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Resilient nations.*

# Guidance Paper

## Finance Structure and its Management for a Rural Electrification NAMA

A model approach to financing the development, implementation, and operation of a sector-wide programme for renewable energy rural electrification as a Nationally Appropriate Mitigation Action

Disclaimer: The Guidance Paper is not the official opinion of the UNDP.

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## ACRONYMS

CFL	Compact Fluorescent Lights
CMF	Concept Model of Finance
COO	Community Owned and Operated business model
FPS	Full Private Sector business model
EPC	Engineering, Procurement, and Construction
ESP	Energy Service Provider
GHG	Greenhouse Gas
kWh	Kilowatt hour
kWp	Kilowatt peak
LED	light emitting diode
PPP	Public Private Partnership business model
MRV	Monitoring, Reporting and Verification
NAMA	National Appropriate Mitigation Action
OBA	Output Based Aid
ODA	Official Development Assistance
O&M	Operation and Maintenance
OMM	Operation, Maintenance, and Management
RPZ	Rural Productivity Zone
PV	Photovoltaics (solar)
UNFCCC	United National Framework Convention on Climate Change
US\$	US dollars

# 1 INTRODUCTION

It has been widely acknowledged by the international community that access to electricity is one of the main drivers in the process of sustainable development. Taking words from Helen Clark, UNDP's Administrator, access to energy "transforms the lives of people, communities, and nations. No country ever developed without access to energy" (Clark 2012). In this context one of the main issues facing developing countries is the lack of electricity access by their population, and it is often the rural population which is most affected by a lack of affordable and reliable electricity supply. Therefore, the main objective of this Guidance Paper is to facilitate greater access to electricity by rural communities through the provision of climate finance under a National Appropriate Mitigation Action ("NAMA").

	Population Without Electricity <sup>1</sup>	Currently Installed Capacity (MW) <sup>2</sup>
Gambia	65%	65
Ghana	28%	1,985
Kenya	81%	1,698
Namibia	40%	487
Rwanda	84%	57
Vanuatu	72%	28

Table 1: Lack of Electricity Access in Select Developing Countries

Rural electrification is the process of bringing electricity supply to rural and remote areas. The challenge of rural electrification is how to make electricity available to areas and communities which lack access to a grid based power supply. The primary constraints as to why a large number of people in the world remain unconnected to the grid are typically financial and physical. While the latter deals with the challenges of geography (e.g. hilly areas, large tracts of dense forest land, long distances to reach remote areas) and availability of resources (e.g. oil/gas, water, sunlight, biomass), the former refers to the economic challenges which developing countries face in investment funding, service costs, and revenues & collection. It is noted that it is often financially prohibitive to extend existing power infrastructure into rural areas, via power grid extensions. Cost effectiveness is particularly a problem in sparsely populated countries where distances may be long and therefore grid extension costs high, with the extension resulting in the provision of grid access to a limited number of remote communities (consumers). Therefore, mini-grids (e.g. grids which power one village) are often used as a least-cost long term solution for rural electrification and the use of renewable energy to power mini-grids is becoming increasingly popular. Such mini-grids also encourage further growth in rural economies, especially when efforts target parallel tracks of power and economic development as described in "Integrated Sustainable Rural Development: Renewable Energy Electrification and Rural Productivity Zones" (UNDP MDG Carbon, 2014).

Such rural electrification projects are not normally "bankable" under fully private sector commercial conditions since the rural poor have limited financial resources. Thus, subsidy programs are required to ensure establishment and, potentially, long term viability of these projects. Although subsidies for rural electrification from many international development partner- and multi-lateral finance organizations are available, each funder has their own targets, criteria, and processes for the allocation and disbursement of funds to developing countries. Taking this funder diversity into consideration, this Guidance Paper presents a generalized method for the financing structure of a rural electrification NAMA.

## UNDP MDG-Carbon Actions for Rural Electrification:

*The UNDP MDG-Carbon program has started efforts for promoting the use of new climate finance actions to reach those who are often the poorest in developing countries, e.g. the rural poor. MDG-Carbon is encouraging finance through the design of for NAMAs in several African, Asian and Pacific countries. The target is to encourage sources of international climate finance to utilize their funds to leverage efforts for capacity development and physical establishment and operation of rural electrification projects involving electricity generation through renewable energy.*

## 1.1 Objectives and Audience of this Guidance Paper

The objective of this Guidance Paper is to present a bottom-up approach to using a NAMA as a vehicle to finance renewable energy rural electrification. In doing so, this Guidance Paper provides stakeholders with a Concept Model for Finance (“CMF”) for renewable energy NAMAs in the energy sector. This Guidance Paper focuses on the CMF, as well as on addressing the overall theme of sustainable development for the rural communities.

This Guidance Paper does not offer an in-depth explanation of NAMAs’ overall governance structure or context of applicability under current international conventions. To gain more information on governance structure or context of applicability, please refer to the **Suggested Resources** section (pg. 43) of this Guidance Paper.

In presenting the bottom-up approach, this Guidance Paper defines a physical part of NAMA implementation which leads to the physical GHG mitigation, as a “venture”. Further to this, in addressing NAMA financing and the CMF, this Guidance Note defines a theoretical individual renewable energy mini-grid and its boundary as a “model venture”. Though it is recognized that there are other means to achieve rural electrification, such as grid extensions, pico-systems, and energy services, this Guidance Paper will focus on the renewable energy mini-grid.

This Guidance Paper targets policy makers, regulators and those implementing the individual ventures in developing countries who have a clear priority for the development of rural electrification as a driver for poverty reduction and climate action through income generation and mitigation of GHG emissions. The CMF is meant to facilitate the involvement of multilateral and bilateral financing institutions in the capacity development and financing of renewable energy rural electrification, particularly through the utilization of a NAMA framework which applies the concept of Output Based Aid (“OBA”). Ideally, this Guidance Paper will encourage policy makers, regulators and investors to conceptualize a national and international government co-financing scheme which supports the establishment of renewable power generation and mini-grids in rural communities. Such a financing scheme will be designed in a country specific context and, where development aid is directed, and policy and administrative changes are initiated.

*“Sustainable energy can revitalize our economies, strengthen social equity, and catalyse a clean energy revolution that benefits all humanity. Acting together, we can open new horizons today and help power a brighter tomorrow.”*

Ban Ki-Moon,  
UN Secretary-General

## 2 THE CONCEPT MODEL FOR FINANCE

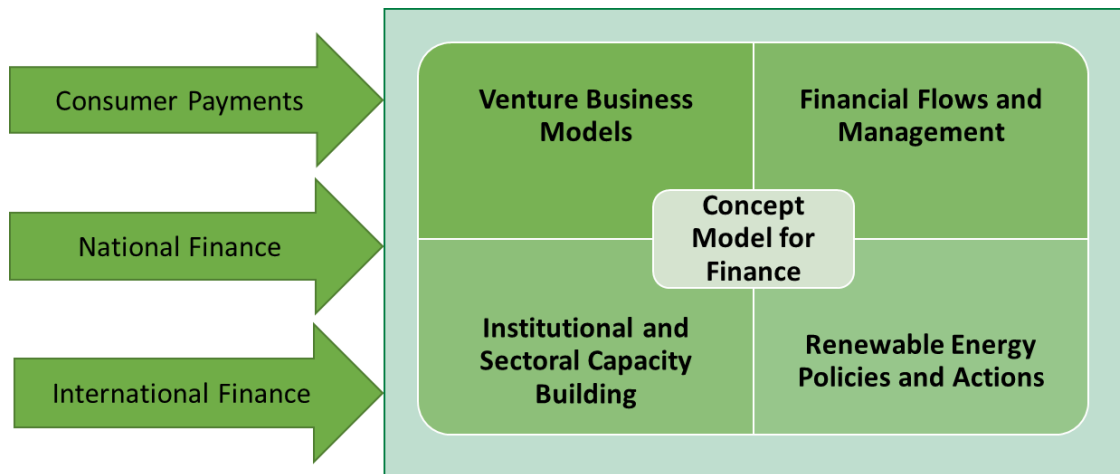
### 2.1 The CMF structure

The CMF's foundation is built upon four main building blocks, presented bottom-up:

- 1) Venture Business Models
- 2) Financial Flows and Management
- 3) Renewable Energy Policies and Actions
- 4) Institutional and Sectoral Capacity Building

This Guidance Paper focuses not just on the building blocks as individual components but also on the interlinkages of the components and the thread of sustainable development which weaves through the four components. This thread helps to build a strong model for financing rural electrification in developing countries, ultimately resulting in host of benefits, including greenhouse gas (GHG) emissions.

As indicated previously, the CMF is based on the concept of OBA, in so far that funds are targeting increasing the output of electricity in remote areas; this electricity is then provided to individuals who lack the financial means to pay the full cost of electricity and public and private sectors cannot bare (or transfer) the cost of change. To increase the electricity output, funds in an OBA scheme facilitate the establishment and operation of the NAMA and most importantly the individual ventures for renewable energy rural electrification, which provide electricity to the rural consumers / individuals. In this manner the CMF receives funds (or costs reductions) which cover the entire life time of the NAMA, and the funds originate from low consumer service payments, national government measures or programs, and from development partner country and multilateral institution programs. This approach creates two primary tracks of NAMA finance which are external to the ventures business boundary, specifically national and international finance as shown in Figure 1. Note that the ventures business boundary brings in community finance through consumer payments.



*Figure 1: Building blocks and funds of the Concept Model for Finance (CMF)*

Financing a NAMA is not only about directly financing the implementation and operation of individual ventures, but also about financing the actions needed for transformational change in the sector and the cost of operating the NAMA. In the context of a renewable energy rural electrification NAMA, it is foreseen that the two primary tracks of external finance will need to fund several parallel bodies, actions, and incentives in order to ensure long term sustainability.. These bodies, actions and incentives may include:

- Bodies: NAMA Approval Committee, NAMA Coordinating Authority, NAMA Venture Approval Expert Group, etc.;
  - Actions: Institutional and sectoral capacity development;
- Incentives: Grant and subsidy schemes; cost reduction schemes; and/or loan schemes.

The building blocks and interlinkage of the CMF are further described in the following sections of this Guidance Paper.

## 2.2 Venture Business Models for Rural Electrification Mini-Grids

There are numerous options for business models for rural electrification with mini-grids involving renewable energy electricity generation and distribution (ARE 2011a). Most of these business models revolve around a central entity, referred to in this Guidance Note as Energy Service Providers (“ESPs”). In this manner, 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 Guidance Note and NAMA finance, ESPs in business models 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 with mini-grids, especially those involving renewable energy, in developing countries, there exists a general paradox between the affordability of the consumed electricity and the cost of the consumed electricity: the cost of consumed electricity often much higher than the level of affordability within a rural community. It is this paradox that must be taken into account in business models and venture finance, in terms of short and long term risks and sustainability.

A private sector based business model for rural electrification mini-grids, where private sector ESPs invest in and operate the mini-grids on a long term basis, faces resistance due to perceived and real risks leading to what are often referred to as market failures. These market failures in developing countries amongst others include the lack of: established revenue mechanisms for renewable energy, guarantee mechanisms of payment for services, financing from the domestic banking sector, local technical know-how and, in some cases, political instability. In short, the wide spread implementation of a fully private sector based business model can only be viable once the perceived and real market failures no longer exist. The establishment and functioning of enabling mechanisms which overcome such market failures eventually encourage viable private sector activities in the energy sector. These enabling mechanisms require a significant level of sectoral and institutional development, economic activity, and rural individual income generation.

There exist two other potential business models which require direct financing by international development partners and multilateral institutions; these models help lead to the development of, and pave the way for, new rural electrification enabling mechanisms in target countries. These business models are the Community Owned and Operated (“COO”) and Public Private Partnerships (“PPP”) models which are further described in Sections 2.2.2 and 2.2.3. When addressing the different business models, what is noteworthy is the

potential difference in unit cost (US\$/kWh) of electricity in delivered by a mini-grid. The COO business model often has the lowest unit cost, followed by the PPP, and after this the Full Private Sector (“FPS”) with the highest cost. The difference in unit cost is derived due to the level of profits required by private companies to operate and/or make investment in the ventures, plus the cost of servicing debt. To illustrate this and give a rough idea of unit cost difference a simple explanation of a FPS business model is provided in Section 2.2.4.

In terms of implementing the CMF in a NAMA, it is highly recommended that a phased implementation approach be utilized as follows:

**PHASE 1:** In the first years of the NAMA, focus is placed on implementing the four main building blocks to the operational level, and piloting approximately 5 to 10 ventures under the COO business model, or the PPP if viable;

**PHASE 2:** In the remaining years of the NAMA, focus is placed on operation, inclusion of new ventures, and in allowing greater access to the private sector through the FPS business model, if enabled mechanisms can cover the higher unit cost or, preferably, help to reduce the unit cost.

### 2.2.1 Rural Productivity Zone (RPZ)

A major sustainability component of the CMF is the creation of a Rural Productivity Zone (RPZ) at the venture level. The RPZ is based on a paradigm of an integrated approach to sustainable rural development. It consists of setting up an ‘Energy System’ and ‘Associated Infrastructure’ in a rural area that provides power for a range of activities that leads to income enhancement and social development. Economic activity results in money being generated, which in part goes into paying for the investment, operation and maintenance of the energy system and infrastructure. In this manner RPZs increase the ability of consumers to make consumer payments, by allow for more community level income generation. In addition to economic activities RPZ offer the provision to potentially include social infrastructure for healthcare and education, which builds a sense of ownership and supports local capacity development leading to the community’s sustainable development (UNDP MDG Carbon 2014).

### 2.2.2 Community Owned and Operated (COO):

A COO business model operates a mini-grid as a cooperative and is established in rural communities where the private sector is not willing to operate or where the community wishes to handle all ESP activities. The community’s activities under a COO model include ownership, operation, maintenance, and management services. The short-comings of the COO model include the lack of community: awareness, buy-in, technical skills, business development & operation skills, and financing. This means that the application of a COO

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