded at least monthly

Data / Parameter:	$FS_{national}$
Data unit:	US$
Description:	National financial support (i.e. subsidies) spent per activity
Measurement procedures (if any):	All finances disbursed need to be tracked as per the standard governmental tracking procedures.
Monitoring frequency:	Measured continuously and recorded at least monthly

9.1.4 Transformative Change

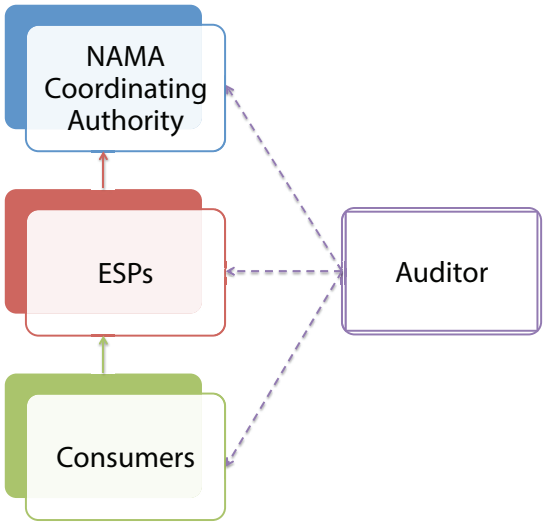
The NAMA Coordinating Authority will be charged with interpreting the ER and SD data and applying it to wider components of transformative change e.g. outcomes and impacts. These components cannot be measured annually but should be considered at the end of each phase and at the end of the NAMA's lifetime.

9.2 Reporting

9.2.1 Reporting Structure

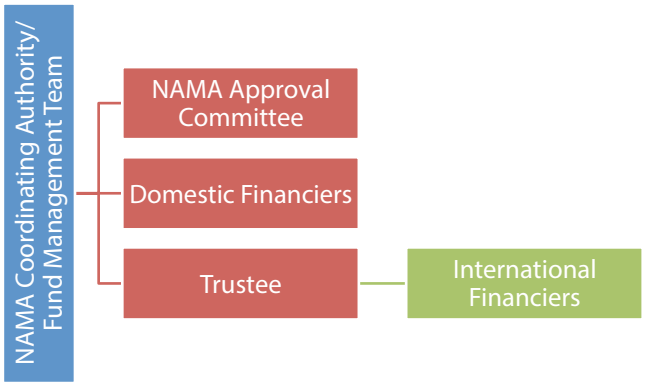
The central actor in the MRV structure is the NAMA Coordinating Authority. The NAMA Coordinating Authority holds the database of all collected data; ESPs report all data to the Coordinating Authority. The Coordinating Authority also acts as the main communicator of information to the high level decision makers, the NAMA Approval Committee, as well as to the financiers of the NAMA, at both the domestic and international levels. The MRV reporting structure is therefore composed of two components: 1) the data system component, as seen in Figure 19; 2) the decision making component, as seen in Figure 20.

Figure 19. MRV data system components



As seen in Figure 19 above, the data system component includes four stakeholders. MRV data flow from consumer (e.g. households, RPZ users) to ESPs who are managing ventures to the NAMA Coordinating Authority. Regular audits, or verification, are an important component of maintaining a transparent and well-functioning MRV system, so the auditor is included as one of the major stakeholders.

Figure 20. MRV decision making structure



The MRV decision-making structure includes five key stakeholders. The NAMA Coordinating Authority reports the data compiled in the data system to the NAMA Approval Committee, domestic financiers and the Trustee; the Trustee in turn reports the MRV data to the international financiers.

9.2.2 Reporting Forms

The NAMA Coordinating Authority is charged with creating reporting form templates. These forms will include at least the following information:

- details about the venture;
- ESP contact details;
- description of the measurement system;
- data parameters measured;
- default values applied;
- sampling plan details;
- calculation of emissions reductions.

The reporting form template will be provided by the NAMA Coordinating Authority to the ESPs. The completed forms will provided annually by the ESPs to the NAMA Coordinating Authority.

9.3 Verification

The goal of verification is to have an independent third party auditor ensure that the NAMA is operating as planned and that the measurement and reporting system is 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[23] or under another accreditation system agreed upon by the Government of The Gambia and International Partners.

Verification should occur every one or two years. Each verification will consist of:

- a desk review of documents;
- a site visit/interview of key stakeholders;
- drafting of the verification report;
- provision of feedback on the report by the NAMA Coordinating Authority;
- finalization of the verification report.

23 A list of entities accredited by the CDM Executive Board is available from CDM, 2015.

10 Conclusion

The Rural Electrification with Renewable Energy NAMA offers The Gambia a unique opportunity to expand rural electrification. The NAMA is divided into two phases which include a number of ventures. From Phase 1 to Phase 2, the models of the ventures will mature and upscale. In Phase 1, the ventures are small scale, community based ventures managed by either PPPs or the private sector; the ventures have a strong focus on income generating RPZs, as well as household connections. In Phase 2, the ventures are larger scale, connected to regional mini-grids or the GBA, and are fully private sector managed. Significant capacity-building, coupled with the experience gained by learning-by-doing as the ventures are established, will result in the private sector in The Gambia being fully capable of generating renewable energy. Importantly, the establishment of public sector governance structures and an appropriate institutional framework will permit smooth collaboration between the public and private sectors, ensuring that the citizens of The Gambia have sufficient access to renewable energy.

Over the course of its 15-year lifetime, the NAMA activities will cost approximately US$63.50 million. These financing needs will be met by both international partners and from domestic sources. International financing will fund a significant amount of Phase 1 capacity- building costs and venture equity. In Phase 2, international financing will decrease and will mainly be for continued capacity-building and venture debt. National financing will come from consumer payments, most likely in the form of pre-payment, Treasury budget lines and a subsidy on electricity. National measures will also include tax holidays for ESPs. A variety of financial mechanisms, such as grants, a renewable energy fund and a loan facility will facilitate the flow of finance to ESPs.

MRV is crucial in the success of the NAMA. Data parameters for both GHG emissions reductions and SD indicators are regularly measured, recorded and verified. This data will then be used to determine the transformative change which will occur as a result of the NAMA activities.

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Annex 1: Phase 1 Ventures Technical Design Requirements

The technical design requirements of the Phase 1 ventures (RE-CEC and RE-MG) can be seen in Table 19 and Table 20, respectively. Phase 2 venture technical requirements will be detailed during Phase 1.

Table 19. RE-CEC technical design requirements

Model Design - Renewable Energy Community Energy Centre Venture			
CAPEX Costs	**Quantity**	**Unit Price**	**Cost (US$)**
PV Panels (250Wp)	185	250	46,245
Panel Mounting Frames	185	75	13,873
DC Wiring	647	6	3,885
AC Wiring	400	15	6,000
Inverters/Trans (DC/AC)	5	9,000	45,000
Battery Inverter (DC/AC)	4	5,000	20,000
Monitoring/Control	5	3,000	15,000
Battery Pack	53	1,150	60,950
Household batteries (distribution)	150	350	52,500
Low Voltage lines 1X240	500	15	7,500
Distribution Boxes	3	600	1,800
Transmission Poles	3	500	1,500
Panels/Lighting Kits	53	150	7,950
Power House - Building	100	250	25,000
PV Site Civil Works (mm)	30	400	12,000
PV Site Security (mm)	24	400	9,600
PV Site M&E Works (mm)	24	700	16,800
Transmission Civil Works (mm)	0	400	0
Transmission M&E Works (mm)	0	700	0
Transport	2	5,000	10,000
7-1/2 hp Water Pump & Controls	1	5,000	5,000
Backup-Genset & Controls	2	16,000	32,000
Sub-Total			***392,603***
Engineering & Supervision			**58,890**
Other & EPC Margin			**78,521**
TOTAL			***530,014***

Table 20. RE-MG technical design requirements

Model Design - Renewable Energy Micro-Grid Venture			
CAPEX Costs	**Quantity**	**Unit Price**	**Cost (US$)**
PV Panels (250Wp)	185	250	46,245
Panel Mounting Frames	185	75	13,873
DC Wiring	647	6	3,885
AC Wiring	400	15	6,000
Inverters/Trans (DC/AC)	5	9,000	45,000
Battery Inverter (DC/AC)	4	5,000	20,000
Monitoring/Control	5	3,000	15,000
Battery Pack	53	1,150	60,950
Low Voltage lines 4x240	3,710	20	74,200
Low Voltage lines 1X240	2,650	15	39,750
Distribution Boxes	16	600	9,600
Transmission Poles	58	500	29,000
Panel/Meter/Light kit & Installation	53	250	13,250
Power House - Building	100	250	25,000
PV Site Civil Works (mm)	30	400	12,000
PV Site Security (mm)	24	400	9,600
PV Site M&E Works (mm)	24	700	16,800
Transmission Civil Works (mm)	38	400	15,264
Transmission M&E Works (mm)	19	700	13,356
Transport	3	5,000	15,000
7-1/2 hp Water Pump & Controls	1	5,000	5,000
Backup-Genset & Controls	2	16,000	32,000
Sub-Total			***520,473***
Engineering & Supervision			**78,071**
Other & EPC Margin			**104,095**
TOTAL			***702,638***

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Annex 2: Qualitative SD indicators

Venture Name	**Renewable Energy Micro-Grids**				
Domain	**Indicator**	**Identified impacts**	**Explanation of chosen indicator**	**Effect on indicator**	**Monitored (Y/N)**
Environment	Air pollution/ quality	Reduced indoor pollution	The NAMA will reduce consumption of kerosene/paraffin in lanterns which are associated with severe indoor air pollution from soot and noxious fumes.	Positive	No
	Climate change adaptation and mitigation	Avoidance of GHG emissions	The NAMA will partially replace electricity production from stand-alone diesel generators and reduce kerosene/paraffin consumption in lanterns, and thus GHG emissions are avoided.	Positive	Yes
Social	Health	Improvement of health and health care conditions	The NAMA will improve people's health by avoiding burning kerosene/paraffin, which causes severe indoor air pollution by emitting noxious fumes and soot. Kerosene lighting is extremely hazardous and is responsible for many burns and deaths. It will also improve healthcare conditions by providing lighting and refrigeration for rural clinics where vaccines could be conserved, blood storage refrigerators could be installed, operations could be carried out with sterilizations measures, diseases could be diagnosed and prevented, and pregnancies could be monitored.	Positive	Yes

Venture Name	Renewable Energy Micro-Grids				
Domain	**Indicator**	**Identified impacts**	**Explanation of chosen indicator**	**Effect on indicator**	**Monitored (Y/N)**
Social	Livelihood of poor, poverty alleviation, peace	Poverty reduction	The NAMA will improve lighting conditions, allowing children to study at home, which has a significant impact on improving children's education in rural families and their future employability. Kerosene/paraffin lighting is extremely hazardous and is responsible for loss of property through fire, as well as many burns and deaths. Prevent loss of property due to natural disasters by giving the possibility of installing radio receivers, remote weather measuring, data acquisition and transmission (for example, river levels and seismographs) earthquake monitoring systems, emergency power for disaster relief, etc. Allow for the implementation of safety measures such as street lighting, security lighting, remote alarm systems, electric fences, road signs, etc., including electrification of police stations. Prevent loss of food thanks to installation of refrigeration appliances. Promote better food processing, adding value to the agricultural products (e.g. flour instead of grain). Promote creation of new income-generating activities thanks to electricity for lighting and running machines.	Positive	YES
	Time savings/time availability due to project	Improved Productivity and economic diversification	With better lighting, adults may also pursue productive activities in the house after nightfall. The implementation of the NAMA will make people less dependent on kerosene/paraffin and will decrease the amount of income spent on fuel.	Positive	No

Venture Name	Renewable Energy Micro-Grids				
Domain	**Indicator**	**Identified impacts**	**Explanation of chosen indicator**	**Effect on indicator**	**Monitored (Y/N)**
Growth and Development	Access to clean and sustainable energy	Decreased dependency on fossil fuels	Energy plays a critical role in economic development and poverty alleviation. In the absence of reliable grid electricity, people depend mostly on diesel generators and kerosene/ parafin lamps for lighting. The implementation of the NAMA will make people less dependent on expensive fuels and will decrease income spent on fuel.	Positive	Yes
	Education	Better learning conditions	Enhance education by allowing studying after nightfall for both children and adults. Creates opportunity for adults to have additional/informal education (distance learning, e-courses) thanks to internet connection. Provides better learning conditions into schools, such as computer facilities, internet and distance learning.	Positive	Yes
	Empowerment of women	More jobs to women	The NAMA will create opportunities for new income-generating activities for women, e.g. handicrafts, food processing, hair-dressing, starting small shops, sewing workshops, etc.	Positive	No
	Energy security	Improved energy security	The NAMA will enable use of the local energy sources, creating independence from the geo-political situations.	Positive	No
	Capacity building	Increased knowledge sharing and capacity among rural communities	The NAMA will provide capacity building on mini-grids for communities. The NAMA will raise awareness and provide capacity building amongst the rural population about renewable energy.	Positive	No

Venture Name	Renewable Energy Micro-Grids				
Domain	**Indicator**	**Identified impacts**	**Explanation of chosen indicator**	**Effect on indicator**	**Monitored (Y/N)**
Economic	Income generation/ expenditure reduction/ Balance of payments	Enhanced productivity, efficiency and increased business opportunities; lower electricity expenditures	The NAMA will foster productivity, increase production efficiency and production time, enable added value activities and encourage new income-generating activities. The generation of income would enhance economic growth and provide the means to afford the electricity	Both	Yes
	Job Creation (# of men and women employed)	Jobs creation	The implementation of the NAMA will require the use of several local/ national entities to undertake: renewable energy technology supply and installation, mini-grid operation, entry survey, awareness rasing, marketing, accounting and software development.	Positive	Yes

Venture Name	Renewable Energy Micro-Grids				
Domain	**Indicator**	**Identified impacts**	**Explanation of chosen indicator**	**Effect on indicator**	**Monitored (Y/N)**
Environment	Air pollution/ quality	Reduced indoor pollution	The NAMA will reduce consumption of kerosene/paraffin in lanterns which are associated with severe indoor air pollution from soot and noxious fumes.	Positive	No
	Climate change adaptation and mitigation	Avoidance of GHG emissions	The NAMA will partially replace electricity production from stand-alone diesel generators and reduce kerosene/paraffin consumption in lanterns, and thus GHG emissions are avoided.	Positive	Yes

Venture Name	Renewable Energy Micro-Grids				
Domain	**Indicator**	**Identified impacts**	**Explanation of chosen indicator**	**Effect on indicator**	**Monitored (Y/N)**
Social	Health	Improvement of health and health care conditions	The NAMA will improve people's health by avoiding burning kerosene/paraffin, which causes severe indoor air pollution by emitting noxious fumes and soot. Kerosene lighting is extremely hazardous and is responsible for many burns and deaths. It will also improve healthcare conditions by providing lighting and refrigeration for rural clinics where vaccines could be conserved, blood storage refrigerators could be installed, operations could be carried out with sterilizations measures, diseases could be diagnosed and prevented, and pregnancies could be monitored.	Positive	Yes
	Livelihood of poor, poverty alleviation, peace	Poverty reduction	The NAMA will improve lighting conditions, allowing children to study at home, which has a significant impact on improving children's education in rural families and their future employability. Kerosene/paraffin lighting is extremely hazardous and is responsible for loss of property through fire, as well as many burns and deaths. Prevent loss of property due to natural disasters by giving the possibility of installing radio receivers, remote weather measuring, data acquisition and transmission (for example, river levels and seismographs) earthquake monitoring systems, emergency power for disaster relief, etc. Allow for the implementation of safety measures such as street lighting, security lighting, remote alarm systems, electric fences, road signs, etc., including electrification of police stations. Prevent loss of food thanks to installation of refrigeration appliances. Promote better food processing, adding value to the agricultural products (e.g. flour instead of grain). Promote creation of new income-generating activities thanks to electricity for lighting and running machines.	Positive	Yes

Venture Name	Renewable Energy Micro-Grids				
Domain	**Indicator**	**Identified impacts**	**Explanation of chosen indicator**	**Effect on indicator**	**Monitored (Y/N)**
Social	Time savings/time availability due to project	Improved Productivity and economic diversification	With better lighting, adults may also pursue productive activities in the house after nightfall. The implementation of the NAMA will make people less dependent on kerosene/paraffin and will decrease the amount of income spent on fuel.	Positive	No
Growth and Development	Access to clean and sustainable energy	Decreased dependency on fossil fuels	Energy plays a critical role in economic development and poverty alleviation. In the absence of reliable grid electricity, people depend mostly on diesel generators and kerosene/parafin lamps for lighting. The implementation of the NAMA will make people less dependent on expensive fuels and will decrease income spent on fuel.	Positive	Yes
	Education	Better learning conditions	Enhance education by allowing studying after nightfall for both children and adults. Creates opportunity for adults to have additional/informal education (distance learning, e-courses) thanks to internet connection. Provides better learning conditions into schools, such as computer facilities, internet and distance learning.	Positive	Yes
	Empowerment of women	More jobs to women	The NAMA will create opportunities for new income-generating activities for women, e.g. handicrafts, food processing, hair-dressing, starting small shops, sewing workshops, etc.	Positive	No
	Energy security	Improved energy security	The NAMA will enable use of the local energy sources, creating independence from the geo-political situations.	Positive	No
	Capacity building	Increased knowledge sharing and capacity among rural communities	The NAMA will provide capacity building on mini-grids for communities. The NAMA will raise awareness and provide capacity building amongst the rural population about renewable energy.	Positive	No

Venture Name	Renewable Energy Micro-Grids				
Domain	**Indicator**	**Identified impacts**	**Explanation of chosen indicator**	**Effect on indicator**	**Monitored (Y/N)**
Economic	Income generation/ expenditure reduction/ Balance of payments	Enhanced productivity, efficiency and increased business opportunities; lower electricity expenditures	The NAMA will foster productivity, increase production efficiency and production time, enable added value activities and encourage new income-generating activities. The generation of income would enhance economic growth and provide the means to afford the electricity	Both	Yes
	Job Creation (# of men and women employed)	Jobs creation	The implementation of the NAMA will require the use of several local/national entities to undertake: renewable energy technology supply and installation, mini-grid operation, entry survey, awareness rasing, marketing, accounting and software development.	Positive	Yes

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